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**MISCELLANEOUS PAPERS 1 (1968)**  
**LANDBOUWHOGESCHOOL WAGENINGEN – THE NETHERLANDS**

*B<sub>2</sub>/B<sub>2</sub>*

**DISSERTATION ABSTRACTS OF THE**  
**AGRICULTURAL UNIVERSITY, WAGENINGEN**  
**THE NETHERLANDS**  
**1918-1968**

**H. VEENMAN & ZONEN N.V. – WAGENINGEN – 1968**

Landbouwhogeschool  
**AFD. AGRARISCHE GESCHIEDENIS**  
Wageningen

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## INTRODUCTION

On the occasion of the Agricultural University's Golden Jubilee, the Centre for Agricultural Publishing and Documentation (Pudoc) has presented the University with a bibliography of the theses for the degree of doctor of agricultural science, defended or prepared at the Agricultural University up to now. The Agricultural University accepts this excellent gift with great gratitude, the more so because it realizes a long-standing desire. Our gratitude is firstly to the Director of Pudoc, Ir D. J. Maltha, and to Ir T. Eernstman, staff member of Pudoc, who edited this book. Our gratitude also goes out to the many graduates and the many members of the scientific staff of the Agricultural University, who compiled the abstracts of the bibliography.

In the Netherlands there is one Agricultural University, situated in Wageningen, and derived in 1918 from the State College of Agriculture, Horticulture and Forestry. The main tasks of the Agricultural University are teaching and research. Over the years also many autonomous institutes of agricultural research administered by the Ministry of Agriculture and Fisheries have been established in Wageningen.

This strong concentration of agricultural teaching and research gives Wageningen with about 800 graduates within its bounds, rightly claim to the title 'Centre of Agricultural Science'. For the benefit of users of this bibliography outside the Netherlands, at first some information on the course of the studies at the Agricultural University will be given.

Before taking examinations at the Agricultural University, students must possess a leaving certificate from a secondary school or from one of the agricultural colleges. These leaving certificates are obtained after completing at least 11 or 12 years at school (including primary school) so that students are at least 17 years old when they register.

The study at the Agricultural University has three parts. The first part lasts about one year, after which undergraduates take the propaedeutic (preliminary) examination. This preliminary part of the study gives them a general background for all future courses. Subjects include mathematics, physics, chemistry, biology and economics. After passing the propaedeutic examination the undergraduate can choose from about twenty study-programs.

Study for the second examination, the candidate's examination, takes about two and a half years. In this period the student obtains a broad orientation in the specialized field of study which he has chosen.

During the last part of the study, the student specializes within his chosen field, and he is brought into active contact with research. This part of the study takes about two years, it is completed with the final examination, the 'ingenieurs' examination. In this last part of the study the student has to spend six months in practice on farms, in laboratories, or with agricultural institutions.

The 'ingenieur'-diploma gives the right to the title of 'landbouwkundig ingenieur' (indicated by the abbreviation 'Ir' before the name). This title is

generally in high esteem. It allows the bearer to be admitted for a doctorate at the Agricultural University. (Those who had obtained, before 1918, a diploma in agriculture under the Secondary Education Act of 1863, or a B-certificate of proficiency for teaching agriculture were also admitted for a doctorate).

In special cases the Minister of Agriculture and Fisheries may exempt students from the 'ingenieur'-diploma and admit them to the university to work for a doctorate. This dispensation has been used especially since 1945 for graduates from abroad who have already obtained a university degree in agriculture elsewhere. A special procedure of selection is followed in these cases.

The right to submit a doctoral thesis has been used throughout the years quite extensively though at a fluctuating rate. So far 423 doctoral degrees have been taken, 354 by graduates from Wageningen ('landbouwkundig ingenieur's') and 69 by others, who were admitted under one of the special arrangements mentioned before. Of the total, 47 were granted a doctorate cum laude. Taking into account that for obvious reasons only a small number of the graduates of the last few years have yet had the chance to submit doctoral theses, the proportion of 'landbouwkundig ingenieur's' going on for a doctorate is 1 in 7 to 8.

A survey of the university's scientific activity, as seen from graduations is not complete if not also the doctorates, obtained by university staff members, who have not been educated in the Agricultural University, are mentioned. As far as could be ascertained, there are 73 such doctorates. When these scientists obtained their doctor's degree elsewhere, their professors at the Agricultural University acted as (joint) promotors.

Some graduates of the Agricultural University have taken their doctor's degree at universities abroad, their number is not exactly known. A number of foreign students has come to Wageningen for doctoral studies; 56 have graduated as doctor in agricultural science at Wageningen, mainly since 1955. Most of them were from Africa, especially from Egypt and South Africa.

The periods elapsing between graduation as 'landbouwkundig ingenieur' and the completion of the doctoral thesis are highly varied. Sometimes it takes only a few years, half the graduates complete it within 7 years, 15% returned only after 12 years or more since graduation as 'ingenieur' to the university.

H. A. J. M. Beekman was the first to receive a doctorate by defending a thesis. This ceremony took place nearly three years after the establishment of the Agricultural University. It is noteworthy that he was appointed professor. Seven years later he acted as a promotor himself. The first female doctor in agricultural science was Miss Ir Sibergina Wagenaar, in the academic year 1953-1954.

The following account is intended for those unfamiliar with the manner in which a doctor's thesis takes shape at the Agricultural University, and with the rules and customs associated with it. The right to be admitted for a doctorate is laid down under article 46 of the Act governing university agricultural education. This right is detailed in the statutes of the Agricultural University. Research is the central point of the thesis. The thesis should give evidence of originality

and of ability to work independently on a scientific problem. The problem studied is determined after deliberation between promotor and student. If the subject of the thesis pertains to the speciality of more than one professor, the student is supervised by two promotors. Research is usually in a laboratory or an institute, not necessarily in Wageningen, but research may also be performed independent of any laboratory or institute. The student is of course in regular contact with his promotor on the progress of his research. The results of this research are recorded in the doctor's thesis which has to be written in the Dutch language according to the rules, though application of exemptions to this rule leads more and more to publication in one of the universal languages. The thesis has to be approved by the promotor before it can be defended at the promotion ceremony against the objections of the Senate or a Senate Committee. The thesis is usually published in print.

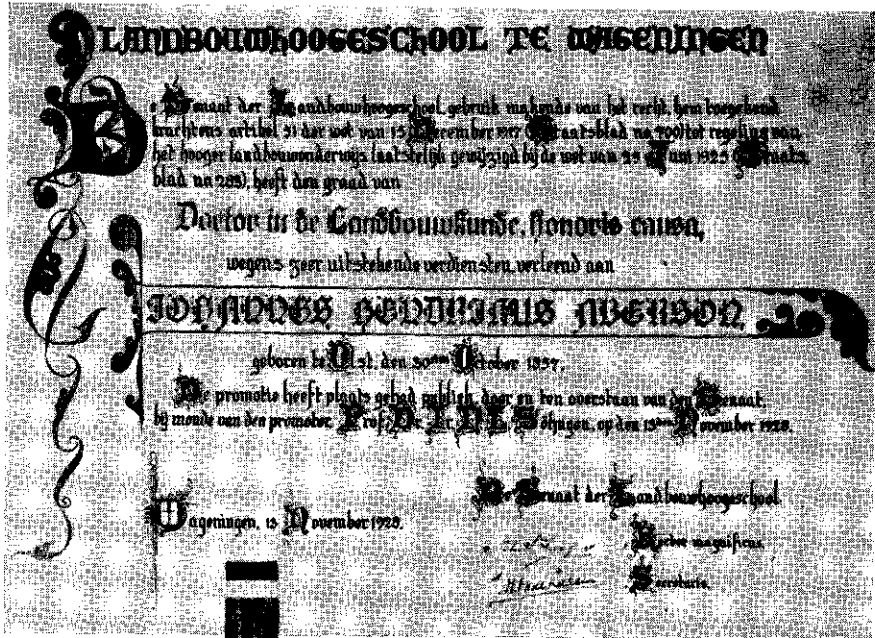
In the past a graduate did not publish his results until his research was completed. By reason of the rapid development of experimental science throughout the world, this custom could not be maintained in recent years. To establish himself as the originator of a new idea, the scientist now often publishes a brief article on an aspect of his research as early as possible in a journal. After his research has been completed the content of such articles is incorporated in the thesis.

The doctor's thesis must be accompanied by a number of propositions or theorems relating to the agricultural sciences.

The ceremony in which the future doctor defends his thesis and his propositions in a discussion with his professors is performed in accordance with the academic traditions in this country. In recent years it takes place in the Auditorium of the Agricultural University. It is looked upon as one of the greatest if not the greatest day in the scientific career of the young doctor.

The highest honour the University can award is a honorary doctorate, which up to now has been granted 23 times since the foundation of the Agricultural University. This doctorate is awarded, as laid down in the law, for 'exceptional merit'. Up to now four distinguished agronomists and scientists from abroad have received this high scientific distinction.

The Rector Magnificus  
of the Agricultural University,  
F. Hellinga



*The diploma for honorary doctorate in agriculture was hand-lettered until 1956. They were not based on a special model so that each has an individual character. The example shows the hand-lettered diploma of Prof. Dr J. H. Aberson.*

# LANDBOUWHOGESCHOOL TE WAGENINGEN

De Senaat der Landbouwhogeschool verkent, op grond van artikel 46, derde lid, der wet van de 15de december 1917 (Staatsblad No 700) en regeling van het hoger landbouwonderwijs, zoals deze wet laterzijdelijk is gewijzigd, de graad van

DOCTOR IN DE LANDBOUWKUNDE

aan **HENDRIKUS ALBERTUS LUNING**

geboren te 'S-RAVENHAGE

den 11 NOVEMBER 1908

na verdediging van een proefschrift met volgende, getiteld:

**ECONOMIC ASPECTS OF LOW LABOUR-INCOME FARMING**

op een private promotie, naar overstaan van de Senaat en op gezag van de promotor

**PROF. DR. H. BLIJMHOOSTEN**

Wageningen, den 11 DECEMBER 1967

De Senaat der Landbouwhogeschool

 Rector Magnificus

 and Secretary

*Diplomas for doctorates in agriculture have always been printed. Their form has been changed several times. Of the current one an example is given in this figure of the diploma of Dr Ir H. A. Luning, the last graduate in 1967.*

**HONORARY DOCTORATES**  
awarded since the foundation of the Agricultural University

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Date	Name	Promotor
16-12-1918	F. E. Posthuma†	J. H. Aberson
16-12-1918	P. van Hoek†	J. H. Aberson
17-11-1921	L. Broekema†	Dr M. J. van Uven
20- 9-1926	A. E. Mayer†	Ir B. van der Burg
23- 3-1928	H. de Vries†	Dr J. A. Koning
14- 5-1928	S. Leefmans†	Dr W. K. J. Roepke
13-11-1928	J. H. Aberson†	Dr Ir N. L. Söhngen
9- 3-1938	Jhr S. van Citters†	Dr H. A. J. M. Beekman
27-10-1938	B. Sjollema†	Dr J. Hudig
6-12-1945	D. S. Huizinga†	Dr Ir G. Minderhoud
10- 3-1947	E. H. Krelage†	Dr E. van Slogteren
9- 3-1948	Sir John Boyd Orr	Dr E. de Vries
9- 3-1948	S. L. Louwes†	Dr Ir G. Minderhoud
9- 3-1948	S. Smeding†	Ir M. G. Visser
9- 3-1948	F. P. Mesu	Ir F. Hellinga
9- 3-1956	S. L. Mansholt	Dr Ir C. H. Edelman
10- 3-1958	A. G. Dumon	Dr Ir J. C. Dorst
9- 3-1963	J. F. van den Brande	Dr A. J. P. Oort
9- 3-1963	T. C. Oudemans	Dr Ir G. Hellinga
13-11-1967	N. G. Addens	Dr E. W. Hofstee
13-11-1967	J. Boldingh	Dr H. J. den Hertog
13-11-1967	M. L. Dantwala	Ir J. H. L. Joosten
13-11-1967	A. W. van de Plassche	Dr Ir S. J. Wellensiek



## ACKNOWLEDGMENTS

We are deeply indebted to all those who wrote the abstracts. They are named in the index of abstractors.

Thanks are also due to the following who assisted in the production of the book. Mr J. C. Rigg helped with the many problems of translation. Without his efforts and experience this work could not have been completed in time.

Mr G. de Bruyn, librarian of the Institute of Phytopathological Research and of the Laboratories of Phytopathology, Entomology, Virology and Zoology of the Agricultural University gave most valuable help in seeking out and writing to persons who could prepare abstracts on phytopathological, entomological, virological and zoological subjects.

Miss J. T. Nahuys carefully and assiduously typed (and retyped!) the manuscript. Mr W. van Rosmalen assisted in checking the final scripts and preparing them for the printer. Ir W. R. Sturms sought out the graduation dates at other universities and titles of professors.

Mr J. Vermeulen planned the typography.

The Editor

## SOME REMARKS ON THE USEFULNESS AND THE USE OF THESE ABSTRACTS

### *The usefulness*

When it was considered how the Centre for Agricultural Publications and Documentation (Pudoc) could contribute to the celebration of the fiftieth anniversary of the Agricultural University, the idea arose of preparing a book of short summaries of its theses to make their contents more widely accessible. Our appreciation must be extended to the Senate of the Agricultural University for accepting this proposal and to the Editorial Board of the 'Mededelingen van de Landbouwhogeschool' in which series these collected descriptions are being published.

All along, the celebrating of half a century of agricultural research on an academic level motivated the decision that all dissertations should be described from 1918 onwards. One might, of course, object that the dissemination of the contents of the earlier dissertations would not be so important. This might be partly true, yet there was reason enough in publishing earlier dissertations. Firstly to provide some insight into the research carried out at the Agricultural University of Wageningen in the fifty years since its establishment. Secondly older publications may often contain very valuable data, whose existence was completely forgotten. Thirdly many of the theses give a very thorough survey of the literature on the subject studied. Fourthly the compilation of summaries of all dissertations should be very useful for those studying agricultural history, or more especially the history of agricultural research or that of the Agricultural University.

When this question was considered it could be surmised that also an other influence played a hidden role in arriving at the decision that all theses should be treated. This influence became clearer when this decision was afterwards occasionally discussed with others who once studied at Wageningen. They all readily agreed with this decision, and also with the idea of publishing these summaries in a chronological order. There has always existed an invisible tie between all the Wageningen students. This invisible tie created a never failing interest between members of the Wageningen family in each other's actions, whether still at Wageningen, elsewhere in the Netherlands or abroad, and whatever their generation.

Although half a century is rather a long time, yet it is so short that several agricultural graduates, who received their doctorates in the early years of the existence of the Agricultural University, are still living, while some of them even from time to time make important contributions to agricultural science or give valuable advice for the benefit of several aspects of social life. The fact that the majority of the graduates are still active, although they are sometimes far away, often leads to such questions as: 'What was the problem, he studied for his thesis?' 'When did he graduate?' 'Who was his promotor?' 'Have you heard this story about him?' 'No, that was someone else' 'What were his main conclusions?' 'Didn't someone else graduate on a related topic about the same time?'

The fact that such questions must often have arisen was reason enough that everybody, having heard of the plan to publish these abstracts in chronological order, approved of it, although probably all these persons agreed with the plan from emotions, rather than reason, a sober consideration having probably brought many of them to the opinion that a division into separate headings according to related subjects would have been more convenient when using these collected abstracts. How relieved they all were, although not having opposed with words the chronological order, to hear that a key to subjects would also be made: a systematic index. So indeed it was the general feeling: let it happen, first in a chronological order; let us for once be not too rational in our rational(?) age, but yet not omit to be so somewhere!

If a historian or a philosopher would read these lines, he would probably say 'What do you agriculturists know about true rationality; do you know what is really important, and what is your real contribution to mankind?' Many of us would admit: 'No, we don't know', or perhaps refer them to the Department of Agricultural History or that of the Agricultural Economy of our University. But perhaps they could also answer that only results of many persons could give an amount of material, with which an attempt could be made to get a more all-embracing picture and so a real one. And that, although this information could also be grouped according to subjects and indeed such a division would be very useful and indispensable in studying certain subjects, the different fields of study, having developed in the same period, are so interwoven, that their separation would disturb the picture of the sometimes slow and sometimes rapid progress in agricultural science with all its cognate spheres.

One doctor in agricultural science said to me: 'Why publish this book? There are publications of 'Wageningen' far more important than its theses.' This may be true for some fields, but for others not. From several laboratories a rather representative part of their research (representative as to the kind and level of research) could be published as theses, so that a valuable part of the scientific achievements obtained in our charming town on the borders of the Rhine, is reflected to us through the short summaries compiled from its theses. This cannot be made more clear than by pointing to the probability that Virgil would have found plenty of material in the contents of these summaries to add several books to the four constituting the 'Georgica' and could have gained a good insight into many aspects of modern agriculture, horticulture and forestry. One could even wonder if he would now need more than the six, seven or eight years then used to write the four books (37-30 B.C.).

This mass of results also implies that the students of today will find here a noteworthy survey of important data helpful for keeping themselves up to date and to form their own survey of Wageningen's scientific attainments and of how they were reached.

This assertion does not, however, mean that one can always find the main conclusions of every author in the summary of his dissertation. All summaries are not composed in the same way as it soon appeared that each thesis had to be described in a particular way, which was always largely imposed by the demand not to surpass a certain number of lines. Sometimes it was possible

briefly to mention the intention of the research and the author's main conclusions, at other times it was only possible to mention the problems studied by the author, a record which sometimes could not even be more than a rather vague description as a result of the complicated contents of the thesis. This last way of treatment is, however, not out of harmony with the original conception that these summaries in first instance should only refer to the original literature.

One aspect of the contents of the theses has not been considered. This is the wisdom which can be gained from their prefaces. Not only everybody interested in the history of the persons, connected with agricultural and related sciences, in their careers, in the way they achieved their scientific results can find there ample material to consult, but also those who enjoy finding out something of their personal feelings and their experiences in life. Isn't it true, for instance, that one can feel something of the great breath of life and of the peculiar events which can be met with in life, when reading lines such as are in the Foreword of the thesis of the forester F. KRAMER (no. 22, 1926): 'The preparation of this thesis brought me, after a seven years' stay in the tropics, back in Wageningen, in that typical forestry sphere I so well remembered. To you, Very Learned HAM, Highly Esteemed Promotor, first of all I acknowledge my thanks for the great willingness with which you received me, and for the pleasant co-operation which I met with. With thankfulness I remember, besides your lectures, those of...' ('De bewerking van dit proefschrift bracht mij, na een verblijf van zeven jaren in de tropen, terug in Wageningen, in die typische boschbouwsfeer, welke ik mij nog zoo goed herinnerde. U Hooggeleerde HAM, Hooggeachte Promotor, dank ik in de eerste plaats voor de groote bereidwilligheid, waarmede Gij mij zijt tegemoet gekomen, en voor de aangename medewerking, welke ik van U mocht ondervinden. Met dankbaarheid gedenk ik hier naast Uwe lessen, die van...').

#### *The use*

The summaries of the theses have been placed in a chronological order from 9 March 1918 until 9 March 1968 and have been numbered from 1 to 423 inclusive. After this follow the summaries of theses defended at other Universities in the Netherlands or abroad, theses for which the mental or the practical preparation was at Wageningen under the supervision of a professor or reader of the Agricultural University. The summaries of these theses of other Universities have been numbered from E1 to E73. This group is arranged alphabetically by name of the Dutch Universities and lastly are the foreign Universities. Within these University groups a chronological order has been maintained.

In the title of the thesis at the head of its summary has also been mentioned whether the thesis was also published in an other way: as in a periodical or in a book series. Beneath each summary is the name of the promotor or those of two promotors. Beneath the summaries of theses of other universities than Wageningen, there is also the name of the supervisor at the Agricultural University.

There are three indexes. Firstly an alphabetical index of the doctoral graduates with the dates of their graduation, and the serial numbers of their theses.

(which numbers have also been given to the summaries).

Secondly follows a subject index, in which a subject classification can be found according to the Universal Decimal Classification, as extended for agriculture and its auxiliary sciences in F. AE. Koekebakker's Agricultural Code, and supplemented by data from the full UDC Code where necessary.

Thirdly an alphabetical index of promotor has been given, in which all doctors are grouped under the names of their respective promotor. For these promotor also the subject on which they lectured has been mentioned. If two promotor were involved in a graduation, an asterisk has been placed behind the name of the graduate in this index. The other promotor can then be found beneath the summary of the thesis. The summaries can be found by their serial numbers behind the name of the graduate in this index.

T. Ernstman

## LIST OF ABBREVIATIONS OF THE NAMES OF THE ABSTRACTORS

Scientific officers of Pudoc made 111 abstracts, 106 of which were made by the editor, as a gift of Pudoc to the Agricultural University.

To complete this book within a short time, the help was needed of many experts. So most of the other abstracts were written outside Pudoc, or were lifted almost word for word from existing abstracts. When a thesis was summarized by the author himself, the attribution 'Author' is placed after the abstract. The names of other abstractors are given as initials, which are explained below. Sometimes abstracts have been a joint task, usually indicated by a symbol such as Author/X. Often this was because the abstract provided had to be abridged.

Mr J. C. Rigg of Pudoc advised on the English and translated some abstracts.

A.	Dr Ir A. D. Adamse	d.He.	Prof. Dr H. J. den Hertog,
An.	Dr Ir G. W. Ankersmit		Dr G. B. R. de Graaff, and
B.	Ir M. Bekedam		Dr H. C. van der Plas
v.d.B.	Ir J. van den Burg	I.	Prof. Ir S. Iwema
Be.	Dr Ir R. Best	J.	Ir A. R. P. Janse
Bev.	Ir W. A. Beverloo	Ja.	Ir B. H. Janssen
Bi.	Dr W. Tj. Binnerts	Jo.	Prof. Ir J. H. L. Joosten
Bo.	Drs G. J. Bollen	Ju.	Ir S. H. Justesen
Bot.	A. P. Botjes	K.	Dr G. A. Kamerbeek
Bou.	Ir J. Bouma	d.K.	Drs C. A. D. de Kort
Br.	Ir M. G. M. Bruggenwert	Ko.	Dr Ir F. F. R. Koenigs
Bu.	Prof. Dr Ir P. Buringh	Koo.	Ir G. A. Koopstra
D.	Dr Maria H. Deinema	Kor.	Ir G. J. J. Kortstee
v.D.	Dr Ir A. van Diest	Kos.	Drs S. Kostelijk
De.	Dr Ir J. Dekker	Kr.	Drs J. J. Krabbe
Der.	Drs W. J. Derksen	L.	Ir J. A. Lasschuit
v.Di.	Dr Ir J. B. M. van Dinther	L.A.	Ir R. A. L. Lincklaen Arriëns
Do.	Prof. Dr D. J. Doeglas	Le.	Prof. Dr Ir H. A. Leniger
E.	Ir T. Eernstman	Li.	Dr Ir T. A. Lie
E.-VI.	Dr A. W. Edelman-Vlam	Lin.	Dr W. Lindeman
v.E.	Ir F. van Egmond	Lu.	Dr Ir H. A. Luning
F.	Dr Ir E. J. Fortanier	Lij.	Dr J. H. W. Lijfering
G.	Ir B. F. Galjart	M.	Ir D. J. Maltha
Ge.	Ir M. Gerlach	v.M.	Dr Ir M. A. J. van Montfort
Go.	Drs. H. J. Gorter	v.d.M.	Ir Q. P. van der Meer
Gr.	Dr E. H. Groot	M.D.	Dr Ir E. Meijer Drees
H.	Prof. Dr Ir F. Hellinga	Mi.	Drs W. J. Middelhoven
d.H.	Dr H. de Haan	Mo.	Ir G. Montsma
v.d.H.	Ir Maria C. van der Haven	Mu.	Prof. Dr Ir E. G. Mulder

N. Ir A. Noomen  
v.d.N. Dr Ir P. C. van den Noort  
No. Drs A. T. J. Nooij  
Not. Dr D. J. G. Nota  
O. Prof. Dr A. J. P. Oort  
Ov. Miss A. A. Over  
P. Ir A. Perk  
v.d.P. Dr J. M. G. van der Poel  
Po. Dr Ir R. D. Politiek  
Pon. Prof. Dr Ir L. J. Pons  
R. P. Reiniger M.Sc.  
Ri. J. C. Rigg  
Ro. Ir H. K. Roessingh  
Ros. Ir M. Rosanow  
Roz. Ir A. Rozendaal  
Ru. Dr Jakoba Ruinen  
S. Ir J. H. G. Slangen  
v.S. Ir D. H. M. van Slogteren

St. Prof. Dr Th. Stegenga  
Sy. Dr Ir J. Sybenga  
V. Ir J. G. P. Verheij  
v.d.V. Dr Ir J. H. van der Veen  
Ve. Dr Ir B. Verhoeven  
Vo. Ir M. P. M. Vos  
W. Dr Ir P. Walstra  
d.W. Dr Hendrika J. W. de Widt  
v.d.W. Prof. Dr Ir J. P. H. van der  
Want  
v.d.We. Drs A. D. van der Weij  
Wi. Dr G. Wiertz  
d.Wi. Prof. Dr H. C. D. de Wit  
Win. Ir C. J. G. Winkelmolen  
Z. Ir L. C. Zachariasse  
d.Z. Dr Ir J. W. de Zeeuw  
Za. Dr J. C. Zadoks  
Ze. Dr L. P. Th. M. Zevenhuizen  
Zu. Ir F. C. Zuidema

## ABBREVIATIONS USED IN THE ABSTRACTS

Summ.	summary
Afrik.	Afrikaans
Arab.	Arabic
Du.	Dutch
Eng.	English
Fr.	French
Ger.	German
Indon.	Indonesian
Ital.	Italian
Port.	Portuguese
Span.	Spanish
Afd.	Afdeling
ARR	Agricultural Research Reports <sup>1</sup>
IG-TNO Rep.	Report of the Instituut voor Gezondheids- techniek TNO, Delft, Netherlands
LEB-Fonds Publ.	Publicatie van de Stichting 'Fonds Landbouw Export Bureau 1916-1918', Wageningen, Netherlands
Meded. IPO	Mededelingen van het Instituut voor Planten- ziektenkundig Onderzoek <sup>2</sup>
Meded. ITBON	Mededelingen van het Instituut voor Toegepast Biologisch Onderzoek in de Natuur, Arnhem, Netherlands
Meded. IVRO	Mededelingen van het Instituut voor Rassen- onderzoek van Landbouwgewassen
Meded. KNMI	Mededelingen van het Koninklijk Nederlands Meteorologisch Instituut, De Bilt, Nether- lands
Meded. LH	Mededelingen van de Landbouwhogeschool, Wageningen, Netherlands
Rev.	Review
Tijdschr.	Tijdschrift
Verhand.	Verhandelingen

<sup>1</sup> Since 1 Januari 1964 the series VLO (Verslagen van Landbouwkundige Onderzoekingen) has been issued under two titles: VLO and ARR (Agricultural Research Reports). The VLO's are in Dutch, while ARR's are in English or occasionally other international languages. The numbering of the publications is according to order of issue; VLO's and ARR's form one numerical series.

<sup>2</sup> All Institutes and Laboratories mentioned in the titles of the journals are at Wageningen, unless indicated otherwise.



Versl.	Verslagen
VLO	Verslagen van Landbouwkundige Onderzoekingen <sup>1</sup>
BET method	Brunauer Emmett Teller method
cv.	cultivar
cvs	cultivars
2,4-D	2,4-dichlorophenoxyacetic acid
DD	a mixture of 1,2-dichloropropane and 1,3-dichloropropene (a nematocide)
DDT	1,1,1-trichloro-2,2 bis ( <i>p</i> -chlorophenyl)-ethane
FSH	follicle-stimulating hormone
GA <sub>3</sub>	gibberellic acid
GA <sub>4</sub> , and other numbered GA's	other gibberellins than GA <sub>3</sub>
ICSH	interstitial-cell-stimulating hormone
IU	international units (vitamins)
LD plants	long-day plants: plants flowering after a certain amount of days of long photoperiods
LD treatment	long-day treatment (treatment with long daily photoperiods during a certain amount of days)
MCPA	2-methyl-4-chlorophenoxyacetic acid
r.h.	relative humidity
SD plants	short-day plants: plants flowering after a certain amount of days of short photoperiods
SD treatment	short-day treatment (treatment with short daily photoperiods during a certain amount of days)
2,4,5-TP	2-(2,4,5-trichlorophenoxy-) -propionic acid
UV radiation	ultraviolet radiation

Abstracts of dissertations of the Agricultural University,  
Wageningen, The Netherlands, in chronological order,  
9 March 1918–9 March 1968,

1. H. A. J. M. BEEKMAN Economische gevolgtrekkingen, voortvloeiende uit een analyse van den djati-opstand en van het djati-boschbedrijf op Java / *Economic conclusions from an analysis of the teak forest and its management in Java*. 1920, pp. 8 + 166.

Beekman tried to define the financial rotation of teak high forest in a clearance felling system, allowing for modifying factors. For practical reasons only one site of quality (IV) in one forest district was considered. This district had been used for timber production for 20 years. Through its favourable situation and therefore favourable marketing and ease of transport, and smooth labour relations, the yield of timber had been increased more than anywhere else in Java. These conditions were taken as an ideal standard.

He tried to assess the stand value, the value of the normal wood stock, the forest value and the internal rate of return. For this purpose first the contrasts between the 'soil rent theory' and the 'forest rent theory' were examined. The first theory was held preferable.

The calculations demonstrated 50 years as best for the financial rotation with an interest rate of 3%, after which also the influences of the fallow period, the cutting period, the ringing period and preceding culture on the financial calculations were studied. The income from teak forestry was compared with those of other tropical cultures. Through these and other considerations Beekman arrived at conclusions on the justification for teak forestry on certain soils.

Promotor: Prof. Dr Ir A. H. Berkhout

E.

2. J. G. OORTWIJN BOTJES De bladrolziekte van de aardappelplant / *Leaf-roll disease of the potato plant*. 1920, pp. 8 + 136. Du. a. Eng. summ.

Macroscopic and microscopic symptoms of leaf-roll disease of potatoes were extensively discussed in an analysis of the cause. Infected plants, derived from healthy tubers, frequently showed no symptoms during growth. Sometimes signs of discolouring and of rolling could be detected, first in the uppermost leaves, but they were not distinctive for this disease. If the seed potato was already infected, leaves, first the lowest, hardened and rolled about 30 days after the plant came up. This was preceded by a disturbance of starch breakdown. After the external symptoms necrosis of the phloem always developed and was specific. Information on the abnormal action of certain enzymes in diseased plants was reviewed.

The disease was contagious during growth. Transfer was by lice and probably also bugs. Another possibility was transfer within the soil. The rapidity of spread depended largely on still unknown environmental conditions. Control was sought first in the possibility of breeding less susceptible varieties, as there were great differences in susceptibility.

Promotor: Prof. Dr H. M. Quanjor

E.

3. J. A. EZENDAM De kwantitatieve botanische analyse van veevoedermiddelen / *The quantitative botanical analysis of feedingstuffs*. 1921, pp. 8 + 84.

It was of importance in the evaluation of feedingstuffs to know its quantitative composition. A qualitative botanical indicated purity but a quantitative test was needed for the degree of purity. Natural feedstuffs always contained a certain amount of foreign material, which could be considered either as natural or chance contamination. The manufacturer had to ensure that commercial feedstuffs had a high degree of purity. Whenever there was consideration in the trade of standards for purity, it was necessary to be able to check these standards.

Ezendam worked out a method of measuring impurities both quantitatively and qualitatively. It was tested on some feedstuffs and thus led the way for microscopic study of feedingstuffs.

Promotor: Prof. Dr J. H. Aberson

I.

4. G. BREMER Een cytologisch onderzoek aan eenige soorten en soortsbastarden van het geslacht *Saccharum* / *A cytological study of some species and species hybrids of the genus Saccharum*. 1921, pp. 14 + 112. Du. summ.

Within the wild cane, *Saccharum spontaneum*, 56 bivalent chromosomes are found in a regular division of pollen mother cells, indicating a somatic chromosome number 112.

Several well known varieties of sugar-cane, *S. officinarum*, appeared to have 40 chromosomes in the haploid phase and 80 in the somatic phase. But in these canes, meiosis was often seriously disturbed, reducing the fertility. This was also so with the very thin Indian canes Chunnée and Ruckree II, having 90-91 chromosomes somatically.

In relation to the reduced fertility of *S. officinarum*, it was remarkable that hybrids between *S. officinarum* ( $n = 40$ ) and *S. spontaneum* ( $n = 56$ ) were very fertile, since usually hybrids between species with different chromosome numbers are partly fertile or totally sterile. However the hybrids between the above species did not have  $40 + 56 = 96$  chromosomes, but  $40 + 40 + 56 = 136$  chromosomes. This was also so for Kassoer, a similar interspecific hybrid found wild, that was especially used for hybridization with *S. officinarum*.

Cytological research of Kassoer and the hybrids from crosses of *S. officinarum* with *S. spontaneum* demonstrated that 68 bivalents could be counted in the metaphase of reduction division.

The doubling of the *S. officinarum* chromosomes from 40 to 80 is probably due to longitudinal splitting of the *S. officinarum* chromosomes during fertilization in the zygote, thus providing  $(2 \times 40) + 56 = 136$  chromosomes.

Promotor: Prof. Dr J. A. Honing

Author

5. C. L. VAN DOORN *De credietbehoefte van den Indonesischen landbouwer / Credit requirements of the Indonesian farmer.* 1922, pp. 124.

The mutual relation was studied of the communal credit system and Indonesian society. The penetration of world trade in Indonesian farming at the end of the 19th and beginning of the 20th century was influenced by population increase, demand for previously unknown products and taxation. The necessary money was obtained by growing commercial crops and by working on European plantations.

Various forms of credit before the development of trade and ways of preventing profiteering from money-lending were discussed. The Indonesian credit system was said to have derived largely from a changed conception about this society rather than from needs originating through a deep change in Indonesian society. Reasons were set out why co-operative credit had developed less adequately in many parts of Java than in India. The relationships determining the manner in which agricultural work was carried out were discussed. It was demonstrated how the granting of credit through the communal credit system could influence the establishment of share-cropping and tenancy.

Credit for buying seed, breeding livestock, land improvement and for buying land were considered. Credit for buying land would not lead to an intensifying of agriculture such as would occur in Europe.

Promotor: Prof. Dr J. C. Kielstra

Go.

6. J. G. B. BEUMÉE *Floristisch-analytische onderzoeken van de korte flora in kunstmatig aangelegde djati-plantsoenen op Java, in verband met de ontwikkeling van den djati-opstand / Floristic analytical studies of the short flora in artificial teak plantations in Java, in relation to the development of the teak stand.* 1922, pp. 10 + 166. Du. summ.

Floristic analysis of regular and closed plantations of teak in Java showed a soil vegetation mainly of woody species. The rest was chiefly annuals. The short flora consisted of only a few species, never or only rarely seen outside the teak forest. Also recently introduced plants occurred and sometimes formed an important constituent. The regularity of the vegetation within each separate experimental plot and the decrease in the chance of development of introduced seeds in a closed soil vegetation made possible the occurrence of growth indicators for teak. These indicators seemed to be few. Climbing plants were limited chiefly by humidity. The large and woody species needed also certain physical soil conditions, and so, like the ferns, occur only in the better teak stands. The *Amomum* species depended on a favourable top soil and were restricted to soils allowing rapid and large growth of teak. In one region *Gastrochilus* (*Zingibera-*

*ceae*) occurred only in the better teak forests. *Ophioglossum reticulatum* indicated poor soil.

Promotor: Prof. Dr J. Valckenier Suringar

E.

7. J. HOOGLAND Landbouwcoöperatie, in het bijzonder coöperatieve aankoop van landbouwbenodigdheden in Nederland / *Agricultural co-operation, especially co-operative buying of agricultural supplies in the Netherlands*. 1923, pp. 8 + 150.

The agricultural co-operatives in the Netherlands have always had difficult problems. It often happened that the co-operatives were beneficial to farmers, because the prices of the products sold were higher and of the products bought lower.

The agricultural co-operatives are non-profit-making organizations. The author stressed the point that there could also be serious disadvantages to this status. Other firms and corporations were more aggressive, and were more oriented to technical progress and the introduction of new products.

It was found that the supply co-operative in particular had to concentrate on the buying of products; it seemed to be possible to combine this business with banking, but not with the selling of products.

Promotor: Prof. Dr W. C. Mees R.Azn  
(After the death of Prof. Ir S. Koenen)

Koo.

8. R. WIND Het looistofvraagstuk in Nederlandsch-Indië / *Problems with tanning substances in the Netherlands East Indies*. 1924, pp. 12 + 301.

To improve the East Indian leather industry a search was made for tan barks and other tanning products, and their suitability and productivity per ha were assessed. At first (1917–1924) the study concentrated on tanning products already locally used, including those from mangrove forest, but considered also some promising local and exotic (some well known) products. For all species considered botanical data, geographic distribution and, where possible, information on bark production and quality, and on culture of the trees were discussed.

Other topics were trade in leather and tanning substances in the Netherlands East Indies, trade in mangrove bark and catch and tanned hides in the Malayan Straits Settlements, leather dressing and working in the Netherlands East Indies, research on tanning substances, experiments on practical tanning and on methods of collecting bark. Finally followed the main conclusions for supply of

tanning substances for the home industry. An appendix included a key to the tree species of mangrove forest.

Promotor: Prof. A. te Wechel

E.

9. J. C. DORST Knopmutatie bij den aardappel en hare betekenis voor den landbouw / *Bud mutations in the potato and their agricultural significance*. 1924, pp. 12 + 118. Du. summ. Also published in *Genetica* 6 (1924)1-123.

Gradual deterioration during vegetative propagation had never been demonstrated in the potato but sudden changes which remain constant had repeatedly been described. However, erroneous conclusions might result from admixtures, modifications and diseases. A collection of bud mutations, mainly from the varieties Eigenheimer (18 items), and Roode Star (12 items), contained several morphological types as well as colour.

Experimental proof of bud mutations was by separate propagation from different sectors of chimeric plants. Thus, with blue/yellow chimeric tubers of Eigenheimer, eyes from the blue and yellow sectors gave plants with blue and yellow tubers, respectively. Similarly, tubers from normal and raspberry-leaf stems gave normal and raspberry-leaf plants, respectively. In total 7 bud mutations were studied in this way. Some of the bud mutations reverted.

No definite conclusions could be reached about the origin of bud mutations. Where the character was not transmitted through potato seeds, it was tentatively suggested that the subepidermal layer did not contain the mutation. Induction of adventitious buds in different layers may lead to a better understanding.

The importance was emphasized of clonal selection to remove bud mutations to maintain uniformity, and to propagate and test types of possible agricultural value.

Promotor: Prof. Dr J. A. Honing

v. d. V.

10. H. LOOS Bijdrage tot de kennis van eenige bodemsoorten van Java en Sumatra / *A study of some soil types in Java and Sumatra*. 1924, pp. 8 + 216.

The study was of the mineral composition of soil samples of six rather heavy-textured soils from the lowlands of Java (five soils) and Southern Sumatra (one soil). These soils were cultivated and mainly used for growing rice and sugarcane. Of most soils three samples were studied (upper, middle and lower layer).

Methods of the determination of the mechanical composition, the water capacity, the hygroscopy and especially the mineral composition were described. Methods were mainly optical.

A detailed description was made of all minerals observed. These descriptions could be compared with the description of the properties of the minerals in the

samples, which properties are given in the appendix.

No conclusions were drawn on the origin, weathering and agricultural evaluation, because information was not sufficient to allow such conclusions. Many micrographs show the various minerals.

Promotor: Prof. J. van Baren

Bu.

11. W. DE MOL De reductiedeeling bij eenige *Triticum*-soorten / *The reduction division in some species of Triticum*. 1924, pp. 10 + 48. Du. summ. Also published in *Genetica* 6 (1924)289-336.

Reduction division and haploid chromosome number of several species and varieties of *Triticum* were studied in haematoxylin-stained microtome sections (16-18  $\mu$ ) after Bouin Allen fixation. Five stages of nuclear contraction ('ball') could usually be distinguished: preleptotene, prezygotene, postzygotene, postdiakinesis, postinterkinesis. Pachytene was not clear. A multipolar spindle frequently preceded the normal bipolar one in first prometaphase.

*T. monococcum* and *T. dicoccoides* (one variety each) had 7 chromosomes; *T. dicoccum*, *T. turgidum*, *T. durum*, *T. polonicum* (one variety each) 14; *T. vulgare* (eight varieties), *T. compactum* (two varieties), *T. spelta* (one variety) 21. These observations confirm those of Sakamura and of Sax except for *T. dicoccoides* where Sax found  $n = 14$ . The frequent reports of  $n = 8$  must be rejected. Taxonomic classifications from chromosome number agree with those from morphology, sexual affinity, serological and Vavilov methods, except for *T. dicoccoides*.

Relations between species, and origin were discussed on basis of published information and the present results. Hybridization (e.g. with *Aegilops*) was considered improbable because of hybrid sterility, but polyploidy must have been an important factor.

Promotor: Prof. Dr J. A. Honing

Sy.

12. J. G. J. A. MAAS Het tapsysteem bij *Hevea brasiliensis* op experimenteel grondslag / *The tapping system in Hevea brasiliensis on experimental basis*. 1924, pp. 12 + 202.

The history of the rubber culture and the historical development of tapping systems in South America and Asia were discussed. The tapping systems were then analysed for many factors: the influence of number, length, direction, inclination, depth, height from the ground and consecutive position of tapping faces on the latex production. Also the influence of cutting hour, cutting frequency and rest periods was studied. The influence of the amount of bark cut on yield and the influence of the age of the bark on the regeneration process were considered. The influence of external factors on diameter and number of latex



vessels in the bark was also studied.

The choice of a tapping system was considered from an economic aspect. An analysis was made of cost price and tapping labour. Suggestions were advanced to change the tapping system on the ground of this labour analysis.

At that time the trend of development of the tapping systems was still towards less damage to bark. Economic considerations had little influence on the choice of tapping system. But sometimes less frequent cutting was more profitable, even more so on occasion by larger cuts.

Promotor: Prof. Dr W. K. J. Roepke

E.

13. S. J. WELLENSIEK Een onderzoek naar de factoren, die ontijdige knolvorming bij vroege aardappels bepalen / *A study on factors determining premature formation of tubers in early potatoes*. 1924, pp. 58.

Premature formation of tubers ('submarines') is a disturbance in the normal growth of a planted seed potato, resulting in the formation of some small daughter tubers without any aerial growth. In certain years losses may be heavy. The main cause is the formation of sprouts during storage which have to be removed. All factors preventing or reducing such sprout formation favour normal development: especially low temperature (above freezing-point) and light during storage, also late lifting of the seed tubers, large tubers, planting at higher temperature and in moist soil.

The underlying process of premature tuber formation was assumed to be loss of water by removal of sprouts during storage, resulting in an increase in the concentration of solutes. Essentially the same occurs with normal tuber formation but there by an increase in assimilates. This concept was supported by plasmolysis studies in the hairs of the sprouts.

Promotor: Prof. Dr H. M. Quanjer

Author

14. P. VAN DER GOOT Onderzoekingen over levenswijze en bestrijding van den witten rijstboorder op Java / *Research on the biology and control of the White Rice Borer on Java*. 1925, pp. 16 + 278.

For practical control, a study was made of *Scirpophaga innotata* Wlk., a noxious rice stalk borer in certain regions of Java.

Caterpillars normally developed and pupated in stalks that had not reached the stage of ear formation. In paddy from before flowering, however, caterpillars entered into a resting stage (diapause), induced by food rich in carbohydrates and proteins.

After harvest diapausing caterpillars remained in the stubble. Further development started after at least 3 months diapause and the stubble and the soil were wetted. This was usually with the first heavy rainfall in the west monsoon. The

longer the diapause the sooner moths appeared; with a 3 months' diapause moths emerged 80 days after rainfall began, with a 6 months' diapause after a mean of 33 days.

The cultural practice of timed rice sowing was introduced. Sowing started not earlier than one month after the first rains had fallen. Thus infestation of the young fields was prevented for the greater part.

Promotor: Prof. Dr W. K. J. Roepke

v. Di.

15. G. MINDERHOUD *Ontwikkeling en betekenis der landbouwindustrie in Groningen / Development and significance of agricultural industry in Groningen.* 1925, pp. 12 + 286. Du. summ.

Important products of agriculture in the province of Groningen were marketed for industrial processing. The chief products involved were potatoes, straw, sugar-beet and milk. Potato meal and straw board had already become important industries in the previous century. Reasons why, and the way in which, agricultural co-operatives took control of most of this industry and further extended it were examined and described. Financial advantages for members of the co-operatives were shown.

Because of some failures in this development, the conditions which must be fulfilled for a successful co-operative factory were analysed. This concerned chiefly the statutes governing the society: the acquirement of capital, the right and the duty to supply raw material, entry and resignation of members, depreciation and the setting aside of reserves, responsibility of members for debts of the society, the management board of the factory and the influence of the members' meeting.

Principles governing potato-meal and straw-board factories applied also to beet-processing and dairy factories. The significance of the different industries for the welfare of the province were sketched.

Promotor: Prof. Dr W. C. Mees R. Azn

Author

16. G. H. VAN DER KOLFF *Bevolkingsrietcultuur in Nederlandsch-Indië; een landbouweconomische studie / Native culture of sugar-cane in the Netherlands East Indies; an agricultural economic study.* 1925, pp. 12 + 288.

The origin and history of sugar-cane in the Dutch East Indies were described and consecutive phases of development of Indonesian agriculture were suggested. Cultivation and processing of native sugar-cane in the 1920' and some data on trade in sugar lumps were examined.

The importance of native sugar-cane as a cash crop was stressed and needed encouragement rather than discouragement. There was some conflict between the native sugar industry in its infancy, still modest in size and technique, and

the economically powerful Dutch sugar concerns with their elaborate plantations and factories. In close agreement with the Western sugar interests the Government policy favoured the status quo, both thwarting the extension of native enterprise and preventing any form of co-operation. The thesis condemned this policy and saw the common interest as the only safe solution in the future. A gradual transition was needed to a system where the local cane-growers could supply the large factories with cane for refining.

Promotor: Prof. Dr J. C. Kielstra

Author

17. D. TOLLENAAR Omzettingen van koolhydraten in het blad van *Nicotiana tabacum* L. / *Conversions of carbohydrates in the leaf of Nicotiana tabacum L.* 1925, pp. 6 + 142. Ger. summ.

*Nicotiana tabacum* L. was chosen as an experimental plant for several practical reasons. The plants were grown in large pots in a glasshouse at 22°C and great humidity in February-March and September-October until 4 normal leaves were present. Each day at 16.00 h the plants were brought into darkness at 28°C which made them completely free of starch at 10.00 h next morning. At this moment assimilation and other experiments were started.

These experiments studied: formation of starch by assimilation at 28°C; formation of starch from sugar solutions at 28°C or at 1.5°C; the significance of carbohydrates for transport of substances in the leaf; the conversion of starch at different temperatures; the accelerated starch breakdown with drying and other related phenomena; the small starch conversion in tobacco with leaf mosaic and in other virus-diseased plants; the changes occurring with drying and fermentation, particularly in carbohydrate content.

To kill the enzymes before drying, the plucked leaves after weighing were first treated with boiling ethanol. The further treatment of the leaf extract and the methods of estimating sugars and starch were extensively described. The results of the analyses were thoroughly considered.

Promotor: Prof. Dr J. H. Abersson

E.

18. J. DE HOOGH Bijdrage tot de kennis van den groei van *Pseudotsuga taxifolia* Britton in Nederland in verband met zijn beteekenis voor den Nederlandschen boschbouw / *Growth of Pseudotsuga taxifolia Britton in the Netherlands, in connection with its significance for Dutch silviculture.* 1925, pp. 118.

Development of the green Douglas fir in the Netherlands in different places with different methods of planting was studied by enquiry, personal research and from the literature. The climate and soil types seemed suitable. Game, insects and fungi caused little damage. The stands studied all derived from seed from north-west America but the exact origin was never known. This could ex-

plain differences in development and frost resistance. Planting of experimental forests was therefore advised with seed from different latitudes and heights above sea-level.

Even on poorer soils the yield was much higher than the best stands of Scots pine, sometimes more than double. Wood production declined over 30 years much more than in Germany through lack of thinnings by too wide a spacing.

Further advantages over Scots pine were better decomposition of needles, straighter stems, harder wood as measured by resistance to crushing through a higher porportion of summer wood and early formation of heart wood. A disadvantage was the severe self-pruning. Experience on planting and culture were discussed. Growth in length was strongly influenced by rainfall in the same year.

Promotor: Prof. S. P. Ham

E.

19. R. WIND HZN Onderzoek naar de vooruitzichten van de houtverkolings-industrie in Nederlandsch-Indië / *Studies on the outlook for the charcoal industry in the Netherlands East Indies*. 1925, pp. 12 + 211.

Despite the increase in substitutes for wood the world consumption of wood had increased. The principal timber-producing countries could not raise their production so that tropical forests would have to supply more of the world's timber. Tropical exploitation of timber however involved many difficulties and the supply may be more suitable for pulping or processing into wood cellulose, acetic acid, methanol, tar and charcoal.

The charcoal industry in the Netherlands East Indies would be most successful if there was a ready market for the charcoal, as for tin-smelting or blast furnaces. The sale of other products such as acetic acid for coagulation of latex could help to promote the industry. Decline of the United States charcoal industry by competition with synthetic methanol might improve the market in countries where methanol was not a principal product. In the Netherlands East Indies the sale of acetic acid, wood tar and charcoal seemed secure for the charcoal industry and perhaps there was scope for export.

Promotor: Prof. A. te Wechel

E.

20. W. H. DE JONG Een studie over emelten en hare bestrijding / *A study on leather-jackets and their control*. 1925, pp. 6 + 130.

After a survey of the literature since 1602 on leather-jackets in agriculture, systematic and biological features are discussed of species important for the Netherlands. Next follow questions of more direct agricultural importance. The excreta and the intestinal content could not derive much from humic sand, as microscopical scrutiny showed little silica in the gut. Leather-jackets would

only eat humic sand if food was scarce. Living or dead plant material was their food. Although attacking many plants, they sometimes showed preference, as for white clover over grass. The author observed more injuries on stalks and leaves above or just under the soil surface than on roots.

The larvae attacked practically all Gramineae, many field and garden crops (incl. flowers) and sometimes seedling trees. The adult crane-fly however preferred grass and clover land, and there laid its eggs, so that meadows were most attacked. The larvae were hardly harmful during their first instars, considerably harmful in the 3rd instar, and most in the 4th (usually in spring). The larvae of *Tipula maculata*, *T. vernalis* and of the *T. oleracea*-group pupated by the beginning of May but those of *T. paludosa* still fed in May, June or even in July. Feeding stopped 8 to 14 days before pupation. The intestinal canal then largely emptied. After a discussion of influences on the numbers of leather-jackets, control measures are critically reviewed.

Promotor: Prof. Dr W. K. J. Roepke

E.

21. J. R. BEVERSLUIS De micrografische identificatie van hout / *The micrographic identification of timber*. 1925, pp. 8 + 132. Eng. summ. p. 67. (Scheme and directions for use also published in English).

The timber of dicotyledonous trees could not be classified on microscopic features in harmony with taxonomic practice because botanical systems were still faulty and not generally recognized, and because microscopic descriptions of timber were not uniform enough for compilation. To find whether timber features could be conformed with a botanic taxonomy, a scheme was drafted for the description of secondary wood of dicotyledonous trees based on definite, uniform and comparable characteristics.

On this basis short descriptions were compiled of the timber of 93 species and a table was composed of species identical in microscopic structure. The 24 most important characteristics of the 42 families represented were described. Families and species were indexed.

Promotor: Prof. A. te Wechel

E.

22. F. KRAMER Onderzoek naar de natuurlijke verjonging en den uitkap in Preanger gebergtebosch / *Research on natural regeneration and selective cutting in mountain forests of the Preanger, Java*. 1926, pp. 8 + 182. Du. a. Ger. summ.

To study whether a regular satisfactory wood production could be achieved in the mountain reserve forests of Java, a study was made of natural regeneration and choice of method of selective felling on 3800 ha of the Goenoeng Gedeh complex. In 2 nearby forest areas (34 plots of 110.8 ha in total) and in another

area (6 plots of 16.5 ha in total; parallel experiment) comparisons were made of methods of selective felling, to promote the best of the 200 timber species. At first trees for felling were selected by diameter, in later years primarily to obtain open places for regeneration. No more than 10% should be cut, in view also of the cutting damage. The regeneration was periodically counted in 263 and 26 squares of 1 are, respectively.

In the native forest, regeneration was usually inadequate except sometimes in large clearings. Clearings of less than 10 are, especially those of 1 are often regenerated well with a mixed stand. Larger clearings of 0.1–0.3 ha did not always regenerate well because of competition from weeds. An interval of 10 years between the selective cuttings was advised. The duration of the regeneration was estimated to be 50 years.

Promotor: Prof. S. P. Ham

E.

23. A. GRIJNS Waarnemingen omtrent den bacteriophage by *Bac. danicus* en *B. radicolica* / *Observations on bacteriophages of Bacillus danicus and Bacterium radicolica*. 1926, pp. 104 + 3.

Bacteriophages of *Bacillus danicus* and *Bacterium radicolica* were isolated from soil and root nodules. An extensive study was made on the effect of heat in the inactivation of bacteriophage of *B. danicus*. A chemical analysis of these cultures of *B. danicus* with or without bacteriophages showed a strong increase of amino and protein N in the supernatant of lysed cultures.

Experiments with aseptically-grown clover plants proved that bacteriophages for *B. radicolica* were absent from the plant. Nodulation of the plant by *B. radicolica* was not reduced in the presence of bacteriophages.

Promotor: Prof. Dr Ir N. L. Söhngen

Li.

24. J. T. P. BIJHOUWER Geobotanische studie van de Berger duinen / *Geobotanical studies of the dunes near Bergen, Netherlands*. 1926, pp. 204, Du., Eng. a. Ger. summ.

The area studied was between Egmond and Schoorl (12 km<sup>2</sup>; 6 km long). Plant associations were described by estimate and by combining the map-square method of Clements and the method of Raunkiaer. The dune area was divided into 7 parts, different in vegetation. Towards the south the density of the vegetation and the number of species increased. In each part 7 or 8 plant associations could be distinguished with different watertables. Plant species of only local occurrence were grouped into: A. Northern plants; B. Plants very near the sea; C. Plants of waste places (such as verges); D. Southern plants. The A and D species were calcifuges and calciphils, respectively. The B species were true halophytes, the C and some of the D species were nitrophils.

Lime status and pH of soil were closely correlated. The dunes of Bergen were the most acid ones of the Netherlands and differ from the old inner dunes. The lack of some plants and animals on the Friesian islands suggests the former existence of a large post-glacial river between Egmond and Texel. So the dune sands of Bergen are fluvial.

Promotor: Prof. Dr J. Jeswiet

E.

25. A. THORENAAR Onderzoek naar bruikbare kenmerken ter identificatie van boomen naar hun bast / *A study of bast features suitable for identification of trees*. 1926, pp. 8 + 208. Du. summ. 60 Photographs of transverse sections bound separately.

To facilitate further discussions and to inform tropical forestry experts, the formation and anatomy of bark were reviewed in association with its terminology. Sections deal with: secondary phloem; dilation and sclerosis; their influence on primary bark parts and on secondary phloem; interxylary phloem; pith ducts; periderm; lenticels and dead outer bark. Next follows an analysis of what could usually be seen of the anatomy of the bark and the crust with a  $\times 10$  lens and with the naked eye. The features noticed were then evaluated as distinctions for bark species. Information was given on odour and taste.

Then follow descriptions of 60 investigated barks of the Indonesian Archipelago, analysed by these means. A  $\times 10$  lens proved sufficient for identification.

The sequence of bark features from common to special features was shown to be usually: cork layer, stone cells, fibres, soft bark parts, secretory organs, bark rays, while the primary bark parts, often having disappeared, could only serve as distinguishing features for a limited number of barks.

If the number of bark parts considered were to be further enlarged the use of a  $\times 20$  lens might become necessary.

Promotor: Prof. Dr E. Reinders

E.

26. J. TH. WHITE Een onderzoek naar fijnheid en verdeeling van het phosphorzuur en zijn opneembaarheid in de mergelgronden van Java / *A study on fineness, distribution and availability of phosphoric acid in the marginalitic soils of Java*. 1926, pp. 12 + 144. Also published in Meded. Algemeen Proefstat. Landbouw 23 (1926).

In 1907 it had been established by Marr and Geerts, that marginalitic soils with a content of less than 0.03%  $P_2O_5$  soluble in cold 25% HCl or 0.01% soluble in 2% citric acid were P deficient. An attempt was therefore made to explain why some soils with P well above this limit responded to superphosphate.

Assuming that the availability of  $\text{Ca}_3(\text{PO}_4)_2$  depended on its specific surface area, fractions by size were isolated from the soils by Mohr's method of mechanical analysis, and P was estimated in the fractions. P content of the sand fraction was high and decreased with decreasing particle size to a value below the established limits. This contrasted with the rule for soils in temperate climates. Neubauer tests showed that P in the clay fractions was 100% available, but that of the silt and sand fractions only for 30%. The distribution of P over the size fractions was especially unfavourable for the margalites rich in P and explained their favourable reaction to P fertilizer.

Promotor: Prof. Dr J H. Aberson

Ko.

27. W. H. C. KNAPP Botercontrole in Nederland. De geschiedenis van de Nederlandsche botercontrole in verband met de boterwetgeving en -handel / *Butter quality inspection in the Netherlands. The history of inspection of butter quality in the Netherlands for butter legislation and trade.* 1927, pp. 16 + 552.

A short history of dairy farming and of butter production and trade in the Netherlands was given with fuller description of the then recent development of the butter and margarine industry and commerce. Special emphasis was laid on the adulteration of butter. The system of butter quality inspection, as it evolved in the course of time, was extensively described and discussed. Scientific, technical, administrative and economic aspects were considered, and the relative merits of different inspection systems were outlined. Finally, recommendations for future control were given and elucidated. The existing system of private inspection stations set up by the dairy industry, under statutory regulations and government supervision, was generally considered preferable.

Promotor: Prof. Ir B. van der Burg

W.

28. H. R. A. MULLER Onderzoekingen over *Colletotrichum Lindemuthianum* (Sacc. et Magn.) Bri. et Cav. en *Gloeosporium fructigenum* Berk. forma *Hollandica nova forma* / *Studies on Colletotrichum lindemuthianum* (Sacc. & Magn.) Bri. & Cav. and *Gloeosporium fructigenum* Berk. f. *hollandica nova* f. 1927, pp. 12 + 93. Eng. summ. Also published in Meded. LH 30 (1926) 1.

From diseased pods of *Phaseolus vulgaris*, 4 strains were isolated of *Colletotrichum lindemuthianum*: Z I and Z II from Zeeland; E from Enkhuizen; W from Westland. The strains differed from the American strains  $\alpha$ ,  $\beta$  and  $\gamma$ . Tests on bean varieties used by Leach suggested that Z strains were related to form VIII of Leach and strains E and W were identical with forms IV and V. The Dutch strains differed in both severity and manner of attack on test varieties of bean, and in lethal and optimum temperatures. The fungus overwintered in the soil and could survive severe cold,  $-15^\circ$  or  $-20^\circ\text{C}$ , for 10 days. Especially in



light, cultures at least 2.5 months old produced perithecium-like bodies containing structures resembling asci.

From diseased pods of *P. multiflorus* growing under apple-trees, a strain (K) was isolated and identified as *Gloeosporium fructigenum* because it attacked apples but was only mildly pathogenic on a few varieties of *P. vulgaris*. It was named *f. hollandica* because it was distinct from the forms *germanica* and *americana*. Passage of K through apple or tomato increased its virulence to them, while passage through *P. vulgaris* decreased virulence to fruit and increased that to bean. After adaptation to apple, properties of strain K on tomato was the same as *C. lindemuthianum*.

Promotor: Prof. Dr H. M. Quanjer

Ri.

29. C. COSTER Zur Anatomie und Physiologie der Zuwachszonen- und Jahresringbildung in den Tropen / *The anatomy and physiology of growth zones and annual rings in the tropics*. 1927, pp. 12 + 226. Ger. summ.

Distinct zones of growth were usually only found in tropical deciduous trees with a periodically resting cambium. Reversedly a periodically resting cambium proved not to produce always distinct zones. All possible combinations of cambial activity and the formation of zones were shown to occur in the tropics. The zones could be distinguished in cross-sections by a) radial compression of the fibres formed before the new burst of cambial activity, b) a thin circular layer of parenchyma, c) a thin layer of libriform fibres, d) alternating widths of layers of libriform fibres and parenchyma, e) layers alternating in vessel diameter or arrangement. Most species formed either marked zones in east and west Java or less marked or irregular zones in the more even climate of west Java. Only a few species formed no growth zones at all in the more even climate.

Young trees often did not form growth zones or only temporary ones, so that the zones were not a direct indication of age. Imported evergreen trees (except leafy trees with individually flushing branches) from cooler climates had no zones or vague ones. Renewed growth in leafy trees was always induced by substances or stimuli conducted from the sprouting leaf buds (and later from leaves) or from flowers (in leafless trees).

Promotor: Prof. Dr E. Reinders

E.

30. P. C. LABOUCHÈRE De geschiedenis van het Belgische trekpaard en de invloed van Indigène du Fosteau op de Nederlandsche trekpaardfokkerij / *The history of the Belgian horse and the influence of Indigène du Fosteau on the Dutch Draft horse breeding*. 1927, pp. 238. Du. summ. p. 127.

The evolution of the horse in America and Europe was discussed, and the author's ideas on the origin of the present draught horses in Holland and Bel-

gium were presented on the basis of measurements by him and others on excavated skulls. In the older layers of the mounds ('terpen') in Friesland horse skulls were of the slender Oriental type, probably akin to *Equus Przewalski*, introduced by the northern streams of the Celts, and probably identical with the Helvetian-Gallic horse. In more recent layers remains were of the heavier *Eq. robustus*, probably introduced by the Teutons during the tribal migrations. Finds from still more recent layers indicate that these two types were crossed, probably giving rise also to the Friesian horse.

In Belgium the two types seemed to have occurred also first separately. There they became mixed before the Christian era. During the great tribal migrations the Teutons again introduced an *Eq. robustus*-type to Belgium causing new mixing, but possibly less in the Ardennes. This could explain the more slender Ardennes horse and the heavier Brabançons, which were spreading further in Belgium.

Dutch Draft horse breeding was much improved by the large quantity of first-class breeding material, transferred for safety from Belgium during the First World War. The blood line of Indigène du Fosteau had played a very important role.

Promotor: Prof. Dr D. L. Bakker

E.

31. W. J. DROESEN De gemeentegronden in Noord-Brabant en Limburg en hunne ontginning. Eene geschied- en landhuishoudkundige studie / *The landed property of municipalities in North Brabant and Limburg and their reclamation. A historical and agricultural economic study.* 1927, pp. 222.

In olden times the diluvial sands of the southern Netherlands around the village nucleus formed widespread heaths, fens and bogs. On them the farmers had rights of grazing, and of digging peat and turf. In Saxon areas in the eastern Netherlands these lands became common property (marches or commons, Du. marken), while in the south, under the influence of French law, the land became municipal property.

Over the centuries they were reclaimed on a small scale; new settlements and villages grew up.

From the beginning of the 19th century the government encouraged reclamation and many thousands of hectares were sold, chiefly for forestation.

In 1856, North Brabant had about 100,000 ha and Limburg about half as much municipal waste land; figures in 1923 were 33,000 and 12,000 ha.

Artificial manures, credit (Raiffeisenbanks) and education allowed the establishment of farms on sands at the end of the 19th century. The farmers bought or rented areas of waste to enlarge their farms or to establish entirely new farms. This was later encouraged by cheap credit from the government and through reclamation by the unemployed. Large-scale reclaimers preferred areas of marsh and fen.

The advantages and disadvantages of these forms of reclamation, and of sale or renting out by the municipality were considered.

Promotor: Prof. Dr W. C. Mees R. Azn

Author

32. W. S. SMITH Een onderzoek naar het voorkomen en de oorzaken van de verschijnselen, welke worden aangeduid met den naam 'ontginningsziekte' / *Study on the occurrence and the causes of the phenomena termed 'reclamation disease'*. 1927, pp. 14 + 150. Ger. summ.

11 apparently diseased soils gave the same general symptoms of 'reclamation disease' with oats and peas in pot experiments. The number of microbes was smaller and the proportion fungi/microbes was always larger in diseased soils than in similar normal soils. As soil sterilisation brought no cure, the disease could not be ascribed to microbes. The widespread opinion that the disease occurred on a certain black peat (Du. Gliede) was confirmed by pot experiments, also if Gliede was mixed with sand.

Two groups of organic substances could be separated by hot ethanolic extraction, one coming out of solution after cooling, the other remaining in solution. From the solution a crystalline substance could be obtained, afterwards called 'Gliedine', causing disease symptoms after application to peas and oats. At minute concentrations it stimulated growth of oats. The residue caused grey speck disease in oats.

Fertilizer trials with differently diseased soils showed that only compost or  $\text{CuSO}_4$  could restore the soil (also in the 2nd year).

As 'Gliedine' slowly evaporated at  $100^\circ\text{C}$ , diseased soils were heated 3 h per day for 3 days, resulting in restoration of slightly diseased soils, almost cure of moderately diseased soils, and delay of disease symptoms on very diseased soils.

The curing effect of  $\text{CuSO}_4$  must very probably be ascribed to the formation of an insoluble compound with 'Gliedine'.

Promotor: Prof. Dr J. H. Aberson

E.

33. W. BEIJERINCK Over verspreiding en periodiciteit van de zoetwaterwieren in Drentsche heideplassen (Bijdrage voor het samenstellen eener Nederlandsche wierenflora) / *On the distribution, the periodical occurrence and fructification of freshwater-algae in the moor pools of Drente, Holland. Contribution to the compilation of a flora of Dutch algae*. 1927, pp. 6 + 212. Eng. summ.

The pools were all situated in the diluvium of the Dutch northern province of Drente. From the macroflora 3 main types of pools were distinguished which paralleled 3 clearly distinguishable associations of the algal flora. Several algae may serve as type species. In plankton collected and isolated by centrifuging from open water, Flagellatae usually predominated, *Desmidiaceae* were few and

*Bacillariaceae* and *Cyanophyceae* were almost absent. *Protococcaceae* and *Desmidiaceae* may temporarily predominate in the plankton of some pools.

The periodic fluctuation of the whole algal vegetation (comprising plankton and benthos) was traced in six places, of which two dried up sometimes in the summer of 1925. The association of algae in a pool fluctuated over the year. Seasonal development was parallel in the different pools for only a few of the species. Heat and light were important factors for the development of the algae. Which of them was decisive in a particular case was difficult to establish. Their influence on reproduction could not be explained.

Promotor: Prof. Dr A. H. Blaauw

E.

34. C. J. H. FRANSSEN *Aphis fabae* Scop. en aanverwante soorten in Nederland / *Aphis fabae* Scop. and related species in the Netherlands. 1927, pp. 12 + 90. Du. summ. Also published in *Tijdschr. Plantenziekten* 33 (1927) 193–282.

The black beanfly was known as *Aphis rumicus* L. until the studies of Börner and Janisch began in 1915. They distinguished 9 spp. with little morphological difference but with great biological differences. The group were of great economic importance because of direct damage through sucking and because of indirect damage by virus transfer.

A new method was used for rapid preparation of microscopic slides. The studies confirmed the observations of Börner and Janisch. The group was enlarged to 11 spp. The spp. differed in hair pattern and length, proportional length of antennal segments, distribution of lateral tubercles and of secondary rhinaria, habit of the hind tibia of oviparous types and winged or wingless habit of the male. Attempts at infestation with pure colonies showed great differences in host range. The most important sp. was *A. faba* Scop., which overwintered on *Euonymus* spp., especially *E. europeus* L., and also on *Deutzia crenata* Sieb. & Zucc., *Philadelphus coronarius* L. and *Viburnum opulus* L. In spring the blackfly migrated to such plants as broad, French or dwarf bean and beet. Other species were *A. cardui* L., *A. viburni* Scop. (em. CB), *A. ilicis* Kalt., *A. rumicis* L. (em. CB), *A. hederæ* Kalt. (em. v. d. Goot & Franssen), *A. euonymi* Fabr. (em. CB), *A. mordwilkoï* B. & J., *A. philadelphi* CB, *A. podagrariae* Schrank and *A. börneri* Franssen.

Promotor: Prof. Dr W. K. J. Roepke

Author

35. D. L. ELZE De verspreiding van virusziekten van de aardappel (*Solanum tuberosum* L.) door insecten / *Transmission experiments with insects of virus diseases of the potato* (*Solanum tuberosum* L.). 1927, pp. 8 + 88, Du. a. Eng. summ.

The object was to study the relation between virus and the transmitting insect, especially the aphids *Myzus persicae* Sulz., *Myzus pseudosolani* Theob., *Macrosiphum solanifolii* Ashm., *Aphis rhamni* Fonsc. and *Aphis fabae* Scop. The diseases studied were leafroll, common mosaic (virus A), crinkle (virus Y), stipple streak (virus Y<sup>e</sup>), interveinal mosaic (virus X), aucuba mosaic (virus F) and spindling sprout.

The aphids transmitted these viruses, except aucuba mosaic virus. *M. persicae* was the best transmitter.

The development stage of the aphid was of no influence.

A specific relation between *M. persicae* and leafroll virus was found. Only after incubation of the virus in the insect for 24–48 h was the aphid able to transmit leafroll virus. After living 10 days on a resistant plant the aphid was still able to infect the potato plant but the virus could not be transmitted from mother insect to offspring.

When the virus-bearing aphid cast its skin the leafroll virus was not lost.

The virus was transmitted downwards to the tubers in about 4 weeks.

The susceptibility of young plants was very high, in contrast to older plants (old-age resistance).

Promotor: Prof. Dr H. M. Quanjer

Roz.

36. J. H. F. DECKERS De waterstaatstoestanden in Noord-Brabant binnen het stroomgebied der Maas – voorheen en thans – uit een economisch en landbouwkundig oogpunt beschouwd / *Water management in North Brabant, within the Maas watershed, then and now, as an economic and agricultural problem.* 1927, pp. 8 + 260.

The region concerned, reaching eastwards to the provincial boundary with Limburg, southwards to the Belgian frontier, westwards to a sand ridge through the city of Tilburg and northwards to the River Maas, covers 300,000 ha. It consists mainly of undulating sand soils. The general slope from south to north averages 60 cm per km. The whole region discharges into the Maas through natural streams. Most of this system, serving over 80% of the area, has a common outlet near Bois le Duc.

Since the early Middle Ages drainage deteriorated through a rise in the Maas river-bed, building of watermills along the streams, lack of upkeep of channels and intentional military interference with outflow, Bois le Duc derived its impregnability as a frontier fortress from nearly permanent inundations.

Impact on agricultural development was disastrous. The turning-point was reached in 1813 when the region achieved its present political status, though substantial improvements started only after the institution of river authorities around the 1860's. Discharge was still poor and agriculture was still suffering.

Promotors: Prof. Dr W. C. Mees R. Azn and Prof. Ir M. F. Visser

d.Z.

37. C. COOLHAAS Bijdrage tot de kennis der dissimilatie van vetzure zouten en koolhydraten door thermophile bacteriën / *The dissimilation of carbo-hydrates and salts of fatty acids by thermophilic bacteria*. 1927, pp. 10 + 144, Du. summ.

The dissimilation of calcium formate and acetate, cellulose, amylose and sugars was investigated at temperatures above 55°C. It was found that calcium formate and acetate were quantitatively fermented to CO<sub>2</sub> and CH<sub>4</sub> by thermophilic bacteria. All experiments were carried out with mixed cultures as it was impossible to obtain a pure culture of these bacteria. The thermophilic fermentation of cellulose, amylose and sugars yielded calcium formate and acetate, CO<sub>2</sub>, H<sub>2</sub> and sometimes CH<sub>4</sub>. A correlation between these two processes was, however, missing. Two isolated strains of the genus *Bacillus* were able to hydrolyze cellulose and amylose but no fermentation was observed. Another strain of *Bacillus* fermented amylose and sugars producing CO<sub>2</sub>, H<sub>2</sub>, and butyric, acetic and lactic acids. The thermophilic fermentation of plant residues leading to CO<sub>2</sub> and CH<sub>4</sub> was shown to proceed much more readily than the mesophilic process.

Promotor: Prof. Dr Ir N. L. Söhngen

D.

38. T. H. THUNG Physiologisch onderzoek met betrekking tot het virus der bladrolziekte van de aardappelplant / *Solanum tuberosum* L. *Physiological investigations in relation to the virus of the potato leafroll disease* 1928, pp. 2 + 74. Eng. summ. Also published in *Tijdschr. Plantenziekten* 34 (1928) 1-74.

Starch accumulation was an important characteristic of a large group of virus diseases to which the potato leafroll disease belonged. There were two different conceptions about the cause of this phenomenon: a disturbance of the enzymic processes, and a disturbance of transport. Thung investigated which of the two viewpoints was correct for potato leafroll. His conclusion was that enzymic processes were not influenced by the virus, but that phloem transport was disturbed.

The disturbance in the transport in primarily infected leaves was confined to the lower part of the petiole. This was not so with the secondarily infected leaves. Consideration of the following facts supported the hypothesis that phloem in the primarily diseased leaves underwent its first disturbance in the lower part of the petiole. The virus was transmitted to the leaves by aphids; the young developing shoots were primarily infected by taking nutrients from older ones. The virus entered the young leaf with the nutrients. Consequently the lower portion of the petioles was reached first by the virus and there the disturbing action of the virus started. In the secondarily diseased plants the ways of

transport were severely and uniformly diseased; transport took place in the same way as in healthy leaves but considerably slower.

Promotor: Prof. Dr H. M. Quanjer

M.

39. I. RIETSEMA Beschrijving en rangschikking van in Nederland voorkomende kersenvormen / *Description and classification of cherry types in the Netherlands*. 1928, pp. 242. Du. a. Eng. summ.

The history of the systematics of the subsection *Eucerasus* was reviewed. Since Linnaeus the number of species increased until Roemer, whose startling results caused a reaction. At that time botanists only recognized 3 or 4 species. Rietsema proposed only *Prunus avium* L. and *P. cerasus* L. as species. *P. fruticosa* Pall. was attached to *P. cerasus* as a dwarf variety. All sweet garden cherries were grouped with *P. avium* (Dutch: Kriek; also the crosses of 'Kriek' and sour cherry), all sour cherries (and hybrids), showing no *avium* or *mahaleb* characteristics, with *P. cerasus* (Dutch: Waal). An intermediate group (Duke; Dutch: Rojaal) was considered as *avium* × *cerasus* and sour cherry was considered as a *mahaleb* hybrid.

A morphological classification of all discussed cherries was made according to fruit and leaf. As a key leaf margins and stipules were important. Descriptions were given of 56 forms of garden and orchard cherries (37 indigenous, 19 exotic), the mazzard (wild 'Kriek'), the ground cherry (wild 'Waal') and of *P. mahaleb*, using about 66 characteristics of each form, to determine the species and the smallest systematic unit; forma was preferred to clone.

Promotor: Prof. Dr J. Jeswiet

E.

40. K. T. WIERINGA Quantitatieve permeabiliteitsbepalingen / *Quantitative estimation of permeability*. 1928, pp. 8 + 81. Also published in *Protoplasma* 8 (1930) 522-584.

Permeability of cell membranes of pressed baker's yeast was estimated by estimating the decline in concentration of the permeating substance. Therefore it was necessary to know the amount of water imbibed in the cell walls, the free water in the cells, and the imbibed water of the dispersed colloidal phase (protoplasm) in the cells.

With correction for the dispersed colloidal phase, the yeast cells behaved according to the law of Boyle Mariotte van 't Hoff. The uptake of substances by yeast cells was estimated chemically. Inorganic cations and anions were taken up according to lyotropic range,  $\text{Ca}^{2+} < \text{Mg}^{2+} < \text{Na}^+ < \text{K}^+ < \text{NH}_4^+$  and  $\text{SO}_4^{2-} < \text{Cl}^- < \text{NO}_3^-$ .

Uptake of organic acids depended closely on their degree of dissociation. Of the sugars tested lactose did not permeate, whereas glucose was rapidly ad-

sorbed by the cell surface. Some substances were adsorbed by the disperse phase ( $K^+$  and urea).

Promotor: Prof. Dr Ir N. L. Söhngen

Author

41. C. K. VAN DAALEN Bijdrage tot de kennis van de chemische en botanische samenstelling van het hooi en van den invloed, welke enkele meststoffen daarop uitoefenen / *Chemical and botanical composition of hay and the influence of some fertilizers on it*. 1928, pp. 10 + 188, Du. summ.

This study was concerned with the most important results of some fertilizer trials on grassland. It was established how the amount of hay gained from the trial fields was extremely divergent. The factors causing these differences and the influence of N, P and K on the chemical and botanical composition of the hay were examined. This was considered separately for each fertilizer. On the chemical composition, attention was especially to N, P, K, Ca and total ash. Part of the trial was on the influence of stage of cutting.

This trial has been of great importance in the further development of grassland research in the Netherlands.

Promotor: Prof. Dr J. H. Aberson

I.

42. F. H. ENDERT Geslachtstabellen voor Nederlandsch-Indische boomsoorten naar vegetatieve kenmerken, met een beschouwing over de practische en systematische waarde dezer kenmerken / *Keys for the identification of Netherlands East Indian trees after vegetative characteristics, with notes on the practical and systematic value of these characteristics*. 1928, pp. 10 + 242. Du. summ.

An attempt was made to provide an identification key, to trees of the former Netherlands East Indies, based solely on vegetative features. Most species flower or seed for limited periods. Only wild plants were included and only those reaching a diameter of 40 cm at chest height, a branchless trunk of at least 2 metres and a total height of 10 metres under favourable conditions. Species restricted to the East of the archipelago were omitted through lack of data.

Identification required only a  $\times 10$  magnifying glass and a sharp knife. The tables include 442 genera from 92 families. The families themselves were not distinguished, as the genus can more easily be defined; the species of one genus have more vegetative features in common than did a family. The features were selected so that the genera appear only in one or a few places in the key and that related genera or even families may be close together.

The tables are preceded by an annotated survey of the features used and some remarks on their systematic value.

Promotor: Prof. Dr J. Jeswiet

E.



43. H. M. J. HART Stamtal en dunning. Een oriënterend onderzoek naar de beste plantwijdte en dunningswijze voor den djati / *Stem number and thinning. A preliminary study on the best spacing and thinning method for teak forests.* 1928, pp. 14 + 220, Du. summ.

Thinning trees by form and defects (tree-class thinnings) and practical or free thinning (according to the surrounding trees) were unsuitable for comparing thinning methods by the subjectivity of the involved tree classification methods.

A thinning criterion based on 'top height' and 'stem number' proved objective. By assuming different ratios between crown diameter and height at a certain developmental stage of the trees, reduction in stem number could be obtained, related to the mean 'top height', which was height, measured and averaged on the 100 highest trees, uniformly distributed over 1 ha. Assuming different ratios gave different stem number reductions. Thus the results of different objective thinning grades could be compared.

Initial stem number was determined by the ratio crown diameter: height and by the relation between spacing and amount of thinning. In spacing experiments the influence of spacing on stem form and the tree defects already yielded conclusions about stem number (not too low; higher on worse soil), mixed plantations and the way of planting (planting in rows was recommended). Conclusions on amount of thinning were not yet possible. The method was simple in practice, even for other tree species.

Promotors: Prof. Dr H. A. J. M. Beekman and Prof. S. P. Ham

E.

44. J. H. ENGELHARDT Bijdrage tot de kennis van capillaire verschijnselen in verband met de heterogeniteit van den grond / *Capillary phenomena in relation to heterogeneity of the soil.* 1928, pp. 10 + 74. Du. summ.

The negative value of capillary pressure (D) was defined and its practical significance considered. The results of former research on rate and final value for capillary uptake were discussed.

The author constructed various meters for the measurement of capillary uptake. They were described and their dimensions and properties were compared with those used by other workers. The minimum and maximum values for D due to the heterogeneity of the soil material were tabulated for a series of sandy soils or soil fractions. These results were compared with those obtained in model experiments with perforated disks.

A series of new concepts was defined, concerning the forms and properties of isolated water in the soil profile. The terms 'sejunction' and 'funicular' and 'pendular' water were discussed. Their importance was demonstrated by a series of model experiments with sand fractions of different size grades. The distribution functions for the pores of these sands were calculated and compared with the experimental results. A few calculated examples were discussed on the importance of the isolated water for aeration of soil. Conclusions were derived

for the presence of cracks in the soil profile and the influence of the distribution of rainfall on the amount of available water to plants.

Promotor: Prof. Ir J. H. Thal Larsen

J.

45. L. J. VROON De bevolkingstheecultuur in de Residentie West-Priangan / *Native tea cultivation in the West Priangan Residency*. 1928, pp. 10 + 175.

The importance of the native tea cultivation in the West Priangan Residency, situated in the south-western part of Java, was demonstrated by the fact that approximately 45% of the total production of 25 million kg dry tea in 1926 was prepared from leaves bought from native planters, the rest originating from estates.

There were booms in prices paid to native planters through severe competition among buying firms at certain times. At slack periods there was an extreme fall in price.

To improve this situation a purchase system was devised which guaranteed tea merchants sufficient raw material of a consistently good quality at a reasonable price and guaranteed native planters a sufficient outlet for their product at a price related to the price of dry tea on the world market.

The trading risk previously borne exclusively by the native planter was now more fairly spread.

Promotor: Prof. Dr J. C. Kielstra

Author

46. J. A. A. M. H. GOOSSENS Onderzoek over de door *Phoma apiicola* Klebahn veroorzaakte schurftziekte van de knolselderijplant, *Apium graveolens* L., en over synergetische vormen en locale rassen van deze zwam / *Study on celeriac scab caused by Phoma apiicola Klebahn and on synergetic forms and local strains of this fungus*. 1928, pp. 8 + 78. Eng. summ. Also published in *Tijdschr. Plantenziekten* 34 (1928) 11: 271-316, 12: 317-348.

Symptoms of *Phoma apiicola* on celeriac were described. Severe ones were like the *Phoma* rot described by Bennet (*Mich. Agric. Exp. Stat. Tech. Bull.* 53 (1921)). Seed did not transmit *P. apiicola* but contained a second unidentified *Phoma* sp. with larger spores and not harmful to celeriac. Two isolates from different places near Venlo and Maastricht differed in ability of pycnosporos to grow on Coons' liquid medium. On agar pycnosporos yielded 2 forms differing in profusity of growth and in pycnosporos size, forms *macroforma* and *microforma*. The new micro form was constant at room temperature but at 0° to 5°C yielded pycnosporos of both forms.

In mixed culture it promoted pycnidial formation by the macro. The observations were explained not by heterothallism but by conjunct ('synergetic') growth of pycnidia. Inoculation experiments suggested that the micro form was identi-

cal with *Phyllosticta apii*. Only 2 of 20 varieties of celeriac showed any resistance to *P. apiicola*. On agar the macro form lost its virulence but occasional transfer to celeriac or culture with the micro form restored it.

Promotor: Prof. Dr H. M. Quanjier

Ri.

47. J. H. BECKING De djaticultuur op Java. Een vergelijkend onderzoek naar de uitkomsten van verschillende verjongingsmethoden van den djati op Java / *The culture of teak in Java. A comparison of different methods of teak regeneration in Java.* 1928, pp. 14 + 304.

After a discussion of the history of the regeneration methods in teak forests of Java since the end of the 18th century, and also briefly of that in India, regeneration systems for teak were reviewed: A. The Taungya system (in which field crops are grown between the rows of teak one year after planting); B. Growth from young seedlings (the number of seedlings can be increased before clear-felling); C. Interplanting with shade trees for weed control, physical improvement of the soil, erosion control and improvement of soil flora and fauna; if shade trees were leguminous, they improved supply of nitrogen; introduction of a second tree species, of which the best was *Leucaena glauca*; D. mixed regeneration (completely mixed in rows or in groups).

Descriptions of equipment and methods for the study include assessment of site quality and volume of commercial timber, geological and physical assessment of soil and soil flora. Thorough comparisons follow of 1) methods A and B, 2) method A with (= A + C) and that without *L. glauca*, 3) method A with *L. glauca* (= A + C) and that with other indigenous species. Method A was much preferred to B, method A + C (with *L. glauca*) to that without *L. glauca*, and to that with other indigenous species. But close mixture with other indigenous species needed more research. The possibilities of plantations with more species deserved more attention.

Promotor: Prof. S. P. Ham

E.

48. A. MINDERHOUD Onderzoekingen over de wijze, waarop de honingbij haar voedsel verzamelt / *Studies on the manner in which the bee collects its food.* 1929, pp. 94. Du. summ.

Bees were kept in an indoor hive and could reach the outside only through a glass-covered low gallery. In the middle of this was a passage 5 cm wide, closed by 2 parallel elastic bands. A light push on the elastic was sufficient to restrain her, to mark her or to sample (with a needle) some pollen from her she collected. The species of the pollen was identified. Most bees spent the whole day on one plant species and repeated this several days. Water collectors were marked at the drinking place. They spent the whole day collecting water from

one site. By bringing their tongues momentarily into contact with pollen during drinking, these bees suddenly changed their behaviour. They no longer looked for water at the drinking place but for the sweet material they had encountered. They returned to saucers of sugar syrup for days on end. These and complementary observations showed that the environment of the worker bee was extraordinarily limited. Her behaviour was primarily determined by habit.

Promotor: Prof. Dr W. K. J. Roepke

Author

49. P. N. BOEKEL *De zuivelexport van Nederland tot 1813 / Dutch export of dairy products before 1813*. 1929, pp. 12 + 224. Du. summ. after each chapter.

Dairy farming and dairying increased sharply in the 13th and 14th century with the evolution of towns in the Netherlands. In the 12th and 13th century the Netherlands already had exports of dairy products to western Germany and the southern Low Countries; in the 14th and 15th century also to the Baltic; in the first half of the 16th century also to north Germany, the Rhineland, Brabant and Flanders, northern France, Spain and Portugal. The Netherlands had some imports from England, France, Italy and Scandinavian countries.

In the 17th century animal husbandry and dairying flourished but in the 18th century increasing pressure of customs and epidemic outbreaks of rinderpest were a severe setback. Production of dairy products and trade were strictly regulated. During the 18th century dairying techniques were improved. The towns of Holland were the most important places for the export both for home products and for foreign products.

In the 'French time' (1795-1813) the government took important measures for the improvement of animal husbandry and dairying. Through the Continental System during the war with Great Britain, trade was restricted. Nevertheless export of dairy products increased and after the 'French time' this export was very important for the Netherlands.

Promotor: Prof. Dr W. C. Mees R. Azn

M.

50. H. TH. HIRSCH *De inlandsche landbouwproductie in verband met het welvaarts-probleem / Indigenous agricultural production in relation to the welfare problem*. 1929, pp. 117.

In an economic study of the Netherlands East Indies a distinction was made between absolute and relative deficiency in prosperity. Of the indigenous population 80% was engaged in agriculture. Material economic development had lagged behind non-material development.

To raise the prosperity of the rural population further encouragement of the farmers was needed to intensify and rationalize their farms, and raise their production and efficiency in food and cash crops, especially in view of their rising

needs and the growing population. Circumstances and conditions were then favourable for larger exports. The shift from subsistence agriculture towards export agriculture should however be gradual to allow an increase in economic resilience of the farmers.

Promotor: Prof. Dr J. C. Kielstra

L.A.

51. B. K. BOOM *Botanisch-serologische onderzoekingen / Serological studies in botany*. 1930. pp. 8 + 78.

The author tried to confirm the results of Mez et al., who, assuming specific antigens for each plant species, tried to set up a botanical taxonomy by serological differentiation of plant proteins.

The filtrate, 2, 3, 4, 5 or 6 ml, of an extract of ground seeds of a plant species was always injected into one of the ear veins of a rabbit 6 times every 5 days. After the 6th injection with this antigen solution a blood sample was taken and centrifuged after congealing. The serum was pipetted, the complement made inactive by heating and the titre of the serum estimated (in dilution degree of the seed extract for minimum precipitation). If the titre was not yet sufficient, more was injected. When sufficient, all the blood was taken from the rabbit and serum was separated. For various plants it was then checked whether a protein solution of their seeds or green parts reacted with this anti serum. The precipitation method as well as the conglutination method was used.

For great groups of plants closer relationships could be established with good certitude (confirming results of Mez). But classification of genera and species should be cautious (contrast Mez), as unspecific reactions often occur.

Promotor: Prof. Dr G. Grijns

E.

52. A. SEVENSTER *Het bevolkings- en emigratievraagstuk in Nederland en in den Nederlandschen landbouw / The problem of population and emigration in the Netherlands and in Dutch agriculture*. 1930, pp. 8 + 140.

The population increase in the Netherlands in the years after the first World War caused the author to study its consequences, particularly in relation to Dutch agriculture. The concepts 'overpopulation and underpopulation and optimum population' were discussed in the light of the theories of Malthus and many others. As definition the standard of living, measured by average income per head, was chosen.

The population density and the possibilities of changing the agricultural production were also judged from an economic aspect. Employment in agriculture could be diminished by planning and mechanization; intensification and reclamation could increase employment.

In the 1920's the prices of land and the rent of farms increased sharply and

did not respond to the decline in prices of agricultural products. This led to a partial overpopulation that may be ascribed to the large number of farmer's sons, born during prosperity, who had been waiting for a farm. Besides the possibilities of extending agricultural employment, emigration of farmers and farmer's sons was considered one of the best remedies for this problem. Improvement of the facilities (without direct subsidies of the Government) for settlement in France were discussed.

Promotor: Prof. Dr W. C. Mees R.Azn

Lij.

53. TH. G. E. HOEDT *Indische bergcultuurondernemingen, voornamelijk in Zuid-Sumatra. Gegevens en beschouwingen / Highland crops on plantations in the Netherlands East Indies, particularly in South Sumatra. Data and discussions.* 1930. pp. 12 + 244.

Highland crops was here used of tropical perennial crops (cinchona, coffee, rubber, tea), cultivated mainly in mountain districts. These crops were grown on estates, owned by western companies and managed by European staff. The organization of the highland plantation industry in Java and Sumatra, particularly South Sumatra, concerned with economic and technical interests of the estates was described in detail.

Attention was paid to natural, economic, social and legal conditions under which European planters had to work.

Particularly discussed problems were labour supply, important because the estates could not recruit sufficient labour from the local thin population, which disliked plantationwork. For that reason labour had to be imported from dense populated centres in Java. Importation was allowed only if estates issued labour contracts to future plantation coolies according to Government regulations (Coolie Ordinance).

Besides financial and social conditions labour contracts could include penal sanctions to prevent desertion of estates by coolies. Contracts without such penal sanctions were also possible (Free Coolie Ordinance). Merits and consequences of both kinds of contracts were critically discussed.

Agricultural development and results were discussed with the help of numerous figures. A map shows the position of estates, road and rail communications and distances to seaports.

Promotor: Prof. Dr J. C. Kielstra

Author

54. C. E. VAN DER ZIJL *Verbetering der cassave-cultuur door middel van proefvelden / Improvement of cassava culture with trial plots.* 1930, pp. 10 + 128. Du. summ.

To evaluate the influence of each cultural practice, trial plots of cassava were

established on West Java. The calculated mean differences and errors were also compared with those of preceding experiments with sugar-cane.

Cassava was shown not to require deep tillage. The influence of planting time was very great. The optimum time could be easily established by experiments. Closer spacing diminished root production per plant but this loss was compensated by the larger number of plants. Only very wide spacing notably diminished yield. Planting deeper than 2 in. diminished meal yields. Cuttings from gardens 17.5 months old proved better than from gardens 19.5 and 24.5 months old. The removal of stems from the plantations for the making of cuttings gave a meal loss of 8 to 9% if one stem was left on each plant and one of 10 to 16% if all stems were cut. Cutting 5 months before harvesting caused slightly less setback than 9 months before it. The influence of fertilization was rarely marked (K, P) or almost negligible (N, Ca). Green manuring had no influence. An optimum age period for ripeness could be established. Seven varieties could be ranged according to their productivity, as also 7 seedlings selected by Koch.

Promotor: Prof. J. E. van der Stok

E.

55. L. G. E. KALSHOVEN De biologie van de djati-termiet (*Kaloterme tectonae* Damm.)\* in verband met zijn bestrijding / *Biology of the teak termite* (*Kaloterme tectonae* Damm.)\* *as a basis for its control*. 1930, pp. 12 + 154. Eng. summ.

Sections of the text are on the systematics and the fully illustrated morphology of the species (with description of *N. dalbergiae* n.sp.), postembryonic development of the individuals, formation of the soldier caste, details of swarming habits, sex attraction, and foundation of new colonies (in old snags at some height in standing trees), method of estimating the approximate age of the colonies, factors controlling the appearance of sexuals, peculiar 2nd instar larva with thoracic lobes in mature colonies (still unexplained), advanced habit of using excrement for such purposes as building. Graphs show the course of development of the colonies during the first 2½ years (in artificial nests and in the forest), the rapid growth to about the 6th year (top size 2800 individuals), and the ensuing natural decline. Twenty plates with 50 illustrations cover the outward appearance of infested trunks, devices for caging nests on trees or severed from the trunk and placed in the open; cross sections of infested portions, breeding experiments in specially constructed artificial nests, the 7 larval and nymphal stages, soldiers of different size and their pseudonymphs, neoteinics, a complete incipient colony, method of trapping sexuals, experiments on the radius of flight, predators and inquilines.

\* The species has since been classified as *Neoterme tectonae* Damm.

Promotor: Prof. Dr W. K. J. Roepke

Author

56. J. H. J. VAN DE LAAR Onderzoekingen over *Ophiobolus graminis* Sacc. en *Ophiobolus herpotrichus* (Fr.) Sacc. en over de door deze fungi veroorzaakte ziekten van *Triticum vulgare* Vill. en andere Gramineae / *Investigations on Ophiobolus graminis* Sacc. and *Ophiobolus herpotrichus* (Fr.) Sacc. and on the diseases of *Triticum vulgare* Vill. and other Gramineae caused by these fungi. 1931, pp. 8 + 196. Fr. summ. Also published as Meded. Instit. Fytopathologie, Lab. Mycologie en Aardappelonderzoek 55.

Due to the increasing importance of the wheat disease 'tarwehalmdoder' in the Netherlands, research was started on its occurrence and cause. An extensive literature review proved the identity of 'tarwehalmdoder' with take-all or whiteheads, which were caused by *O. graminis*. The symptoms of the disease were root rot, decreased growth with drying of the leaves, blackening of the stem base and premature ripening.

Other fungi found on the stubble of *Ophiobolus*-diseased plants were described.

Ascosporous isolates of *O. graminis* and *O. herpotrichus* in pure culture were used in artificial inoculations. Inoculation with *O. graminis* resulted in whiteheads. Only about half the isolates of *O. herpotrichus* were virulent on wheat and barley causing death of seedlings. This symptom was different from foot-rot and root-rot.

The occurrence of *O. graminis* on many Gramineae was reported. Resistance did not occur in existing wheat varieties. Environmental factors influenced the severity of the disease. Good crop rotation and cultural practices could limit economic losses.

Promotor: Prof. Dr H. M. Quanjer

Ge.

57. E. DE VRIES Landbouw en welvaart in het Regentschap Pasoeroean. Bijdrage tot de kennis van de sociale economie van Java / *Agriculture and welfare in the Regency of Pasuruan. Information on the social economics of Java*. 1931, pp. 8 + 312 + appendices. Also published as Meded. Afd. Landbouw (Dept. L., N.en H., Ned. Indië) 16.

De Vries compiled a historical review of agricultural development in the Regency of Pasuruan (East Java) from the beginning of the nineteenth century until 1929. Special attention was given to the sugar industry, coffee, pepper, indigo culture, animal husbandry, irrigation, trade, fisheries and handicrafts. Much information was given on demographic situation, landownership, land tenure, credit provisions, human diet, use of irrigated fields (sawahs), rice varieties, rice productivity, the coconut, kapok and mangga illustrated by tables and charts. Detailed aspects of the agriculture in a small district (Poh-djentreck)



near the town of Pasuruan were presented. The book ends with some suggestions and deliberations on ways of improving the welfare of the county.

Promotor: Prof. Dr J. C. Kielstra

Jo.

58. P. H. BURGERS De stichting van een boschbedrijf in Andalusië. Een bedrijfsanalyse / *Establishment of a forestry enterprise in Andalusia. An economic analysis.* 1931. pp. 14 + 166.

The author described his search for the most profitable way of bringing into culture 5000 ha in Andalusia, west-south-west of Seville, on an extensive sand plateau probably of diluvial origin. By appraisal of the trees and crops already thriving in Andalusia, he settled for *Eucalyptus globulus*, taking into account that there would be a ready demand for young heart-free wood for the paper industry.

The most profitable exploitation was as coppice on a rotation of 8–10 years. There was also possible scope as timber for Spain and other countries. The manufacture of wood waste to charcoal also needed study. Other possible outlets were as tar products and leaf oil.

*E. globulus* could also be grown profitably and without risks in other regions of Spain, in other Mediterranean countries and in other continents where there was sufficient water and a rather loose soil and there was sufficient cheap labour.

Promotor: Prof. A. te Wechel

E.

59. J. G. OSSEWAARDE Het proefveldonderzoek bij de rijstcultuur op Java / *Research on rice cultivation in Java by field trials.* 1931, pp. 6 + 180.

A historical review was given of the development of rice cultivation in Java, of the influence of the Netherlands colonial government on the agricultural methods by advice before and after local research, and of the development of field trial techniques and the organization of systematic research. The principle of randomization was not applied at that time. Tests of significance were made by comparing a given difference with three times its estimated standard deviation. To reduce standard deviation the elimination of a linear trend in fertility for different places was discussed in detail. From the results of field experiments between 1911 and 1926 the relation between expected yield and the standard deviation was studied for different soil types and only the data were used of trials, where fertility of the area was even enough to be chosen as the place for a trial. This relation seemed to be reasonably linear. Attention was paid to the power of a test in relation to standard deviation. In the period considered investigators were more concerned with lack of bias in estimators than their

efficiency. In this thesis the importance of efficiency is stressed and more insight is given into the possibilities offered by field experiments.

Promotors: Prof. J. E. van der Stok and Prof. Dr M. J. van Uven v.M.

60. A. M. P. A. SCHELTEMA Deelbouw in Nederlandsch-Indië / *Share-tenancy in the Netherlands East Indies*. 1931, pp. 10 + 426.

Scheltema described extensively the manifold terms in share-tenancy encountered in the Netherlands East Indies and reviewed share-tenancy in the world. Legal, economic and social aspects of share-tenancy in the Netherlands East Indies were thoroughly discussed. The descriptions and considerations showed, that the aspects of share-tenancy were of considerable complexity.

In general share-tenancy was an obstacle to technical improvement, but served mobility of the production factor land, and to some extent regulated the wages in agriculture and in other occupations, especially in purely farming communities.

The author considered that legal control of share-tenancy was not desirable.

Promotor: Prof. Dr J. C. Kielstra Jo.

61. V. R. IJ. CROESEN De geschiedenis van de ontwikkeling van de Nederlandse zuivelbereiding in het laatst van de negentiende en het begin van de twintigste eeuw / *Dairy-farming in the Netherlands at the end of the 19th and the beginning of the 20th century*. 1931, pp. 12 + 206.

At the end of the 19th century Dutch butter was losing its reputation. After the introduction of margarine about 1870, some dishonest merchants took the opportunity to sell an adulterated article as pure butter. Although the amount of adulterated butter was a small fraction of total output, it did great harm to the Dutch butter trade abroad.

Many farmers were slow in adopting the more scientific methods of dairying practised on large farms in Denmark.

The depreciation of the butter became a challenge for the government and for dairy farmers. Butter Control Stations under government supervision were readily founded all over the country and farmers who entered the scheme of supervision were allowed to use a government buttermark, guaranteeing that the butter was pure. A parallel control system was made for cheese production. At the same time, production methods were improved by agricultural education.

The Government marks succeeded in greatly enhancing the reputation of the Dutch butter and cheese.

About the beginning of the 20th century factories gradually took over the production of dairy products from the farmer.

Promotors: Prof. Ir B. van der Burg and Prof. Dr Ir G. Minderhoud v.d.P.

62. B. DE HOOGH De economische betekenis der ontginningen / *The economic importance of reclamation*. 1932, Part I (Text), pp. 8 + 132, Du. summ. Part II: tabl. 28.

The reclamation of wood and moorland was an important aspect of the growth and development of Dutch agriculture. The economic aspects of these types of reclamation were examined. Reclamation activities appeared to depend on economic conditions. In the period 1825–1935 some 255,000 ha were reclaimed, but the rate was not always the same. Reclamation has always been important in the densely populated Netherlands. The government was interested in reclamations and assisted poor farmers with some subsidies on interest. There were some objections to these subsidies; it was said that this money could better have been used for other purposes within and outside agriculture. The conclusion was that these subsidies were fully warranted. Government could facilitate reclamation also in other ways such as improving roads and the system of water control. Another part of the thesis concerns the economic problems of farmers on the new land; their incomes were generally low especially at the start and the financial burdens were heavy. So there were quite a lot of failures. To improve this situation the author proposed the creation of a Commission for Advice on Land Reclamation and the giving of some credit facilities to new farmers.

Promotor: Prof. Dr W. C. Mees R. Azn v.d.N.

63. H. A. MIDDELBURG De invloed van den kalktoestand van juvenielen Merapi-aschgrond op eenige kwaliteitseigenschappen van Vorstenlandsche tabak / *The influence of the lime status of Merapi volcanic ash on leaf quality of Vorstenlanden tobacco*. 1932, pp. 10 + 68. Du. a. Eng. summ.

The influence of lime status of volcanic-ash soil was examined by pot trials in conditions as similar as possible to those of the plantation. Soils used were fine juvenile Merapi ash, the most important soil for tobacco growing, and, as a contrast, weathered laterite. In laterite artificial graduations in lime status were achieved by mixing with increasing quantities of hydrated lime or S. The lime saturation and the base saturation were examined on clay  $< 5 \mu$  or  $< 20 \mu$ . The laterite proved to be less saturated with Ca than the ash clay. Na formed a much larger proportion of bases in the laterite soil. Fe and Al were liberated in acid soil from which lime was removed, resulting sometimes in poisoning symptoms (leaf-spots).

Leaching of Cl was directly promoted by liming, resulting in decrease of leaf-Cl and improving so its fire-holding capacity. The colour of the fermented leaves became more drab and more even, but also darker by a high lime status. Seedling development in unfertilized ash soil was also improved by liming (turning dark green), and injured by addition of S (turning yellowish green).

Aftereffects of lime status on the seed-beds could be observed after planting in the field and dressing with  $(\text{NH}_4)_2\text{SO}_4$ . The young plants from highly saturated soils showed a better development and leaf quality.

Promotor: Prof. Dipl. Ing. J. Hudig

E.

64. H. J. FRANKENA Een statistisch onderzoek naar den invloed van het weer op de opbrengst en het gehalte van suikerbieten in Nederland / *The influence of the weather on yield and sugar content of sugar-beet in the Netherlands*. 1932, pp. 8 + 174. Eng. summ.

Correlation coefficients were calculated to examine the relation over the period 1899–1926 between beet yield and sugar content, and rainfall, sunshine and temperature. For every decade and combinations of two or more decades of the period March-October, the correlation coefficient was calculated. The interrelations between the three elements were also considered. The main purpose was to find critical periods as a basis for forecasting yield.

There were two critical periods for yield. The sowing period (20 April–20 May) had to be dry. The correlation coefficient with the rainfall was  $-0.66 \pm 0.11$ . The month of July had to be warm and bright. (Correlation coefficient for temperature  $+0.60 \pm 0.12$  and for hours of sunshine  $+0.66 \pm 0.11$ .)

Sugar content was stimulated by a bright dry autumn. Correlation coefficients were for hours of sunshine  $+0.61 \pm 0.12$  and for rainfall  $-0.72 \pm 0.09$ .

The main cropping districts Zeeland and Groningen differed strikingly in the correlation coefficient for temperature in August: for Zeeland (south of the Netherlands)  $+0.27 \pm 0.17$  and for Groningen (north of the Netherlands)  $+0.62 \pm 0.12$ .

The main regression equation for beet yield was  $X = M + 761x_2 - 75x_3$ .  $M$  = average yield (kg/ha),  $x_2$  = departure from average temperature ( $^{\circ}\text{C}$ ) during the last 20 days of July and  $x_3$  = departure from average rainfall (mm) during the period 20 April to 20 May.

Promotor: Prof. Dr D. van Gulik

Author

65. Jhr. J. C. MOLLERUS Officieele vertegenwoordiging van Landbouw, Nijverheid en Handel / *Official representation of agriculture, industry and commerce*, 1932, pp. 8 + 510.

There were many organizations of farmers in the Netherlands. It was feared

that this number was too high for efficiency. One possibility to organize a more efficient pressure group was to organize an Agricultural Board. The thesis examines all the types of farmers' organizations and the proposals for an Agricultural Board. The conclusion is that the farmers' organizations were not so inefficient as was widely believed. An Agricultural Board would have some severe difficulties in combining the very different viewpoints of the various farmers' organizations and difficulties would arise about its financial basis. So the author concluded that the establishment of an Agricultural Board was not a good solution of the problems of farmers' organizations.

Promotor: Prof. Dr Ir G. Minderhoud

Koo.

66. B. J. B. GROENEVELD De invloed van D-vitamine en ultra-violette bestraling bij verschillende verhoudingen van Ca:P in het dieet / *The influence of vitamin D and ultra-violet radiation with different Ca:P-ratios in the diet.* 1932, pp. 6 + 76.

Two series of experiments with, respectively, 72(32♂ and 40♀) and 36 (all ♀) spotted rats examined the influence of UV radiation and vitamin D on Ca and P metabolism. The experiments started at weaning of the rats (21–28 days) and lasted for 7 weeks in the first and for 5 weeks in the second series. Rations were used with Ca:P ratios varying between 1:0.45 and 1:2.8. Growth curves, skeletal X-ray photographs and Ca and P balances were studied.

Ca:P ratios between 1:0.96 and 1:1.27 proved optimum. Net absorption and retention of these minerals was maximum at that ratio. The rations with extreme Ca:P ratios induced rickets that healed with both treatments. It was in these rations that net absorption of Ca reacted most sensitively to vitamin D or UV treatment. At all Ca:P ratios some reaction was observed with vitamin D and with UV-treatment. Excess of one of the two minerals inhibited the retention of the other. Inhibition by Ca was more potent than by P.

Promotor: Prof. Dr G. Grijns

Wi.

67. G. H. A. LEIJENAAR Fijnheid en verdeeling van een als meststof toegediend natuurlijk fosfaat / *Fineness and distribution of natural phosphate used as a fertilizer.* 1932, pp. 8 + 116, Du. summ.

This study was to examine whether grinding of an insoluble fertilizer to different degrees of fineness produced a limit below which further grinding did not accelerate solution of the particles. Such a limit was indeed found. Below 30 m $\mu$ , the distribution of the particles became very uneven because individual particles tended increasingly to stick together. Mixing fine particles with coarser ones could improve the situation, but the percentage of coarse particles should not be too high.

Grinding natural phosphates to colloidal fineness was useless, since the colloidal state was lost during drying of the product. The smaller particles tended to aggregate thus preventing uniform distribution throughout the soil.

The availability of P in natural phosphates improved with the physiologically acid reaction of N fertilizers such as  $\text{NH}_4\text{HCO}_3$  and  $\text{NH}_4\text{NO}_3$ . A first requirement for rapid absorption of P from natural phosphates was a low concentration of  $\text{Ca}^{2+}$ .

Promotor: Prof. Dipl. Ing. J. Hudig

v.D.

68. F. E. NIJDAM Kruisingen met *Trifolium pratense* L. / *Crosses in Trifolium pratense* L. 1932, pp. 8 + 118. Du. a. Eng. summ. Also published in *Genetica* 14 (1932) 161-278.

With few exceptions, red clover is self-incompatible. Reciprocal crosses between 30 pairs of unrelated parents sampled in a population, were all compatible. Three full-sib  $F_2$ 's from one of these crosses showed, in  $8 \times 8$  diallel crosses, 2, 2 and 4 incompatibility groups, and an  $F_3$  showed, in a  $15 \times 15$  diallel cross, 2 incompatibility groups. The data were explained by a (large) series of S alleles, as proposed by East for *Nicotiana* and by Filzer for *Veronica*.

In a number of progenies, male-sterility (degenerate anthers) was found and a recessive factor was identified.

Seed-coat colour (yellow versus violet) was polymerically controlled (up to 5 cumulative factors), complicated by environmental and within-plant variation. In certain progenies a factor for violet (v) and an intensifier (X) could be identified. The quality of yellow and of violet was controlled by C-c and by R-r, respectively.

Flower colour was determined by the factor G for anthocyanin production and by B-b for purple or pink, along with at least 3 intensifiers of purple.

Two chlorophyll abnormalities depended on recessive factors (chlorina and albina) and one was plasmatically inherited (albomaculata). Two types of dwarfs (nanella and nana) were single recessives.

Promotor: Prof. Dr J. A. Honing

v.d.V.

69. P. M. H. H. PRILLWITZ De invloed van den basentoestand van den grond op de ontwikkeling van de theeplant (*Thea sinensis* Linn.) / *The influence of base status of the soil on development of the tea plant* (*Thea sinensis* L.). 1932, pp. 10 + 120. Du. summ.

Application of slaked lime retarded growth of young tea plants on most soils in pot trials. Application of S, although beneficial to the growth of tea plants, had an adverse effect on the soil, when applied in large amounts. It lowered both the base saturation and the adsorption capacity of the soil. Therefore the

use of S on strongly weathered soils with a poor reserve of minerals could not be recommended. The injurious effect of applying S to slightly weathered soils with a sufficient reserve of minerals had no practical significance, since the adsorption complex impoverished of bases, enriched itself again by gradual weathering.

Another advantage associated with the use of S was that it seemed to control some parasitic root fungi of the tea plant, fungi which mainly occurred on slightly weathered young volcanic soils.

How far these results of pot trials would also hold for field conditions would largely depend on the thoroughness of mixing S and soil. In new plantations, S could be applied primarily to the plant holes. In nursery trials, however, S should be mixed with the whole top soil. The influence of base status of the soil on adult tea plants was not studied.

Promotor: Prof. Dipl. Ing. J. Hudig

E.

70. H. VAN VLOTEN *Rhabdocline pseudotsugae* Sydow, oorzaak eener ziekte van Douglasspar / *Rhabdocline pseudotsugae* Sydow, cause of a disease of Douglas fir. 1932, pp. 8 + 168. Du. a. Ger. summ.

The fungus *Rhabdocline pseudotsugae* Syd. on *Pseudotsuga douglasii* Carr. and *Ps. glauca*. Mayr. was studied in detail.

The fungus is biotrophic. Invaded cells remain intact. Flecking of the needles occurred after winter killing of invaded host cells. Apothecia on diseased needles were only formed when needles remained attached to plant.

Resistant or partially resistant trees were found. The disease was widely dispersed by selling young plants infected in the nursery.

Promotor: Prof. Dr H. M. Quanjer

Za.

71. C. KOOY LZN Over doelmatige veevoeding in Nederland / *Practical livestock feeding in the Netherlands*. 1933, pp. 8 + 106, Du. summ.

At the end of the 1920's the opinion was current that livestock in the Netherlands were being fed too freely, so that there was a significant waste of fodder, animal production too dear.

The study showed that according to the number of livestock and their production, and the amount of feedstuff exported and imported, there was only a slight waste or none at all. Kooy looked for reasons for the currency of the opinion and for the contrary result of the calculation. He examined 4 questions: whether production of feedstuffs within the Netherlands should be higher than statistics reported; whether livestock production in the Netherlands should be lower than the statistics said; whether feeding standards for the livestock should

be too high; and whether the nutritive value of the feeding should be judged too low.

The study demonstrated that losses in storage and in the course of supply were too little appreciated and that feeding was uneven from one season of the year to another.

Promotor: Prof. Dr Ir G. Minderhoud

I.

72. J. A. VAN STEUN Duinbebossching / *Dune afforestation*. 1933, pp. 8 + 318.

The history of dune afforestation in the Netherlands was described in six periods varying in maintenance. Afforestation of dunes in other countries of Europe was reviewed. The origin and evolution of the Dutch dunes were traced, and data were mentioned on the mineralogical and chemical composition of the dune sands. After discussion of other ecological factors those of importance for afforestation were listed as nutrient deficiency, low content of humus and of fine sand, adverse watertable, wide range of soil temperature, the mobility of the sand, windiness, less rainfall than further inland, and damage by rabbits. Further special attention must be paid to local differences in lime content, exposure of slopes and height above the watertable (valleys).

Techniques of dune afforestation were discussed: landscaping, soil preparation, drainage, fixation, road making, planting (chiefly *Pinus* spp.), the differences between the results of direct sowing and of planting out, the protection of forest margins, thinning and exploitation. Plant diseases and damage and some data on cost were discussed.

The importance of dune forests (enlargement of the forest area, defence against drifting, wood production and regional social advantage were examined and the most important dune forests were described.

Promotor: Prof. S. P. Ham

E.

73. F. W. OSTENDORF De groei van jonge *Hevea-oculaties* / *The growth of young Hevea buddings*. 1933, pp. 6 + 96, Eng. summ. Also published in *Arch. Rubbercultuur* 17 (1933) 7-9: 119-212.

Results were presented of studies on the initial growth of *Hevea* buddings, at the Proefstation West-Java, Buitenzorg (now Bogor). The time elapsing between cutting off the stock above the union and sprouting of the implanted bud was a clonal character; so also was the angle between the young sprout and the stock. The formation was described of successive shoots or leaf storeys. The characteristic periodicity shown by most buddings was not due to an inherent tendency of the plant towards interrupted elongation growth but depended on environmental conditions, the girth of the stock, and the growth vigour of the



clone. As these conditions became less favourable, there was a gradual transition from completely aperiodic leaf formation with a constant rate of elongation to periodic shoot formation with increasingly long resting periods between the formation of successive shoots. This periodicity of shoot formation, and the decreasing size of successive leaves within a shoot resulting in its typical umbrella-like shape, were explained as the effect of an interaction between a fairly even moisture supply to the growing point and changing water consumption by the developing leaves.

Promotor: Prof. J. E. van der Stok

Author

74. A. A. C. SPRANGERS *De economische beteekenis van het bosch voor Nederland / The economic importance of forest for the Netherlands*. 1933, pp. 304.

The history of forests in the Netherlands was described. In more recent times Dutch forests supplied a modest but interesting portion of Dutch timber. They supplied all agricultural timber, stakes and poles for horticultural and agricultural crops, almost all firewood, a third of the pit props and most of the wood for protecting stream banks. Poles had many uses. The wood of the Canadian poplars satisfied the whole need for clog making and for matches, and there was a surplus for export. Secondary uses were important: tannins, bilberries, tree seeds and hunting rents.

The forests also attracted tourists and were thus of aesthetic and economic value.

Despite the replacement of forest by agriculture the forest area was being increased by the afforestation of waste lands. The reclamation of waste lands principally for afforestation needed active promotion, although cost had to be considered. Management had to be based on production. Grading and volume measurement of felled timber, culture of Canadian poplar, and the sale of different timbers needed more attention.

Promotor: Prof. A. te Wechel

E.

75. H. N. KLUIJVER *Bijdrage tot de biologie en de ecologie van den spreeuw (Sturnus vulgaris vulgaris L.) gedurende zijn voortplantingstijd / Biology and ecology of the starling (Sturnus vulgaris vulgaris L.) during its reproduction*. 1933, pp. 8 + 146. Eng. summ.

In February, March and April starlings fed in a flock on the fields near nestboxes. At night they roosted together in thousands in the reeds of a pool, 5 km from the nestboxes. In February or March each ♂ occupied a particular nestbox. Early in the morning they left the flock, and stayed and sang by the nestboxes for 10–30 min., then returned to the flock but returned soon. The ♀ visited the nestbox a few weeks later. The ♂ had then already started building the nest.

Later the ♀ largely completed it. The nests consisted of straw; during the breeding period they were lined with feathers.

The ♀ more often brought food to the young than the ♂. An aphisiograph was used to record the number of feeds brought to the young. To determine the food of the young quantitatively and qualitatively a closely fitting collar of aluminium was placed round their necks for 4 h a day, so that they could not swallow the food. This food was removed from the oesophagus with forceps or from the nest if the young had already rejected it. The food consisted almost entirely of animals. Among 17.933 deliveries there were at least 313 species, among which 267 insect species. Earthworms were only found in minute quantities. Carnivorous arthropods formed 30% of the food. Although plots with many *Tipula* larvae were more often visited by the starlings than those with fewer larvae, a colony of starlings had little influence on the population of *Tipula paludosa*.

Promotor: Prof. Dr W. K. J. Roepke

E.

76. M. D. DIJT *Conjunctuurbeheersching door middel van internationale valorisatie van tarwe, suiker, katoen, koffie en rubber met behulp van goederenschappen / Trade cycle control by international price-fixing for wheat, sugar, cotton, coffee and rubber by marketing boards.* 1933, pp. 8 + 216.

Dijt considered that trade cycles would be almost eliminated by stable prices for raw materials. He explained how an international trade cycle policy was made possible by the establishment of marketing boards for a number of important raw materials. For the particular product the board fixed a buying and a selling price and administered the available stocks by supporting demand by purchases. In the system no restriction of production was proposed. The price of each product was tied to that of gold. The stocks could be financed by bonds issued by the government or by money created as an equivalent of the stock of raw materials. The marketing boards had to be the result of international co-operation. The costs would be borne by the interested countries.

Promotor: Prof. Dr W. C. Mees R.Azn

Kr.

77. E. SNELLEN *De aanvoer van arbeiders voor den landbouw in Suriname / The supply of agricultural labour in Surinam.* 1933, pp. 8 + 168.

Not long after its discovery in the sixteenth century Surinam developed a plantation economy, needing many slaves from Africa. After the abolition of slavery in 1863, agricultural labour became very scarce. The thesis emphasizes the period 1863–1933, when the government of Surinam actively encouraged labour immigration from India and the Netherlands East Indies. The Government's immigration policy, its implementation and organization and the fi-

nancing of immigration are discussed.

These indentured labourers were allowed to opt for government settlement schemes after the expiry of their contracts. Thus developed a sector of agricultural smallholders. The final chapter describes the function of the plantations as employers and outlines agricultural development among smallholders.

Promotor: Prof. J. E. van der Stok

Lu.

78. H. E. WOLFF VON WÜLFING Stamvorm en inhoud van den djati in plantsoenen (*Tectona grandis* L.F.; *Verbenaceae*) / *Trunk form and volume of plantation-grown teak*. 1933, pp. 10 + 254. Eng. summ.

The author's procedures and methods were described for compiling General Volume Tables for teak, from which Local Tables can be derived. Only easily and rather accurately measurable characteristics should be used: tree height, length of trunk free of branches and timber-yielding length of trunk and trunk girth at 1.30 metre. Girths at 1.50 metre and 1.70 metre were also necessary, to avoid abnormal trunk bases. The Table should also contain estimated volumes of whole tree and its parts with bark, and diameter, girths and volumes of the tree without bark at different heights.

But more data were needed to construct the Table, primarily the mathematical expression of the trunk form. Two true form quotients are required to represent the trunk form of teak with satisfactory accuracy in a simple equation. Estimation of the form class of an individual tree was only possible by direct measurements, so average form classes were used. These classes for the various trees and stands of one single kind of wood usually varied so little that for any one Table practically only one form class was required. The slight variation in form class of teak can easily be incorporated in the Volume Tables.

Promotors: Prof. Dr H. A. J. M. Beekman and Prof. Dr M. J. van Uven E.

79. L. KOCH Cassaveselectie / *Cassava selection*. 1934, pp. 12 + 86, Du. summ.

Cassava is indigenous in South America, from where it was introduced to all tropical countries of the old world. It was introduced to Java in 1810; the planted area there and on Madura in 1934 far surpassed that of any other country in the world. Seedling selection has achieved important results only in Indo-China and the Netherlands East Indies.

Many trials on flowering and fertilization were carried out and have shown how to obtain seed of good provenance, how to germinate them and how to establish plantations with them. Thus techniques of selection had improved gradually.

The important nutritive qualities of the roots were described, while external

influences on several of them were traced. The choice of parents influenced the behaviour of the seedlings, but this did not imply that a certain quality was transmitted from the parents to their offspring or to many of them. Many correlations demonstrated that generally no genetic objections could be raised to combining of desired qualities.

Hybrids between cassava and *Manihot glaziovii* gave 30 generally fast growing plants, of which a part could be crossed mutually and with both parents. Some directives were given for the future. The desirability was stressed of importing many cassava varieties and *Manihot spp.* from South America, for large-scale selection of hybrids in the Netherlands East Indies.

Promotor: Prof. J. E. van der Stok

E.

80. PH. LEVERT Inheemsche arbeid in de Java-suikerindustrie / *Indigenous labour in the Java sugar industry*. 1934, pp. 10 + 346.

Levert analysed the dualistic character of the Java sugar industry (entailing the cultivation of sugar-cane on peasant farms). The significance and use of labour was discussed as a factor of production in indigenous societies. A historical analysis was presented on the use of native labour during the period 1600–1879, when the Government's measures on labour were most strongly felt.

Since 1879, private enterprises came into prominence and the period consisted of two stages, the first until 1918, with attempts to solve the labour problems in an individual patriarchal way and a second one (1918–1930), when political economic problems caused an interplay of three factors: government, indigenous population and the centralized sugar industry. The impact of the world crisis on this industry in the early thirties was discussed and suggestions were made on the status and use of indigenous labour.

Promotor: Prof. J. E. van der Stok

Lu.

81. A. PH. WEBER Betrekkingen tusschen de constitutie van organische verbindingen en den invloed van het hydroxyl-ion by hydrolyse / *Relations between the constitution of organic compounds and the influence of the hydroxyl ion during hydrolysis*. 1934, pp. 6 + 94. Du. a. Eng. summ.

Rates of saponification of  $\alpha$ -chlorotoluene,  $\alpha$ ,  $\alpha$ -dichlorotoluene and  $\alpha$ ,  $\alpha$ ,  $\alpha$ -trichlorotoluene and of their *ortho*, *meta*, and *para* isomers of halogen, nitro methyl and carboxylic derivatives in neutral, alkaline or acid medium were measured. The velocity of the hydrolysis in the different ranges of pH could be correlated with the effect of substituents present in the aromatic compounds and with the character of the catalysts involved in the reactions.

The results obtained when saponifying in basic medium could be reasonably

explained by the 'alternating polarity effect' (valid at that time) and by assuming a general electron shift in the direction of the negative substituent.

Promotor: Prof. Dr S. C. J. Olivier

d.He.

82. P. SCHOORL Natriumgebrek bij ratten / *Sodium deficiency in rats*. 1934, pp. 8 + 90. Du. a. Eng. summ.

Rats on a diet of rolled oats 400, purified casein 16 and cod liver oil 2 g developed severe sodium deficiency. Na in the basal ration was 0.009%. Addition of different sodium salts caused immediate recovery. The deficiency was difficult to produce because of uncontrolled sodium uptake by the craving animals. Symptoms included increased activity, depression of growth and finally even weight loss, decreased fur growth, thinning and ulceration of bald spots left and right of the spine and just behind the head, excessive licking and dehydration.

With sodium citrate added to the basal ration there was a positive correlation between amount of sodium and rate of resumed growth. Optimum growth was achieved with 0.1 – 0.2% added Na. Na could not be replaced by K or Li. K did not possess the Na-expelling effect postulated by Bunge because Na requirement was independent of K in feed and because a fixed addition of Na gave a reproducible growth in depleted rats, however much K in diet. N excretion during deficiency mainly as urea, was excessive, and it seemed that Na was needed for protein synthesis. Conception was normal but reproduction was impossible. Weight gain during pregnancy was much reduced and no milk was secreted. After severe Na deficiency kidneys could not conserve sodium until an ample supply had been available for a short while. Body temperature was normal during deficiency but was rather high some time after resupplying sodium.

Promotor: Prof. Dr G. Grijns

Bi.

83. F. A. VAN BAREN Het voorkomen en de beteekenis van kali-houdende mineralen in Nederlandsche gronden / *The occurrence and significance of minerals containing potassium in soils of the Netherlands*. 1934, pp. 120. Du. summ.

The importance of mineralogy and of research on mineral reserves for agriculture and forestry were examined from published data.

Van Baren studied some problems of the mineral associations distinguished by Edelman as petrological provinces or groups. Studies on the heavy fraction (sp.gr. > 2.9) of the minerals caused him to introduce new divisions of the B<sub>Elsloo</sub> province and to introduce a new province, the B<sub>Eysden</sub> province. The light fraction (sp.gr. < 2.9) could also be classified into provinces. Thus it was

possible to obtain a picture of the distribution of feldspars in Dutch sands. Lastly he studied the fraction  $< 30 \mu$ . Three Dutch clays completely different in K content were examined microscopically and radiographically for mineralogical causes of the difference; results were unexpectedly good. In clays also was there a provincial character, according to origin. Mixture of two sediments in the finer fractions proved sometimes to be completely different from that of the coarser fractions. There was a parallel between natural fertility and mineralogical composition.

Promotor: Prof. Dr Ir C. H. Edelman

E.

84. W. K. HUITEMA De bevoelingskoffiecultuur op Sumatra, met een inleiding tot hare geschiedenis op Java en Sumatra / *Indigenous coffee cultivation in Sumatra, with an introduction to its history in Java and Sumatra*. 1935, pp. 238. Du. summ.

The history of government-owned coffee plantations formed three periods: under the Dutch East Indian Company and the Commissaries General, during the 'Cultuurstelsel' (Culture system), and after 1905. The history of indigenous coffee cultivation formed two periods: during the 'dwangstelsel' (forced-labour system) and since 'dwangstelsel'.

The present coffee areas, their climate and their relevant geomorphology, geology, pedology and plant-sociology were described. The native methods for *Coffea robusta* L. and *Coffea arabica* L. were each discussed. Agricultural problems deserving special attention were selection methods, shading, intensive measures (weeding, pruning, stumping, soil fertilization, green-manuring, wind protection, the control of *Stephanoderes hampei* which attacks beans, harvesting method, other bean constituents, seed inspection, and reforestation.

It was concluded that the native coffee growing was still in the beginning of its development. Although scientific research already started some decades earlier, many problems remained to be solved, also for the European enterprises. The management analyses made by the Division of Agricultural Economy in 1930 would be of great help in elucidating problems concerning indigenous plantations and in planning further improvements. Extension had to give further assistance.

Promotor: Prof. J. E. van der Stok

E.

85. R. H. J. ROBORGH A study on the nature of clay. 1935, pp. 128. Eng. a. Du. summ.

The study was intended to elucidate by HCl extraction the composition of that part of the clay fraction, essential for adsorption phenomena in the soil and also its resistance to attack by HCl.

HCl extraction of 12 alluvial clay soils did not indicate the composition of the adsorption complex, as the analyses of the HCl extracts showed very different values for the composition of the Al-Fe-Si-complexes which were brought into solution, whereas the values for adsorption and residual adsorption showed that the chemical composition of the adsorptive parts of the clay fraction  $< 2 \mu$  of the different soils was uniform.

The uniformity of the clay fractions of the 12 soils in adsorption capacity, behaviour towards HCl extraction and the influence of this extraction on adsorption values suggested that the soils could be of the same mineralogical origin. However total analyses of the clay fraction yielded divergent  $\text{SiO}_2 : \text{Al}_2\text{O}_3$  and  $\text{SiO}_2$ :sesquioxide ratios for the different soils.

Therefore it was supposed that only the films of the hydrolytic products of the minerals present in clay were identical.

Promotor: Prof. Ir J. Hudig

Br.

86. H. W. VAN DER MAREL Bijdrage tot de kennis van de kationen- en anionen-adsorptie van tropische en Nederlandsche gronden / *A study on the cation- and anion-adsorption of tropical and Dutch soils.* 1935, pp. 10 + 150. Eng. summ.

When percolating a soil with neutral or weakly alkaline normal solutions (pH about 8.3) of different acetates, the order of cation adsorption,  $\text{Mg} > \text{Ca} > \text{Ba} > \text{Na}$ , follows that of solubility of the hydroxides. However cation adsorption for  $\text{NH}_4$ , K, Ba and Na when percolating thereafter with the chloride solutions are alike.

The above constant cation value (in m-equiv./100 g) does not change with repeated exchanges neither does it change when acid or alkaline solutions are used such as 0.05 N HCl, 0.5 N  $\text{FeCl}_3$ , 0.5 N  $\text{AlCl}_3$ , about 0.2 N  $\text{Ba}(\text{OH})_2$ . Tropical soils may contain much material inactive or hardly active in cation exchange (quartz, iron-, aluminium hydroxides, silicic acid and kaolinite) which disturb the relation between total surface (particles  $< 2 \mu$ ) and cation value.

After treating soil with HCl sp.gr. 1.035 for 0.5 h at  $55^\circ\text{C}$ , cation value decreases slightly but still remains proportional to the surface of the soil particles. The amount of silica in excess of (or less than) the amount of  $\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$  (in m-equiv.) dissolved by HCl sp.gr. 1.035 for 1 h at  $55^\circ\text{C}$  and the  $\text{SiO}_2/(\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3)$  quotient are correlated with the amount of  $\text{PO}_4^{3-}$  which is fixed from Ca  $(\text{H}_2\text{PO}_4)_2$  solution. The amount fixed depends also on temperature, duration of the reaction and concentration of the components (soil and Ca  $(\text{H}_2\text{PO}_4)_2$  solution).

$\text{Cl}^-$  and  $\text{SO}_4^{2-}$  are bound to the soil as iron and aluminium hydroxide compounds which, however, are easily hydrolyzed.

Promotor: Prof. Ir J. Hudig

Author

87. M. J. L. DOLS Vergelijkend onderzoek op ratten en kuikens over de identiteit van het kunstmatige antirachitische vitamine (bestraald ergosterol) en het natuurlijke vitamine D uit kabeljauw-levertraan / *Comparative investigation on rats and chickens dealing with the identity of the artificial antirachitic vitamin (irradiated ergosterol) and the natural vitamin D of cod liver oil.* 1935, pp. 12 + 140. Du. a. Eng. summ.

Cod liver oil 2% sufficed to protect chickens against rickets, but irradiated ergosterol equivalent in rat units of vitamin D, equivalent to 20% cod liver oil, was not sufficient. No single fact pointed to the presence of another factor in cod liver oil being indispensable besides vitamin D to protect chickens against rickets.

Unsatifiable matter from cod liver oil, irradiated cholesterol or concentrate from tunny liver oil, all in rat units of vitamin D equivalent to 2% cod liver oil were within limits of experimental error equally protective against rickets in chickens. Crystalline irradiated ergosterol was not identical with vitamin D from cod liver oil. The provitamin D in cholesterol, activated antirachitically by ultraviolet irradiation, was not ergosterol. Requirement of vitamin D by chickens from the 1st till the 75th day, either as cod liver oil or as tunny liver oil concentrate or of irradiated cholesterol was 250 IU per 100 g ration, about 80 IU daily per chicken.

To find rickets in chickens, radiography sometimes yields more information than examination of the skeleton post mortem. The average ash content of the tibiae was not a reliable comparison of the antirachitic efficiency of vitamin D preparations in chickens.

Promotor: Prof. Dr G. Grijns

Author

88. M. J. BOERENDONK Historische studie over den Zeeuwschen landbouw / *Historical study of the agriculture in Zeeland.* 1935, pp. 376. Du. summ.

With 14 chapters devoted to technical aspects and 8 chapters on social, economic and geographical studies, this was the first comprehensive historical study of agricultural development in a Dutch province. The study covered the period 1200–1900 and focused on the agricultural profession and the prosperity of farmer and farmhand, and not on juridical and political facets as was customary.

In contrast to most other agricultural regions of Europe the closed village economy was non-existent through international trade and navigation.

Weaving, breweries, madder factories and weekly markets grew up in the villages. New crops were introduced by the impulses of commerce: madder 1380, buckwheat 1485, potatoes, tobacco, hop, cabbage, Jerusalem artichoke in the 18th century and mangold, sugar-beet, caraway, clover and lucerne in the 19th century. Cereals, rape-seed, beans and peas were the ancient crops cultivated in a 7 years rotation. The lease period had the same duration.



Agriculture was mainly crop growing on the 'wheat system', intensified by the cultivation of flax and madder, requiring deep tillage and abundant manure. Cattle raising was considered only as a necessary evil for getting manure.

This agriculture occupied a prominent place in Europe, but measured by our standards the prosperity was unstable, the farmhands were poor and often unemployed. Up to 1870 the farmers were lacking initiative and there was a painful surplus of them and of their labourers.

A new era of dynamic progress was opened at the end of the 19th century, despite the agricultural crisis, by the introduction of extension, organization, artificial manure and sugar-beet growing, the sugar-beet in place of madder.

Promotor: Prof. Dr Ir G. Minderhoud

Author

89. J. F. KOOLS Hoema's, hoemablokken en boschreserves in de Residentie Bantam / *Hoemas, hoema blocks and forest reserves in the Residency of Bantam*. 1935, pp. 188.

The conflict whether certain districts of indigenous forest should be assigned to agriculture or forestry, had been more heated in Bantam than in all the outlying provinces of the Netherlands East Indies. At the beginning of this century an abortive attempt was made to eliminate shifting (ladang or hoema) cultivation. To evaluate the advantages and disadvantages of the hoema system with special reference to forest reservation, the author studied the hoema cultivation as an agricultural system, its consequences for local people and for other land use, crop yields, the traditional (adat) law and the legal hoema regulations in Bantam. Kools arrived at the conclusion that the aims in the hoema region should be: 1. Establishment of field crops between young forest tree seedlings (Taungya system) to provide immediate relief; 2. research into intensification of the hoema cultivation; 3. rigorous checks against illegal reclamation.

Hoema cultivation must be considered as a primitive extensive agricultural system, which did not need to exhaust the soil, but usually did. It was recommended that shifting cultivation be restricted to particular forest blocks, also in the rest of Java and in Madoera.

Promotor: Prof. A. te Wechel

E.

90. W. J. DEENEN Bloei en bloeislaging van de robusta koffie op Sumatra's Westkust / *Flowering and setting in Robusta coffee on the west coast of Sumatra*. 1936, pp. 120. Du. summ.

As an insight into flowering and fruit yield the percentage of flowers yielding fruits was estimated. To allow for variation between branches, many flowers must be taken. The extent of flowering of robusta coffee depended on the relation between vegetative and generative growth, both showing a maximum and a

minimum, while factors favouring one were often adverse for the other. The physiological condition of the trees strongly influenced fruit setting. *Stephanoderes hampei* F. may penetrate berries 3–5 months old. Consequently rotting and damage may lead to a considerable fall. This fall depended much on the condition of the tree and not on the number of *S. hampei*. Falling was also favoured by sunny and dry periods.

A good regular shading promoted flowering and fruit production, due mainly to a better water supply preventing yellowing and dying of the leaves. Too much shading may be harmful to the generative growth, so pruning must lead to more light during wetter months. For a better water supply the humus content of the soil could be improved. The percentage fruit set of primary, secondary, upper, medium and low branches showed that ‘topping’, preventing water shortage in dry periods, was not harmful for fruit set. Lower trees also facilitate the control of *S. hampei* and the harvesting.

Promotor: Prof. J. E. van der Stok

E.

91. A. L. S. BÄR Over de systematische veranderingen in uitwisselings-capaciteit van klei / *Systematic changes in exchange capacity of clay*. 1936, pp. 148. Eng. summ.

Clay particles in suspension are surrounded by an electrical double layer, whose inner layer consists of  $\text{OH}^-$ . There is a linear relation between the amount of  $\text{OH}^-$  in this inner coat and the pH of the equilibrium solution. Consequently the charge on clay particles is a function of the pH of the equilibrium solution.

The degree of flocculation depends mainly on the electrokinetic potential of the clay particles. Therefore differences in flocculation with several salts are closely related to valency and polarizability of the ions.

Calculations from measurements of the capacity of the electrical double layer suggested a specific surface area of  $500 \text{ m}^2$  per g of bentonite.

Cation exchange does not occur only on clay minerals containing Al in tetra-valent positions as it was earlier suggested. Ground kaolinite and halloysite, neither of which contains tetravalent Al, have a considerable cation-exchange capacity. Anion exchange rarely occurs on clays. This follows from the fact that after breaking such a layer as  $\text{Al}_2(\text{OH})_6$  of a clay mineral, there are usually no Al ions in the equilibrium solution to form a double layer with Al as inner coat.

Promotor: Prof. Ir J. Hudig

Win.

92. E. MEIJER DREES De bosvegetatie van de Achterhoek en enkele aangrenzende gebieden / *Forest vegetation of the Achterhoek, Gelderland, and some adjoining areas*. 1936, pp. 172.

The tree, shrub, herb and moss vegetation of woodland in the Achterhoek

and neighbouring areas was analysed. It was described according to the concepts of the French and Swiss school of Braun-Blanquet. The study was confined to woodland whose composition approached the natural state. Experimental areas were of different form from 150 to 300, sometimes 800 m<sup>2</sup>. The sociological survey was supplemented by data on habitat, growth and age of the stand and the vegetation layers. The descriptions of the different plots were combined into tables, indicating the characteristic species of the association, the higher sociological units, the companion species and the accidental species, while subassociations were separated according to differentiating species. The descriptions and tables refer to plant communities belonging to *Alnion glutinosae*, *Alneto-Fraxinion*, *Quercion* and various degeneration stages.

These chapters are preceded by a discussion of different climax theories. The work closes with an attempt to reconstruct the original vegetation.

Promotor: Prof. Dr J. Jeswiet

E.

93. O. BANGA *Physiologische symptomen van lage-temperatuur-bederf / Physiological symptoms of breakdown at low temperature*. 1936, pp. 152. Eng. summ.

At a safe temperature (over 13°C) in a green fruit of tomato the acid content increases and the respiration quotient  $\frac{\text{CO}_2}{\text{O}_2} < 1$ . When the fruit colour changes from green to yellow and red, the acid content decreases suddenly and the respiration quotient quickly increases to  $\frac{\text{CO}_2}{\text{O}_2} > 1$ .

At a harmful temperature (well below +12°C) acid content and respiration quotient of a green fruit behave normally during the first few days, but then the increase in acid stops and  $\frac{\text{CO}_2}{\text{O}_2}$  becomes one. In green tomatoes with low temperature breakdown acid very slowly decreases after return to a safe temperature instead of increasing, and  $\frac{\text{CO}_2}{\text{O}_2}$  is about 1 instead of  $< 1$ ; with the (imperfect)

colour change the sudden drop in acid is absent and  $\frac{\text{CO}_2}{\text{O}_2}$  is 1.

No indications for an abnormal sugar respiration were found.

From these results and from data in the literature a working hypothesis was made that low non-freezing temperature causes an irreversible physical change in the protoplasm of the tomato fruit, so that normal protein hydrolysis does

not take place, and no amino acids become available to form organic acids by deamination.

Promotor: Prof. Ir A. M. Sprenger

Author

94. W. A. J. OOSTING Bodemkunde en bodemkartering in hoofdzaak van Wageningen en omgeving / *Soil science and soil survey mainly of Wageningen and district*. 1936, pp. 128. Du. summ.

The thesis was the first of a series concerned chiefly with soils of the Netherlands and was a totally new approach to the problems of survey, genesis and classification, ensuing from the publications by Staring (1856, 1860) and van Baren (1908, 1927).

Oosting's concept of soil science was a wide one. His thesis deals with the basic principles of modern soil science. It was only in and after the Second World War that soil survey developed along these lines. Oosting also indicated the importance of such auxiliary sciences as agricultural history, archaeology, quaternary geology, agrohydrology and geomorphology.

Methods were described and information was given on soil genesis, emphasizing the function of vegetation and human influence.

New ideas were developed on quaternary geology, different from those embodied in the Geological Map. Some chapters were devoted to hydrology, enclosure (related to human occupation), archaeology and history of some settlements on the southern Veluwe. The importance was stressed of studies of the relation of the plant to the soil profile and of mapping of Dutch soils, which had not yet started. It was pointed out that this was a task for people trained in agricultural sciences. Soil maps should be based only on soil properties and should be useful to as many people as possible.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

95. H. J. SCHOPHUYS Het stroomgebied van de Barito. Landbouwkundige kenschets en landbouwvoorlichting / *The Barito river basin: agricultural features and agricultural extension*. 1936, pp. 208.

A description was given of the geology, topography, vegetation, climate and other characteristics of the Barito watershed in Borneo with a classification of soils and agricultural regions. For the lowlands and swamps wet rice cultivation was used as a criterion. Details were given of rice growing and its adaptation to the specific conditions of these lowlands and swamps, some of which were tidal.

An analysis was given of the population, its composition, origin and social and economic characteristics, the relation of agricultural and cultural phases of the population, and the function and working of the agricultural advisory service. This service succeeded in restoring local institutions to organize provi-

sional water boards and encourage wet rice cultivation. The advisory service also promoted rural handicrafts.

More local participation was needed from the beginning in all development efforts, such as reclamation, irrigation and drainage projects, to develop self reliance and initiative. There were great opportunities for rural development even on lands earlier classified unsuitable for commercial agriculture. A soil survey of the main agricultural regions was urgently needed. 3 maps were added.

Promotor: Prof. J. E. van der Stok

L.A.

96. J. B. H. IJDO De invloed der bemesting op het carotine- en vitamine C-gehalte van de plant / *The influence of fertilizer on the carotene and vitamin C content of plants*. 1936, pp. 8 + 122. Du. a. Eng. summ.

For practical reasons *Spinacia oleracea* was chosen for these pot experiments in a greenhouse. For the quantitative estimation of carotene, a short method was developed. The vitamin C content of leaves decreased rapidly at room temperature and even at ice-box temperature, so analysis had to be rapid (titration with 2,6-dichlorophenolindophenol in acid medium).

The pots contained pure washed quartz sand or an exactly analysed sandy soil, and were supplied with Krüger's nutrient solution.

Increasing the N supply increased the carotene and vitamin C content. Increasing K supply decreased carotene content, but increased vitamin C content. But decrease in carotene content was only obvious in plants grown with little N. The increase of vitamin C content was usually most distinct in plants grown with much N, although it was fairly clear in the whole combined experiment. The influence of P, Ca and Mg salts was small.

A final section attempts to interpret the data to demonstrate a relation between chlorophyll and carotene. Ascorbic acid was considered to be a product of photo-synthesis. This could explain the peculiar course of carotene and vitamin C contents with K fertilizers. K deficiency acted as a N excess, while K excess acted as N deficiency.

Promotor: Prof. Dr G. Grijns

E.

97. W. FEEKES De ontwikkeling van de natuurlijke vegetatie in de Wieringermeer-polder, de eerste groote droogmakerij van de Zuiderzee / *The establishment of natural vegetation in the Wieringermeer Polder, the first large reclamation in the Zuyder Zee*. 1936, pp. 8 + 320. Du. summ. Also published in *Nederl. Kruidkundig Archief* 46 (1936) 1-296.

The reclaimed sea bottom grew first a felt of blue and silicious algae, except in ditches. In very moist places unusual associations of green algae developed with some sulphur and purple bacteria.

The subsequent introduction of plants to the new land was promoted by water, by air only for a few anemochores, by birds to a slight extent and by men sometimes.

Of the 261 naturally dispersed species only about 50 could develop socially, and only a few of them over larger areas. Most species were nitriphilous, indicating the importance of N in the establishment. Dominance was studied by the Scandinavian method of plant sociology. Species distribution curves (Jaccard) were constructed.

Natural selection occurred mainly among seedlings. The reaction of the most important halophytes and glycophytes to salt concentration was examined. *Musci* and *Hepaticae*, although wind-distributed, formed associations only after a heavy leaching of salt by rainfall. *Fungi* appeared after a year. Finally the fauna and the usefulness of these investigations were considered.

Promotor: Prof. Dr J. Jeswiet

E.

98. E. J. À CAMPO Wiskundige waardeering van arbeidspraestaties / *Mathematical evaluation of labour output*. 1956. pp. 10 + 58. Du. summ. in *Landbouwk. Tijdschr.* 54 (1942) 368-375.

The greater part of the cost price of palm oil was spent on harvesting the ripe bunches. To harvest at the moment of best ripeness, the bunches had to be collected every 5 to 8 days.

An oilpalm estate was divided in 8 divisions of approximately 2000 acres, under supervision of an assistant manager. Topographical differences in the divisions gave rise to very variable harvesting costs. Judging the cost price depended usually on common sense.

On flat terrain the oil palms were planted in rows perpendicular to a railway line; on sloping terrain in widely divergent directions. The following labour analysis was drawn up: the labour effort of the harvesters to detect the ripe bunches; the labour effort to climb into the palm trees to cut off the bunches; the labour effort to carry the bunches to the railway; the labour effort to load the bunches into trucks. A formula was derived for the production per labourer. It represented a hyperbola for production per acre from 0 to  $\infty$  and contained variables mainly dependent on topographic influences. Weather conditions and other influences explained the deviations from the most probable straight lines (reciprocals) and hyperbolae.

Promotors: Prof. J. E. van der Stok and Prof. Dr M. J. van Uven

Author

99. G. D. NEL Die ontstaan en ontwikkeling van beesboerdery in Suid-Afrika en in besonderheid van die Friesveefokkery / *Origin and development of cattle farming in South Africa, especially of Friesland breeding*. 1937, pp. 14 + 228. Afrik. summ.

Original imports of Black Pied cattle were of various types and productive potential and could hardly be called Friesians. South African Frieslands contain blood from Afrikaner, Bechuana and Damara cattle and so are very heterogeneous. Uncontrolled breeding with native and with several imported breeds continued until about 1905, resulting in total degeneration of some outstanding native breeds. After 1905, with the foundation of a herd association this haphazard crossing slowly decreased. The register played an important part but was of no scientific merit and required reorganisation. Many Friesland herds in South Africa are very heterogeneous, both phenotypically and genotypically. Outstanding Friesland herds were always linebred and originated mainly from Jan 3265 FRS, Ceres 4497 FRS and Albert 1306H FRS. The openness of the register permitted registration of grades and ought to be abandoned. A few uniform herds of Frieslands were already available in South Africa. The new registration system of 1933 was more national, requiring a basic conformation and production score. But the scoring system ought to be revised to emphasize general features of conformation rather than figures. The 'Preferent Sire' award should be supplied only after a very thorough test of all progeny.

Promotor: Prof. Dr D. L. Bakker

Mo.

100. A. P. C. BIJHOUWER Een bijdrage tot de kennis omtrent het bloeien en het vruchtdragende vermogen van den mangga (*Mangifera indica* L.) / *A contribution to information on the flowering and fruiting of the mango tree, Mangifera indica* L. 1937, pp. 166. Du. a. Eng. summ.

The introduction describes the geographical distribution of the mango, and gives new data on its occurrence on Java and Madura, and calculates the financial profits for the population. The observations on flowering are described, which may contribute to the knowledge on flowers and inflorescences in general, and may serve as guides in crossing experiments with mango varieties. The chapter on yields contains facts of value for trade and in crossing techniques.

Results of crossing experiments are discussed. Two varieties could set fruit without wind and insects; another one was closely dependent on wind. The preliminary fruit set was 5 to 24 times as large as final yield. Flies were the only regular visitors, although not in large numbers. There were no wild bees in Pasuruan.

Introducing hives each of 13,000 to 15,000 bees per 10 trees into the mango gardens showed that some mango varieties were frequently visited, others less so. The commercial varieties attracted many (or fairly many) bees. Although no definitive conclusions could be drawn, an increased yield of 23 fruits per tree would already meet the expenses of bee-keeping. For peasant culture the profits would be even greater.

Promotor: Prof. Ir A. M. Sprenger

E.

101. G. HOUTZAGERS Het geslacht *Populus* in verband met zijn beteekenis voor de houtteelt / *The genus Populus and its significance in silviculture*. 1937, pp. 10 + 266. Du. a. Eng. summ.

The genus *Populus* L. can be divided into 5 sections. This study deals with the classification and description of the species and varieties of the section *Aigeiros* Duby (black poplars), which contains almost all the important cultivated types in the Netherlands. The botanical information was supplemented by information on origin, distribution, possible origin from crosses, their Latin and popular names, and their cross fertility. Some data were given on the wood and its use, periods of flowering, budding and leaf fall and description of leaf prints. The data were compiled into a determinative key, a botanical and a geographical classification of the genus *Populus* L. and a table contrasting the features of important species of the section *Aigeiros*.

The culture of the poplar could be of greater value to the low-lying Netherlands. Wood production per tree could be much enlarged. Confused nomenclature often led to introduction of susceptible types. A plea was made for international control.

Promotor: Prof. Dr J. Jeswiet

E.

102. A. G. A. IDENBURG Systematische grondkaarteering van Zuid-Sumatra / *Systematic soil survey of Southern Sumatra*. 1937, pp. 168. Eng. summ.

This systematic soil survey covers an area of about 50,000 sq.km, that consists of marshes, coastal plains, hills and mountains. Soils were classified as dry-land soils, marsh soils and peat soils, and subdivided as Residual and Sedimentary soils. Most soils are derived from liparitic, dacitic and andesitic volcanic rocks. All soils are influenced by recent fertile volcanic ash, which had rejuvenated these soils. Only 8% of the area was cultivated; most land was covered with tropical rain-forest.

The soil map shows 65 soil mapping units. The principle soils are different Lateritic soils, especially Yellowish-Brown Lateritic soils, Reddish-Brown Lateritic soils, Alluvial soils and swampy marine Hydromorphic soils. Of all soil mapping units descriptions were made of typical soil profiles, the parent material, the chemical, physical and mineral characteristics and an evaluation was given of their agricultural value.

Promotor: Prof. Dr Ir C. H. Edelman

Bu.

103. G. HELLINGA Heteroauxin und Polarität, morphologische und elektrische, bei *Coleus*-Stecklingen / *3-Indoleacetic acid and polarity, morphological and electrical, in Coleus cuttings*. 1937, pp. 6 + 70. Ger. a. Du. summ. Also published in Meded. LH 41 (1937) 1.



Transport of 3-indoleacetic acid (IAA) in *Coleus* cuttings is only towards the base (indicated by root formation). The physical basis of Went's theory (1932) on IAA anion attraction by a positive pool and repulsion by a negative pool, was shown to be incorrect. Yet potential difference (PD) could be responsible for polar transport. PD-measurements showed that with both normal and inverted cuttings the upper end was always more negative than the lower (held) end. As also no apical transport of basally applied IAA took place in inverted cuttings, PD was not the cause of polar transport. But in inverted cuttings with apically applied IAA upward basal transport took place, against the assumption of electrical transport. Before root formation, the PD was equal in normal and inverted cuttings, independent of IAA application. After root formation, however, the cuttings with and without IAA all showed a marked PD.

An electrical field did not influence IAA transport but weak electric currents induced apical root formation in normal cuttings with apically applied IAA, so that IAA is probably retained. 0,01  $\mu$ g IAA only induced root formation, larger doses also cambial activity, formation of callus, tracheal elements and sclerenchyma bundles (otherwise occurring at older age).

Promotor: Prof. Dr E. Reinders

E.

104. K. EBES Vorming van thyllen in geveld beukenhout / *Formation of thyloses in felled beech wood*. 1937, pp. 56. Du. a Ger. summ.

After felling, beech wood may form thyloses, blocking the xylem vessels, so that they can not be sufficiently impregnated with creosote. This decreases the durability and value of the wood for such purposes as railway sleepers. Ebes found that thyloses may be formed throughout the year through pits from wood ray cells next to the xylem vessels. Trials with small logs showed that thyloses appeared sooner at higher temperatures. After a loss of 40–45% moisture no more thyloses appeared. Fresh uptake of moisture induced further thyloses, unless moisture dropped below about 60%. Ebes confirmed Klein's observation (1923) that when water was pressed through a branch and air through one of its laterals, the branch developed no thyloses, while the lateral formed many. From this it was concluded that the penetration of air into the vessels caused formation of the thyloses.

To limit thyloses trees should be felled in a season with low temperatures, and drying of the timber should be encouraged by sawing the wood early. More experiments were needed to find how quickly railway sleepers dried.

Promotor: Prof. Dr E. Reinders

E.

105. W. N. MIJERS Groeiplaatsboniteering van djatiboschgronden in verband met grondkaarteering / *Evaluation of teak forest soils in connection with soil survey*. 1937, pp. 2 + 156. Du. summ. after each chapter.

The relation between soil conditions and vegetation, especially of teak forest was studied. Chemical or physical characteristics of the soil only did not give reliable results. Soils were then studied in the field and a detailed soil map of about 1000 ha of teak forest was made. This soil map shows the occurrence and distribution of 29 soil types, which were briefly described. For some soils some chemical and physical characteristics were given in tables. Most soils are Lateritic and Margalitic soils of varying composition and morphology. Often there are horizons with mottled clays or lateritic concretions. Some soils are derived from andesitic, others from quartz-rich or other parent material. The Margalitic soils are developed in heavy-textured clays. Further to this soil investigation an intensive study was made of the vegetation in the same area of Java. The vegetation was classified into various groups according to the development of the forest trees, the shrubs and the ground flora. It was concluded that the soil map was a very important tool for the prediction of the suitability of the land for growing teak.

Promotor: Prof. Dr Ir C. H. Edelman

Bu.

106. G. G. P. SAUBERT The influence of alcohols on the protoplasmic membrane and colloid models. 1937, pp. 8 + 90. Du. summ. Also published in *Recueil Travaux bot. néer.* 34 (1937) 709-797.

Experiments with colloid systems attempted to achieve a better understanding of biological processes. The influence of alcohols on phosphatid coacervates was compared with their influence upon the protoplasmic membrane of living cells of the alga *Chara ceratophylla*. Some similarity could be seen between the influences of methanol, ethanol and butanol. But the alcohols exerted their influence upon the living membrane at much lower concentration than they did on the phosphatid coacervates (ratio 1:10) and on the dielectric medium (1:10). Propanol, however, decreased the permeability of the living protoplast, in the opinion of the author by condensation of the membrane, but opened up the phosphatid coacervate. Very low concentrations of propanol could, however, increase the permeability of the protoplasmic membrane in a similar way as it increased the volume of the coacervate.

In explaining the influence of alcohols on the permeability of the protoplasmic membrane the author considered: action on the carbon chains of the membrane components; action on the dielectric condition of the system; the structure of the system (amorphous or oriented). The use of phosphatid coacervates as a model did not mean that the protoplasmic membrane was thought to be an amorphous system. Alcohols would probably open up a protoplasmic membrane composed of oriented components.

Promotors: Prof. Dr E. Reinders and Prof. Dr H. J. C. Tendeloo

E.

107. A. J. ZUUR Over de ontzilting van den bodem in de Wieringermeer / *Desalinization of the soils of the Wieringermeer*. 1938, pp. 8 + 192. Du. summ. Also published by Directie van den Wieringermeerpolder, Afdeling Onderzoek.

The initial concentration of salt in the soil moisture of the Wieringermeer (reclaimed from the sea in 1930) was about 2%. The moisture content of the soil and hence the salt content in dry matter increased with increasing clay content.

Percolating rainwater attained the concentration of the soil moisture within a depth of 25 to 50 cm. Diffusion hardly influenced salt movement as such, but was highly instrumental in equalizing the salt concentration of the percolating rainwater and of the soil moisture.

In comparable leaching conditions the topmost layer of sandy soils was leached faster than of clay soils. For the deeper layers the reverse was true. Usually the low permeability of the clayey subsoils hampered passage of water. In soils with vegetation upward capillary transport did not exceed about 50 mm a year. Seepage retarded desalinization considerably.

The better the drainage the faster the leaching. After laying an adequate field-drainage system the rains of one winter leached sufficient salt from sandy soils to allow crop growth; for a comparable leaching of clay soils the rains of two to three winters were required.

Promotor: Prof. Ir M. F. Visser

Ve.

108. E. G. MULDER Over de beteekenis van koper voor de groei van planten en micro-organismen, in het bijzonder een onderzoek naar de oorzaak der ontginningsziekte / *The influence of copper on the growth of plants and micro-organisms, in particular a study into the cause of the reclamation disease*. 1938, pp. 8 + 134. Ger. summ.

Cereal plants growing on newly reclaimed peaty and heath soils often showed serious symptoms of 'reclamation disease' which were cured by adding Cu salts. To elucidate the function of Cu in this plant disease, several plant species were grown in purified water-culture and sand media practically free from Cu. The symptoms of Cu deficiencies obtained were identical with the symptoms of plants growing in 'diseased' soil. The considerably larger amounts of Cu needed by plants growing in 'diseased' soil proved to be due to the fixation of Cu by the black organic matter of the soils.

Further evidence that a low content of available Cu was the cause of reclamation disease was provided by a microbiological method. In this test the colour of the spores of *Aspergillus niger* grown in a copper-deficient medium supplied with small amounts of soil was a measure of Cu supply to the fungus.

In addition to fixation by certain types of organic matter, bacteria producing hydrogen sulphide may precipitate soluble Cu so that it becomes, at least temporarily, unavailable.

With humid air, symptoms of Cu deficiencies were less severe. Copper-defi-

cient wheat plants were more susceptible to fungus diseases. Application of Cu salts may sometimes cause manganese deficiency. Cu was found to be required by some micro-organisms.

Promotor: Prof. Dr J. Smit

Author

109. E. L. LEVIE Ontwikkelingsmogelijkheden van coöperatieve organisaties voor den verkoop van ooft in Nederlandsch-Indië / *Possibilities of developing fruit-marketing co-operatives in the Netherlands East Indies*. 1938, pp. 8 + 138. Du. summ.

The scope for co-operatives for fruit marketing was considered in view of the development of orchards from kitchen gardens to commercial production, with fewer types of fruit trees or even monoculture. Such specialization had not then proceeded far, so that little fruit was supplied by each grower and it varied widely in quality in the markets. Much fruit was sold on the tree, representing a considerable credit. Fruit was an important source of ready money for the farmers either as producers or as middlemen. A review was given of fruit-marketing co-operatives in the world with special reference to the United States and the Netherlands.

The possible task and conditions for co-operatives in the Netherlands East Indies were considered but the author concluded that difficulties of standardization, credit and managerial skill were still almost insurmountable. Yet co-operatives could have been of great help to improve the status of the growers.

Promotor: Prof. Ir A. M. Sprenger

Jo.

110. J. B. VAN DER MEULEN Over het effect van hyperthyreodiseering bij witte leghorns / *The effect of hyperthyroidism on White Leghorn hens*. 1938, pp. 10 + 162. Du. a. Eng. summ.

Oral feeding of White Leghorn hens on a thyroid preparation generally had only a very small toxic effect when given in one dose. A higher death rate occurred when given in small doses on consecutive days.

The hens fell into a moult, varying from slight to complete, 7 or 8 days after thyroid feeding. Severity depended on dose, season and feeding. The sensitivity to moult induction increased gradually from January to May, reaching maximum in summer. During natural moult in September hens were almost insensitive to thyroid preparation. This resistance decreased gradually until February-March.

After giving thyroid preparation, 1-3 eggs were produced, then followed a temporary interruption in egg production, varying in length with the individual, but usually in almost direct proportion to the quantity given. The maximum interruption lasted about 1.5 months despite larger doses. After moulting this

maximum diminished to about 3 weeks. After an induced moult the birds rarely moulted again in autumn; yet egg production ceased as usual. Thus advanced moult cannot increase winter production. After induced interruption, normal egg production was resumed.

The influence of thyroid feeding on moult periodicity was probably controlled by another mechanism than that on egg production. A hypothesis was drawn up to explain these mechanisms.

Promotor: Prof. Dr G. Grijns

E.

111. W. H. DIEMONT Zur Soziologie und Synoekologie der Buchen- und Buchenmischwälder der nordwestdeutschen Mittelgebirge / *The sociology and synecology of beech and mixed beech forests of the Northwest German Low Mountain Area*. 1938, pp. 8 + 182. Ger. summ. Also published in *Mitteilungen d. Floristisch-soziologischen Arbeitsgemeinschaft in Niedersachsen (Hannover), Heft 4* (1938).

The beech (*Fagus sylvatica* L.) occurs in Europe in pure and mixed mesophile, deciduous, dominantly broad-leaved forests belonging to the phytosociological order of the *Fagetalia silvaticae*. This order includes the true beech forests united into the *Fagion* alliance and is represented in the area considered by the *Fagetum boreoatlanticum* (with 5 subassociations), and the mixed beech forests belonging to the *Fraxino-Carpinion* and represented by the *Querceto-Carpinetum medioeuropaeum* (with 2 subassociations). A further subdivision into variants and subvariants was made.

Some of the subassociations only occur on soils with a high watertable; others represent ultimate equilibrium stages in vegetational development under normal conditions, called climax vegetation types. Diemont concluded from his investigations that the climax types varied with the soil; nevertheless, within one climatic region, they were so much alike to be considered members of one climax swarm ('Klimaxschwarm'). However distinct differences between the floristic composition on northern or eastern slopes and on other slopes were found; within one region such types may be combined into one climax group ('Klimaxgruppe').

Physical and chemical soil analysis supported the botanical classification. Climatic data were added. Some notes were included on the ephemeral vegetation occurring after removal of the forest.

The natural forest types and the ecological conditions under which they occurred supplied valuable information on the most suitable tree and shrub species for reforestation and the treatment of the forest.

Promotor: Prof. Dr J. Jeswiet

M.D.

112. D. A. VAN SCHREVEN De gezondheidstoestand van de aardappelplant onder den invloed van twaalf elementen / *The influence of twelve chemical elements on the health of the potato plant*). 1939, pp. 8 + 158. Also published in Meded. LH 43 (1939) 1.

The influence was studied of K, P and N in the potato variety President in an outdoor experiment in stoneware cylinders filled with alluvial riverine sand and in a greenhouse in glazed stoneware pots filled with glass sand, partly treated with concentrated HCl. From the outdoor plants, sections were cut through the middle of the first and ninth internode. With an Abbé's prism, drawings were made, indicating diagrammatically the various tissues. The surface areas of the various tissues were measured with a planimeter. The average percentage of each tissue was calculated for each treatment (KPN, NP, KN, KP, P, K, N, O).

The external and internal symptoms of Ca, Mg, Mn, Fe, B and Zn deficiency and those of Mn, B and Cu excess were studied in some potato varieties grown in glass sand or water culture. The effect of Na and Cl was studied in water culture by adding increasing amounts of NaCl, or CaCl<sub>2</sub> to the medium. Tubers showed internally typical symptoms only in Ca and B deficiency. The tuber disease from calcium deficiency was called medullary necrosis.

Promotor: Prof. Dr H. M. Quanjier

Author

113. J. J. FRANSEN Iepen ziekte, iepenspintkevers en beider bestrijding / *The elm disease, the elm bark beetles and their control*. 1939, pp. 8 + 118. Eng. summ.

From the larvae and adults of the elm bark beetle *Scolytus scolytus* F. *Ceratostomella ulmi* could nearly always be isolated. The mite *Pseudotarsonemoides innumerabilis*, living on the elm bark beetles, was transported by them to the newly cut egg tunnels in the tree, from where the mites transported the spores of *C. ulmi* through the larval tunnels to the pupal cells, where they disseminated the spores in such a way that these form a typical sward of coremia. In the absence of mites this was always lacking in the pupal cells. The dispersal of elm disease by other insects proved improbable. The exact relation between the quantity of elm bark beetles and the occurrence of new outbreaks of elm disease could be established.

The different feeding techniques of *S. scolytus* were studied both in field and laboratory trials. The generations of these beetles were compared for different meteorological conditions. The number of generations varied greatly. Both 4 generations and (as a rule) 1 generation a year were observed. They always overlapped, so there were no periods without beetles. Breeding material had to satisfy special requirements. These requirements and the way, in which a pile of wood was attacked, were fully discussed.

After explaining that control of the fungus was not possible, Fransen con-

cluded that the only way to combat the elm disease was to destroy elm bark beetles. Control measures tested by Fransen were fully described.

Promotor: A Committee from the Senate  
of the Agricultural University, Wageningen

E.

114. A. VAN DER MEULEN Over den bouw en de periodieke ontwikkeling der bloemknoppen bij *Coffea*-soorten / *The structure and periodic development of flower buds in Coffea species*. 1939, pp. 8 + 128. Eng. summ.

In regions with abundant rainfall coffee shows a flowering rhythm quite different from that in regions with distinct dry and wet periods. Some species and varieties flower only on the first-year wood, other ones also on the older wood. In some flowering lasts much of the year, other bloom heavily for only a short time. To find whether these differences already appear in the origin of the flowers, descriptions were made of the morphology and development of the branch system, the inflorescence and the flower with *Coffea canephora* P. var. *robusta* Linden and *C. macrochlamys* K. Sch. var. *excelsa* A. Chev., and besides of the structure of the inflorescence of *C. arabica* L. The structure of the inflorescence of *Coffea* L. was shown to derive from the structure of the vegetative parts of the plant. Eight stages could be distinguished in the development of the vegetative points of third degree into flowers.

Between the periodicity of floral initiation on primary side-branches of some *Coffea* L. spp. and the periodicity of wet and dry periods, different relations were found for different species and varieties, but in the second half of a dry period flowers never arose. Constantly wet regions gave robust plants with few flowers and so smaller yields than regions with periodic drought giving thinner plants with many flowers. Much useful literature on flowering was reviewed.

Promotor: Prof. Dr A. H. Blaauw

E.

115. G. J. VINK De grondslagen van het Indonesische landbouwbedrijf / *The basic elements of the Indonesian Peasant Farm*. 1941, pp. 204.

Vink analysed the basic elements of farm management in Indonesian small-holdings. General principles of farm management were tested in an economic environment, where social conditions had a large impact. The amount of influence on the individual farm enterprise was discussed for the various peasant societies of the Indonesian archipelago. Thereafter the use and allocation was described of the factors of production: nature, labour and capital on the smallholders' farm. A summary was given of labour analyses, carried out in cultivation of sawah rice and other crops. The types of labour and the distribution of labour within the family were described. The farmer's land assets were discussed with reference to land tenure and the size of holdings. The intensity of farming

was considered in an extensive analysis of the exploitation and use of natural resources in the 'ladang system'. Special attention was paid to type and quantity of agricultural investments by the peasant farmer.

Promotor: Prof. J. E. van der Stok

Lu.

116. J. DOEKSEN Bijdrage tot de vergelijkende morphologie der *Thysanoptera* / *Contribution to the comparative morphology of Thysanoptera*. 1941, pp. 4 + 114. Also published in Meded. LH 45 (1941) 5.

The morphology of a wide range of Thysanoptera, including both primitive and highly specialised species, was described.

It proved possible to find lines of development in the great diversity of forms and the homology of specialized structures such as mouth parts and wing veins could be ascertained.

Structural details of the external sex organs and legs, partly overlooked by earlier workers, were described and their importance made clear.

From the morphological studies, a slightly altered taxonomic system was devised.

Promotor: Prof. Dr W. K. J. Roepke

Author

117. G. F. HAUSER Die nichtaustauschbare Festlegung des Kalis im Boden / *The unexchangeable fixation of potassium in soil*. 1941, pp. 172. Ger. a Du. summ.

Types of bonds between K and soil constituents were summarized with published data; Volk's remineralization model and a model of Gorbunov were rejected. Experimental results suggested that an equilibrium existed between exchangeable and unexchangeable K. Only soils with an inorganic colloid fraction could fix K in an unexchangeable form.

Fixation capacity was correlated with clay percentage.

Differences between river clay and marine clay were clarified by content of minerals low in K and by the influence of naturally occurring humic substances. Micaceous earth was especially K. fixing while humic substances did not fix potassium but increased the capacity of minerals to fix K.

Distortion of the humic film by oxidation or a pH shift lowered the fixation capacity of soils. Adding artificial humic substances to soil did not restore fixation capacity but lowered it by blocking access to the grid.

Field trials showed that prolonged K consumption without replenishment enlarged the K-fixing capacity. On K-fixing soils, heavy K dressings had a transient effect, so a K dressing in autumn was purposeless. Fixation of K was so strong that even under heavy K dressings, there was no leaching of K.

Promotor: Prof. Ir J. Hudig

v.E.



118. A. F. VAN DER SCHEER Over mastitis veroorzakende streptococci / *Streptococci causing mastitis*. 1941, pp. 14 + 200. Du., Ger., Eng. a. Fr. summ.

The aim of this work was the identification of mastitic streptococci by cultivation and biochemical tests, and, where necessary, by serological methods. It was concluded that horse-serum agar was an excellent medium for the isolation of mastitic streptococci. Addition of 0.1% aesculine improved diagnosis and allowed most kinds of mastitic streptococci to be recognized immediately. A simple guide elucidates the practical use of the cultural medium. Main criteria were behaviour with aesculine and litmus milk, type of colonies, haemolytic or not, and behaviour with raffinose and trehalose.

Promotor: Prof. Dr D. L. Bakker

St.

119. A. PASVEER Een statistisch onderzoek over de factoren, welke invloed uitoefenen op de kwaliteit van de Nederlandsche boter / *A statistical study on the factors influencing the quality of Dutch butter*. 1941, pp. 132. Du. summ.

The studies were on the quality of a large number of commercially produced butters, grouped into salted and unsalted, winter and summer butters. Chemical, microbiological and physical quality characteristics were evaluated, and their mutual relations and relations with some particulars of the manufacturing methods were studied. The data pairs showing significant correlations were further studied, in order to trace the cause of the relations.

Some of the results are: the detrimental effect of salt on production and maintenance of the butter aroma, partly by inhibiting acid development; the increasing pH of the butter serum with increasing hardness of the wash water; the detrimental effects of a coarse moisture dispersion and of contamination through the wooden churn on the bacteriological keeping quality. It is supposed that diacetyl is not the main component of the butter aroma.

Promotor: Prof. Ir B. van der Burg

W.

120. D. R. MANSHOLT Beschouwingen over een onderzoek naar de waterschapslasten in Nederland / *Reflexions on a study of taxation by river catchment authorities in the Netherlands*. 1942, pp. 20 + 384. Du. summ.

Water control is very important for the Netherlands. There is a variety of water-control organizations.

Usually such an organization consists of the landowners in the district, or in a polder. They are responsible for all public works in their district. They must pay for construction, depreciations, repairs and maintenance to dikes, canals and roads. Different forms of these organizations were examined; their total costs and the spread of these costs over the landowners. A complete description

was given of the cost of water control in the various districts. There were large differences, according to the type and difficulties of water control. An important conclusion was that the method of spreading the cost over the landowners was not right and some suggestions for improving this aspect of the water-control organizations were given. To improve their efficiency some suggestions for adaptation of the form of the organizations and the regulations which governed them were also given. This thesis was written in war-time in the hope of a solid basis for reconstruction of water-control organizations when the war was over.

Promotor: Prof. Dr M. F. Visser

v.d.N.

121. C. SCHIERE Melkproductiecontrole in het Zuidhollandse en Utrechtse kaasdistrict / *Milk recording in the South Holland and Utrecht cheese producing districts*. 1942, pp. 8 + 88. Du. summ.

Milk recording is an important factor in checking the profitability of dairy farming. In the cheese district considered, where full-cream Gouda cheese is produced on the farm, the customary records of milk yield and fat content were insufficient, because output was determined by the cheese yield of the produced milk, which in its turn depended largely on the casein content of the milk. It was found that the rather weak correlation between fat and casein contents could not serve as a basis for prediction of the cheese yield in practice. Therefore a simple method was devised for estimating the yield of fat-free cheese. This factor was found, however, to correlate sufficiently well with fat content and density of the milk. Consequently, a multiple regression equation was calculated between percentage cheese yield, and fat content and density, that could successfully be applied in profitability checks and for breeding programmes.

Promotor: Prof. Ir B. van der Burg

W.

122. D. DE WAAL Het cyanophore karakter van witte klaver (*Trifolium repens* L.) / *The cyanophoric character of white clover (Trifolium repens L.)*. 1942, pp. 6 + 136. Du. summ.

The positive correlation found in New Zealand between quality of white clover and its hydrocyanic acid content, could not be confirmed for Dutch white clover in the Netherlands. HCN occurred bound to an incompletely identified glucoside. As Weevers and Treub et al. found the glucoside and HCN contents varying in other plants during the day, the author tried to find out whether similar variations occur in the HCN content of white clover. The bromometric method of Schulek was modified so that HCN was titrable at a definitely alkaline pH (instead of acid or neutral). The experimental plants were grown under close control: constant illumination, and, within limits, usually constant temperature and air humidity.

HCN in Dutch and New Zealand white clover increased rather sharply after sunrise, reaching a maximum rather soon (e.g. after 4 h), then decreasing. This variation only occurred if the weather conditions of the successive days were much alike. Otherwise it was disturbed, often with a second maximum after noon. A maximum must be assumed for the night also. At least 50 leaves must be analysed.

These and other results seemed sufficient to start breeding research on HCN content in the Netherlands.

Promotors: Prof. Dr H. K. H. A. Mayer Gmelin  
and Prof. Dr H. J. C. Tendeloo

E.

123. E. W. B. VAN DEN MUIJZENBERG De invloed van licht en temperatuur op de periodieke ontwikkeling van de aardbei *Fragaria grandiflora* Ehrh. en de betekenis daarvan voor de teelt / *The influence of light and temperature on the periodic development of the strawberry, Fragaria grandiflora Ehrh., and its significance for its culture.* 1942, pp. 8 + 160. Du. summ.

The morphology and yearly development of the strawberry were described from the literature and from research, particularly those of the cv. Deutsch Evren in the Netherlands. In the successive chapters, the following subjects as influenced by season temperature, light and humidity were treated separately: the formation of runners and the effect of removing them; the formation of leaves and lateral crowns, and the effect of removing flower clusters; the induction of the preprimordial flowering state, dependent on short days (SD) of 6, 8, 10 or 12 h for at least 6 days and mostly about 2 weeks; with 10° to 15°C induction also after longer days; the inert state in autumn and the inhibited state in winter; the elongation of flower clusters (the longer the SD treatment during floral induction, the shorter the axis of flower clusters and the longer the flower stem); flowering and fruit set; fruit formation and harvest (in summer about 100 days between the start of SD treatment and fruit ripening).

Descriptions were given of the general methods of culture. Finally followed a survey of existing methods and those developed by van den Muijzenberg from his experiences with temperature (heating, cold treatment) and light (SD treatment, LD treatment, artificial light supply). Eleven methods were described for different year periods, by different environments and environmental changes to get a year-round culture. Three methods of eliciting several yields a year were elaborated.

Promotor: Prof. Ir A. M. Sprenger

E.

124. L. J. VAN DIJK Landschapsbedrijven als middel tot opheffing van onontwikkelde streken in Nederlandsch-Indië. Een studie over het vraagstuk van de ontwikkeling van Nieuw-Guinea, met conclusies over locale overheidsbedrijven

voor bosch- en landbouw, gebaseerd op verplichte medewerking van de bevolking, en getoetst aan de mogelijkheden op Japèn en de verwachtingen voor de cultuur van *Agathis* | *Regional co-operative enterprises as a way of improving undeveloped regions in the Netherlands East Indies. A study on the problem of developing New Guinea, with conclusions on local governmental enterprises for forestry and agriculture, based on compulsory co-operation by the population, and tested on the possibilities on Japen and expectations for the culture of Agathis.* 1942, pp. 202.

The study was of the island of Japen north of Western New Guinea, a wild and undeveloped part of the East Indies.

The island had vast forests; in the past some attempts to develop forestry and agriculture failed.

The author suggested exploitation of forest by-product copal, obtained by tapping *Agathis*, a coniferous tree. The natives were already familiar with the tapping of this tree in a very primitive way but organisation had failed. The author suggested growing artificial plantations of *Agathis*. Transport costs for the *Agathis* timber seemed too high.

Government supervision, organisation and financial support were needed.

Promotor: Prof. A. te Wechel

L.

125. G. POSTHUMUS Een mathematisch-statistische studie over de nauwkeurigheid van het organoleptisch onderzoek van boter | *A mathematical statistical study on the accuracy of the organoleptic tests of butter.* 1943, pp. 8 + 124. Du. summ.

The quality of butter, produced by the dairies in the Netherlands, is regularly tested by experienced testers after storage for 2 weeks usually at 14°C. Odour, taste and texture are tested. Usually a score is given, running from 1 (bad) to 5 (excellent). An analysis was made of the accuracy of the evaluations.

Differences in and between testers in score, for tests on many or one sample were assessed by the standard deviation of the score of one, or the mean score of 2 or more judges (subjective accuracy). Deviations were normally distributed. Accuracy was expressed as the correlation coefficient ( $r$ ) between the scores by one or more judges and the 'real' score (the mean score given by many judges): the objective accuracy.

An extensive mathematical treatment was given to show how  $r$  depends on the number of judges. Starting from the fact that for 2 judges  $r = 0.80$ , the value for 1 judge was found to be  $r = 0.686$  and for 3 judges 0.853. At least 3 judges were necessary. Methods were given of expressing the capability of 1 judge in terms of  $r$ . The subjective and objective accuracy of judges can differ much.

Promotors: Prof. Dr M. J. van Uven and Prof. Ir B. van der Burg

Author

126. A. W. G. KOPPEJAN *De regeling der agrarische defensieschade / The administration of war damages in agriculture.* 1943, pp. 160. Du. summ.

Damages caused to agriculture and horticulture by defensive measures could be reimbursed in various ways. Reimbursement could be by replacement at government expense, replacement in kind, or by financial compensation. Three systems were draughted for estimating damages in field cropping or pasturing: 1. The book-keeping method in which the financial surplus was calculated on the damaged farm and similar undamaged farms; 2. Immediate settlement based on an estimate of the surplus for the crop derived from data on this crop for 3 similar farms; 3. Fixed damages, which were an extreme simplification of method 1.

These systems were equally suitable for estimating compensation in land reallocations and in land acquisition for roads. The principle of damage estimates by calculating farm profits after excluding 'internal risks' was important for many studies on farm economics, especially studies on the financial consequences of changes in farming system.

Promotor: Prof. Dr Ir G. Minderhoud

Koo.

127. R. L. BEUKENKAMP *De wereldgraanhandel. Bijdrage tot de kennis van zijn ontwikkelingsgeschiedenis / International trade in cereal grains. Contribution to the knowledge of its developmental history.* 1945, pp. 10 + 284. Du. summ. p. 153 and p. 269.

The history of the grain trade was described. Since ancient times wheat had been dominant as the source of man's daily bread. In the middle of the 19th century trade in other grains increased with demand for feedstuffs in the production of meat and eggs, and with the use of cereals as raw material in numerous industries. Trade increased sharply with rising demand and with increasing production in new countries. World production reached its peak in the period 1925-30. This period however laid the basis for the agricultural crisis. After 1925 many European countries protected their own wheat production. The influence was described of methods of transport, technical improvements in agriculture and rising incomes of the consumers.

Promotor: Prof. Dr Ir G. Minderhoud

Koo./Ri.

128. W. A. NIEUWDORP *De bladrandchlorose van Rhododendron catawbiense 'Grandiflorum' / Chlorosis of the leaf margin of Rhododendron catawbiense Grandiflorum.* 1945, pp. 8 + 180. Du., Eng., Ger. a. Fr. summ.

*Rhododendron catawbiense* Grandiflorum, an economically important decorative shrub, suffered from chlorotic leaf symptoms in parts of the Boskoop area.

Two types of symptoms occurred: 1. Yellowish-reddy-green discoloration along the margins and between the primary veins to about half way along the midrib about July (in transmitted light there were many translucent spots), changing to cadmium-yellow in autumn; 2. Yellow (tissue)-green(veins) marbling of the leaf. Chlorotic leaves had, on average, 44% less chlorophyll than healthy leaves.

Soil acidity was  $8 \times$  less for affected than for healthy plants, both soils consisting of clayey peat. The adsorptive complex of bad soils was richer in bases than that of good soils. The higher pH of bad soils resulted from a higher Ca saturation. Above pH 5.1 leaf symptoms arose, abnormal root-hairs formed already at lower pH values. More lime in the soils resulted in higher Ca contents for the plant and lower contents of N,  $PO_4$ , K and Mg. The disease was shown to arise through shortage of N. Despite sufficient acidity too dry a soil also induced the disease. Application of dredgings proved unfavourable (pH about 5.7); a sulphur dressing was favourable (not Al-, Fe-, or Mn-sulphate) for soils with pH > 5.1.

Promotor: Prof. Ir J. Hudig

E.

129. J. C. A. VAN DOORMAAL, S.V.D. *Onderzoekingen betreffende de lössgronden van Zuid-Limburg / Investigations of loess soils from south Limburg.* 1945, pp. 12 + 94.

There were two hypotheses on the formation of loessoid soils in south Limburg. F. H. van Rummelen and W. J. Jongmans explained the origin by weathering of underlying rocks and reworking of the weathered material by water; J. H. Druif concluded on qualitative mineral data that the soil material was wind-borne from the north.

Detailed descriptions of places and sample profiles, and quantitative data on heavy minerals and grain size confirmed the hypothesis of Druif. The mineral associations of loess soils were similar to those of glacial deposits in the central and northern parts of the Netherlands and deviated considerably from those of the underlying rocks. The grain size was characteristic for loess.

At least two deposits were present: the oldest, possibly of Riss age and the younger Würmian.

Promotor: Prof. Dr Ir C. H. Edelman

Do.

130. J. P. SUIPKENS *Wiskundige beschouwingen bij eenige hoofdstukken uit de filosofie der landbouwwetenschap / Mathematical considerations of some philosophical points in agricultural research.* 1945, pp. 138. Du. summ.

Because of the many factors involved in agricultural problems experimental methods could not be based on *ceteris paribus*, as in other natural sciences, but

required factorial trials with simultaneous variation of many factors. A complete factorial experiment was unworkable in practice because of the large area required but trial size could be reduced by ignoring interactions of higher order.

Interactions of higher order sometimes cancelled out main effects and interactions of lower order. To avoid this undesirable effect, analogous functions called 'main action' and 'interplay' were introduced. The trial could be reduced to a smaller size by splitting the complete factorial experiment into part-experiments of factorial form for a small number of factors. Various possibilities were studied, including the replication of some treatments in different experiments to adjust results. Replicates were needed also to estimate variances and to compare these with interactions. Thus the estimation of variance from interaction terms could be avoided.

Promotors: Prof. Dr M. J. van Uven and Prof. J. E. van der Stok Ju.

131. J. E. MUNTINGA *Het landschap Westerwolde / The Westerwold landscape.* 1945, pp. 12 + 342. Du. summ.

The subject of this study is the origin and later development of a sandy region in the eastern part of the province of Groningen. Cut off from its surroundings by inaccessible peat moors, this region preserved its original character for centuries.

The book falls into three parts. The first chapters deal with the geological, political and demographic history of Westerwold. The means of subsistence are discussed at some length, the main being agriculture. Muntinga stated that the construction of canals, roads and tramways in the first decade of the 20th century ended the isolation of the district. Certainly one of the most striking changes in the farming conditions in Westerwold was the improved drainage, allowed by the construction of the canals. Land reclamation, potato-flour mills and dairy factories gave more employment than ever before. Agricultural education raised the farmer's income. Both arable and pastoral lands were much more intensively farmed. There was a clear switch to arable farming. The better conditions of living resulted in a considerable growth of the population.

The last part of the book is devoted to speculations on the future.

Promotor: Prof. Dr Ir G. Minderhoud v.d.P.

132. S. VAN DER WIJK *Crop-insurance.* 1945, pp. 4 + 132. Du. summ.

Crop insurance was fairly new in the Netherlands but there was no legal objection or limitation to particular crops. If a crop were insured, it was important that the whole area of the crop were insured. Speculative insurance seemed preferable to mutual insurance.

Crop insurance covered all risks outside human influence, and lasted from

1 May until threshing was complete. Percentage liability of the insurer should be limited and damage should never be completely reimbursed. A threshing certificate was considered as a way of ascertaining yield. Crop value was calculated after threshing. This and the market price at that time gave a basis for calculating premiums and any damage.

The chief differences of the system in the United States were: 1. The possibility of payment of premium and of damages in kind; 2. Insurance value was prearranged; 3. Insurance had to be arranged before the crop was sown; 4. Premium had to be paid immediately.

Crop insurance made the rent-reduction rights under tenancy law more acceptable also for the landlord. Compulsory crop insurance should be introduced only in extreme cases.

Promotor: Prof. Dr Ir G. Minderhoud

Koo.

133. H. J. MATHOT Factoren die de variatie van het vitamine C in de plant bepalen / *Factors determining the variation of vitamin C in plants*. 1945, pp. 8 + 176. Du.a. Eng. (4 pp. inserted) summ.

An attempt was made to explain the great variation in vitamin C content in garden crops, so that vitamin C content may be increased by altering the influencing factors. Ascorbic acid content (AA-ct) was estimated by titration with 2,6-dichlorophenolindophenol. Differences in AA-ct between plant varieties were attributed to polyfactorial genetic differences. Between the AA-ct's of (sub-units of) different genera no correlation with taxonomic order could be found.

AA-ct of rose hips was correlated to the ratio K:Ca:Mg in ash. At the green stage AA-ct was highest when none of the cationic ratios deviated from the average. The same held for the coloured hips, but with other averages (higher K%) and higher AA-ct's. The ideal curve of AA-ct during fruit development may be modified by the weather. A maximum usually occurred in ripe fruit. In leaves it varied with incident solar energy; dehydroascorbic acid showed the opposite course.

Growth substances strongly influenced both ascorbic acid and total vitamin C in the bark of cuttings and in germinating peas. After its formation from sugars, AA acts, particularly on chloroplast surfaces, as a transporter of H from chlorophyll. There it acts as a hydrogen donor and buffer.

Promotor: Prof. Ir A. M. Sprenger

E.

134. J. TEMME Over de afbraak van Ca-cyaanamide in den grond / *Decomposition of calcium cyanamide in the soil*. 1946, pp. 10 + 100. Du. a. Eng. summ.

The weed killer calcium cyanamide was also a slowly acting N fertilizer. It



released N as urea, which was subsequently converted to ammonium carbonate and nitrate. The first phase was mainly physico-chemical involving hydrolysis to calcium hydroxide and cyanamide, which was then hydrolysed to urea. It was promoted by free  $H^+$  in the soil and exceeded any possible microbiological action, as application initially caused a decrease in the soil microflora.

The second phase was microbiological; first urea was released. The herbicidal effect was due to the formation of dicyanodiamide and its decomposition products, which were toxic also to most micro-organisms. It formed at high pH (8-10) if the topdressing became moist. Nitrification was depressed in concentrations higher than 10% of total N. But the initial effect perhaps limited the proliferation of pathogens.

Apart from killing weeds, it might injure both crop and microflora, if not incorporated into the soil.

A method was developed of estimating the rate of ammonification and nitrification of calcium cyanamide for different soil samples and, thus, the amount of fertilizer needed for optimum effect.

Promotor: Prof. Dr J. Smit

Ru.

135. TH. E. GALESLOOT Over de vroeg beginnende gasvorming in kaas / *On the early production of gas in cheese*. 1946, pp. 4 + 124. Du. a. Eng. summ. Also published as LEB Fonds Publ. 29.

The early production of gas in cheese, called 'blowing' was caused chiefly by some coli-aerogenes bacteria of the aerogenes-cloacae type and intermediate types. These bacteria produced gas in a combined fermentation-curdling test both on milk and on cheese; they were called blowing-positive strains.

A second group of coli-aerogenes bacteria, although forming acid and gas from lactose in a synthetic lactose medium, did not produce gas in the combined fermentation-curdling test. This was apparently due to the presence of citric acid in the combined test since this acid prevented blowing-negative coli-aerogenes strains producing gas from lactose; the citric acid was reduced to succinic acid. As a result these blowing-negative types decomposed the sugar present in the medium without forming gas. Excess of citric acid, however, may be fermented with production of gas. Citric acid always increased gas production by blowing-positive strains through its fermentation. Blowing caused by blowing-positive strains decreased when negative strains were also present.

It was found that  $KNO_3$ ,  $KNO_2$  and  $KClO_3$  prevented gas production from lactose by blowing-positive strains. These compounds seemed to be reduced, thus inhibiting gas production from lactose, while intermediate products occurred which prevented the development of the coli-aerogenes bacteria.  $KClO_3$  appeared to be the most efficient inhibitor. Under practical conditions

addition of 1 g per 100 litres milk may be sufficient. Lactic acid fermentation was not influenced by adding this amount of  $\text{KClO}_3$ .

Promotor: Prof. Dr J. Smit

A.

136. P. VAN DER BURG Bijdrage tot de kennis van de caseïnaat fosphaat-phase der melk / *Contribution to the knowledge of the caseinate-phosphate phase of milk*. 1946, pp. 74. Du. summ.

A critical discussion was given of the extensive literature on the nature of the complex of calcium caseinate phosphate. A series of different experiments were performed to elucidate this complicated problem. It was inferred that calcium bound to casein must be considered separate from the calcium bound to inorganic phosphate. Casein-bound calcium was thought to be linked to the ester phosphate groups of the casein molecule. This contradicted the often assumed structure of double salts, and the author supposed the inorganic phosphate and the remaining calcium to be separately and individually linked to various reactive sites on the casein molecule, mostly amino and carboxyl groups. The relation Ca/P of the adsorbed ions was found to be about 1.5.

On heating milk, according to the author tricalcium phosphate was precipitated from the serum, and subsequently calcium and phosphate were replenished from the caseinate complex. This could go on until all was present in the form of tricalcium phosphate. This could be re-adsorbed as such onto the caseinate complex.

Promotor: Prof. Ir B. van der Burg

W.

137. G. W. HARMSSEN Onderzoekingen over de aërobe cellulose ontleding in den grond / *Studies on aerobic decomposition of cellulose in the soil*. 1946, pp. 8 + 230. Du. a. Eng. summ.

Harmsen detected and isolated nearly all of the microbes previously mentioned in the literature: 1. The *Cellvibrio* group did not form a unit but only represented cellulose-decomposing strains within a large morphological group; 2. The *Cytophaga* group was mainly dependent upon cellulose as a foodstuff; 3. *Polyangides*, belonging to the Myxobacteriaceae; 4. *Bacilli* were not strictly specific cellulose-decomposers although some strains preferred cellulose to soluble carbohydrates; 5. *Actinomycetes* were the chief cellulose-disintegrators in most soils; 6. *Proactinomyces* and *Mycobacteria* or *Corynebacteria*.

Harmsen also studied the distribution of cellulolytic microbes and their function in the soil. Nearly all groups of microbes appeared to play their special part in the decomposition of cellulose. The different groups formed a succession during decomposition. After manuring most soils with material rich in cellulose, only a few species proved quantitatively important (alkaline soils: actinomy-

cetes, cellvibrios or polyangides; acid soils: fungi).

On almost synthetic cellulose agar, many cellulolytic bacteria were markedly stimulated in their growth by extracts of plant or animal origin, by soil or by stable manure, and often by metabolic products of several other microbes. For this reason mutual stimulation, such as of cellvibrios by actinomycetes or of *Cytophagae* by *Bacilli*, was frequent in cellulose decomposition.

Promotor: Prof. Dr J. Smit

Ze.

138. T.J. J. HUISMAN Een onderzoek naar de invloed van de celmembranen en eenige andere factoren op de verteringscoëfficiënten / *Influence of cell membranes and some other factors on digestibility coefficients*. 1946, pp. 12 + 114. Du. summ.

Factors affecting the digestibility of feedstuffs were studied with special attention to cell wall components such as crude fibre, lignin, silicic acid, pentosans and tannic acid.

Lignin in feeds was estimated by a new method. Lignin in grass increased with age and with higher rates of N. In the second cut lignin was higher than in the first. Lignin had more effect than crude fibre and silicic acid on digestibility. Chemical and microscopic studies showed that the lower digestibility of protein if fibre content was high was not caused by lower penetration of the cell walls by digestive enzymes. True digestibility for protein hardly depended on protein and crude fibre in the feed. Perhaps higher crude fibre content may increase the number of intestinal bacteria. More of the intestinally secreted protein would then be incorporated in bacteria which would stimulate the protein secretion, and increase the amount of metabolic faecal protein. There might be a limit to the increase in metabolic faecal protein, reached in ruminants and in pigs on rations with crude fibre contents similar to those in ruminant rations.

Promotor: Prof. Dr E. Brouwer

Wi.

139. S. OEDIN De gemeente Huissen. Proeve eener sociaal-geografische analyse / *The municipality of Huissen. Approach to an analysis in human geography*. 1946, pp. 320.

This research, originally under the auspices of Professor van Vuuren, was accepted by Professor Edelman after the war because of a vacuum in the Social Economic Department of the Agricultural University. Because of the change of promoters the description of the physical environment was extended. The development of Huissen was closely dependent on the history of the River Rhine, on whose bank it was originally founded near the bifurcation of the Rhine and Yssel. After the diversion of the bifurcation and its silting up Huissen lost its importance as a trading centre. The sandy soil, after which the hamlet of Het

Zand was named, consisted of deposits of dike breaks and of breaks in the natural levees before the dikes were built. On these sands tobacco cultivation was introduced in the eighteenth century. After its disappearance this crop was in turn followed in the 19th century by the introduction of market-gardening and fruit-growing both for the nearby town of Arnhem and especially for the rapidly developing industrial area of the Ruhr.

The social and economic conditions of farmers and farmworkers throughout its history and at present were fully discussed.

Prospects for the development of Huissen as a horticultural centre after the severe damage of the Second World War were considered.

Promotor: Prof. Dr Ir C. H. Edelman

E.-VI.

140. C. B. VAN STRAATEN VAN NES *Zwavelzure-ammoniak-proeven in de Java-suikerindustrie en een methode tot bepaling van het optimum in deze proeven* | *Experiments with ammonium sulphate in the sugar industry of Java and a method of estimating optimum rate.* 1947, pp. 86. Du. summ.

Orthogonal polynomials were applied for the estimation of optimal dosage instead of, as formerly, considering only significant differences in yield of pure sugar. Polynomials of second degree fitted the observed cane yields satisfactorily. Very large observed values of the regression coefficients indicated serious disturbance; if so, the yield/rate relation was not well represented by a polynomial.

No simple mathematical function was found to represent the regression of sugar content on fertilizer rate. The correlation between cane yield and sugar percentage was a good measure for judging sugar percentage for a given rate, at least for correlation coefficients within the region  $-0.8$  and  $0$ . Other values pointed to serious aberrations. Large negative values of the regression coefficient of the term of the second degree and small values of that of the third degree corresponded to low correlation. If so, correlation coefficients calculated from the data, ignoring those from the lowest rate, were more useful.

If more than 30% of the cane lodged, the mathematical function was not satisfactory.

Promotor: Prof. Dr M. J. van Uven and Prof. J. E. van der Stok

Ju.

141. J. VAN SCHUYLENBORGH *A study on soil structure.* 1947, pp. 8 + 110. Du. summ.

As soils differ in capacity to form a structure, it is necessary to distinguish between intrinsic structure and actual structure. Intrinsic structure is the capacity of a soil to form a certain structure. Actual structure is the structure of the soil at a certain moment.

Using experiments and published data, the factors that influence both structures were discussed. This study showed that it was necessary to distinguish between floc structure, microstructure and macrostructure as the successive states of aggregation. In soils with very low electrolyte content only microstructure and macrostructure could be distinguished.

A review was given on methods of estimating soil structure in the field and laboratory. Apparent discrepancies in the results of methods of estimating the structure of a soil were explained.

Finally water relations in soils with different structures were investigated with tensiometers.

Promotor: Prof. Ir J. Hudig

Author

142. J. J. DUYVERMAN De landbouwscheikundige basis van het streekplan. Het centrale veengebied Utrecht en Zuid-Holland / *The basis in agricultural chemistry of the district plan. The central fen area in Utrecht and Zuid-Holland.* 1948, pp. 344. Du. summ.

The main problems in the area studied were the irreversible drying and shrinkage of the soils. Factors of importance in this process were defined. To trace such factors the origin of pure peats and of mixtures of peat and clays was considered. Ways were suggested of preventing drying out and soil shrinkage.

Promotor: Prof. Ir J. Hudig

Meded. LH 50 (1950)

143. J. E. TJIA (TJIA BING-SIEN) Electrometrisch onderzoek der thee-fermentatie in verband met de kwaliteit / *Electrometric research into tea fermentation as related to quality.* 1948, pp. 10 + 130. Du. a. Eng. summ.

Fermentation of tea-leaf was compared with different leaf ages, grades of leaf withering, temperatures and aerations. Fermentation was known to be very important for the final quality of tea. Careful estimation of redox potential proved suitable for study of fermentation in a single leaf. Potentiometric titration under aerated water (so not as normally in factories) showed that 'Buds' ('Pecco': best quality leaves) contained more ascorbic acid (AA) and fermented more rapidly than older leaves. More withered leaves fermented more actively and completely. Optimum temperature for fermentation was found to be about 26°C. Aeration to a certain point encouraged fermentation strongly. Thorough grinding promoted fermentation most. AA had to be oxidized to allow reddish brown discoloration of fermenting tea-leaves. 'Buds' oxidized AA much quicker than older leaves.

It was assumed that 'potential quality' of a fresh leaf was correlated with active fermentation. So in practice leaves had to be rolled often but briefly, while the rolling and fermenting rooms should be thoroughly aerated, although

the leaves should not be allowed to dry. Ascorbic dehydrogenase, polyphenol oxidase and peroxidase were involved in the oxidation of AA. Traces of  $\text{Cu}^{2+}$  (occurring in the prosthetic groups of ascorbic dehydrogenase and polyphenol oxidase) accelerated oxidation of AA in leaf extracts.  $\text{Fe}^{3+}$  less so. By rectilinear adjustment fermentation activity could be calculated. It was higher for 'Buds' than for older leaves.

Promotors: Prof. Dr H. J. C. Tendeloo and Prof. Dr E. C. Wassink E.

144. A. VONDELING *De bedrijfsvergelijking in de landbouw. Een economisch-statistische studie / Farm efficiency comparisons. An economical statistical study.* 1948, 8 + 180. Du. summ.

The abundance of data, gathered by farm accounting bureaux, offered ample opportunities for economic research. Vondeling advocated the use of such data to compare farm efficiencies, because research in this field would enable farmers to examine more thoroughly the efficiency of their management decisions to improve the net results of their efforts in farming. Opinions of other workers were considered, and the possibilities and pitfalls of the method were carefully discussed.

The statistical part of this study was based upon groups of data which could be taken from 17,735 farm accounts made by the Cooperative Central Farm Accountant in Friesland in the period 1923–40 initially for 527 (in 1923) and finally for 1452 farms (in 1940) per year. The analysis was by the Hollerith system.

The results of the studies led to a discussion of aspects of farming in the period 1923–40, of structural differences between types of farming in this period and of differences in organization and in financial results between farms of similar type.

An outline was given of what had to be done to make comparisons of farm efficiency generally accepted in advisory services and in practical farming.

Promotor: Prof. Dr Ir G. Minderhoud Z.

145. F. W. G. PIJLS *Een gedetailleerde bodemkartering van de gemeente Didam / A detailed soil survey of the community of Didam.* 1948, pp. 8 + 116. Eng. summ. Also published as VLO 54.1 (1948), serie *De Bodemkartering van Nederland*, deel I.

The soil survey was to obtain data on the community of Didam, because of agricultural, economic and social problems (many smallholders) and to find the possibility of extending horticulture. Other studies were of pleistocene cover sands and holocene geology, soil formation, vegetational and occupational history since palaeolithic times.

The soil map consists of physiographic units, an old reclamation sand landscape, a recent reclamation landscape and a river-clay landscape. Each of these soil landscapes was classified into soil series and types, based on thickness of topsoil, depth of gleying and mechanical composition, all of direct value for agriculture. The old reclaimed sand landscape was, for example, classified into old arable sand soils (plaggen soils) and old grassland soils (Humic Gleysoils). Some trial samples were taken to compare the productivity of the soil types. It was concluded that agricultural crops showed more pronounced differences than grassland, because also management played an important part. Horticulture might be improved by taking advantage of natural circumstances (soil, water control).

A remarkable fact, studied in this area, was the deposit of iron ochre in many subsoils, caused by seepage water from the hills of Montferland. It consisted chiefly of goethite ( $\alpha$ -FeOOH) and affected growth of crops.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

146. W. J. VAN LIERE De bodemgesteldheid van het Westland / *Soil conditions in the Westland*. 1948, pp. 8 + 152. Du a. Eng. summ. Also published as VLO 54.6 (1948), serie De Bodemkartering van Nederland, deel II.

The Westland, a horticultural area also called Glass District, situated in the west of the Netherlands, was surveyed to obtain data on the relation between soils and their suitability for horticulture. The study was by the usual methods of soil survey.

Sedimentation and soil formation explained differences in facies and soil characteristics. The soils in this region were distinguished by strong influences of groundwater, resulting in severe compacting ('broek' soils) and human activity such as digging off dune sands ('afgeesten') and raising low-lying soils ('opveren'). Van Liere used the best holding method to compare yields and growth on different soil types. This method compared well managed holdings, so that non-soil factors were eliminated. The soil in profile pits and root distribution (mainly of grapes, tomatoes and cucumbers) were studied. Economic data (selling prices, production costs) were also considered. From the results ensued a suitability map for horticultural crops and a recommendation for some soil improvements, chiefly tile-drainage. Other methods (organic manuring and deep cultivation of subsoils) did not improve soils.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

147. A. P. A. VINK Bijdrage tot de kennis van loess en dekzanden, in het bijzonder van de Zuidoostelijke Veluwe / *Contribution to the knowledge of loess and cover sands, in particular of the southeastern Veluwe*. 1949, pp. 8 + 148 + 6 enclosures. Eng. summ.

A detailed map of loess and cover sand, occurring along the south-eastern border of the Veluwe, Gelderland, was made to check hypotheses on the origin of loess and cover sand.

The eastern flank of the Veluwe hills, consisting of glacial sand and gravel, proved to be covered by fine cover sand near the summit, loess lower down and fine sandy colluvium at the bottom. This colluvium partly covers the fluvial deposits of the River Yssel.

Many samples from the deposits in this area, from surrounding countries, and Greenland and Iceland were analysed for heavy mineral and grain size.

The relation was determined between the geomorphology of the area, the position of the samples and the mineral and granular compositions.

The importance of these studies for soil survey was stressed.

The origin and deposition of loess and cover sands were described extensively.

Promotor: Prof. Dr Ir. C. H. Edelman

Do.

148. J. J. POST Statistisch onderzoek naar de samenhang tussen het weer, de grasproductie en de melkaanvoer / *Statistical study on the correlation between weather, grass production and milk supply*. 1949, pp. 8 + 120. Du., Eng., a. Ger. summ. Also published as Meded. KNMI serie A 55.

A study was made by calculating correlation and regression coefficients, and by rising frequency diagrams of the relation between the weather factors temperature (mean daily temp. taken from observations at 8, 14 and 19 hours), cloudiness and number of days with at least 1 mm precipitation, and the production of grass (first cut in June) and the milk supply during June–September.

Independent of soil and the differences in climatic circumstances, a reliable positive correlation was found between the grass production and the number of days with precipitation and cloudiness during the period 1 May–10 June. In this period there was a negative correlation with temperature. From data obtained from the western part of the Netherlands a reliable positive correlation was found with temperature during the winter.

The milk supply during June–September was positively correlated with number of days with precipitation and cloudiness in the months July and August. The correlation with temperature in these months was negative.

Reliable correlations were found in May in districts where grazing in the weeks before mowing caused risk. The correlations with cloudiness and precipitation were positive, while those with temperature were negative.

Otherwise the correlations in May were unimportant as was expected.

Promotor: Prof. Ir B. van der Burg

Author

149. G. HAMMING Het samenvatten van rassenproeven en het toepassen van vruchtbaarheidscorrecties met niet-orthogonale methoden / *Pooling experi-*



ment on crop varieties and applying corrections for soil fertility by non-orthogonal methods. 1949, pp. 12 + 198. Also published as VLO 54.19 (1949). Eng. summ. only in VLO.

Although a formula should be adequate, inadequate formulae had often to be used through lack of knowledge. With adequate formulae weighting of data was dependent on error expectation. With inadequate formulae weighting should be focused on representativeness. Some other pitfalls were discussed.

Correlation analysis was contrasted with regression analysis. These two models had in common that items of a universe were stochastically dependent on a functional relationship. Essential for correlation was that both correlated variables obeyed a probability distribution; for regression analysis this did not need to be true. In correlation the principal axis was a sound base for understanding relationships, while the regression line was a sound base for predictions. The contrast between understanding and prediction was discussed at large.

Special problems of pooling experiments were discussed. In principle a transformation of yield data was advisable if the interaction variety  $\times$  experiment could be thus reduced. Yet the transformed yields remained inadequate. So weighting, if used, had to improve representativeness. A missing-plot technique for pooling was given.

A separate part deals with the reduction of residual error by drawing free-hand fertility maps. This may be much more effective than the corrections provided by the design. A criterion was developed for avoiding undue detail in free-hand curves.

Promotors: Prof. Dr M. J. van Uven and Prof. Ir W. J. Dewez

Author

150. A. F. SCHOOREL De landbouwkundige grondslag van snoei en pluk bij assamthee / *The agricultural basis of pruning and plucking of Assam tea*. 1950, pp. 8 + 182. Du. a. Eng. summ. Also published in *Archief Theecultuur 16* (1950) 4: 127-318.

From experiments the following conclusions could be drawn: The increase in diameter of the stems of free growing tea plants is practically proportional to time if the growing conditions of the shrubs do not change. However, tea plants in gardens producing tea leaf are planted so closely, that full development of the bushes is hampered. Pruning and plucking further influences the trees physiologically.

Tea shoots have an alternation of periods in which leaves are formed, and periods in which the development of leaves completely stops. Every shoot has its own rhythm not necessarily coinciding with that of other shoots of the same bush. This rhythm is not autonomic but is determined by outward circumstances. The effect of plucking green leaves for the production of dried tea can be divided into influences of the kind of leaves plucked, the length of the plucking round

and the kind of leaves left on the bush on the production, quality of the leaves, and physiological condition of the plant. So nine different influences can be distinguished.

Over a long period tea bushes cannot stand such severe plucking that would prevent the plucking level rising. Consequently pruning periodically is essential to keep the tea plantation productive. Pruning of tea gardens is also necessary to keep the plants in a good physiological condition.

Promotor: Prof. Dr Ir C. Coolhaas

Author

151. J. S. VEENENBOS De bodemgesteldheid van het gebied tussen Lemmer en Blokzijl in het randgebied van de Noordoost Polder / *Soil conditions of the area between Lemmer and Blokzijl in the border-area of the Noordoost Polder*. 1950, pp. 10 + 162. Eng. summ. Also published as VLO 55.12 (1950), serie De Bodemkartering van Nederland, deel V.

The cause for research was the complaint of considerable desiccation of the grasslands after the reclaiming of the North-East Polder. Soil conditions were studied, and watertable soil infiltration, and productivity and quality of grassland were assessed.

Originally the area was a peatbog, flooded about 300 A.D. by the Zuyder Zee and covered with clayey sediments ('knip' clay, also sandy sediments of levee-like form). The transition between clay cover and peat was a black layer of peaty clay rich in humus. Dikes were constructed after 1400.

Regional extension and composition of the peat was studied. It was initiated in the Boreal Period, as *Phragmites* and *Carex* peat (topogene) and *Sphagnum* peat (ombrogene) with a rise in watertable, flooding and subsoil topography. Desiccation caused the 'rodoorn' clays, pillar and prismatic structures of the 'knip' clay, grit-layer formation in peaty clays and severe fissuring, especially in *Carex* peat. Improvement was difficult, because of the properties of the peat (permeability and irreversible drying). Moling and pipe-infiltration sometimes caused improvement, if the watertable reached the grit layer.

Very dangerous was *Sphagnum cuspidatum* peat, giving rise to very uneven land, deep fissures and withering of grass.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

152. C. RIETSEMA Proeven van een geographische verklaring van de verbreiding van de onderscheiden agrarische bedrijfvormen in drie en tachtig gemeenten van Hollands Noorderkwartier / *Studies on a geographical explanation of the distribution of the different types of farming in 83 municipalities in North Holland north of the River Y*. 1950, pp. 105. Eng. summ.

The influence of geographical factors on the distribution of different types of

farming was studied in the part of North Holland north of the River Y, the 'Noorderkwartier', with the exception of Kennemerland.

As a working hypothesis, it was assumed that each farm or farm activity developed according to the favourableness and adversity of conditions for any farms which may compete. To simplify the study the area was divided into 14 cultural districts, in each of which one or more farming activities predominated. Of these categories of agricultural production, 6 were described for each of the cultural districts. The survey showed that geographical factors did indeed influence the distribution of the different farming types but that the farmer's capital and sometimes his personal initiative were very important. The distribution of different farms in the cultural districts was used as confirmation of the hypothesis; the occurrence of horticulture was a clear illustration.

Promotor: Prof. Dr E. W. Hofstee

Meded. LH 51 (1951)

153. J. B. M. VAN DINTHER Morphologie en biologie van de schildluis *Chionaspis salicis* L. | *Morphology and biology of the scale insect Chionaspis salicis* L. 1950, pp. 8 + 80. Eng. summ. Also published in *Tijdschr. Plantenziekten* 56 (1950) 173–252.

To help fill the gap in information on scale insects in the Netherlands, a study was made on *C. salicis*, a species mainly infesting willows. It was considered useful to become familiar with scale insects because of the danger of the San José-scale (a fruit-tree pest) spreading northwards from France and Germany.

All stages of *C. salicis* were described, distribution and recorded food plants were reviewed, literature on toxicity of insecticides against scale insects were summarized.

*C. salicis* overwintered as egg. Minimum hatching temperature was 17°–18°C. Experiments with temperatures from –1° to 13°C (90% r.h.) showed temperature-sensitive egg stages; temperature below zero was not necessary for later development.

Young nymphs appeared in April, winged and wingless adult males in July; females oviposited in September, reproduction being mainly parthenogenetic. Sterility in the female was observed and an inverse relation between fertility and population density was found.

In experiments with other food plants, males developed on many, but females reached maturity and oviposited only on poplars.

*C. salicis* was parasitized, twice a year, by *Aphytis fuscipennis* to a total of 14%.

Promotor: Prof. Dr W. K. J. Roepke

Author

154. J. DOORENBOS Opheusden als boomteeltcentrum | *Opheusden as a tree-growing centre*. 1950, pp. 88.

The district, its social structure, its development, technical and economic aspects of Opheusden as a tree-growing centre were discussed. The earliest information on tree growing at Opheusden was from 1650. It had always formed part of the mixed holding. Large-scale nurseries of the type found in the rest of the Netherlands never developed in Opheusden. Through the particular structure of farming and the social relationships of the community, tree growing lagged behind for a long time in Opheusden and only adapted itself with difficulty to market requirements. This difficulty was also associated with the limited variety of culture possible on the clay soil. Until 1932 times had frequently been prosperous, while the independence of the holdings made the farmers less vulnerable to set-backs. After the Second World War, in which the village had been almost entirely destroyed, a healthy spirit of enterprise had grown up among the villagers, so that the future could be viewed with optimism. This enterprise was visible in the effort put into reconstruction, in the activeness of the local association of tree-growers, the high membership of the Dutch General Inspection Service for Field Crops and the greater desire for technical education.

Promotor: Prof. Dr E. W. Hofstee

Meded. LH 51 (1951)

155. M. OOSTENBRINK Het aardappelaaltje (*Heterodera rostochiensis* Wollenweber), een gevaarlijke parasiet voor de eenzijdige aardappel-cultuur / *Potato eelworm* (*Heterodera rostochiensis* Wollenweber), a dangerous parasite for potato monocultures. 1950, pp. 8 + 230. Du. a. Eng. summ. Also published as Versl. Meded. Plantenziektenkundige Dienst 115.

The study on occurrence, biology and significance of *H. rostochiensis* on potato was the first quantitative study of a plant nematode and laid the basis for regulatory control of this new parasite. Known facts about *Heterodera*, particularly *H. rostochiensis* were tabulated and summarized from 243 references, and geographical distribution was mapped. Morphology, life cycle, number of generations and population dynamics were studied; symptoms of plants and crops were described; the host list was compiled.

Experiments and observations demonstrated the noxious character of the nematode, the rapid increase of mild infestations, the slow decrease and persistence of established infestations, the steady spread (expressed mathematically), the difficulty of finding light infestations and therefore the weakness of repressive quarantine.

None of 358 potato varieties and 18 other *Solanum* species tested was resistant; they differed in susceptibility. Chemical control was effective but uneconomic.

Organic manures and different tilling had little effect. Nematode density before planting was closely related to ensuing damage. Crop rotation maintained yields without eradicating infestation. Early lifting was effective in the same way.

Examination of soil samples was useful for finding and diminishing infesta-

tion and damage; techniques were developed and put into operation. In anticipation of resistant potato varieties and curative procedures, regulatory control was recommended.

Promotor: Prof. Dr W. K. J. Roepke

Author

156. G. DE BAKKER De bodemgesteldheid van enkele Zuidbevelandse polders en hun geschiktheid voor de fruitteelt / *Soil conditions of some Zuidbeveland polders and their adaptation for fruitgrowing*. 1950, pp. 12 + 182. Eng. sum. Also published as VLO 56.14 (1950), serie De Bodemkartering van Nederland, deel VI.

The geomorphology and soil conditions of some polders were studied, mainly consisting of sandy creek-ridge soils and marshy clay soils on peat (Old Land). Also a few New Land polders (Young sea clay) were surveyed.

Important soil characteristics were granular composition at different depths and water control, which govern suitability for crop growth. Soil series and types, present land-use and suggestions for soil improvement were reviewed and described. The results of studies on the requirements of fruit-trees on various soils were described. Data were collected from seven orchards, each uniform in planting and treatment, but with different soil conditions at short distances. Very detailed soil survey and watertable measurements were made and condition of fruit-trees (vegetative growth, settling, yields) was assessed. This method was called 'inferior site inquiry' being a method in land classification. Results showed great influence of soil conditions, permitting a provisional arrangement in three suitability classes and allowed some conclusions on the requirements of fruit-trees (apple, pear, plum, cherry and currant).

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

157. J. W. SEINHORST De betekenis van de toestand van de grond voor het optreden van aantasting door het stengelaaltje (*Ditylenchus dipsaci* (Kühn) Filipjev) / *The significance of soil conditions for infestation by stem eelworm (Ditylenchus dipsaci (Kühn) Filipjev)*. 1950, pp. 8 + 59. Du. a. Eng. summ. Also published in *Tijdschr. Plantenziekten* 56 (1950) 291-349 and as Meded. IPO 8.

Field observations indicated that infestation by stem nematodes in rye and other crops depended on the type and condition of the soil. In laboratory experiments the mobility of these nematodes was greater in loams than in sands and much greater above a soil's moisture equivalent than at lower moisture contents. Great mobility could occur at both small and large pore volumes and average pore diameters. The mobility of stem nematodes in soil decreased as temperature increased and was often much greater in partially sterilized than in natural soil. A heat-labile water-soluble substance that reduced nematode ac-

tivity could be extracted from certain soils in which nematode activity was small. A method of extracting nematodes from plants was described.

Promotor: Prof. Dr A. J. P. Oort

Author

158. G. SISSINGH Onkruid-associaties in Nederland. Een sociologisch-systeematische beschrijving van de klasse *Rudereto-secalinetea* Br.-Bl. / *Weed associations in the Netherlands. A sociological systematic description of the class Ruderto-secalinetea Br.-Bl.* 1950, pp. 8 + 226. Fr. summ. Also published as VLO 56.15 (1950) and as Stat. Internat. Geobot. Mediterr. Alpine, Montpellier, Communication 106.

The concept was rejected that in the Mediterranean and Euro-Siberian regions the class *Rudereto-Secalinetea* would consist of vicarious orders or alliances. The following views were presented:

The characteristic species of this class are indigenous and foreign adventive weeds. Its associations are made up of colonists. Most end their cycle within a year by natural succession (the indigenous associations) or by human influences (almost all adventive ones).

Because all these associations are adventive, nitrophilous, anthropogenous weed communities, they can be called domestic associations.

Four orders can be distinguished in the Netherlands. The *Secalinetalia* and the *Chenopodietalia* (formerly considered as one order) cover associations on regularly cropped soils tilled at least once a year. The *Secalinetalia* overwinter on most fields with autumn and early spring sown field crops; the *Chenopodietalia* occur in weeded crops. The *Potentillo-Polygonetalia* cover associations of rosette and tread plants on compacted substrates. The *Onopordetalia* occur on muck heaps, refuse and verges with nitrogen-rich substrates.

The floristic composition and the growth conditions of all associations were discussed at length.

Promotor: Prof. Dr H. J. Venema

E.

159. A. MARIS Enkele aspecten van het kleine-boerenvraagstuk op de zandgronden / *Some aspects of the problem of small landholdings in the sandy soil areas.* 1951, pp. 2 + 140. Du. a. Eng. summ.

A study of 13 communities representative of sandy areas throughout the whole Netherlands indicated that the main cause of inefficiency was disproportion between available labour and arable land. Intensification would remove the advantage held by large farms over small farms but would make heavy demands on the farmer's ability. On the smallest holdings intensification could never absorb all the labour. It was necessary to encourage young people to leave the land to reduce the supply of labour. This would be easier if they were well

educated. On the smallest units there was not sufficient work for one man and amalgamation was the only answer. On large farms sons were often used as cheap labour with no prospect of obtaining their own holding; thus there also it was necessary for people to leave the land.

Promotor: Prof. Dr E. W. Hofstee

Meded. LH 52 (1952)/Ri.

160. H. R. GIRGINKOÇ Untersuchungen über die 'zwarte houtvatenziekte' der Futter- und Zuckerrübe, verursacht durch *Pythium irregulare* Buisman / *Investigations on black vessel disease of mangold and sugar-beet caused by Pythium irregulare Buisman*. 1951, pp. 6 + 62. Ger. a. Eng. summ. Also published in Meded. LH 51 (1951) 1.

The relation was studied between black vessel disease of beet and factors influencing the condition of the soil. Field observations demonstrated that the disease occurred exclusively on sandy soils and that wet and cool weather during May and June encouraged the disease.

The virulence was studied of several strains of *Pythium irregulare* and one strain of *P. debaryanum*. All these strains could cause damping-off but only a few strains of *P. irregulare* could cause black vessel disease. Toxic metabolites of the fungus, secreted in the lateral roots and transported through the water-conducting tissues, caused the symptoms of black vessel disease. A correlation could be demonstrated between the pathogenicity of the different strains and the toxicity of their staling products.

The amount of nutrients in the soil had no influence on the severity of the disease but acid soil (pH 7.1–4.9) encouraged the disease.

The influence of the temperature was clearest at a moisture content of 20–50% of the moisture-holding capacity of the soil, the disease being more severe at a higher temperature.

There was a positive correlation between severity of the disease and moisture content of the soil.

Promotor: Prof. Dr A. J. P. Oort

Bo.

161. A. R. GÜRAY De bodemgesteldheid van de IJpolders en een onderzoek naar het verband tussen de bodem en de suikerbietenopbrengsten in de Haarlemmermeer en de IJpolders in het jaar 1949 / *Soil conditions in the Y-polders and an investigation on the connection between soil and yields of sugar beet in the Haarlemmermeer and the Y-polders in 1949*. 1951, pp. 10 + 86. Du. summ. Also published in *Boor en Spade V* (1952) 1–92. Eng. summ.

A soil survey in the Y-polders was combined with studies of yield of sugar-beet on different soils. Subsoil differences were shown to be the most important factor. Topsoils in the Y-polders proved to be uniform in composition and to

consists of young Ysselmere clay (underwater deposits) with a lutum (clay) content of 35–40%. The thickness of the clay layer proved to be very varied. Sands, peat, peat detritus, peaty silt were the materials of which the subsoil was built up through an intricate history of sedimentation. Therefore soils were classified on clay thickness and subsoil characteristics.

To test the agricultural value of this classification, yields of various soil types were compared in the polders and on some soils of the Haarlemmermeer. This data proved that high humus contents caused low contents of sugar. The influence of decalcified topsoils and cat-clay subsoils was not important in 1949 because of the weather. Coarse sandy subsoils and heavy layers had much influence; maximum yields were achieved on soils with 75 cm Y clay. A suitability scheme for sugar-beets was derived from the data.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

162. P. BURINGH Over de bodemgesteldheid rondom Wageningen / *Soil conditions in the environments of Wageningen*. 1951, pp. 8 + 132. Eng. summ. Also published as VLO 57.4 (1951), serie De Bodemkartering van Nederland, deel IX.

Because of the growing need for more experimental ground for the Agricultural University and the Agricultural Institutes, this study was made to indicate soil qualities around Wageningen and the possibilities of soil improvement (water control). Soil classification was based on the concepts of soil landscapes, ranges and types; these categories were defined as units with corresponding geological origin, similarity of main soil properties and water control (visible as reduction and oxidation phenomena). Connections between geomorphology and hydrology were studied in soil catenas with a view to drainage improvement.

Geological studies proved the occurrence of some loamy layers, influencing water table. Details of the surveyed area, remarks on soil formation and suggestions for a Dutch system for soil classification completed the study.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

163. G. S. VAN MARLE Spintbestrijding met moderne insecticiden in de Aalsmeerse bloementeelt / *Controlling red spider mite with modern insecticides in the Aalsmeer flower-growing industry*. 1951, pp. 128. Eng. summ.

Some insecticides were tested in systematic trials or on a small scale, especially for ovicidal action, residual activity in relation to life cycle of red spider mite (Tetranychidae), herbicidal activity and method of application. Practical experience with them was gained with flowers under glass.

Azobenzene was a good acaricide and was also herbicidal but could in practice only be used on carnations. Parathion was satisfactory, except as a powder, if



used repeatedly; resistance to it arose once just before the trial ended. Sodium selenate, a systemic insecticide, was efficacious for carnations; excess stunted growth. The selenate spray damaged roses. Soil treatment was satisfactory only in high doses. Pestox (bis(bisdimethylaminophosphonous anhydride)) had some effect on carnations and hortensias, and was transmitted through carnation plants. In practice an old remedy, spintspuit (mite spray), was effective but was laborious and raised risks from fungi. TEP (a tetraethyldiphosphate) was also tested.

Promotor: Prof. Dr W. K. J. Roepke

Author/R.

164. P. L. ARENS A study on the differential thermal analysis of clays and clay minerals. 1951, pp. 132. Du. summ.

Differential thermal analysis (DTA) as a method of analysing properties of chemical compounds, more especially of clay minerals, developed rapidly, but lack of quantitative interpretations left many problems to be studied. A historical review was presented, showing the purpose of the study. Equipment was described in detail, with special attention to sample holders and calibration techniques.

The influences were discussed of rate of temperature rise, of type and place of the thermocouples, of packing and type of inert materials and clays, and of the adsorbed cations. Usually the effects were demonstrated with experimental curves. The theory of heat transfer was worked out and applied to the DTA. Attention was given to the problems of peak shifting. Measurements obtained with different equipment were compared and conclusions were drawn on corrections that could be made.

The author stressed the significance of the DTA method, especially in pedology. Two appendices give the solution of the differential equations used and the standardization rules for DTA equipment.

Promotor: Prof. Dr A. C. Schuffelen

J.

165. F. R. MOORMANN De bodemgesteldheid van het Oudland van Veurne Ambacht / *Soil conditions in the Oldland of Veurne Ambacht*. 1951, pp. 4 + 124. Fr. summ. Also published in *Natuurwetenschappelijk Tijdschr.* 33 (1951) No. 1-4 (Ghent, Belgium).

Belgian holocene marine deposits, similar to those in Zeeland, were surveyed. The formation of this area in south-west Belgium was associated with the Atlantic (Old Marine Deposits) and Subatlantic marine transgressions (Duinkerken I-III); in the Subatlantic Period sands and clays were deposited on the surface peat (dating from the Subboreal). The same distinction of the coastal area as in the south-west of the Netherlands could be made along the Belgian coast: Old Land, Middle Land and New Land soil landscapes, each with their own sedi-

mentary and geographical history. Soils were classified according to this sedimentary history (physiography and morphology system). Soil formation in this area was closely correlated with hydrology, which governed decalcification.

The relation between soils and crop production was studied (mainly field crops), using a method developed by Belgian soil scientists.

The position of the settlements in relation to agricultural problems was described and measures to improve agriculture (manuring, treatment, drainage) were recommended.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

166. D. C. VAN DIJK Forstliche Bodenkartierungen im Keupergebiet des Strombergs in Württemberg / *Forestry soil surveys in the Keuper geological area of Stromberg in Württemberg*. 1951, pp. 8 + 120. Ger. a. Eng. summ. Also published as Geol. Abt. Württ. Statist. Landesamtes Mitteilung 22.

A detailed soil survey was made for forestry purposes in the Keuper hill area of Stromberg in north-west Württemberg. The soil profiles consisted chiefly of heavily weathered diluvial deposits, usually clayey, sometimes sandy, not rich in lime, and numerous deposits of loess. The Keuper deposits (the most recent deposits of Trias) underlying the soils hardly had any part in their structure. Most soils had moved by soil slip during the glacial period, giving rise to special mixed soils and a multilayered structure. Native weathered soils seldom occurred. From the structure of the shifted material, the land morphology and the slope governing solifluction, 3 terraces could be distinguished. These resulted from the main layers of hard sandstone between the Red and the Grey Keuper Clays.

In most of the forests there were slightly podzolized brown forest soils. The growth of all types of timber was determined by the soil units. Growth of the native oak, beech and hornbeam, and the introduced conifers pine, European larch, and spruce distinguished different types of deciduous forest soils of the former middle forest. The economics were discussed first of oak and then of beech. The chief conifer was pine, mixed either with oak or beech according to situation. Its growth on heavy clay in basins was outstanding. European larch was particularly suited to solifluctive soils, consisting of a clayey subsoil with a loamy topsoil. The failure so far of spruce through drought and bark beetles was ascribed entirely to its situation in dry valleys.

Promotor: Prof. Dr Ir C. H. Edelman

E.

167. H. MEIJER Rural Brazil at the cross-roads. 1951, pp. 8 + 208.

The study attempts to detect and discuss the most urgently needed changes, as to resource distribution, production methods and supporting services in Brazilian agriculture. For that, it was necessary to describe and evaluate the

existing situation in rural Brazil, a task taken up in the first part of the study. Discussion covers production factors, the place of agriculture in the national economy of Brazil and the general aspects of agricultural production. A series of tables and diagrams shows the production per state and the trends in area and average yield for the period 1939–1949 for the most important products.

Part two of the study considers some well defined problems and inadequacies of the existing situation in agriculture in more detail. The most urgently needed improvements in the production of some important crops are enumerated.

For some problems and inadequacies, solutions are suggested and an attempt is made to assess the consequences of modernization in Brazilian agriculture.

Promotor: Prof. Dr E. W. Hofstee

G.

168. B. VEEN Herkomstenonderzoek van de Douglas in Nederland / *Provenance research of the Douglasfir in the Netherlands*. 1951, pp. 130. Eng. summ.

Botany, strains and natural region (topography, geology, soil types, climate and ecology) were described for *Pseudotsuga taxifolia* (Poir.) Britt. in the coniferous forests of North West America. Seeds of 35 known provenances were introduced in different parts of the Netherlands between 1923 and 1930 and planted in pilot trials. Height after 10 and 15 years distinguished 4 quality classes for origin. Measurements of volume per unit area at 25 years of age did not much alter this division.

Usually firs of maritime origin, particularly from western and southern aspects, were better than those of continental origin. Different origins from a small area may give very different results, so that it is essential to look for other factors influencing tree growth, particularly inherent differences. Origins of greater height than a few hundred metres above sea level and from continental areas caused trees to grow too slowly in the Netherlands. The method of planting and the species for mixed plantations greatly influenced growth.

The more continental the climate of origin, the earlier the fir budded. The most maritime one was never injured by late spring frost. Those of continental origin suffered much from *Rhabdochline pseudotsugae*, while those of maritime origin were not attacked.

Promotor: Prof. Dr G. Houtzagers

E.

169. C. W. C. VAN BEEKOM De invloed van onderzoek op de ontwikkeling van de teelt van uien en sjalotten / *The influence of research on the development of onion- and shallot culture*. 1951, pp. 132. Du. a. Eng. summ. Also published in *Meded. Tuinbouwvoorlichtingsdienst No. 59* (1952) 1–132.

After having reviewed the international history of the genus *Allium* and the economic importance of the onion crop in the Netherlands the author described and compared the situations before and after a 12 years' period (1939–1951) of research on onions and shallots. In this period research was started on practical problems on choice of variety, manuring, cultural methods, control of diseases, and storage.

This period of 12 years saw an increase in productivity of 6% of the onion selections, an economy of N fertilizer and a yield increase of 2.5% by correct rates of N. Labour and seed were saved and crop care was better by sowing in rows instead of broadcast.

There was much less infestation by yellow dwarf of the onion seed crop and shallot crop and onion maggot was under control. Storage losses were limited by preventing frost injury. Growing of onions from sets was entirely a result of research.

Finally prospects were outlined on choice of variety, mechanization and storage. Future activities of the Netherlands Onion Federation were forecast.

Promotor: Prof. Dr Ir S. J. Wellensiek

v.d.M.

170. C. MASTENBROEK Over de differentiatie van *Phytophthora infestans* (Mont.) De Bary en de vererving van de resistentie van *Solanum demissum* Lindl. / *Investigations on the differentiation of Phytophthora infestans* (Mont.) De Bary and the inheritance of immunity in *Solanum demissum* Lindl. 1952, pp. 122. Du. a. Eng. summ.

In 1943 the breeding work on immunity to blight (*Phytophthora infestans*) on the Plant Breeding Station of the Central Bureau at Hoofddorp started by using the two races then known in the Netherlands; later 7 new races of *Phytophthora* were found. The spectra of all known races were investigated and test series composed. The relationships and differences between the races were outlined in schemes.

Segregations in the crosses investigated by repeated inoculations with distinct races could be explained by the hypothesis of three genes for immunity. Segregation ratios indicated that these genes were dominant allelomorphs of three independent genes.

Other authors postulated genetical factors in explaining their observations. To coordinate the hypotheses test series were exchanged.

Although differentiation had been known already for about 25 years the 'new' races were not found on varieties of *Solanum tuberosum* in practice. This supported the supposition that the 'common' race was superior to the other races on varieties of *S. tuberosum*.

Some specimens of *S. demissum* and other *Solanum* spp. were tested for susceptibility to 8 races. There were great differences between the varieties of

*S. demissum*. Some of the progenies of single plants were homozygous for immunity.

Promotors: Prof. Dr Ir J. C. Dorst and Prof. Dr A. J. P. Oort

d.H.

171. TH. J. FERRARI Een onderzoek over de stroomruggronden van de Bommelerwaard met als proefgewas de aardappel / *An agronomic research with potatoes on the river ridge soils of the Bommelerwaard*. 1952, pp. 8 + 132. Eng. summ. Also published as VLO 58.1 (1952).

In agricultural research many factors have to be studied simultaneously to clarify a problem. The usual field trial with interference is not usable for this purpose. It is difficult or expensive to investigate the influence of factors, which are difficult or impossible to change, such as watertable, structure and clay content.

The method proposed avoided normal field trials with interference and used single plots distributed over a wide area. Natural variation in factors was used without interference. A graphic method of regression analysis, multifactorial analysis (Du. polyfactor analyse), was used to distinguish the influences of all growth factors. A method of testing the reliability of the results was worked out.

A trial with potatoes demonstrated the method. About 88% of the explainable yield variance could be explained by nine factors: date of planting, distance to farmstead, acidity, K content, K dressing, content of organic matter, clay content, watertable and depth of reduction. This makes it plausible that important factors have not been neglected. The correlation coefficient between calculated and actual yields was 0.86.

Promotors: Prof. Dr A. C. Schuffelen and Prof. Dr N. H. Kuiper

Author

172. J. SCHELLING Een bodemkartering van Noord-Limburg (Gemeenten Ottersum, Gennep en Bergen) / *A soil survey of northern Limburg (Municipalities Ottersum, Gennep and Bergen)*. 1952, pp. 12 + 140. Eng. summ. Also published as VLO 57.17 (1952), serie De Bodemkartering van Nederland, deel X.

Northern Limburg, badly damaged during the war from 1940–45, was studied in relation to the design of a rural plan. Soil survey was necessary to establish suitability for crops and soil improvement.

The genesis took mainly place during the Würm glaciation; the Rhine and Meuse were braided rivers, depositing gravelly and sandy materials. During the degeneration of these rivers, more sandy and loamy deposits originated, the 'Hochflutlehm', mainly pre-Allerød. From the Meuse valley sands were blown eastwards (Preboreal and Boreal), forming a broad area of inland dunes. In the Boreal the transition to a meandering system took place and Holocene deposits replaced the 'loams'.

The results of the survey allowed propositions on reclamation and improvement of drainage and soils. Suitability for crop production was derived from the soil maps, farmers' experience, yield figures and rental values. The landscape was dated by pollen analysis of peaty layers.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

173. N. H. H. ADDENS Zaaizaad en pootgoed in de Nederlandse landbouw / *Seeds and seed-potatoes in Dutch agriculture*. 1952, pp. 284. Du., Eng., Fr. a. Ger. summ.

The annual input for seed was about 7.5% of the total cost of the crop; selection and testing of new varieties costed only 0.1%; plant breeding increased the return from field crops by at least  $\frac{1}{2}$ % annually. After an introduction to the theme of which these are some of the main results there are 8 further chapters, dealing with: standards for seed; use and handling of seed; purchase of seed by farmers; local and regional seed exhibitions; introduction of new crops and varieties; field inspection of crops for seed; the Plant Breeders' Decree (1941); the marketing of Dutch seeds and seed potatoes. Changes in the testing of seeds and seed potatoes are sketched for the last three quarters of a century. Measures, which Dutch breeders, seed-growers, seed-merchants and the government were taking to improve varieties, seeds and seed potatoes are reviewed and discussed.

Promotor: Prof. Ir W. J. Dewez

Author

174. G. J. VERVELDE Zoutophoping door plantenwortels. Een fysisch-chemische studie over het binnentreden en de verplaatsing van ionen in een ruimte met een amphotere kolloid / *Salt accumulation by plant roots. A study on the physical chemistry of ion uptake and transfer in a space with an amphoteric colloid*. 1952, pp. 90. Eng. summ.

A Donnan relation between the medium and the outermost layer of the root or cell contents was supposed. Measurement of membrane potentials, indicating an unequal distribution of ions across the root wall, was the only practical way of showing its existence. Measurements of root potential in solutions of a broad pH range revealed the amphoteric nature of the root contents. The concentration of cell-bound (colloidal) ions, is the difference between the dissociated fractions of acid groups and of basic groups. This surplus varies with pH. If the constants  $K_1$  and  $K_2$  (concentration of cell-bound ions =  $K_1 \log c_{H^+} + K_2$ ) are estimated, the concentration of fixed ions can be calculated for any pH. The adsorption capacities thus calculated with the prevailing pH values better approach the mineral contents in plant material than LUNDEGÅRDH's conclusion that a strongly acid component is present.

The function of  $c_{H^+}$  gradients in salt transport in an amphoteric system is also considered. Maximum accumulation of anions and cations takes place near the iso-electric pH. Three stages in the accumulation processes are distinguished: formation of organic acids in young tissue; accumulation of mineral anions from the medium; decrease of acidity, causing cation absorption and salt accumulation.

Promotor: Prof. Dr H. J. C. Tendeloo

E.

175. C. VAN DEN BERG De invloed van opgenomen zouten op de groei en productie van landbouwgewassen op zoute gronden / *The influence of absorbed salts on growth and yield of agricultural crops on salty soils*. 1952, pp. 8 + 118. Du., Eng. a. Fr. summ. Also published as VLO 58.5 (1952).

In some crops the quantity of absorbed salts proved to be strongly influenced by concentration in substrate, in other crops much less so. Ca proportion of total absorbed cations limited absorption, whereas salt uptake was favoured by higher temperatures.

The possibility of limiting absorption was less, the higher the proportion of Ca (or the relation divalent/monovalent cations) in the plant. Salt tolerance of crops seemed to be related to the relation Ca/other cations in the plant.

The less sensitive the plant to salt, the less the influence of high temperatures for the crops studied. This indicated the great importance of osmotic pressure of the substrate and correlated water shortage for growth of crops tolerant to salt. For growth of crops sensitive to salt, osmotic pressure proved much less important. In sensitive crops yield reduction mainly resulted from high salt absorption by the plant and an unfavourable balance of ions in the plant. In cool wet years, with low transpiration, salt in the soil may increase the yield of salt-tolerant crops in the Netherlands. In the large salty areas of the world this effect is offset by the generally prevailing high temperatures, as in the Netherlands in a warm year.

Promotor: Prof. Dr A. C. Schuffelen

Author

176. A. S. TUINMAN Enige aspecten van de hedendaagse migratie van Nederlanders naar Canada / *Some aspects of present-day migration of Dutchmen to Canada*. 1952, pp. 10 + 92. Du., Eng. a. Fr. summ. Also published as Versl. Meded. Min. Landbouw, Visserij, Voedselvoorziening, No. 2 (1952), and as Serie Buitenlandse Agrar. Aangelegenheden, No. 5.

After the Second World War most of the restrictions against entry to Canada as an immigrant were abolished, although the admission of farmers and farm workers has never been restricted. The ideas about Canada's immigrational capacity fluctuated with the economic situation; after 1950 the doors were

opened to others than farmers and farm workers.

The Dutch immigrants in Canada were distinguished by high ambitions in their career. Almost all arrived with their relatives, only seldom in larger groups, although the religious affiliation was rather high among them. New Canadians were not expected to lose their cultural identity; they had to integrate, not assimilate.

Availability of land, level of production and consumption, land-ownership and credit facilities were all favourable. By interviewing some Dutch settlers the financial results of the first years of residence in Canada could be studied. Also the Settlement Service (a governmental institute) could supply information on the success of the Dutch immigrants. After four years about half of them were already independent farmers. Integration in Canadian society was successful; hardly anyone wished to be repatriated.

Promotor: Prof. Dr E. W. Hofstee

Lij.

177. K. VAN DER MEER De bloembollenstreek. Resultaten van een veldbodemkundig onderzoek in het bloembollengebied tussen Leiden en het Noordzeekanaal / *Soil conditions in the Bulb district*. 1952, pp. 8 + 156. Eng. summ. Also published as VLO 58.2 (1952), serie De Bodemkartering van Nederland, deel XI.

The Dutch Bulb Fields are situated on the Beach-ridge landscape between the Rhine Estuary and the Y-Polders in the mid-western part of North Holland and South Holland. Culture of some horticultural crops (tulips, daffodils) is important in this area because of the special requirements of these crops: rather coarse, calcareous, deep sandy and highly porous soils easy to penetrate by roots, without organic matter, without impermeable layers and a stable water-table. Continuous deep digging is inevitable. Soil formation (mainly decalcification) in the beach ridges over some 3000 years has caused non-calcareous topsoils and a slight podsolization; the soils have been improved by digging off sand. The area has been influenced by peat growth, marine and estuarine sediments and shifting sand. The soil survey resulted in a soil map, indicating soil quality. From the results ensued the recommendation of improving soil by suction dredging. This had to be planned and carried out very carefully, because the formation of humous and clayey layers in the new profile would make the soil completely unsuitable for valuable horticultural crops. Geological studies on Middle and Late Holocene geology and stratigraphy showed that the beach ridges were formed during and after the deposition of the Atlantic Old Marine Clay (4000-2000 B.C.).

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.



178. J. SEVENSTER *Productie en bestemming van melk in Nederland II. Een confrontatie van twee studies / Production and fate of milk in the Netherlands. 2. A contrast of two studies.* 1953, pp. 116. Du. a. Eng. summ.

Milk production is a very important part of Dutch agriculture. From the great interest in the factors that affect milk production and milk marketing, various important studies ensued about 1950. Sevenster compared the results of these studies. He gave some estimates for the milk consumption and production over a period of 10 years (1950–60). He found that the Netherlands had some advantages in the production of cheese and that the consumption of cheese was important for nutrition and national health; so he recommended increase in cheese production. Sevenster also found that production of butter was less profitable. These findings accorded with trends in Dutch agriculture. The capacity of the industry for cheese, condensed milk and milk powder expanded in that period especially on the sandy soils. It seemed desirable to promote this expansion to such an extent that butter production would become independent of seasonal fluctuations in milk production.

Promotor: Prof. Dr J. Horring

v.d.N.

179. TH. M. WORMER *Morphologische waarnemingen aan rijstplanten, gegroeid bij verschillende lengten van de photoperiode / Morphological observations with rice plants, grown with different photoperiods.* 1953, pp. 4 + 154. Du. summ. after each chapter.

After a literature study the morphology is described of rice plants grown under short (12 h) and long (18 h) photoperiods. The varieties Nero di Vialone, Kameji, Fortuna, Tjina and Karang Serang were used. Effects of photoperiod on leaf growth were examined. In Nero di Vialone tillering was studied. An active tillering period was distinguished in which buds developed rapidly into tillers; thereafter tillering stopped and some tillers died back. The photoperiod had no effect on tiller number. When tillering continued after floral initiation had occurred in the main culm, the time of flowering of the tillers was irregular. Renewed tillering was found in some widely spaced Kameji plants after floral initiation.

In Nero di Vialone buds at the base of the main culm and of the principal tillers normally developed into tillers, although some buds elongated, and did not grow out. The buds of flowering plants of Nero di Vialone and Kameji were found to contain panicle primordia.

The direct and indirect effects of photoperiod on elongation of stem, panicle, sheath of the uppermost (flag)leaf, peduncle and awns are described.

Promotor: Prof. Dr Ir C. Coolhaas

Be.

180. H. C. DE ROO De bodemgesteldheid van Noord-Kennemerland / *Soil conditions in North Kennemerland*. 1953, pp. 12 + 202. Eng. summ. Also published as VLO 59.3 (1953), serie De Bodemkartering van Nederland, deel XIV.

Extraction of drinking water from the dunes in North Kennemerland had caused a permanent fall in watertable in the dune area, impairing the suitability of originally valuable soils for horticulture. At the request of the provincial government of North Holland, this area and adjoining polders were investigated. The study of profiles and fossil gley horizons allowed assessment of former water tables and provided data for the plan to replenish the reserve of fresh water by surface water from the rivers in the central parts of the coastal dune area of the Netherlands. North Kennemerland consists of old dunes (beach barriers or ridges), young dunes, peat and marine deposits. After the formation of the old marine sand and beach ridges (4000–2000 B.C.) the sea broke in and deposited sandy inland deltas (300 B.C.). After reconsolidation of the shore banks, peat started to grow again, till a new transgression (4th–9th century) caused the deposition of the 'knip' clay, which was superficially eroded two centuries later (shallow inland lake-formation). The properties of this clay were studied and yielded a theory on genesis. The absence of  $\text{CaCO}_3$ , brackish water and high adsorption of  $\text{Mg}^{2+}$  seemed to be responsible for the formation of this compact sticky and poorly structured soil.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

181. B. VERHOEVEN Over de zout- en vochtuithouding van geïnundeerde gronden / *Salt- and moisture conditions in soils flooded with seawater*. 1953, pp. 8 + 202. Eng. a. Fr. summ. Also published as VLO 59.5 (1953).

In 1944 and 1945 large areas of the Netherlands were inundated with sea-water. After removing the flood-water the salt and moisture figures of the soil were checked, usually to a depth of 80 cm, for several winters and summers. The drying and salinization (in particular of the plough ridge) of the soil in summer and the rewetting and leaching in winter were studied. The distribution of salt through the soil was governed mainly by downward passage of precipitation and upward capillary transport of soil moisture during summerweather. Irregular distribution in short distances was primarily due to unequal rates of intake.

To calculate the downward passage of water through the soil, the loss of salt from a column of soil was divided by salt concentration of the solution leaving the bottom of the column. This concentration was assumed equal to the mean concentration of the lowest part of the column during leaching. Conditions limiting this method were discussed.

Capillary rise was calculated in a similar way. Rainfall, soil moisture and capillary rise were considered in calculation of evapotranspiration.

Promotor: Prof. Dr Ir A. J. Zuur

Author

182. C. T. DE WIT A physical theory on placement of fertilizers. 1953, pp. 8 + 71. Eng. summ. Also published as VLO 59.4 (1953).

A theory was developed enabling calculation of the effect of any placement method of fertilizer on yield if the effect of one method is known.

This theory was based on the following established facts. The reactions between soil and fertilizer rate are the same for broadcasting and placement methods if the concentration of fertilizer is the same. A definite relation exists between yield and uptake of the nutrient, which is in general independent of the method of placement. As an approximation, the ratio between the increases in nutrient uptake with two methods of application depends only on the ratio of the volumes of soil fertilized to the same concentration.

Promotors: Prof. Dr W. R. van Wijk and Prof. Dr A. C. Schuffelen Author

183. A. P. KOLE A contribution to the knowledge of *Spongospora subterranea* (Wallr.) Lagerh., the cause of powdery scab of potatoes. 1954, pp. 8 + 66. Eng. a Du. summ. Also published in *Tijdschr. Plantenziekten* 60 (1954) 1-65.

After a brief general introduction, the first part of this exhaustive study of powdery scab (*Spongospora subterranea*) deals with the morphology, cytology and life history of the fungus. In the Netherlands the disease was largely restricted to the sands and sandy peats of the north-east, where it was not severe except in very wet seasons. The life cycle was similar to that of related genera. Fusions of zoospores proved to be purely vegetative. Infection of tubers had 2 phases: penetration and necrosis of invaded cells; and the formation of warts by stimulation of cell division. Formation of warts was ultimately arrested by the formation of a wound periderm under the site of infection, but the fungus may already have spread through surrounding epidermal tissue, causing dry rot.

The second part deals with the relationships between environment and infection. Resting spores germinated more rapidly if dried and apparently only in the presence of host roots. In air-dry soil resting spores survived 56 days at  $-24^{\circ}\text{C}$ . Minimum, optimum and maximum temperatures for infection of root-hairs were below  $11^{\circ}$ ,  $14^{\circ}$ - $20^{\circ}$ , and  $22^{\circ}$ - $25^{\circ}$ , respectively. Between pH values of 5.2 and 7.5, soil pH had hardly any influence on invasion of root-hairs. At  $16^{\circ}$  to  $20^{\circ}$  the incubation period for tuber and root infection was less than 3 weeks.

Promotor: Prof. Dr A. J. P. Oort

Rev. Applied Mycol.

184. D. VAN DIEPEN De bodemgesteldheid van de Maaskant / *Soil conditions in the Maaskant region*. 1954, pp. 12 + 212. Eng. summ. Also published as VLO 58.9 (1952), serie De Bodemkartering van Nederland, deel XIII.

During the last two centuries floods of the Meuse depressed agricultural production to a low level on the Meuse Bank, a broad area of north-east North Brabant flooded each year. In 1930 the Meuse was canalized, the Beers Meuse disappeared and flooding ended. Yet development of modern farming after land re-allocation did not start. To study the possibilities of improvement, soils were surveyed.

The area proved to consist mainly of river deposits (natural levees and heavy-textured river backswamps) with a typical layout of shape. The basin soils showed typical problems, the establishment of farms on the swamps might be a solution if market gardens were developed on the levee soils.

Besides making extensive soil descriptions and studying soil fertility and formation (gleying), and the history of hydrology and water control, holocene geology was studied. The dating of several peaty layers permitted the reconstruction of the holocene history of the Meuse. Influences of the Peelhorst and Peel graben system were probable.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

185. Miss SIBERGINA WAGENAAR A preliminary study of photoperiodic and formative processes in relation to metabolism, with special reference to the effect of night temperature. 1954, pp. 8 + 58. Eng. summ. Also published in Meded. LH 54 (1954) 2.

Since temperature is an important influence in the activity of most metabolic processes, its influence was examined in some long-day plants, *Spinacia oleracea*, *Brassica*, *Hyoscyamus niger*. If during the dark period respiration were the determining factor, flowering response should increase or decrease with temperature.

In spinach, flowering response increased with temperature up to 13°C, in *Brassica* and *Hyoscyamus* no such optimum temperature was found.

Flowering was, however, promoted in *Brassica* plants by cold nights at the beginning of the experiment. So several processes interfere in flowering, one of them may be respiration. In long-day plants a short photoperiod in the middle of a long night induced flowering. A temperature of 2°C during this illumination retarded flowering.

So the photochemical reaction was closely related to a biochemical one.

No relation was found between flowering response and starch hydrolysis during darkness. Sucrose applied to the plant increased flowering response with a day-length of 10 h, while stronger light had no influence.

More knowledge of plant biochemistry was required to indicate which processes were involved.

Promotor: Prof. Dr E. C. Wassink

Author

186. D. DE ZEEUW De invloed van het blad op de bloei / *The influence of the leaf on flowering*. 1954, pp. 8 + 44. Du a. Eng. summ. Also published in Meded. LH 54 (1954) 1 and as Lab. Tuinbouwplantenteelt Publ. 120.

Flowering of the SD plant *Perilla crispa* was also possible in LD and in continuous light, if lighting was weak enough. The light range within which flowering is possible, decreased with increasing day length. With an illumination of 300  $\mu$ watts/cm<sup>2</sup> spherical cross-section, seedlings were day-neutral. Older plants proved more predisposed to flower than seedlings. In plants with two equivalent but differently illuminated shoots the brightly lit shoot initiated flowers in long days through influence of the weakly lit shoot; this influence was stronger after defoliation of the brightly lit shoot. Neither in bright nor weak light (with SD or LD) did defoliation qualitatively influence flower initiation. Even 0.5 cm leaf surface was sufficient for flower initiation.

With the day-neutral tomato (*Lycopersicum esculentum* var. Ailsa Craig) defoliation advanced flower initiation and increased the number of flowers. Brighter light decreased the number of leaves before the initiation of the first flower cluster; in very weak light the plants could be kept vegetative for a year.

With the day-neutral *Phaseolus vulgaris* var. Vroege Wagenaar defoliation of the main shoot promoted development of axillary shoots, through whose later defoliation the number of flowers could be increased. There was a positive correlation between flower number and light intensity. Flower initiation itself was however independent of intensity, day length, removal of cotyledons or defoliation but the number of flowers decreased through removal of the cotyledons.

In SD plants too much growth regulator probably inhibited flowering; in other plants this was caused by the growing leaf. Flowering probably needed an equilibrium between available assimilates and growth regulators.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

187. J. BENNEMA Bodem- en zeespiegelbewegingen in het Nederlandse kustgebied / *Movements of land and sea-level on the Dutch coast*. 1954, pp. 10 + 86.

Since 1945, detailed soil surveys were made in the maritime districts of the Netherlands. They increased knowledge of marine deposits, not only for pedologists, but also for geomorphologists. The author combined these data with new palynological and archaeological studies to construct a new time-depth diagram for the relative rise in sea-level during the last 7500 years. The curve was constructed from a number of selected points. At each point the mean sea-level during sedimentation was carefully reconstructed from sedimentation facies and by comparison with recent conditions of sedimentation. With archaeological and palynological data the ages were determined precisely. With the new <sup>14</sup>C method of estimating age only slight correction was necessary.

The author considered the curve to be the result of at least two movements: the absolute rise in sea-level believed to be a logarithmic curve and the tectonic

subsidence being a continuous movement of about 2.5 cm per century. The selected points were as free as possible from subsidence through soil compaction of peat and soft clay layers; otherwise this factor was calculated.

The curve was constructed as a flowing line without undulations indicating a consistent slowly dwindling transgression without minor eustatic fluctuations. The regressive and transgressive phases of marine activity on the Dutch coast were believed to have a periodicity of 525 years and were climatically conditioned, for example by increase in storminess and not by minor eustatic changes in sea-level.

It was concluded that up to about 2050 the transgressive phase with severe storminess and a slight rise in sea-level will persist

Promotor: Prof. Dr Ir C. H. Edelman

Pon.

188. J. A. J. STOLWIJK Wave length dependence of photomorphogenesis in plants. 1954, pp. 8 + 64. Eng. summ. Also published in Meded. LH 54 (1954) 5.

Light of various spectral regions (at low or high intensities) supplemented a short day (SD) in white light, or was used alone at high intensity. Two types of relation of wave length to photoperiodic reaction were found: Crucifers were sensitive to blue and infrared (even SD exposure promoted elongation and flowering) and did not respond to 520–700 m $\mu$  (so this region inhibited flowering in white light despite its blue component); other plants, e.g. *Cosmos bipinnatus* and *Spinacia oleracea* were sensitive to 520–700 m $\mu$ , and showed little or no response to blue and infrared. Flowering of day-neutral plants was not affected by wave length of supplementary light.

All species showed strong response to supplementary blue and infrared radiation, by excessive elongation of a part such as internodes, leaves or petioles. The rate depended on light intensity and the process was inhibited by red or green. Light of restricted spectral regions also induced strong formative and biochemical effects. Infrared counteracted red light. 'Monochromatic' light of high intensity perhaps regulated auxin level, whereas the supplementary light might effect its activity or sensitivity to auxin.

Promotor: Prof. Dr E. C. Wassink

E.

189. F. DE SOET Aanvullende werkgelegenheid / *Increasing employment*. 1954, pp. 14 + 176.

The author illustrates the concept increasing employment in the form it took in the Netherlands. To the author it refers to work undertaken to increase employment for the government or subsidized by it. After placing employment in the whole of the complete employment policy of the government, the various kinds of supplementary works are described. The historical development of

supplementing employment in the Netherlands up to then is clearly reflected. A separate chapter formulates the standards which supplementary employment must reach. The author gives seven criteria. The project must not evoke unemployment somewhere else. The benefit has to be as high as possible. The work has to be purposeful to the labourer too. The influence on private investments has to be as favourable as possible. The import-quota must be small. The biggest possible variety of unemployed has to be taken up. Speeding up, delaying or stopping of the work or a part of it has to be possible. Further a number of rules are given as financial justification. The author thoroughly analyses the method of subsidy. The execution of the works is also reviewed in detail.

Promotor: Prof. Dr Th. L. M. Thurlings

Kr.

190. J. P. H. VAN DER WANT Onderzoekingen over virusziekten van de boon (*Phaseolus vulgaris* L.) / *Investigations on virus diseases of the bean (Phaseolus vulgaris L.)* 1954, pp. 8 + 96. Du. a. Eng. summ. Also published as Meded. IPO 85.

Three viruses were studied which produce diseases in French beans, *Phaseolus* virus 1 (PV1), *Phaseolus* virus 2 (PV2) and a virus isolated from white clover (WKV). Included are symptoms, host plants, properties *in vitro*, occurrence and spread in the field. Special attention was given to the transmission of PV1 by the aphids *Myzus persicae* Sulz. and *Aphis fabae* Scop. From the results, it was postulated that the virus becomes attached to the outer surface of the aphid's stylets when it punctures an infected plant and that the virus may be removed from the stylets only by washing or elution; differences in vector efficiency between *M. persicae* and *A. fabae* might be due to differences in the fine structure of the outer surface of the stylets. A paper-chromatographic method succeeded in demonstrating the presence of characteristic thread-like particles in the sap of bean plants infected with the viruses. The particles in the sap of plants infected with PV1 on PV2 tended to aggregate and associate with amorphous material. The particles in the sap of plants infected with WKV hardly showed a tendency to aggregate.

Promotor: Prof. Dr Ir Th. H. Thung

Author

191. J. C. F. M. HAANS De bodemgesteldheid van de Haarlemmermeer / *Soil conditions of the Haarlemmermeer*. 1955, pp. 8 + 154. Eng. summ. Also published as VLO 60.7 (1954), serie De Bodemkartering van Nederland, deel XV.

The Atlantic marine incursion (5000–2300 B.C.) deposited sands and clays in the western Netherlands at a level about 4 metres below mean sea-level which could be easily studied in the Haarlemmermeer Polder. Some incursions and

their sediments were traced in the terrain (Old Holocene sand, Hoofddorp deposits, Old Marine clay and Beinsdorp deposits); a small regression period allowed soil formation (decalcification on the Hoofddorp deposits). In the Subboreal and Subatlantic period, peat started to grow on top of the marine deposits, interrupted by marine incursions; in Medieval times the peat was eroded and three lakes were formed, which afterwards coalesced into one great lake. This lake threatened to destroy the central part of Holland together with the town of Amsterdam and was finally pumped out and reclaimed in 1853. Granular composition and  $\text{CaCO}_3$  content determined suitability for crop production.

The eroded peat was deposited as peat detritus in many places. There the topsoils were black and N manuring was not necessary, because of good nitrification. Sugarbeet produced less sugar on these soils.

Apart from this, cat clay formation (causing low pH values) and seepage (mainly saline) were studied.

Often deep trenching or deep ploughing was necessary to get a calcareous topsoil.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

192. H. LAMBERTS Verbreiding van de grondslagen voor de veredeling van gele voederlupine / *Broadening the basis for the breeding of yellow sweet lupine*. 1955, pp. 8 + 56. Du. a. Eng. summ.

The author has isolated 19 new alkaloid-free plants from a local variety of *Lupinus luteus*. In one of them freedom from alkaloids was not determined by one of the three known recessive genes. A line from wild Spanish origin was resistant to mildew. The gene for mildew resistance was indicated by Er. The author found resistance to wilt disease (*Fusarium oxysporum lupini*) in Portuguese material. At least three physiological races are concerned. Some lines derived from the Dutch race have been attacked by mosaic disease only after flowering time.

In plants from Palestine a rapid growing line (Pal-type) was found. Rapid growth was due to one dominant gene (Rp).

An attempt was made to create highly productive varieties based on the Pal-type and on such types with a rapid juvenile development, resistance to mildew, wilt, mosaic disease, non-shattering pods which are easily threshable, soft-coated seeds and glabrous pods.

The author showed how important the wild forms have been for the breeding. Only a small proportion of existing forms had been collected. A collection of lupins needed to be organized on an international footing, so that many countries may use these forms for their breeding work.

Promotor: Prof. Dr Ir J. C. Dorst

d.H.



193. H. BROESHART The application of foliar analysis in oil palm cultivation. 1955, pp. 114. Eng. summ.

The chemical analysis of leaves was studied as an indication of fertilizer requirements of the oil-palm in the former Belgian Congo. Position and age of the leaf both markedly influenced chemical composition. Leaflets from the same position in leaf and plant must be compared. The age of the whole palm also had its influence; climatic influences also varied with age (generally more fluctuating in younger palms). Time of year significantly influenced leaf composition. Sampling in the rainy season was advised, between 07.00 h and 10.00 h. Analytical error should not exceed 10%.

For 20 ha bulk samples of 20 to 25 palms should be taken; they give a sampling variation of the same order as the errors in chemical analysis. Two leaflets from each side of the middle part of the youngest leaf (with fully open leaflets) were taken. Chemical composition was directly related to growth and production of oil-palms. There was an 'optimum' leaf composition. Qualitative diagnosis of deficiencies should however be based on characteristic changes in leaf composition for all the elements (N, P, S, K, Ca, Mg, Mn, B, Cu, Zn). A deficiency of a minor element may effect contents of major elements. It was possible to approach the optimum leaf concentration by fertilizing.

Promotor: Prof. Dr A. C. Schuffelen

E.

194. J. D. FERWERDA Questions relevant to replanting in oil palm cultivation. 1955, pp. 8 + 102. Eng. summ.

A search is made for a sound replanting technique for oil palm plantations in the former Belgian Congo, by analysing the influences of the old stand and those of fertilizers on the development of young palms in replanted areas. The advantages of replanting over opening up of new areas are diminished by the greater chance of nutrient deficiency and other diseases. The benefits of retaining the old stand for a certain period of time are greatly reduced by the mortality of the young palms, their poor and slow vegetative development, their greater susceptibility to pests and diseases, the retarded beginning of their productive stage and the slow increase in production. The benefits of fertilizers for the young palms became evident during the second year after planting, but are slightly reduced as long as the old stand is retained.

There is a discussion of the effects of N, P, K, Mg, Ca, Cu, Mn, B, Zn, Ni, Co, and Mb in replanting experiments on a riverine sandy soil and a red latosol, especially their effects on chemical composition of leaves, number of male and female inflorescences and fruit bunches. Various valuable improvements are advised in seed bed and nursery technique.

Promotor: Prof. Dr Ir C. Coolhaas

E.

195. T. VISSER Germination and storage of pollen. 1955, pp. 8 + 68. Eng. summ. Also published in Meded. LH 55 (1955) 1, and as Lab. v. Tuinbouwplantenteelt, Publ. 134.

Germination of pear pollen markedly improved when boric acid was added to the medium. The pollen was more sensitive to boron in water than in 10% sugar solution. Supplying weak solutions of boron to pear branches before flowering resulted in a good germination of the pollen in sugar solution without boron. Spraying apple-trees and pear-trees with boron solutions had no significant effect on fruit set, despite the pollen sensitivity to boron *in vitro*.

The amount of boric acid in the medium determined percentage germination (saturation curve) and length of pollen tubes. Boron was not required until the tubes protruded. Temperature and sugar concentration both showed optimum values for germination. The effect of boron on germination rate was positively correlated with temperature and negatively with sugar concentration. An increase of 10°C roughly doubled this influence on germination rate. Germination was positively correlated with pollen grain number per drop, whether or not boron was present. So the mutual stimulation of the pollen was more effective with boron or with pollen from rather boron-rich branches. Pollen extracts in 10% sugar solution with or without boron stimulated germination (also of other species).

Both apple and pear pollen (and those of many other species) remained viable longest at both low humidity and temperature. In deep-freeze longevity was more than 2 years at -180°. Viability remained unchanged. Longevity would probably have been indefinite.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

196. J. F. G. M. WINTERMANS Polyphosphate formation in *Chlorella* in relation to photosynthesis. 1955, pp. 8 + 58. Eng. summ. Also published in Meded. LH 55 (1955) 2.

Suspensions of *Chlorella* converted orthophosphate into cellular phosphate in the light, especially in the absence of CO<sub>2</sub>, when orthophosphate was largely transformed into polyphosphate. Polyphosphate formation continued for several hours, slowly decreasing, and was saturated at much lower light intensities than photosynthesis with 5% CO<sub>2</sub>. It was maximum at about pH 4, decreasing to zero at pH 7-8. It was not affected by anaerobic conditions and nitrate, but decreased with glucose.

Phenylurethane inhibited polyphosphate formation less than photosynthesis, and in the light-limiting range only. Light saturation was reached at higher intensities.

DNP inhibited photosynthesis and polyphosphate formation to the same extent at all light intensities, and most strongly at low intensities. Sodium azide and NaF inhibited both processes about equally.

Probably high-energy phosphate was formed in light, and transferred to polyphosphate when photosynthesis was curtailed by lack of CO<sub>2</sub>. Glucose may also compete for this high-energy phosphate.

With CO<sub>2</sub> phosphate fixation yielded more stable products, and showed different sensitivity to inhibitors.

Dark fixation required oxygen and was especially sensitive to DNP but less so to glucose and other inhibitors.

Slow decomposition of polyphosphate and release of orthophosphate occurred in darkness under nitrogen.

Promotor: Prof. Dr E. C. Wassink

Author

197. H. A. C. THUSSEN De invloed van de samenstelling van binaire mengsels op het schotelrendement in rectificatiekolommen. / *Effect of liquid composition on plate efficiency in the rectification of binary mixtures*. 1955, pp. 8 + 104. Eng. summ. Also published as VLO 61.12 (1955).

The effect of composition on plate efficiencies for binary mixtures of ethanol and water, n-heptane and methylcyclohexane, and methylcyclohexane and toluene was studied experimentally in an adiabatic distillation column of 3.8 cm internal diameter containing 9 sieve plates. Accurate data concerning the vapour-liquid equilibrium curves were required for the calculation of Murphree plate and point efficiencies. This led to the use of the test for internal consistency of vapour-liquid equilibrium data as introduced by Harington, which was extended to P constant, T variable and corrected for differences from an ideal gas of the vapour phase. An exact graphic method to evaluate the vapour-liquid equilibrium from boiling point composition data of binary mixtures was derived.

The observed point efficiencies on overall gas basis seemed to vary markedly with composition in low and high concentrations. It was demonstrated that these variations could not be attributed to lack of precision in the equilibrium data, interference with the column operation by sampling, variation in physical properties with composition, or a variation in stripping or rectifying factor mV/L with concentration.

The point efficiencies at total reflux seemed to be a function of the corresponding driving forces for mass transfer in the gas phase.

Promotor: Prof. Dr W. R. van Wijk

Author

198. K. VERKERK Temperature, light and the tomato. 1955, pp. 8 + 50. Eng. a. Du. summ. Also published in Meded. LH 55 (1955) 4 and as Lab. Tuinbouwplantenteelt Publ. 138.

In good illumination, six tomato varieties all responded to an increase in day or/and night temperature by faster stem and fruit growth, earlier but smaller

fruit yield with fewer fruits in shorter and lighter clusters, and a reduction in root, stem and leaf weight. Optimum temperatures for moderate growth and high fruit yield were 20°–23°C during the day and 11°–17°C during the night. The night temperature should be at least 6°C lower than during the day.

In poor illumination, plants responded to an increase in light intensity or day length by higher dry weight and leaves that were less thin and darker green; leaf dry weight increased more than leaf area. Cluster size and consequently yield was the first feature to suffer considerably by light reduction. Extra artificial light in winter before planting out gave faster growth and sturdier plants which flowered and fruited earlier than controls. The less the illumination, the more important the correct day and night temperatures. Emphasis was laid on balance between vegetative and generative growth, which was determined by the ratio of light and temperature, which in itself determined the balance between photosynthesis, and growth and respiration.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

199. W. H. UBBINK De veranderingen in het grondgebruik in een zandgemeente (Hengelo, Gld) in de jaren 1900–1950 / *Changes in land use in a municipality on sandy ground (Hengelo, Gelderland) in the years 1900–50*. 1955, pp. 108. Du. summ.

Changes in land use on farms at Hengelo were remarkably more frequent than was usually supposed in such areas. The larger farms had a general tendency to decrease in area, while the smaller farms tended to increase in area.

It was considered that there was a tendency to strive for a certain farm size. Before 1925 this area was slightly less than 15 ha and after 1925 slightly more than 10 ha. A relation with the labour requirement seemed plausible. The most important origin of land to enlarge farms was the reclamation of waste land, followed by renting and then buying of supplementary land.

Part of the change in farm area was not voluntary. The majority certainly was. The number of voluntary changes indicated a strong desire to adapt the size of the family farms to changing circumstances. It was shown that legislation influencing the land market slightly limited the changes in land use.

The establishment of new farms was considerable; the liquidation of farms was less frequent but was a regular occurrence.

Promotor: Prof. Dr E. W. Hofstee

Author

200. J. L. P. VAN OORSCHOT Conversion of light energy in algal culture. 1955, pp. 8 + 276. Eng. a. Du. summ. Also published in *Meded. LH 55* (1955) 5.

The conversion of light energy in algal culture was quantitatively studied under various growth conditions. Absorbed light energy during growth and

energy fixed in organic material were estimated. The efficiency of the conversion was expressed as percentage of fixed energy (calculated from estimates of dry weight and elemental analysis of the cell. Often almost complete light absorption was achieved by high cell density or thick culture layers.

To estimate the maximum fixation of solar energy, such dense cultures were used under natural conditions. Large cultures had an efficiency of 1–5% of the incident light energy in April–November ( $\lambda < 0,7 \mu$ ) and a yield of 1–13 g per metre<sup>2</sup> per day, and small dense cultures one of 8% and a yield of 20 g per metre<sup>2</sup> per day during July and August. From mathematical description of the relation between light intensity and the rate of photosynthesis, yields were calculated for dense cultures. The yields and efficiency of light energy conversion calculated in this way were confirmed in experiments under controlled conditions. The influence of temperature was studied. The source of nitrogen influenced the efficiency of the light conversion but not the chemical composition of the cell. Nitrogen deficiency decreased the efficiency and increased the relation carbohydrate/protein. High lipid contents were attained only after prolonged growth periods, and were associated with very low efficiencies.

Promotor: Prof. Dr E. C. Wassink

E./Author

201. J. WEITS De antirachitische werking van Nederlandse ruwvoerders in verband met het antagonisme tussen caroteen en vitamine D / *The antirachitic activity of Dutch roughages in relation to the antagonism between carotene and vitamin D*. 1956, pp. 8 + 74. Du. a. Eng. summ. Also published in Meded. LH 56 (1956) 1.

A method was devised for estimating vitamin D in roughages. After boiling with 10% alcoholic KOH the material was extracted with petroleum ether, and purified by chromatography through an activated alumina column with petroleum ether. Chromatography removed an unsaponifiable factor antagonistic to vitamin D. The eluate was assayed by the curative X-ray method against a vitamin D standard with white rats.

No vitamin D could be detected in ensiled turnips. Average contents in roughages under Dutch conditions were: grass silage and artificially dried grass about 300 IU, hay cured in windrows and cocks 1000 IU, frame-dried hay 575 IU and straw possibly as windrow hay. Considering the usual rations and the great variation in vitamin D in hays the intake of the vitamin might not be adequate on all farms. Although identification of the antagonistic factor was not possible a relation appeared to exist between the factor and carotene. Synthetic carotene and vitamin A palmitate 100–800 IU daily showed in rats a weak antagonism of a competitive nature. Vitamin A excess in lambs had no effect on serum calcium but lowered serum inorganic phosphorus.

Promotor: Prof. Dr E. Brouwer

Wi.

202. S. A. F. EL-SHIMY The heritability of milk yield and fat percentage in the Friesian cattle in the province of Friesland. 1956, pp. 76. Eng. a. Du. summ.

The heritability of milk yield and fat percentage was calculated of herd-registered cattle in Friesland. The estimates were based on daughter-dam comparisons. Comparisons covered the first three lactations. The average heritability estimates of milk yield within sires, and according to the different kinds of soil, were 35.50 and 37.38 %, with daughter-dam regression and dam-daughter correlation, respectively. Under the same conditions the figures for fat percentage were 76.52 and 81.58 %, respectively.

When the effect of different soils was ignored, average heritability estimates for milk were 36.58 and 38.60 %, respectively. The corresponding figures for fat percentage were 76.40 and 81.60 %, respectively.

If the figures were not calculated on within-sire basis, the average heritability for milk yield was 39.60 and 40.60 %; whereas for fat percentage the estimates were 84.44 and 83.52 %, as calculated from daughter-dam regression, and dam-daughter correlation, respectively.

The most reliable estimates of heritability were by the within-sire daughter-dam regression calculated for each of the different soil types.

Promotor: Prof. Dr W. de Jong

Vo.

203. D. D. MIEDEMA Géographie des races bovines laitières en France / *Geography of breeds of dairy cattle in France*. 1956, pp. 146. Du. summ.

The actual distribution of breeds of dairy cattle in France did not accord with a planned agricultural economy. A study was made of the causes of this discrepancy.

Historical reasons were of great influence and curious measures had been taken to counteract the introduction of carefully selected breeds, adapted to modern agriculture methods.

With the introduction of artificial insemination under supervision of thoroughly instructed people Friesian cattle had increased their distribution as they were the only breed with sufficient number of good breeding males.

Promotor: Prof. Dr E. W. Hofstee

Author

204. H. H. A. SELIM The effects of flowering on adventitious root-formation. 1956, pp. 8 + 38. Eng. a. Du. summ. Also published in *Meded. LH 56 (1956) 6*, and as *Lab. Tuinbouwplantenteelt, Publ. 146*.

The rooting of cuttings from *day-neutral tomato* was not influenced by flower development, nor by SD or LD treatments of them or of the mother plants. In cuttings of the SD plant *Perilla crispa* flower initiation and development severely

inhibited rooting. Leaves produced about 61% of the roots, buds about 16%, stems a small proportion. Together these organs were more effective than their summed separate effects. A supposed substance regulating adventitious root formation would need more than 2 days for transport from the leaves or buds. The physiological age of the cutting markedly affected rooting. The presence of buds during SD treatment may have changed auxin distribution, which became concentrated in the apical region and slightly promoted rooting there. Stems could induce flowering. Day length had no influence during rooting. Light on the base of the cutting inhibited root formation. In the LD plant red clover, flower initiation inhibited rooting of cuttings.

In both SD and LD plants, auxin distribution during flower initiation and development must cause antagonism between adventitious root formation and flowering. This did not apply to day-neutral plants with a vegetative terminal bud, but perhaps to those with a terminal flower bud.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

205. D. E. VAN DER ZAAG Overwintering en epidemiologie van *Phytophthora infestans*, tevens enige nieuwe bestrijdingsmogelijkheden / *Overwintering and epidemiology of Phytophthora infestans, and some new possibilities for control*. 1956, pp. 8 + 68. Eng. summ. Also published in *Tijdschr. Plantenziekten* 62 (1956) 89-156.

Primary foci of phytophthora could be found in potato fields originating from diseased tubers and on refuse heaps. In De Streek (North Holland) the very susceptible variety Eersteling had 1 primary focus per 80 ha of potatoes. Infection from refuse heaps was there of minor importance. Only a small proportion of diseased tubers planted gave a primary focus. Spread from the primary foci was studied. Epidemics of phytophthora under the prevailing weather conditions could be easily explained by spread from the primary foci. 'Field resistance' of the varieties plays a main role in epidemics. A method for testing it in the greenhouse was worked out.

The disease could be controlled not only by spraying but also by careful inspection of seed potatoes and by eradication of primary foci in field and on refuse heaps. Heat treatment of tubers killed the fungus, but would hardly be applicable in practice.

Promotor: Prof. Dr A. J. P. Oort

O.

206. AHMED SOLIMAN SAMRA Relative value and mode of action of some fungicides used as seed disinfectants and protectants. 1956, pp. 6 + 58. Eng. a. Du. summ. Also published in *Meded. LH* 56 (1956) 5.

The first part of this paper deals with investigations at the Phytopathological

Laboratory, Wageningen, into the control of *Alternaria* spp. (mainly *A. raphani*) on radish seed by chemicals. Organic mercury compounds proved better than thiram products and were more effective wet than as dusts, ceresan and germisan wet treatments being the best (99% control) and, as 1% for 4 to 8 min., not phytotoxic.

The fungus was able to penetrate to the interior of the seed and may thus prevent germination. The fungicidal effect of ceresan increased when seed was stored up to 32 days after treatment, but the phytotoxic effects were also greater.

Of the antibiotics tested, some had no effect, and actidione, though giving control, proved too phytotoxic. Rimocidin at 200, 400 or 800 p.p.m. for 16, 8, and 4 h respectively, was more effective; at 400 p.p.m. for 30 h it eliminated deep-seated infection without injury to the seed and in this was superior to ceresan.

The second part deals with the relative value of thiram and mercurials as seed protectants against unspecified soil fungi. In cold tests with maize seed (germination in unsterilized field soil at low temperature) arasan SF-X at 0.2 to 0.3% was the most effective of the thiram products and was less phytotoxic and more persistent than ceresan-new.

Promotor: Prof. Dr A. J. P. Oort

Rev. Applied Mycol.

207. M. S. H. KHALIL The interrelation between growth and development of wheat as influenced by temperature, light and nitrogen. 1956, pp. 8 + 74. Eng. a. Du. summ. Also published in Meded. LH 56 (1956) 7.

Development was studied in wheat, mainly the subtropical varieties Hindi and Baladi. Leaf emergence was faster and the relation shoot/root decreased as temperature increased from 10° to 30°C. After transfer from low night temperature to higher temperatures for daily illumination, the root system was slower than aerial parts in reaching ambient temperature, causing damage to the plant. Warm water circulating slowly through the soil for a few minutes could avoid this. Stem elongation was most favoured at 10°–20°C in the night. Higher night temperatures gave fewer tillers and more leaves. Spikes developed sooner with 10°C than with 27°C at night and later with constant day-night temperatures.

Increase of daylength (8–24 h) increased stem length and decreased tiller number, and leaf number and area. Production of dry matter was highest with 16–20 h and was less with continuous light. Increasing intensities of extra illumination after normal daylight in the greenhouse increased stem length, decreased tillering, leaf formation and leaf area, and accelerated reproduction. Increase in normal illumination suppressed stem elongation, but increased number of tillers and leaves. White and red supplementary light for 3 weeks induced early flowering. Intense red light for 16 h accelerated spike initiation. The relation root/top increased with intensity.

Influence of N depended on light intensity. Low rate of N increased root/



shoot ratio independently of light intensity. The relation C/N in the plant depended on N rate, photoperiod and night temperature. Early flowering usually accompanied a high C/N ratio. The relation of dry matter in heads to that in stems and leaves decreased with increasing N in both SD and LD. The absolute quantity of N in heads or stems, however, increased with high N and was mostly smaller in SD than LD.

Promotor: Prof. Dr E. C. Wassink

E.

208. H. C. M. DE STIGTER Studies on the nature of the incompatibility in a Cucurbitaceous graft, 1956, pp. 8 + 52, Eng. a. Du. summ. Also published in Meded. LH 56 (1956) 8 and as Lab. Tuinbouwplantenteelt, Publ. 147.

Musk melon (M), cucumber (C) and *Cucurbita ficifolia* (F) could successfully be grafted in all single combinations, except for M/F which required foliage on the stock to survive. Defoliation of this stock caused the plant to wilt and die, generally in 4–5 days; necrosis started in the stock: a rapid and specific collapse of its sieve tubes occurred before any visible symptom was evident in the melon scion. With stock foliage present, a good union between xylem and phloem of the partners was formed.

Growth and other phenomena reacted strongly to the number of leaves on a stock. The effect of these leaves depended largely on light intensity. M/F plants could recover from advanced stages of incompatibility, by renewed contact with leaves of the stock species.

From these and experiments with double grafting it was concluded that the stock leaves provided the stock with some specific substance (enzymic or hormonal) enabling the stock phloem to function normally.

Shortage or complete absence of this substance might have influenced some enzymic process in the complex of sieve tube and companion cell, upsetting metabolism as shown by local accumulation of starch. The stock leaves depended on root vitality, which in turn was determined by interaction with the scion. The growth-regulating activity of the stock leaves thus proved to be connected with the nature of the interactions between M and F.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

209. E. I. EL HINNAWY Some aspects of mineral nutrition and flowering. 1956, pp. 8 + 52. Eng. a. Du. summ. Also published in Meded. LH 56 (1956) 9 and as Lab. Tuinbouwplantenteelt, Publ. 148.

In mustard N deficiency accelerated flower initiation and particularly flower bud development. Excess N delayed flowering but increased number of flowers. Of other elements Ca influenced flowering most.

Dill developed its flowers most rapidly with normal or high rates of N. N

deficiency retarded flowering and decreased the number of inflorescences.

In spinach N rate only slightly influenced flowering. N deficiency retarded flower budding by a few days.

*Perilla crispa* reacted most to N and P. Except where N was in excess (2N), the time required for appearance and development of flower buds was negatively correlated with the N concentration, while the number of flowers was positively correlated with it. P deficiency delayed flowering and decreased the number of flowers.

With *Kalanchoë blossfeldiana* N increased the number of flowers and accelerated flowering.

Mineral nutrition had only quantitative influences on the photoperiodic behaviour of the crops studied.

It was concluded that the effect of minerals on the flowering process of LD (mustard, dill and spinach) and SD plants (*Perilla* and *Kalanchoë*) was indirect, through their effect on synthesis of material for flower bud formation, on auxin production and hence on growth.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author/E.

210. R. H. A. VAN DUIN Over de invloed van grondbewerking op het transport van warmte, lucht en water in de grond / *The influence of tillage on conduction of heat, diffusion of air and infiltration of water in soil.* 1956, pp. 8 + 82. Eng. summ. Also published as VLO 62.7 (1956).

The influences were calculated physically of tillage on the temperature of soil and air near the surface, on the composition of the air in the soil and on infiltration capacity for water. The calculations were compared with experimental data obtained in different parts of the world.

Unworked soil was considered to be homogeneous while worked soil consisted of 2 or 3 layers with different volume fractions of solid material; the lowest layer had the properties of uncultivated soil.

The physical aspects of tillage for plant growth involved aeration of a compact soil by increasing the volume fraction of air-filled pores and improving the permeability of the soil and a rather small influence on its temperature. Tilling caused more extreme temperatures of the aerial part of the plant and of the seed, if the depth of working was more than about twice the depth of sowing, and less extreme temperatures of the root zone.

Deep tillage was sometimes not desirable, as in a region with dry cold winters if winter crops are grown and in a dry hot region, because of the increased oxidation of organic matter. In a temperate climate it may be favourable for both winter and summer crops.

Promotor: Prof. Dr W. R. van Wijk

Author

211. M. K. EL-DIN FOUAD Studies on genetic and on chemically induced resistance of cucumber tissues to *Cladosporium cucumerinum* (Ell. & Arth.). 1956, pp. 8 + 56. Eng. summ. after parts 1 and 2. Du. summ. Also published in Meded. LH 56 (1956) 10 and as Meded. Lab. Phytopathol. 163.

A detailed anatomical study was made of the host-parasite relations of cucumber seedlings inoculated with *Cladosporium cucumerinum* and of the effect of treatment with G33, the roots being immersed in a 100 p.p.m. solution of the compound for 48 h before inoculation. It was concluded that the resistance conferred by G33 was situated both in the cuticle and in the deeper tissues, and that the substance was effective only in cells appearing microscopically sound. The effect did not extend beyond the cuticle, and resistance did not seem to be due to plasmatic interaction.

Uptake by the roots of cucumber seedlings of 2,4-dinitrophenol, sodium diethyldithiocarbamate and sodium azide had no effect on either genetic resistance or that induced by G33. However narcosis of seedlings by exposure over solutions of 1.5% ether or 0.24% chloroform caused breakdown of genetic resistance in the varieties Mabro and Proso, though these still remained resistant to *Penicillium italicum* and *Botrytis cinerea* (neither of which normally infects cucumber). But narcosis had no effect on the resistance to *C. cucumerinum* conferred by G33, which, unlike genetic resistance, seemed therefore unrelated to host metabolism. The sap expressed from resistant varieties and from the uninfected portions of older plants of a susceptible variety (Lange Gele Tros) did not inhibit growth of the pathogen in culture.

Promotor: Prof. Dr A. J. P. Oort

Rev. Applied Mycol.

212. J. J. STADHOUDERS De hydrolyse van vet bij de kaasrijping in verband met de smaak van kaas / *The hydrolysis of cheese fat in relation to the flavour of cheese*. 1956, pp. 8 + 68. Du. a. Eng. summ. Also published in Meded. LH 56 (1956) 11.

Fatty acids are important as constituents of cheese flavour. In cheese made from raw milk, milk lipase probably hydrolyses cheese fat to some extent, but cheese made from aseptically drawn milk shows no piquant flavour.

It was established that during ripening no active lipase was formed inside the cheese. Enzymes of isolated strains of *Lactobacillus* and *Micrococcus*, genera normally found in ripened cheese, failed to hydrolyse fat to a measurable extent in normal conditions for hard cheese. Bacteria from the genera *Pseudomonas*, *Achromobacter*, *Alcaligenes* and *Serratia*, belonging to the normal flora of milk, caused considerable fat hydrolysis in cheese, although these bacteria did not grow in cheese, and died within a few days. Micro-organisms growing on the surface of hard cheese could hydrolyse the fat of the cheese rind.

As the fat-splitting bacteria are killed by pasteurization of the milk, cheese from pasteurized milk shows no piquant flavour. Addition of suitable amounts

of cultures of fat-hydrolysing bacteria to pasteurized milk improved the cheese flavour. The acidity of cheese fat was a useful estimate for the lower free fatty acids as they constituted a standard proportion of total fatty acids.

Promotor: Prof. Dr H. Mulder

N.

213. P. VAN DER WAL De structuur van de substantia compacta van de metatarsus in verband met de calcium- en fosforhuishouding by rundvee / *Structure of compact bone of the metatarsus in relation to calcium and phosphorus metabolism of cattle*. 1956, pp. 8 + 96. Du. a. Eng. summ. Also published in *Meded. LH 56* (1956) 13.

In 15 cattle aged from one day to fifteen years the structure and development of the metatarsus, especially compact bone, was studied. For this purpose the metatarsus was divided into 20 slices of equal thickness. The structure, growth and the reconstruction of the metatarsus were discussed.

Next the relation between the calcium and phosphorus balance of cattle and the structure of the metatarsus was studied in material from 64 bulls and 327 cows. The influence was examined of age, date of calving, number of lactations, milk production, stalling period, type of soil and tuberculosis on the structure of the metatarsus.

The structure of compact bone of the metatarsus of cattle was influenced by the calcium and phosphorus balance. From the microscopic structure of the metatarsus conclusions could be drawn about the adequacy of the supply of minerals. The large individual variations in bone structure made it likely, that other factors are also important.

Promotor: Prof. Dr E. Brouwer

Bot.

214. J. A. H. HENDRIKS Het Lelydorp Plan in Suriname. Inleiding tot het vraagstuk van de landontwikkeling op arme gronden in een tropisch gebied / *The Lelydorp Project in Surinam: an introduction to the problem of land development on poor soils in a tropical region*. 1956, pp. 8 + 120.

In 1950 the Welvaartsfonds (The Prosperity Fund) established the Lelydorp Project; a pilot scheme to develop sound fulltime family farms in the Old Coastal Plain. The area was 450,000 ha of sparsely populated rolling sandy ridges covered with tropical rain-forest.

Land development required a general survey of natural conditions and indigenous farming skill, technical research on crops and rotations, and economical studies to define farm types fulfilling economic and social needs.

Soils varied. Most were poor, degenerated rapidly after felling vegetation and easily eroded even on slight slopes. Thus farm allocation should be based on topography and soil conservation.

Technical studies were outlined on reclamation, tree crops (citrus, cocoa, coconuts, oil palm), animal husbandry, fodder crops and pasture land, arable crops and crop rotations.

On preliminary data, 45 farms of 5.8 or 11 ha were allocated, concentrating on crops and livestock. Selection, guidance and assistance (machine pool, marketing, credit) of farmers were discussed.

As tree crops were not yet bearing, input-output results were only provisional.

An analysis of daily, farm by farm, reports of labour use per component (live stock, tree crops, arable land, mixed crops) showed that over the year 1954 on the farms of 11, 8 and 5 ha 1048, 759 and 750 hours, respectively, were spent per ha. For the tree crops these figures were 618, 468 and 364 hours.

The larger farms depended more on outside help (51% of total labour) and could not be considered family farms; the higher labour per ha indicated that they were beyond the farmer's management skill.

In future full-time farms between 5 and 8 ha of a simplified type were recommended. Application of the technical results on smaller, part-time farms was advocated.

Promotor: Prof. Ir J. A. van Beukering

Author

215. L. H. J. BONGERS Aspects of nitrogen assimilation by culture of green algae. 1956, pp. 8 + 52. Eng. a. Du. summ. Also published in Meded. LH 56 (1956) 15.

The N/C relation in green algae was about 0.2, but with N starvation this ratio may decline to 0.04. Such treatment also decreased the chlorophyll content of the cells as well as the rates of photosynthesis and growth.

Supply of substrate N to N-starved algae resulted in formation of cells of 'normal' character. At pH values of 7 to 8, both  $\text{NO}_2^-$  and  $\text{NO}_3^-$  were assimilated at approximately the same rate.

Algae of normal N/C relation did not assimilate substrate N ( $\text{NO}_2^-$  or  $\text{NO}_3^-$ ) if illuminated without a carbon source. Instead,  $\text{NO}_3^-$  and  $\text{NO}_2^-$  became reduced and  $\text{NH}_3$  was excreted into the surrounding medium.

In weak light, the rate of  $\text{NH}_3$  excretion (*i.e.* reduction of  $\text{NO}_3^-$  in the absence of  $\text{CO}_2$ ) was equivalent to the rate of  $\text{CO}_2$  reduction (in the absence of  $\text{NO}_3^-$ ); if both substrates ( $\text{NO}_3^- + \text{CO}_2$ ) were present together both rates decreased, indicating competition for the same reduction.

In strong light (without  $\text{CO}_2$ ) the rate of  $\text{NO}_3^-$  conversion into  $\text{NH}_3$  was a fifth of the rate of  $\text{CO}_2$  reduction. Nitrate and carbon dioxide did not compete for the reduction in strong light.

It was concluded that nitrate reduction was not necessarily dependent upon products of photosynthesis.

Promotor: Prof. Dr E. C. Wassink

Author

216. J. M. WYBENGA A contribution to the knowledge of the importance of sodium for plant life. Investigations with radioactive sodium. 1957, pp. 214. Eng. a. Du. summ.

The literature indicated that Na increased availability of phosphate in the soil. In the plant Na was shown to strengthen tissues, particularly vascular and supporting tissues, to influence cell permeability and imbibition, and to decrease transpiration. In contrast to Rb (like Na able to replace K), Na proved to be selectively absorbed. It may also be selectively bound to cell substances.

Through autoradiographs with  $^{22}\text{Na}$  3 groups of plants could be distinguished for quantitative transport of Na from the root to the stem and leaves. This distinction was consistent with the influence on production, which could be estimated within 6 weeks after sowing.  $\text{Na}^+$  accumulated in the meristematic parts. The uptake and excretion of  $^{22}\text{Na}$  by oats was studied for three growth stages: germination until about 8 cm long, the cultural stage of 3 weeks and the experimental period of 6 days. Na was bound in plants in 3 ways: 1. Readily exchangeable with Na, Ca, K or Mg; 2. Fairly readily exchangeable with Na, but less readily with Ca, K or Mg (selective); 3. No easy exchange with other Na ions (specific).

The effects of top-dressing oats with  $\text{NaNO}_3$  were extensively studied.

Promotor: Prof. Dr A. C. Schuffelen

E.

217. J. R. JENSMA Teelt en veredeling van bloemkool / *Culture and breeding of cauliflower*. 1957, pp. 8 + 56. Du. a. Eng. summ. Also published as Meded. Inst. Veredel. Tuinbouwgew., 96.

A major problem in cauliflower is the occurrence of buttoned plants in which vegetative growth was checked shortly after planting out. This results in too early formation of small curds of poor quality ('premature heading').

It was found that this could be prevented by transplanting small plants. All factors favouring growth of the young plants in the seed-bed promoted buttoning.

Spring crops should be sown late in the autumn and planted out early, whilst early quick-growing varieties should be sown later than late varieties. Plants should be kept cool and dry.

Young plants for summer crops should be grown at rather high densities in the seed-bed. Through severe competition plants thus remained small and therefore less prone to buttoning after transplanting. Experiments on breeding showed that cauliflower could be inbred for several generations without any deleterious effect. Seed-setting after selfing was normal and the crop therefore should be considered as self-fertilizing. This was confirmed by field experiments.

For selection after July plants must be propagated vegetatively. A method of obtaining cuttings from shoots developing on the stem base and roots was described.

Male-sterile plants were found at a rate of 0.05%. It was determined by a single recessive factor.

Earliness was positively correlated with leaf number ( $r = 0.9017$ ).

Firmness of the curd was related to its structure and was determined by recessive genes. Plants with poor curds yielded more seed than plants with firm curds.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

218. R. D. POLITIEK De invloed van erfelijkheid en milieu op de samenstelling van de melk bij Friese koeien en de praktische mogelijkheid van selectie op het eiwitgehalte / *The influence of heredity and environment on the composition of the milk of Friesian cows in the province of Friesland and the practical possibilities of selection on the protein content.* 1957, pp. 174. Du. a. Eng. summ.

The milk composition of individual cows was studied especially as to protein content. In total 729 cows were tested including 238 dam-daughter pairs, 6 large progeny groups of bulls used in artificial insemination and 20 small progeny groups of bulls in natural service. Milk production, and fat, protein, casein, lactose and solids-not-fat were estimated during lactation.

Environmental influences on milk production and composition were studied, e.g. lactation curve, month of calving, age of cow, duration of lactation. The average percentages fat and protein of individual cows were only slightly influenced and generally in the same direction by environmental factors.

The variation in protein percentage ( $\sigma = 0.17$ ) was smaller than that of fat ( $\sigma = 0.27$ ) but this variation was still enough to permit successful selection on percentage protein.

The protein percentage was positive correlated with fat content ( $r = +0.54$ ). The percentage fat and protein were both largely determined by genetic factors ( $h^2 =$  about 0.7). Taking account of the purpose for which milk was used, e.g. cheese production, especially protein was an economically important component of milk.

Protein analysis on a large scale was cheap. For the Netherlands, and for Friesland in particular, it was definitely warranted to base payment for milk on percentages fat and protein and to select both on fat and protein.

Promotor: Prof. Ir W. de Jong

Author

219. L. Bos Heksenbezemverschijnselen, een pathologisch-morfologisch onderzoek / *Witch's broom phenomena, a patho-morphological study.* 1957, pp. 8 + 84. Du. summ. after each chapter. Eng. summ. Also published in Meded. LH 57(1957) 1, *Belmontia* 4 (1957) 1, and as Meded. Lab. Virologie No. 2(1957).

Infectious forms of witch's broom caused by a virus, were observed in

*Crotalaria* spp. and other leguminous crops in Indonesia, and in *Rubus idaeus* and some herbaceous ornamentals, mainly *Tropaeolum majus*, in the Netherlands. A detailed analysis of the abnormalities in *Crotalaria* and *Tropaeolum* was given. A plant infected during its early stages of development became a bushy dwarf. All potential buds developed into negatively geotropic sprouts and no flowers formed. A plant infected late had an almost normal growth habit, but inflorescences grew into complex leafy structures, thus producing broomy branch extremities. The younger their buds at the moment of infection, the more abnormal were the flowers. Thus a series of progressive floral abnormalities from a normal flower up to a completely vegetative leafy branch could be selected. The series of deviations was called antholysis. These abnormalities supported the theory that morphologically the flower must be regarded as a modified leafy branch.

Large-scale virus-induced antholysis demonstrated the morphogenetic antagonism between floral initiation and vegetative growth. Many similar virus diseases were brought together in a group of witch's broom virus diseases. Other factors may cause related aberrations: certain parasitic plants, fungi, bacteria, mites and insects. However, they only incited restricted symptoms of witch's broom. The morphological analysis of witch's broom phenomena provided arguments that growth-hormonal disturbances were involved.

Promoters: Prof. Dr H. J. Venema and Prof. Dr Ir T. H. Thung      Author

220. C. A. HUIJSMAN Veredeling van de aardappel op resistentie tegen *Heterodera rostochiensis* Wollenweber / *Breeding potatoes for resistance to the potato-root eelworm Heterodera rostochiensis W.* 1957, pp. 8 + 86. Eng. summ. Also published as Meded. Stichting Plantenveredeling 14.

Thousands of plants of tuber-forming species of the genus *Solanum* were tested for resistance to the potato-root eelworm. Much attention was given to breeding for resistance by using resistant *andigenum* lines in crosses with *S. tuberosum*. In 1952 for the first time large numbers of resistant *andigenum* seedlings (numbers CPC 1673 and 1685) could be crossed among themselves and with susceptible potato varieties. The explanation of the observed segregations into resistant and susceptible was based on the hypothesis that resistance was due to one dominant gene H and that a tetraploid inheritance scheme could be applied.

Resistant offspring of CPC 1673 was tested at the Estación Experimental Agrícola de la Molina, Peru. All the resistant offspring were severely attacked by the potato-root eelworms occurring in the soil of 'Maco Farm'. Therefore the Peruvian parasite, at least in one place, is of a different race from that in the Netherlands.

In Scotland an aggressive race of the parasite had been found in some places. This race multiplied profusely in resistant potato varieties derived from CPC 1673.



It was advised that the legal restriction in the Netherlands against growing potatoes on the same field be provisionally maintained.

Promotor: Prof. Dr Ir J. C. Dorst

d.H.

221. J. J. VAN DER EYK Reconnaissance soil survey in northern Surinam. 1957, p.p. 100.

By aerial photography and numerous field observations a map with soil landscapes of the northern part of Surinam on a scale of approximately 1:600,000 was constructed. On this map three main landscapes were distinguished: the landscapes with young soils from sedimentary parent materials on young coastal plain, old soils from sedimentary materials or old coastal plain and soils from residual parent materials. The last group included soil landscapes on schists, on granite and on subgreywacke and all lateritic or laterite-like soils.

Near Paramaribo part of the young and the old coastal plain was examined more closely and the results were shown on a reconnaissance soil association map on a scale 1:100,000.

Methods were discussed and ways were considered of using aerial photographs for soil mapping in humid tropical areas covered by dense forests. With expensive and therefore limited fieldwork the relation between soil and aerial photographic image needed to be determined. Individual soils had to be grouped into soil mapping units recognizable on aerial photographs, thus making it possible to follow their boundaries on photographs and to plot them directly. Real physiographic soil maps 1:100,000 could be made with mapping units distinguished on a reconnaissance soil map but with boundaries as detailed as from a detailed soil map.

Promotor: Prof. Dr Ir C. H. Edelman

Pon.

222. P. K. J. VAN DER VOORDE De bodemgesteldheid van het Ritsenlandschap en van de Oude kustvlakte van Suriname / *Soil conditions of the ridge landscape and of the old coastal plain in Surinam*. 1957, pp. 210. Eng. summ.

Agriculture developed remarkably in the old and especially in the young coastal plain of Surinam in the 17th, 18th and 19th century and produced such crops as sugar, cotton, tobacco, cocoa and coffee. In the second half of the 19th century activity decreased severely. With the modern sciences including soil science and survey the Surinam government was now trying to extent agriculture.

The author surveyed some areas in the coastal plain, where there were sandy beachridges, some rich in shells. In the old coastal plain, he studied clay soils and eroded sand ridges of very fine sands, classified them and considered their suitability for fruit crops. Soil genesis was discussed. In the young beach ridges brown to reddish brown, biologically homogenized deep loamy sand soils were

formed with favourable drainage and groundwater podsols with poor drainage. There were all intermediates. In the older coastal clay soils textural B horizons developed in planosol-like soils. Also plinthite was present. Better drained soils were well homogenized, giving physically good brown soils suitable for many fruit crops such as citrus, cocos, oilpalm and coffee. These soils are also very suitable for grassland.

Promotor: Prof. Dr Ir C. H. Edelman

Pon.

223. J. WESSELING Enige aspecten van de waterbeheersing in landbouwgronden / *Some aspects of the water government in agricultural soils*. 1957, pp. 8 + 90. Du. summ. after each chapter. Eng. summ. Also published as VLO 63.5 (1957) and *Über einige Fragen der Beherrschung des Wasserhaushaltes in landwirtschaftlich genutzten Böden* (Translated by Dr. Phil. Hans Fabian, Verden/Aller), Institut für Kulturtechnik und Wasserhaushalt, Wageningen, 1957.

First a review was given of the water requirement and the relation between water use and crop yield. Next the energy status and the mobility of water in the soil were discussed. Based on physical theories a method was developed of calculating the amount of available moisture in the soil with different watertables, physical properties of the soil, transpiration intensity of the crops and root density.

Aeration of the soil was similarly treated. Published data on carbon dioxide production, root density and microbiological activity in the soil were used to develop a mathematical model to derive oxygen and carbon dioxide contents in the root zone. The model was based on steady-state diffusion of gases through the soil.

The models developed were used to derive the watertable required under natural conditions and with subsurface and sprinkler irrigation.

Further a series of experiments in drained plots were described. Apparatus for recording drain discharge and depths of watertable were discussed. Results were analysed to find what factors influenced actual watertable and what criteria should be applied in the design of drainage systems.

Promotor: Prof. Dr W. R. van Wijk

Author

224. E. J. FORTANIER De beïnvloeding van de bloei bij *Arachis hypogaea* L. / *Control of flowering in Arachis hypogaea L.* 1957, pp. 8 + 116. Du a. Eng. summ. Also published in Meded. LH 57 (1957) 2.

The effect of light (intensity, duration and spectral composition), temperature (different day and night temperature) and water (different humidities of the soil and the air) on flowering of groundnut *Arachis hypogaea* L. var. Schwarz 21) was investigated. Because growth and fruit formation were also influenced by

these factors, the relation between growth, flowering and fruiting was the allied problem investigated. Defoliation suppressed flowering: no antagonism was found between growth and flowering. Removal of pegs and fruits promoted flowering which was suppressed by developing fruits.

The initiation of flowers was independent of photoperiodism and of thermo-periodicity and could not be regulated. The formation of leaves and inflorescences were almost inseparable. The opening of flower buds and the total number of flowers formed were highly dependent on external conditions. Hence flower bud initiation was less sensitive to external conditions than the actual flowering.

The experiments gave a better insight into the physiology of flowering, which could be regulated now, more or less, at will. An abundant or poor flowering could be obtained; the opening of flowers could be delayed, prevented or continued 'indefinitely'; in this way almost any number of opened flowers could be obtained at any time of the year or the day.

Promotors: Prof. Dr Ir C. Coolhaas and Prof. Dr Ir S. J. Wellensiek Author

225. F. E. ESSED Estimation of standing timber. 1957, pp. 8 + 60. Eng. a. Du. summ. Also published in Meded. LH 57 (1957) 5.

Some new methods were developed of estimating stem number  $N$ , regression height  $h_{\bar{a}}$ , diameter  $d_{\bar{v}}$  of the tree of mean volume, and the increment  $I$ . Methods for the determination of  $N$  were discussed. The theory about the distance method was explained. Essed defended to use the median  $m_4$  of the distances measured from points chosen systematically (or at random) in the stand, to the fourth tree. The estimate with  $m_4$  was also more efficient than estimates with the other medians ( $m_1$  etc.) or with other parameters.

Mean volume  $\bar{v}$  in even aged stands was calculated from  $v$  with the arithmetic mean diameter, the constant introduced by Berkhout and the coefficient of variation. A formula for  $d_{\bar{v}}$  was introduced. – The tree fork of Becking proved very useful. The expected value of 'the' diameter of a tree proved to be the same with the tree fork as with callipers.

The Cone Method was discussed for horizontal terrain and for sloping ground, as also the accessory conometer. The estimated height could be regarded as an estimate of  $h_{\bar{a}}$ . The Cone Method allowed direct estimation of volume per ha.

A formula was derived to estimate increment with an increment borer.

Promotors: Prof. Dr J. H. Becking and Prof. Dr N. H. Kuiper E.

226. A. I. M. EL MURABAA Factors affecting seed set in brussels sprouts, radish and *Cyclamen*. 1957, pp. 8 + 34. Eng. a. Du. summ. Also published in Meded. LH 57 (1957) 4 and as Lab. Tuinbouwplantenteelt, Publ. 168.

If brussels sprouts were self-fertilized, seed setting increased with age of the flower buds until a maximum some days before buds opened. After that, set decreased rapidly. Warmth shortened the period over which selfing was possible and shortened the period to the opening of the flowers. Most seeds occurred in 7-9 mm long buds.

In crossing, seed set did not decrease just before flowers opened. Warmth shortened the fertilization period. Before flower opening a period (shorter with warmth) existed during which selfing and crossing gave the same results. Crossing after opening of the flowers first increased seed set, later decreased it. This fertilization period was also shortened with warmth.

The inhibition of pollen germination by the style of incompatible plants occurred some days before opening of the buds. With opening it reached a maximum, after that it decreased and disappeared. Application of  $\alpha$ -naphthylacetamide did not overcome incompatibility.

The data on pollination period of radish only showed a few differences from those on brussels sprouts.

*Cyclamen* had no incompatibility. Fruits always contained seeds. Many peduncles rotted prematurely and many fruits were lost. Emasculation favoured this rotting and in some varieties decreased the number of seeds per fruit. Application of  $\alpha$ -naphthylacetamide after castration increased seed set, stimulated elongation of the peduncles and decreased rotting.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

227. J. DEKKER Inwendige ontsmetting van door *Ascochyta pisi* aangetaste erwtezaden met de antibiotica rimocidine en pimaricine, benevens enkele aspecten van het parasitisme van deze schimmel / *Internal seed disinfection of peas infected by Ascochyta pisi by means of the antibiotics rimocidin and pimaricin, and some aspects of the parasitism of this fungus*. 1957, pp. 8 + 80, Du. a. Eng. summ. Also published in *Tijdschr. Plantenziekten* 63 (1957) 65-144.

One of the plant diseases, which is still difficult to control, is leaf, stem and pod spot of peas, caused by the fungus *Ascochyta pisi*. Seed disinfection is unsatisfactory, because the fungus may penetrate deep into the seed, beyond the reach of superficially active disinfectants. Therefore a search was made for disinfectants, penetrating the seeds, using ascochyta-infected seeds for tests. The most effective compounds were the newly discovered antibiotics rimocidin and pimaricin, products of *Streptomyces* spp. They penetrated the seeds and eliminated internal fungus without impairing germination. An 18-h soaking reduced the percentage of seeds with viable mycelium from 80 to less than 1%. Dry or almost dry treatment was less effective. A further drawback of these antibiotics was the reversible loss of fungicidal activity inside plant tissue through adsorption, and inactivation by UV radiation.

Rimocidin and pimaricin were nevertheless of interest because of their selectivity, being highly toxic to most fungi, but hardly toxic to bacteria and

higher plants. Remarkable also was ready uptake by plants and seeds despite their large complex molecules.

A new aspect of the parasitism of this fungus was that the fungus was often present in plant parts or whole plants without symptoms. Rarely the fungus was even isolated from seeds, harvested from plants without symptoms. It was also observed that during ripening of the pods many pycnidia appeared outside the limited brown-edged spots, typical for this disease.

Promotor: Prof. Dr A. J. P. Oort

Author

228. F. K. VAN DER KLEY De betekenis van tweezaadlobbige graslandplanten voor de minerale samenstelling van weidegras / *The significance of dicotyledons in grassland for the mineral composition of pasture*. 1957, pp. 8 + 50. Du. a. Eng. summ. Also published as Afdeling Graslandcultuur LH, Publ. 14.

In 169 paddocks of widely different soil fertility three random samples, one of dicotyledons, one of associated grasses and one of the soil were obtained. The mineral compositions of *Plantago lanceolata*, *Trifolium pratense* and *T. repens* and *Taraxacum officinale* were compared with those of the corresponding grass samples. The variance of their differences was analysed and partial regressions of these differences on stage of growth, temperature and soil conditions were calculated.

Clovers and herbs were richest in Na<sub>2</sub>O, CaO and MgO, in cation excess, alkaline earth alkalinity, and to a lesser extent also in alkali alkalinity. These results were discussed from the aspect of mineral requirements for animals. The actual differences between dicotyledons and grasses varied greatly, however. The effects of herbs and clovers on the incidence of grass tetany was often small or absent.

This was explained by the observation that the preference  $K > Na > Mg > Ca$  was normally greater with cation intake by grasses than by dicotyledons. This might be related to the cation-exchange capacities of plant roots. At higher increments of soil K the effect of the root's cation-exchange capacity on K uptake decreased. Differences between dicotyledons may also be correlated with cation-exchange capacities of plant roots.

Promotor: Prof. Ir M. L. 't Hart

Ov.

229. J. G. P. M. SMEETS Een vergelijkend ecologisch onderzoek in opstanden van *Quercus borealis* Michx. f. en *Quercus robur* L. / *A comparative ecological study in stands of Quercus borealis Michx.f. and Quercus robur L.* 1957, pp. 8 + 162. Du. a. Eng. summ. Also published as VLO 63.6 (1957).

Extensive investigations into the biotic, edaphic and climatic factors of the growth site and timber production figures showed that *Quercus borealis* Michx.f.

was a very useful hardwood species for the Netherlands, especially on well drained but moist sites. The great adaptability of this species allowed culture also on less rich and drier soils. *Q. borealis* was less suited for the improvement of rundown soils or for maintenance of better soils. Other trees with a lower C/N quotient of the litter may be grown for this purpose, or be mixed with *Q. borealis*.

Red oak could only be sown in very dense stands and was unsuited for interspersing in other stands, especially if on poor and dry soils. Undersowing in stands of Scots pine was not satisfactory for soil maintenance. It would be useful if the purpose was to grow *Q. borealis* afterwards. This change must be in good time. Planting of *Q. borealis* was contrary to its growing requirements and growing qualities. Red oak should only be sown in very dense stands (1200–1500 litre acorns per ha); from the outset selective thinning must be consistently applied in these stands.

Promotor: Prof. Dr J. H. Becking

(First approved by the late Prof. Dr G. Houtzagers)

E.

230. J. F. BIERHUIZEN Inhibition of growth and metabolism of *Chlorella* and some other plant types by calcium dipicrylamine and other poisons. 1957, pp. 8 + 60. Eng. a. Du. summ. Also published in Meded. LH 57 (1957) 7.

If potassium is obtained from sea-water by precipitation with calcium dipicrylamine, potassium fertilizers and sea-water will be contaminated with a little dipicrylamine. The influence of calcium dipicrylamine on metabolism of *Chlorella* and some other aquatic and terrestrial plants was therefore studied. It inhibited photosynthesis even at lower concentrations ( $10^{-6}$ – $10^{-8}$ M), than other inhibitors such as ethyl urethane, phenyl urethane, hydroxylamine, 2,4-dinitrophenol and sodium azide. Autotrophic growth was inhibited at almost the same concentration. But heterotrophic growth of *Chlorella* was less inhibited. Respiration was stimulated by up to 60%, even at  $10^{-2}$ M. At this concentration, glucose-stimulated respiration was 50% inhibited but at least partly reversibly. The same degree of inhibition (not reversible by washing) was observed with light saturation as with light limitation in *Chlorella* photosynthesis. This suggested a specific enzyme-inhibitor, influencing certain dark reactions as well as the energy transfer in photosynthesis. Lower temperatures severely increased inhibition of photosynthesis in *Chlorella*.

Despite inhibition of growth and photosynthesis at low concentrations in water culture, the compound was less harmful in the field through the high adsorptive capacity of soil, especially of humus. Only with extreme artificial contamination was there a decrease in yield.

Promotor: Prof. Dr E. C. Wassink

E.

231. A. JONGERIUS *Morfologische onderzoeken over de bodemstructuur / Morphologic investigations of soil structure*. 1957, pp. 8 + 94. Eng. summ. Also published as VLO 63.12 (1957).

Various definitions of soil structure were reviewed and discussed. Soil structure was finally defined as 'the spatial arrangement of the elementary constituents and any aggregates thereof, and of the cavities occurring in the soil'.

The macrostructures, visible to the naked eye or with a lens not exceeding  $4 \times$  linear were divided into two large groups: those consisting of structural elements and those without these units.

A more detailed classification of the elements, formed by geological processes, was found necessary. Special attention was paid to the internal porosity of the elements and to the occurrence of various types of coatings and root prints.

The concept of grade of structure was discussed, and a scheme of description modified.

A classification of structures without structural elements was developed in which emphasis was placed on porosity.

Samples of higher sandy soils, underlying forest and heath, were described to demonstrate specific microstructures seen in thin sections.

Brown podsollic soils and podzols were shown to have characteristic differences in the morphology and mechanical behaviour of humus components.

Promotor: Prof. Dr Ir C. H. Edelman

Bou.

232. C. J. VAN MEEL *Enkele aspecten van de Franse landbouw / Some aspects of French agriculture*. 1957, pp. 10 + 172. Du. summ.

Before the war French agriculture lagged far behind that of other countries. Both then and since it had been better north than south of the Loire. This was caused by many differences such as those in climate, soil type, aspect and use of the soil, variety and quality of crops, types of cattle, agricultural education, extension and cooperation. In farm size the monocultures in south-east (wine) and southern France were an exception. Co-operatives included some wine caves and fruit-marketing organizations. Owned and rented properties occurred throughout France. The 'métayage' and its consequences existed only south of the Loire and was one of the most harmful factors in central and southern France. The 'Statut du fermage et du métayage' of 1946 had already caused much improvement.

After a discussion of rural depopulation the writer pointed out that wheat, pig meat and butter were not of sufficient quality and cheese did not keep well enough for large-scale export. Alcohol surpluses and alcoholism were further problems. Those agricultural regions and farms which had already been most modernized, and had taken the most initiatives, had profited most by State aid

after the war.

This had accentuated the difference between the regions and between farms.

Promotor: Prof. Dr E. W. Hofstee

E.

233. J. F. TH. AARTS Over de houdbaarheid van snijbloemen / *The lasting of cut flowers*. 1957, pp. 8 + 62, Du. a. Eng. summ. Also published in *Meded. LH* 57 (1957) 9 and as *Lab. Tuinbouwplantenteelt*, Publ. 174.

Having established that cut flowers last longer by adding such solutions as sugars, bactericides or acids to the vase water, their mechanism of action was investigated.

Bacteria and fungi had a direct plugging effect, but also acted indirectly on the water conduction of the flower stalk by secreting toxins. A third kind of plugging occurred independent of micro-organisms as a reaction to wounding and intrusion of air. This plugging could be limited by reducing O<sub>2</sub> concentration, lowering the pH and by adding Ca(NO<sub>3</sub>)<sub>2</sub>.

The addition of sugar prevented disintegration of cells through lack of respiratory substrate. In times of higher respiratory activity of the flower parts, the optimum sugar concentration needed in the water increased.

Attempts to decrease respiratory activity of the flower by adding respiratory inhibitors failed. Only in *Matthiola* could the respiratory activity be decreased by gibberellic acid; at the same time the flowers lasted longer.

Boron had a favourable effect in *Convallaria*, *Dianthus*, *Lathyrus* and *Syringa*. Its addition decreased the optimum sugar concentration. In *Dianthus* it acted on the distribution of dry matter within the flower during development.

The possibilities were discussed of practical application of chemicals to make cut flowers last longer.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

234. H. W. J. RAGETLI Onderzoekingen over een virusremstof voorkomend in *Dianthus caryophyllus* L. Werkingsspectrum, remmingsmechanisme en aard. / *Research into a virus inhibitor occurring in Dianthus caryophyllus* L. *Spectrum of activity, inhibition mechanism and nature*. 1957, pp. 8 + 100. Du. a. Eng. summ. Also published in *Tijdschr. Plantenziekten* 63 (1957) 6 and as *Meded. Lab. Virol.* 5.

An inhibitor of carnation proved to inhibit 14 very different viruses when tested on a range of 20 plant species. No viruses insensitive to the inhibitor were encountered. The degree of inhibition was for all viruses dependent on the plant species used as a test plant. The investigated plants could be distinguished into species very sensitive and hardly sensitive to inhibitor. The hardly sensitive ones all belonged to the order Centrospermae. The differences in sensitivity were



quantitative and qualitative. The influence on contamination was expressed as a percentage activity. A decrease in the inhibitor's concentration had a stronger effect on the percentage activity than an increase in virus concentration of the same order.

For various reasons it was considered improbable that inhibition would result from a reaction between virus and inhibitor in a liquid medium. Their mutual independence *in vitro* could be confirmed by ultracentrifuging sap from carnations with mosaic disease. The feasibility was also established of inhibitor acting through the test plant.

Both infectious ribonucleic acid (RNA) of tobacco mosaic virus and the intact virus on *Nicotiana glutinosa* were inhibited by carnation inhibitor. The inhibition was shown not to result from an interaction between the inhibitor and the proteinaceous exterior of the virus.

The virus-inhibiting activity of the inhibitor was finally interpreted on the basis of the 'receptor theory' of viral infection as a blocking of the sites near the leaf surface necessary for successful viral infection.

By ultracentrifuging the molecular weight of the inhibitor could be estimated as at least 10,000. The inhibitor could also be isolated and some of its physical and chemical qualities could be established.

Promotor: Prof. Dr Ir T. H. Thung

E.

235. J. SNEEP De stand van de veredeling bij spinazie / *The present state of spinach breeding*. 1957, pp. 6 + 198. Du. a. Eng. summ.

The state of spinach breeding, including the author's work at the Institute of Horticultural Plant Breeding, Wageningen, was reviewed.

Certain crossing combinations had a favourable effect on the yield. The possibility of combining resistance to *Peronospora spinaciae* (Mont.) de Bary and mosaic (Cucumus-virus 1) made the breeding of hybrid varieties still more attractive. The work required for the removal of all male and intersexual plants from the mother variety was a serious handicap.

Experiments on influencing the sex ratio and the recognition of pollen-bearing plants some time before they flower in the mother variety gave no cause for optimism. However, it was possible to breed a practically completely female first filial generation. The combination of this first filial generation as a round seeded mother variety with a prickly seeded father could bring the possibility of growing hybrid seed on a commercial scale very much nearer. Research in the field of hybrid varieties was considered to be a most important task of the research institutes.

A simple method was worked out for testing young spinach plants for resistance to downy mildew, using sheets of polythene.

Promotor: Prof. Dr Ir J. C. Dorst

d.H.

236. J. H. VAN DER VEEN Studies on the inheritance of leaf shape in *Nicotiana tabacum* L. 1957, pp. 112. Eng. a. Du. summ.

Variation in leaf shape of tobacco depended mainly on three independently segregating gene-pairs with intermediate heterozygotes. Br-br acted on the leaf-base only, giving broadly and narrowly winged (sessile and petioled) leaves. Pt-pt and Pd-pd were cumulative, and acted on the amount of mesophyll. The effect of Pt was twice that of Pd. From ptptpdpd to PtPtPdPd, the leaf-base or petiole became longer, the angle of lateral veins more acute and the leaf-blade narrower, but the length of the midrib and the lateral veins stayed the same.

Among sessile (BrBr) types, variation due to Pt-pt and Pd-pd was continuous, so that the sessile first filial generations must be test-crossed with petioled (brbr) types, to enable classification for petiole length, which was the main criterion. Even then, allowance must be made for the number of leaves, since a higher number induced an upward extension of the region of increasing petiole length, and consequently increased the maximum petiole length of the plant.

The data of previous authors were analysed and, where necessary, reinterpreted. This analysis confirmed that variation in leaf shape of tobacco could be explained in terms of the three gene-pairs.

Promotor: Prof. Dr R. Prakken

Author

237. L. J. PONS De geologie, de bodemvorming en de waterstaatkundige ontwikkeling van het land van Maas en Waal en een gedeelte van het Rijk van Nijmegen / *Geology, soil formation and history of the drainage conditions in the Land van Maas en Waal and a part of the Rijk van Nijmegen*. 1957, pp. 12 + 156. Eng. summ. Also published as VLO 63.11 (1957), serie De Bodemkartering van Nederland, deel XXII.

Geology, soil science and the history of water management were surveyed between the rivers Meuse and Waal. Two terrace-shaped sand plains, covered by loamy aeolian sands border the Nymegen ice-pushed ridge. Further west were well formed soils with manganese banks developed in unpushed High Terrace material. The fluvial Low Terrace developed as a braided river system, leaving a meandering river system just before the Allerød period.

Decalcification and soil formation under wet conditions yielded gley and pseudogley soils. The few well drained profiles developed brown soils, sometimes with textural B layers. Aeolian sands of different grain sizes blown from periglacial rivers, form cover sands and inland dunes. These richer sands formed brown podsollic soils or, with secondary blowing, podsol. Holocene alluvium was laid down in cycles of 550 years, of which the most recent ones were of Roman times and medieval.

Meuse alluvial soils are primarily non-calcareous in contrast to the Waal. The oldest ones from Roman times yielded a brown soil with a weak textural B. The younger ones developed alluvial soils with different textures, contents of

lime and degrees of gleying.

Cultivation was first without dikes, which were first round small village units in the 12th century and protected the whole area by the end of the 13th century. Similarly drainage developed from small units to greater units, which lasted until modern times when the whole area was drained in a modern way.

Promotor: Prof. Dr Ir C. H. Edelman

Author

238. L. C. A. CORSTEN Vectors, a tool in statistical regression theory. 1958, pp. 8 + 92. Eng. a. Du. summ. Also published in Meded. LH 58 (1958) 1, and as Meded. IVRO 35.

Using linear algebra this thesis developed linear regression analysis including analysis of variance, covariance analysis, special experimental designs, linear and fertility adjustments, analysis of experiments at different places and times. The determination of the orthogonal projection, yielding efficient unbiased estimates and playing a dominant role in statistical tests, was extensively considered, in particular by iterative time-saving procedures based on geometrical considerations and on power-series expansions. Subspaces were systematically introduced for levels, for main effects and for interactions. This allowed a general interpretation of orthogonality of classifications. This introduction of subspaces also permitted the simultaneous account of orthogonal polynomials in one or more variables with concurrent classifications. Designs such as balanced and partially balanced incomplete block designs, as lattices and as Latin squares could be characterized by fixed angles between spaces or between physically meaningful subspaces of these effect spaces. The missing-plot technique was developed in a more general and simple form. Finally, estimation and testing problems were discussed for several non-orthogonal classifications, of which one or more had random effects or interactions. This included recovery of inter-block information, and analysis of split-plot designs and series of experiments.

Promotor: Prof. Dr N. H. Kuiper

Author

239. H. A. VAN HOOFF Onderzoekingen over de biologische overdracht van een non-persistent virus / *An investigation of the biological transmission of a non-persistent virus*. 1958, pp. 8 + 110. Du. a. Eng. summ. Also published as Meded. IPO 161.

To clarify the mechanism of transmission by aphids of a non-persistent virus, some aspects of this transmission were studied. The structure of the stylets was examined by optical and electron-microscope. Unknown ridges were observed near the apices of the maxillary and mandibular stylets. The path of the stylets into the host plant was traced by oil-immersion microscopy into pieces of stripped epidermis. Evidence was obtained that virus was picked up by the aphid

from the middle lamella of the transverse cell walls of the epidermis. Transmission by aphids of virus from pieces of stripped epidermis of diseased leaves was much more difficult than transmission from intact leaves. An attempt was made to find the cause of this hampered transmission. Virus was readily transmitted mechanically from dead tissue, but aphids could transmit virus only if tissue was living. It was concluded that the virus transmitted by aphids was in a form different from that transmitted mechanically.

Promotors: Prof. Dr Ir T. H. Thung and Prof. Dr J. de Wilde

Author

240. J. A. D. ZEEVAART Flower formation as studied by grafting. 1958, pp. 8 + 88. Eng. a. Du summ. Also published in Meded. LH 58 (1958) 3 and as Lab. Tuinbouwplantenteelt, Publ. 178.

Graft combinations were made between flowering (donor) and non-flowering (receptor) plants, and grown in a photoperiod unfavourable for flowering of the receptor.

Donor leaves of the short-day (SD) plant *Perilla crispa* caused a maximum flowering response after exposure to 30 SD. By the use of radioactive sucrose it was shown that a functional phloem connection between donor and receptor was necessary for transmission of the floral stimulus. Induced *Perilla* leaves transferred to LD had not lost their capacity to induce flower formation after 3 months. But leaves taken from flowering receptor branches did not function as donors. Thus, photoperiodic induction of *Perilla* was permanently conserved in the SD-treated leaves. This was in contrast to *Xanthium* (SD plant) in which indirectly induced shoots could themselves transfer the floral stimulus to receptors.

Transmission of the floral stimulus was also demonstrated between: *Kalanchoë* (SD plant) and *Sedum* (LD plant), and between Maryland Mammoth tobacco (SD plant) and *Nicotiana sylvestris* (LD plant). In either case, the LD plant as well as the SD plant could function as donor for the other partner. A day-neutral tobacco variety did not cause flower formation in Maryland Mammoth tobacco, but when grafted as interstock between *N. sylvestris* and Maryland Mammoth tobacco it permitted transfer of the flowering stimulus. It was concluded that in graft-compatible species the floral stimuli of SD and LD plants seemed to be identical.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

241. J. F. VAN OOSTEN SLINGELAND De Sijsselt; een bijdrage tot de kennis van de Veluwe bosgeschiedenis / *The Sijsselt; a contribution to the knowledge of the history of the Veluwe-woods*. 1968, pp. 8 + 142. Du. a. Eng. summ.

Sijsselt Wood, since 1427 part of the Kernhem Estate, was in the 15th century an oak coppice and moorland area, sufficient to supply Kernhem with firewood. The inhabitants of the neighbouring hamlet of Maanen however were of old allowed to graze their sheep and to cut peat in this area. The Sijsselt Moorlands were essential for their farming economy. Sheepfarming prevented all extension of woodlands while the remainder dwindled into thin shrubbery. Conflicts between the Lords of Kernhem and the farmers over their grazing rights were numerous.

A general scarcity of timber in Western Europe stimulated forestry in the 18th century. Afforestation of the Sijsselt started in 1769 by planting of oak coppice and planting as well as sowing of Scots pines. Coppice growing was soon stopped but sowing of Scots pines was continued and succesful.

Induced by increasing coppice prices and the damage by the caterpillar *Panolis flammea* Schiff, afforestation with pine retreated to second place about 1850 in favour of oak coppice and beech. But economic conditions were altering: artificial tan was imported; as fuel wood was replaced by coal and oil and the mines asked for pitprops. Growing of oak coppice lost its importance after 1880 and the result was a changeover to pine. Since 1884 pine was sold to the mines. The variety of trees increased after 1900. Beech, red oak and false acacia were replanted.

Promotor: Prof. Dr B. H. Slicher van Bath

Ro.

242. J. RUINARD Onderzoekingen omtrent levenswijze, economische betekenis en bestrijdingsmogelijkheden der stengelboorders van het suikerriet op Java / *Investigations into bionomics, economic importance and possibilities of control of the sugar-cane stalkborers in Java*. 1958, pp. 222. Du. a. Eng. summ.

The most serious borers of cultivated sugar-cane in Java were the striped borer, *Proceras sacchariphagus* Bojer, and the shining borer, *Chiloatraea auricilia* Dudg. Other common ones were the grey borer, *Argyroploce schistaceana* Sn., and the purple borer, *Sesamia inferens* Walk. The first two almost exclusively tunnelled in young weak internodes and diminished their yield of sugar. They diminished the weight of younger internodes and the sucrose content of older internodes, even if they were not themselves infested. Infestation was assessed by the percentage of visibly infested parts. Few canes had to be checked and the method was reasonably accurate in the field.

Infestation varied between clones, and was higher with heavier N dressings and with rapidly growing good cane. It was probably associated with rind hardness and fibre content.

Control with insecticides was effective, especially if concentrated on the youngest leaves.

Promotors: Prof. Dr J. de Wilde and Prof. Dr Ir C. Coolhaas Author/Ri.

243. G. DANTUMA Veredeling van tarwe en gerst op winterhardheid / *Breeding wheat and barley for winterhardiness*. 1958, pp. 8 + 72, Du. a. Eng. summ. Also published as Meded. Stichting Plantenveredeling 18.

Cold resistance appeared to be so complicated and variable, that a clear insight could be obtained only when important factors such as degree of vernalization, stages of growth and development, and hardening were considered in the experiments. For various reasons, breeders are more and more obliged to use extremely varied material in their programmes, such as of breeding for disease resistance.

In 1951 the Foundation for Agricultural Plant Breeding at Wageningen had a refrigerator and hardening equipment installed to provide private breeders with cold-resistant material and to test their new lines for this character. This gave the author the opportunity to study winter-hardiness.

It was possible to develop winter wheat varieties with sufficient winter-hardiness, slight need of vernalization and rapid spring development. Varieties of winter barley could be developed with a better winter-hardiness.

The method recommended by Hoffmann of vernalizing the seed before sowing in autumn to test and select for winter-hardiness was highly practicable. Trials on date of sowing in autumn involving seed vernalization and lengthening of the day were a valuable aid to research on cold resistance.

Promotor: Prof. Dr Ir J. C. Dorst

d.H.

244. L. H. HUIZENGA Het koeliebudgetonderzoek op Java in 1939-40 / *The coolie budget inquiry on Java in 1939-40*. 1958, pp. 8 + 296. Du. summ.

The book is an elaborate report on earnings and expenses of labourers on plantations in Java. The purpose of this study, promoted by the government of the former Netherlands East Indies, was to examine how the coolie families lived and to find criteria to assess wages in the particular communities. Various groups of labourers showed a typical spending pattern. Huizenga analysed the changes in spending caused by an increase in income for a great number of expenses. Special attention was paid to the consumption of food. A line was drawn below which nourishment was considered inadequate. To improve nutrition, standard budgets were drafted. As a limit, at which essential needs were supplied, the income level was chosen at which energy value of the diet increased no more with increase in income. The same limit was found if the income level was taken where the income elasticities of the various spending categories began to deviate from the value one.

Promotor: Prof. Dr Th. L. M. Thurlings

Kr.

245. J. J. JONKER *Bewortelingsonderzoek en ondergrondbewerking in de Noordoostpolder / Root studies and subsoiling in the North-Eastern Polder.* 1958, pp. 12 + 164. Du. a. Eng. summ. Also published as No. 25 in the Series Van Zee tot Land (Tjeenk Willink, Zwolle, 1958).

The aim of this study was to investigate the suitability of the soil layers and profiles for the penetration by roots and of methods of improving root formation by subsoiling.

It was assumed that an adequate moisture supply to the crops required a loam layer at least 70 cm thick penetrable by roots.

Methods for quantitative and qualitative root studies were discussed. Root formation in a homogeneous loam soil profile 100 cm deep was taken as a standard to assess the root systems found in various soil profiles. For some grain crops and winter swede-rape the shoot and root development from germination till harvest were shown in diagrams. Shoot and root quantities were given for winter wheat.

The influences of aeration and texture of soil on root formation and possible causes for poor development were discussed.

After a description of root formation in heterogeneous soil profiles the effects of subsoiling on the roots and yields of several crops were given. Three maps of the western part of the North-East Polder indicate which layers hamper root penetration, and to what depth profiles should be loosened. Areas most badly in need of subsoiling are indicated.

Promotor: Prof. Ir W. J. Dewez

Author

246. W. H. VAN DER MOLEN *The exchangeable cations in soils flooded with sea water.* 1958, pp. 12 + 168. Eng. a. Du. summ. Also published as VLO 53.17 (1957).

The changes in the exchangeable cations of soils flooded with sea-water were extensively studied in the Netherlands after the inundations of 1940, 1945 and 1953. A synopsis of the results was given, both from a theoretical and a practical viewpoint.

Current formulae for ion-exchange tested in the laboratory gave fair descriptions for the competition between two species of cations, but were inadequate if more ionic species were involved. The behaviour of Na in flooded soils in competition with K, Mg, and Ca was therefore described by an empirical Na-adsorption isotherm.

Flooded soils were considerably enriched in Na, K and Mg. Of these, only Na changed noticeably during the first years after renewed drainage. Na was slowly replaced by Ca derived from  $\text{CaCO}_3$ . The changes proceed from top to bottom through the soil profile, the limiting factor being the removal of liberated Na-ions by leaching. The theory of column operation gave a qualitative explanation of the phenomena observed.

The regeneration of flooded soils could be promoted by application of gypsum, calcium chloride or sulphur, of which gypsum was extensively used in practice. Of the gypsum applied, about 50% was effective in removing exchangeable Na from the upper 20 cms. On this basis, an estimation of gypsum requirements could be made.

Promoters: Prof. Dr A. J. Zuur and Prof. Dr A. C. Schuffelen

Author

247. A. B. R. BEEMSTER Transport van X-virus in de aardappel (*Solanum tuberosum* L.) bij primaire infectie / *Translocation of virus X in the potato (Solanum tuberosum L.) in primarily infected plants*. 1958, pp. 8 + 98. Du. a. Eng. summ. Also published in *Tijdschr. Plantenziekten* 64 (1958) 165-262.

The time needed for potato virus X to reach the tubers from the inoculated leaf depended closely on the age of the potato plant. In young plants the virus could be detected in the tubers after about five days. However in the period of maximum tuber formation, virus translocation occurred only incidentally. The phenomenon of gradually decreased speed of virus translocation was called old-age resistance. It also played a part in infections with aphid-borne viruses such as potato leafroll virus and virus Y. It had practical significance for the production of seed potatoes as it was already noticeable in the period of highest aphid populations. When potato plants were inoculated in an advanced stage of development only part of the vegetative progeny got infected. This meant that a plant produced infected and uninfected tubers, and also that a single tuber had infected as well as uninfected parts. The bigger tubers of a primarily infected plant were more often infected than smaller ones. Moreover, the eyes at the top end of the tuber had a greater chance of attracting infection than those occurring close to the heel end.

Promotor: Prof. Dr Ir T. H. Thung

Author

248. F. SONNEVELD Bodemkartering en daarop afgestemde landbouwkundige onderzoeken in het land van Heusden en Altena / *Soil survey and attuned agricultural investigations in het Land van Heusden en Altena*. 1958, pp. 16 + 320. Du. a. Eng. summ. after each chapter. Also published as VLO 64.4 (1958), serie De Bodemkartering van Nederland, deel XVIII.

Investigations were on a river, clay and estuarine landscape for a planned land reallocation in the area. Earlier data seemed insufficient. Research concerned soil conditions and genesis, which were greatly influenced by an incursion in 1421. Physical soil conditions (puddling, water capacity, hydraulic conductivity), closely governed the suitability for crop production and the changes in watertable. Their study was combined with a study of grassland vegetation.



Other important crops, as wheat, and sugar-beet yielded data which were processed by multifactorial analysis. Combinations of these results and soil survey produced a suitability scheme and suggestions for reallocation and rural engineering, especially for river backswamp soils.

Promotor: Prof. Dr. Ir C. H. Edelman

v.d.B.

249. TAN BOE HAN Technology of soy milk and some derivatives. 1958, pp. 8 + 138. Eng. summ. after each chapter. Du. summ.

The technological aspects of the manufacture of soya milk were studied, with special attention to pretreatment of beans (soaking and various methods of grinding), extraction (influence of extraction rate, pH, temperature, time and method of mixing) and the separation of the milk.

Preservation of soya milk by pasteurization or sterilization was briefly studied.

The concentration of soya milk by evaporation was difficult. The heat stability of the milk was influenced by the way of heating before evaporation. By choosing working conditions carefully a fairly high dry matter content could be achieved. A few experiments were made on the manufacture of soya curd and soya yoghurt. Both products had promising applications.

Promotor: Prof. Dr Ir H. A. Leniger

Le.

250. G. VAN DEN ENDE Untersuchungen über den Pflanzenparasiten *Verticillium albo-atrum* Reinke et Berth. / *Experiments with the plant-pathogenic fungus Verticillium albo-atrum Reinke et Berth.* 1958, pp. 12 + 75. Ger. a Eng. summ. Also published in *Acta Botanica neerlandica* 7 (1958) 5: 665-740 and as Meded. Phytopathol. Lab. Willie Commelin Scholten, Baarn, 21.

Among 70 *Verticillium* strains isolated from different hosts throughout the Netherlands, only 2 had the bundled dark hyphae described by Reinke and Berthold (1879) as characteristic of *V. albo-atrum* Reinke & Berth. This species was morphologically the same as *V. dahliae* Klebahn. The name *V. albo-atrum* had priority.

Strains with loose dark hyphae (d.m. type) were less resistant to warmth (35°C) than those with microsclerotia (mscl. type). On artificial media all strains produced toxins, specific for each strain but not correlated with type or pathogenicity. The fungus spreads through the plant's vessels as spores or mycelium. The physiological range confirmed that there was no clear distinction between the two species but demonstrated a difference between mycelial and microsclerotial types. Host range was not limited (contrast Nelson, 1950; Isaac, 1957). Culture on tomato changed the virulence.

Both types could spread in sterile soil between roots of antirrhinums only as

hyphae. After 4 years in the soil only the mscl. type was slightly infective.

Microsclerotia were assumed to be merely storage organs because they did not germinate, even with root secretions.

After an infection resistant crops should be planted and possible carrier weeds eradicated. Use of resistant varieties was difficult because of differences in pathogenicity of *Verticillium* strains but chemical control was inadequate.

Promotor: Prof. Dr L. C. P. Kerling

Author/Ri.

251. J. LUITJES Over de economische betekenis van insektenplagen in bossen (*Cephalcia alpina* Klug en *Diprion pini* L.) / *On the economic significance of forest-insect pests* (*Cephalcia alpina* Klug and *Diprion pini* L.) 1958, pp. 10 + 56. Eng. summ.

During 1952–1956 a study was made of the loss of increment and the consequent financial losses caused by the 1941–1950 outbreak of the spinning larch sawfly (*Cephalcia alpina* Klug) in Japanese larch and the 1950–1951 outbreak of the pine sawfly (*Diprion pini* L.) in Scots pine. Growth losses were compared for different degrees of defoliation. The financial losses were calculated and compared with the cost of control operations, to estimate how severe the insect attack must be to justify chemical control.

Sample plots in the provinces of Drente, Gelderland and Overijssel showed that loss of increment increased with degree of defoliation. Losses of increment in Japanese larch were less on richer loamy soils than on sandy soils. It was presumed that low vigour of Japanese larch and Scots pine, probably indicated by small annual increment of the tree for a few years before an insect attack, favours this attack, and thus defoliation. This would mean that the method of calculating the loss of increment was incorrect. Further research was greatly needed.

Promotor: Prof. Dr J. H. Becking

E.

252. W. M. OTTO Grondverbetering op lage zandgronden / *Land levelling on low sandy soils*. 1959, pp. 8 + 204. Du. a. Eng. summ. Also published as VLO 65.2 (1959).

The wide-scale practice in the Netherlands of land preparation by combining land levelling and improvement of the soil profile was studied. Special attention was given to land levelling projects on sandy soils with a high watertable, used as grassland.

After a description of surface relief, soil profile, grassland production and the interrelation between these factors, the practice of land levelling in the areas examined was analysed. Since levelling changes the microrelief, attention was given to the measurement and description of the relevant characteristics of this

relief.

A primary purpose of this study was to find the effect of levelling on the quality and production of grassland.

The increase in yearly production was found to be about 20 to 30% of the total production of the best grasslands, where total production was about 10 tons dry matter per ha each year. A substantial improvement in quality was measured as well.

Since the results of this investigation could also be used in planning land levelling, special attention was given to the principles of planning this type of land preparation.

Promotor: Prof. Ir F. Hellinga

Author

253. J. VAN SOEST *Stem form and volume of Japanese larch (Larix leptolepis Gord.) in the Netherlands*. 1959, pp. 8 + 76. Eng., Ger. a. Du. summ. Also published in *Uitvoerige Verslagen van de Stichting Bosbouwproefstation 'De Dorschkamp' Bd. 4, Verslag 1 (1959)*.

The following conclusions could be made:

If for volume table construction, the form factor ( $f$ ), instead of the volume ( $v$ ), is used as the dependent variable, better results are obtained.

It matters little whether  $f$  is estimated from the diameter ( $d$ ), or from  $d$  and height ( $h$ ) together.

Estimating  $v$  (or, if more convenient, the so-called form height  $fh$ ) from  $d$  only, on the other hand, leads to much greater inaccuracies.

Estimating  $v$  of  $fg$  ( $g$  = basal area) from  $h$  only is most inaccurate.

From an accuracy point of view graphical and mathematical methods must be considered equivalent.

In actual practice,  $f$  can, for most measurements of standing timber, be derived with sufficient accuracy from a smoothing of  $f$  on  $d$  or from a mathematical solution with the aid of  $f = a + b \log d_{1,3}$ . One should however expect deviations of the  $\bar{f}$  of a stand from the regression line, of up to 10%.

$f$  can be much better estimated by using the regression equation  $f = a + b_1 \log d_{1,3} + b_2 \log d_6 + b_3 \log h$ . Then the deviations of stands are  $< 3\%$  ( $d_x = d$  at  $x$  meter height).

The data investigated indicate that close initial spacings and medium to heavy thinnings lead to relatively high  $f$  values.

The error caused by using  $f$  with  $\bar{g}$  as the stand  $f$ , is negligible.

It is not likely that the functions found will also apply to other tree species.

Promotor: Prof. Dr J. H. Becking

E.

254. E. J. VAN WEERDEN *Over de osmotische waarde en de gehalten aan enige opgeloste bestanddelen van de darminhoud en de mest bij het rund, in ver-*

band gebracht met de resorptie der mineralen / *The osmotic pressure and the concentration of some soluble components of the intestinal contents and the faeces of the cow, in relation to the absorption of the minerals.* 1959, pp. 8 + 100, Du. a. Eng. summ. Also published in Meded. LH 59 (1959) 1.

Osmotic pressure of the contents from various parts of the gut was related to the concentrations of Ca, Mg,  $\text{NH}_4^+$ , Na, K, Cl, total carbonic acid, inorganic phosphate, sulphate and steam-volatile fatty acids in press-juice of gut contents and faeces of 16 cows.

Abomasal contents were slightly hypotonic to the blood. The most important osmotically-active elements were Na and Cl.

In the upper ileum the chyme was strongly hypertonic largely through organic non-electrolytes but also Na and Cl.

Distally in the small intestine osmotic pressure gradually decreased and in the caecum they were almost isotonic with the blood, largely through Na and, to a lesser extent, K and  $\text{NH}_4^+$ .

Strong selective absorption of Na against a concentration gradient caused the hypotony of colonic contents and faeces. Re-absorption from the large intestine was important in the Na metabolism of the cow.

Promotor: Prof. Dr E. Brouwer

Bot.

255. R. A. H. LEGRO *The cytological background of Cyclamen breeding.* 1959, pp. 8 + 52. Eng. a Du. summ. Also published in Meded. LH 59 (1959) 8 and as Lab. Tuinbouwplantenteelt, Publ. 195.

Cytological studies and crossing experiments were carried out in both cultivars and species of *Cyclamen* in connection with breeding. Within 278 groups of *Cyclamen* cvs. grown at different nurseries in Western Europe, there were 48 diploids with  $2n = 48$ , 168 tetraploids with  $2n = 96$ , 58 and 4 aneuploids with  $2n = 92$  and 94, 95, respectively. It was known that the first tetraploid and aneuploid originated in 1863 and 1898, respectively.

The results of reciprocal crosses between diploids and tetraploids were studied. On genetic evidence the origin of the unexpectedly high number of tetraploid descendants was explained by dispermy (fertilization of the female gamete by two male gametes) in the cross  $4n \times 2n$  and analogously by endogamy (fusion of 2 haploid embryo sac nuclei) in the  $2n \times 4n$  cross.

The chromosome range of 14 *Cyclamen* spp. was determined as 20, 22, 30, 34, 48, 84-86, 96 and 136, to be grouped into 3 polyploid series with the basic numbers  $n = 10$ , 17 and 24. Attempts to produce interspecific hybrids failed, except once. Reconstruction of some numbers and creation of missing links by crossing the present-day species was therefore impossible.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

256. M. S. KAMEL A physiological study of shading and density effects on the growth and the efficiency of solar energy conversion in some field crops. 1959, pp. 8 + 102. Eng. a. Du. summ. Also published in Meded. LH 59 (1959) 5.

The growth and the efficiency ( $E_s$ ) of conversion of solar energy were greatly affected in barley by both shading and density, although not always similarly in 1957 and 1958. Observations were made on: height; internode length; shoot diameter; shoot and leaf number; number and percentage of dead leaves; leaf length, breadth, ratio, thickness and area; spike development; awn emergence; spike length; number of heads per plant; number of grains per head and per plant; fresh and dry weights of roots, stem, leaves, heads, seeds, tops and entire plant; 1000-grain dry weight; and the root/top relation. The relation non-photosynthetic tissues to photosynthetic tissues increased with increasing light intensity and with time. With increasing density this ratio decreased in the early stages but increased in the later ones.  $E_s$  increased in the early and late stages with decreasing light intensity, in the middle stages the reverse occurred. In natural field conditions  $E_s$  was maximum in the middle of the growing period.  $E_s$  first (until 56–70 days) increased with density, later on medium density was more efficient. In both seasons proportion of grain and heads increased with density. Shading prolonged vegetative growth and diminished seed production.

In mangold,  $E_s$  increased for each period as well as on average with density. The highest  $E_s$  values also persisted over a longer period in this crop.

Promotor: Prof. Dr E. C. Wassink

E.

257. A. TEMPEL Serologisch onderzoek bij *Fusarium oxysporum* / *Serological investigations in Fusarium oxysporum*. 1959, pp. 8 + 60. Du. a. Eng. summ. Also published in Meded. LH 59 (1959) 7.

Rabbits were immunized with different preparations of *F. oxysporum*.

Antibodies against culture fluid, homogenized mycelium, mycelial extracts and microconidial suspensions reacted in precipitin tests with both culture fluids and mycelium extracts.

Cross reactions between *formae speciales* were very common. The gel diffusion precipitin test proved most suitable to differentiate *formae speciales*. Most sera did not specifically differentiate *formae speciales*. However some reacted highly specifically.

Concerning the character of the antigens it was concluded that the mycelium contained glycoproteins. The glycoproteins split up into polysaccharides and various proteins both during autolysis in the cultures and during extraction of the mycelium.

Rabbits only produced antibodies against proteins after injection with culture liquids or with saline extracts of mycelium. These proteins varied widely in physical properties and it was very difficult to reproduce the same proteins, even by the same extraction procedure. The polysaccharides were much more stable

but antibodies against them could be obtained only by immunization with microconidia. Probably these polysaccharides were present on the surface of the cell wall of the microconidia.

The study demonstrated that the polysaccharides from the glycoproteins of *Fusarium oxysporum* were haptens.

Promotor: Prof. Dr A. J. P. Oort

Author

258. N. C. KEULEMANS Photoperiodiciteit bij *Sorghum vulgare* Pers. / *Photoperiodicity in Sorghum vulgare Pers.* 1959, pp. 10 + 107, Du. a. Eng. summ.

Great millet of 35 varieties from several tropical and subtropical countries were tested for response to photoperiod. Some were analysed and measured extensively with photoperiods ranging from 5 to 24 h in a 24-h day. The development of the growing point was observed in relation to duration of growth from sowing until flower initiation and anthesis. Leaf number, elongation and length of leaves, stem and panicle, dry weight of plant and panicle were noted. The influence of solar radiation, intensity of supplementary light and temperature were, where possible, recorded.

Great millet was a short-day plant highly variable between varieties and types. A range of variations was found 'from quantitative to entirely qualitative responding plants'. In general photoperiodic sensitivity of types decreases with increasing distance from the equator. The optimum photoperiod was about 10 to 11 h in a 24-h day for 10–14 days (dependent on age). Flower initiation starts 4 to 5 weeks after sowing, anthesis 4 to 6 weeks later. A minimum age must be reached before flowering could be induced.

Promotor: Prof. Dr Ir C. Coolhaas

E.

259. J. DE HOOGH Pachtprijsbeheersing en landbouwprijsbeleid in Nederland / *Rent control and agricultural price policy in the Netherlands.* 1959, pp. 10 + 114.

Since 1938 there has been a policy of rent arbitration in the Netherlands. Rent arbitration appeared to be necessary through the price policy of agricultural products. The purpose was to divide agricultural income fairly between farmers and the landowners. The author argued that rent arbitration should also be treated as an instrument and not only a consequence of agricultural price policy. By giving guaranteed prices to the farmers the government influenced on the land rent, but the land rent resulting from arbitration should also influence the guaranteed prices for agricultural products.

The thesis provides a detailed description and analysis of the methods of rent arbitration, and some suggestions for improving the methods. Rent arbitration had had an important influence: before rent arbitration came into force, total

net rent was about 25% of agricultural income, whereas it is now only 5%. It was argued, however, that other influences were also at work; without rent arbitration that percentage could have decreased also.

Promotor: Prof. Dr Ir G. Minderhoud

v.d.N.

260. J. A. VAN RHEE Windbeschutting van cultuurgewassen, vooral onderzocht voor fruit / *Wind protection of agricultural crops, especially studied on fruit*. 1959, pp. 10 + 66. Du. a. Eng. summ. Also published as Meded. ITBON 43, and Meded. Proefst. voor de Fruitteelt in de volle grond, Wilhelminadorp (near Goes), 1.

The use of wind-breaks in orchards was studied. Similar observations were carried out on early horticultural crops such as strawberry and potato, and on field crops such as rye, wheat, sugar-beet, and maize.

Net profits of 10–45% with apple and 12–162% with pear were calculated, if the wind-breaks were 4–6 h away ( $h$  = height of the wind-break). The analysis showed that wind-breaking had an important influence on fruit-setting. Higher mean temperature and humidity in sheltered places may favour pollination and fertilization. Therefore, the recommendation to plant more wind-breaks than usual should be accompanied by advice on planting of wind-break trees coming into leaf before blossom time.

Strawberries yielded significantly more and were much more profitable in sheltered areas. With early potato, higher revenues were obtained only by promoting earliness, perhaps through 'hothouse' conditions in the sheltered zone.

Smaller increases in yield were found for field crops in a zone of nearby 10 h away from the wind-break.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

261. J. MOL Onderzoek naar de bruikbaarheid van de opbrengstwaardeleer voor de taxatie van landbouwgronden / *Enquiry into the usefulness of the theory of revenue flow value in the appraisal of lands*. 1959, pp. 208.

After a survey of the development of the thinking in the Netherlands on the appraisal of agricultural lands, there is an analysis of the Ricardian view on the land rent. Ricardo's concept of rent proved to be tied to some specific suppositions. To him the size of population was endogenous. Mol placed the land rent in five different models, drawn up by him. In the first a legal fixation of the rent, which differed from the equilibrium rent, resulted in a deviation from the optimum size of the plant. An increase in prices of agricultural produce brought about a rise in land rent. In the second model, in which the supply of labour and of land was rigid, a firm relation existed between land rent and wages

in agriculture. Price fixation of one of both production factors had no repercussions in the production sphere. In the third model the supply of land and of labour was rigid. Here the price of produce did not determine the land value. In the fourth model the supply of land was elastic and that of labour rigid, while in the fifth the opposite was true. In the fourth model an artificial increase in agricultural produce entirely benefited the labour. This was not so in the last model. Here the matter of marginal tenant was raised. Finally a number of applications of the principal of revenue value are reviewed.

Promotor: Prof. Dr Th. L. M. Thurlings

Kr.

262. L. J. B. ZEEGERS De toepassing van de additiemethode bij de spectrochemische bepaling van sporenelementen in grondmonsters / *The application of the addition method for spectrochemical determination of minor elements in soil samples*. 1959, pp. 112. Du. a. Eng. summ.

The principle of quantitative spectral analysis was discussed and extended. For Cu 3274, Ni 3414, Co 3435, V 3184 and Pd 3421, the formula  $c = a.i.$  could be used; for Ag 3280, Lomakin's formula  $c = a.i^m$  must be used. Densities of spectral lines were always measured by using Schuffelen's formula. Except for one constant Schuffelen's formula was identical with the transformation formula of Seidel.

The contents of minor elements (Cu, Ni, Co, V, Cr) in sandy soils were lower than in clayey soils. Correlation coefficients for various elements were significant. In sandy soils no correlations were found between Co and the other elements. In clayey soils there were no correlations between (Co, Cu), (Cu, V) and (Cu, Cr).

Promotor: Dr A. C. Schuffelen

d.W.

263. D. W. SCHOLTE UBING Over stralingsmetingen, de warmtebalans en de verdamping van gras / *Studies on solar and net radiation and on evapotranspiration of grass*. 1959, pp. 8 + 94. Du. summ. after each chapter. Eng. summ. Also published in Meded. LH 59 (1959) 10.

Different terms of the energy balance at the surface were discussed. Regression formulae for calculation of net radiation from cloudiness, vapour pressure and temperature were discussed. This type of formula may be used even for short periods by allowing for cloudiness during the night.

Different types of net radiometers, including the 'poor man's radiometer' were compared.

The evapotranspiration of grass was calculated from the water balance of the root zone. Moisture content of the soil at various depths (max. 75 cm) was calculated from thermal conductivity measurements by a non-stationary method.



The ratio of potential evaporation to that of an 'open thin waterlayer' ( $E_0$ ) varies with net radiation. An average value of 0.67 was found.

Of the net radiant heat flux density, 75–80% was used for evaporation and about 25–20% for heating the soil and air. No influence of cutting the grass was observed.

There was a difference in water uptake from field soil and from soil in a Popov pot.

Evaporation under conditions of moisture stress was still dependent on the net radiation and thus on potential evaporation. This also applied to the yields observed.

Promotor: Prof. Dr W. R. van Wijk

Der.

264. I. M. SAID Cation selectivity and cation-anion balance as factors governing the mineral composition of pasture herbage. 1959, pp. 8 + 64. Eng. a. Du. summ. Also published as VLO 65.16 (1959).

The ability was investigated of two grasses *Dactylis glomerata* and *Lolium perenne* to take up K, Na, Mg, Ca, F, S and N from solutions, from soil and from fertilizers. The ratio of the cations and anions in the herbage was estimated. The difference in cation composition of grass species was related to the difference in selectivity between K, Na, Mg and Ca.

Total uptake of cation equivalents in herbage was shown to be determined by the total uptake of anion equivalents and by an internal factor, related to metabolism which determined the cation-anion balance.

The proportions of K, Na, Mg and Ca in total cations depended on availability as well as on the selectivity of the grass species.

If availability and selectivity did not give rise to internal deficiencies of some elements, growth and assimilation could proceed.

Mineral composition resulting from these processes could vary within limits. It was determined both by availability of various elements and by plant species.

Promotor: Prof. Ir M. L. 't Hart

Ov.

265. L. WARTENA Het klimaat en de verdamping van een meer in Centraal Irak / *The climate and the evaporation from a lake in central Iraq*. 1959, pp. 8 + 90. Eng. summ. Also published in Meded. LH 59 (1959) 9.

After describing the continental subtropical climate of central Iraq, Wartena assembled other meteorological observations necessary to estimate evaporation from a lake and irrigation project.

Usual formulae correlating total global radiation with duration of sunshine gave an overestimate with clear sky, an underestimate with cloud cover. A new relationship was derived which gave better results.

A critical discussion of the energy balance of an evaporation pan clearly showed that 'pan factors' could not be constants but depended on weather conditions and time of year. Kohler's theory yielded inaccurate results. Especially in arid regions, to assume a constant ratio between 'potential' and actual evaporation may lead to considerable error but a 'class A' pan satisfactorily indicated irrigation requirements. The 'Piche' evaporimeter was not satisfactory.

To estimate evaporation from the projected storage lake, its surface temperatures were calculated by using elementary meteorological quantities. The method was in reasonable agreement with actual values on the existing Lake of Tiberias. The evaporation from fictitious lakes 10 and 50 metres deep was calculated to be different.

Qualitative influences of wind, humidity and temperature of the atmosphere on evaporation were discussed.

Yearly evaporation from the two lakes was estimated at 2500 mm.

Promotor: Prof. Dr W. R. van Wijk

Der.

266. L. BRAVENBOER De chemische en biologische bestrijding van de spintmijt *Tetranychus urticae* Koch / *The chemical and biological control of the glasshouse red spider Tetranychus urticae* Koch. 1959, pp. 12 + 86. Eng. summ. Also published as VLO 65.5 (1959) and Proefstat. Groenten- en Fruitteelt onder glas, Naaldwijk, Publ. 75.

Glasshouses have a favourable climate for greenhouse red spider mite, which can rapidly proliferate. Up to 1959 its practical control has been by chemicals only. Bravenboer studied whether biological control was also possible.

Chemical treatment acted as a density-independent factor and was unable to regulate the population. It must frequently be repeated and would certainly lead eventually to resistance of the mite, so causing a failure of chemical control in the future.

The predators *Stethorus punctillum* and *Typhlodromus longipilus* could act as density-dependent factors and regulate the population of *Tetranychus urticae*. Although the conditions for biological control were favourable in greenhouses, the predators alone were seldom able to give economic control of *T. urticae*. A single application of a selective acaricide per year gave adequate control.

The first chapters deal also with taxonomic problems over *Tetranychus urticae*, with the influence of temperature on the development of both *T. urticae* and its mentioned predators, their egg production, their diapause (not for *Typhlodromus longipilus*), the influence of the host plant on the reproduction of *T. urticae* and many observations on the behaviour of predators in the presence of their prey.

Promotor: Prof. Dr J. de Wilde

E.

267. R. VAN DE WAAL Richtlijnen voor een ontwikkelingsplan voor de Oostkust van Sumatra / *Suggestions for a development scheme for the East Coast of Sumatra*. 1959, pp. 10 + 142. Du. a. Eng. summ.

Suggestions were made to improve the agricultural situation resulting from the Second World war. The former estate agriculture on the East Coast of Sumatra, established in 1865 by westerners in a sparsely populated and isolated area, occupied 1,000,000 ha in 1940 mainly under tobacco, rubber, oil palms and fibre-plants, but was replaced by foodstuffs during the Japanese occupation, as rice was no longer imported. The Bureau for Land Utilization, established in 1948 in Djakarta, tried to indicate the most efficient integrated use of the land by regional, social, economic and physical planning, in contrast to former incidental actions. An insight was gained into the scope of soil and climate, while some structural defects also came to light of which the chief were the pluralistic structure of society, the legal regulations on tenure, the one-sided production and the presence of cultivated areas as a foreign element, also in a physical sense. The one-sided production appeared from the export of raw materials from estate agriculture and import of manufactured goods and foodstuffs. The area grew only 50% of its rice. The development plan must increase both individual prosperity and regional economic stability and promote the agricultural industries and service establishments.

Promotor: Prof. Dr R. A. J. van Lier

P.

268. E. VAN ROON De toepassing van gedeelde stikstofgiften bij enkele zaadgewassen / *The application of divided nitrogen dressings to some seed crops*. 1959, pp. 131. Du. a. Eng. summ. Also published as Proefstat. Akker- en Weidebouw, Publ. 6.

The influence was studied of split dressings of N on susceptibility to lodging, on yields of grain and straw and on seed quality of a number of seed crops: poppy (*Papaver somniferum*), spinach (*Spinacia oleracea*), radish (*Raphanus sativus*), caraway (*Carum carvi*), winter swede-like oilrape (*Brassica napus* var. *biennis*) and canary grass (*Phalaris canariensis*). The data on yield, lodging and quality were from field trials under normal management. The second application of N was just before flowering. Of the 6 seed crops, at least 3 (poppy, spinach, radish and sometimes caraway) increased in seed production. The other crops reacted either indifferently (caraway, winter swede-like oilrape) or always negatively (canary grass). Split dressings improved seed quality of poppy and radish. The commercial value of other crops was not affected. The effect on straw stiffness (lodging) of the crops concerned was not marked; only for poppy and to a lesser extent spinach and radish did split application provide

some advantage. For poppy, spinach and radish seed N dressing could be delayed until plants were in full bloom.

Promotor: Prof. Dr A. C. Schuffelen

S.

269. P. GAASTRA Photosynthesis of crop plants as influenced by light, carbon dioxide, temperature, and stomatal diffusion resistance. 1959, pp. 8 + 68, Eng. a. Du. summ. Also published in Meded. LH 59 (1959) 13.

The effect was estimated of light intensity, leaf temperature, and CO<sub>2</sub> concentration on photosynthetic rate in leaves of crop plants. The potential capacities of photochemical and biochemical processes and of CO<sub>2</sub> transport were compared.

Resistance to CO<sub>2</sub> transport in various parts of the pathway from external air to reaction centre in the chloroplasts was estimated in absolute units. This allowed quantitative comparison of micrometeorological and physiological effects on photosynthesis.

CO<sub>2</sub> transport towards the leaf is affected by the sum of resistances in external air ( $r_a$ ), stomata ( $r_s$ ), and mesophyll cells ( $r_m$ ). Since  $r_m$  is usually larger than  $r_s$  of open stomata,  $r_m$  is probably an important yield determining factor.

With adequate water-supply, transpiration depends on  $r_s + r_a$ , but not on  $r_m$ . Therefore higher values of  $r_s$  and lower values of  $r_m$  favour the water balance of crops.

With strong light and leaf temperature around 22°C, CO<sub>2</sub> saturation of photosynthesis was reached with CO<sub>2</sub> concentrations between 0.1 and 0.15%.

Techniques were described for accurate measurement of CO<sub>2</sub> and water vapour, leaf temperature, light intensity and diffusion resistance. The importance of different types of light bulbs for photosynthesis was evaluated, and much attention was paid to accurate assessment of effective CO<sub>2</sub> concentration in the air around leaves in assimilation chambers.

Promotor: Prof. Dr E. C. Wassink

Author

270. F. M. MAAS Bronnen, bronbeken en bronbossen van Nederland, in het bijzonder die van de Veluwezoom. Een plantensociologische en oecologische studie / *Springs, springbrooks and springwoods of the Netherlands, especially those of the 'Veluwe zoom'. A phytosociological and ecological study.* 1959, pp. 8 + 166. Eng. a. Fr. summ. Also published in Meded. LH 59 (1959) 12.

The study was of some aspects of the occurrence of springs in the Netherlands, in particular those of the Veluwe Fringe, but also in Twente and south Limburg. These aspects were compared with those in Germany, France, Belgium and Austria. Along the Veluwe Fringe water percolates through layers of gravel or coarse sand to the impermeable layers of clay or sand and mud be-

neath; the springs rise where the junction of these layers reaches the surface. Many springs have arisen through excavations higher in the valleys. Most springs in south Limburg arise where permeable water-holding calcareous layers meet impermeable layers of sand or clay. The temperature and the oxygen content of the large springs of the Veluwe Fringe proved to be constant, those of the smaller ones a bit less so. Their water proved to be generally rich in nitrate, with least solutes near preglacial sands and richest in minerals near loess. In south Limburg it was shown to be very rich in lime.

Discussion of microclimate and physical and chemical status of the soil is followed by an extensive description of plant communities, ecology of the woods, the undergrowth on the forest flushes and of plants in the actual springs and their streams.

Promotor: Prof. Dr H. J. Venema

E.

271. A. M. VAN DOORN Onderzoekingen over het optreden en de bestrijding van de valse meeldauw (*Peronospora destructor*) bij uien / *Investigations on the occurrence and control of downy mildew (Peronospora destructor) in onions*. 1959, pp. 8 + 64, Du. a. Eng. summ. Also published in *Tijdschr. Plantenziekten* 65 (1959) 6.

The life cycle of *Peronospora destructor* (Berk.) Casp. was spore – infection – overwintering – new spore. Wind-borne spores infected leaves and seed stalks of the onion. After replanting bulbs of an infected crop in the following year, mycelium may sometimes spread into the developing leaves and cause systemic symptoms. If the weather were favourable, spores would infect leaves of the surrounding crops. The rate of development of the disease was dependent on weather, source of infection, variety and leaf density.

In laboratory experiments relative humidity was most important for the progress of the infection cycle. In field experiments characteristics of weather favourable for infection were derived from 4 circular experimental fields. Data on overall climate collected 2.2 metres above ground gave an adequate forecast of days critical for infection by downy mildew.

Infection could be reduced by cultivation, hygiene and chemical control. The best results were obtained with low-volume spraying of zineb, once every 7–10 days, at the rate of 3 kg in 150–200 litres water per ha.

Promotor: Prof. Dr A. J. P. Oort

Author

272. L. D. SPARNAAIJ The analysis of bunch production in the oil palm. 1959, pp. 82. Eng. a. Du. (inserted) summ. Also published in *J. W. African Inst. Oil Palm Res.* 3 (1960) 109–180.

Bunch yield of oil palms can be expressed as the product of number of bunches and average bunch weight. Number of bunches is itself composite, being determined by number of leaves, percentage floral abortion, sex ratio and percentage bunch failure. Of these elements sex ratio proved to be most strongly influenced by age, environment and genetic constitution.

Detailed data from a number of cultural experiments on the effects of intercropping, cultivation, manuring and pruning were used to study the effects of various treatments on individual components of yield. The clear response of sex ratio to cultural treatments could be traced to a positive correlation with light intensity and a negative correlation with total nitrogen in soil, in particular during periods of insufficient sunlight. These findings led to the hypothesis that environment affects sex ratio and therefore bunch number, through the ratio between carbohydrate assimilation and nitrogen uptake.

Yield analysis thus facilitated the interpretation of the results of agronomic trials, particularly in Africa where yields were often limited through insufficient sunlight. In breeding of oil palms, yield analysis could enable the plant breeder to estimate the performance of his material under different conditions and could reveal the interactions between sex ratio, fruit quality and sterility.

Promotor: Prof. Dr Ir C. Coolhaas

Author

273. M. WITKAMP Seasonal fluctuations of the fungusflora in mull and mor of an oak forest. 1960, pp. 12 + 52. Du. (p. X) a. Eng. summ. (p. 45). Also published as Meded. ITBON 46.

On agar plates more colonies and species of fungi developed from oak leaves from calcareous mull (loose mixed litter and mineral matter) than from those from mor (usually compact litter layer abruptly distinct from underlying soil; without free calcium). Fungal plate counts, mycelial growth and concentration from soil under calcareous mull were lower and plate counts of bacteria and actinomycetes higher than those from mor; those from acid mull were usually intermediate. The characteristics of the fungal flora seemed influenced by water and calcium content through the chemical composition of the vegetation and its litter, and secondly by the physical factors of soil, the saprophagous soil fauna and the non-fungal microflora. The numbers of micro-organisms and mycelial growth in the mineral soil were influenced by temperature, moisture and added fresh litter. Maximum mycelium concentrations in oak soils were in autumn or winter, but not in pine soils.

Mycelium was decomposed almost equally fast in mull and mor. The mull had 4-10 times as much chitin-decomposing and mycolytic micro-organisms than mor; mor had more mycophagous oribatid mites, consuming individually 3 times as much in summer than in winter. Fruiting bodies of toadstools were most frequent (partly dependent on soil moisture content) about 2.5 months before mycelium reached maximum concentration. The toadstools were mostly

humus and litter fungi in mull, and mycorrhizal fungi in acid mull and mor. Litter fungi occurred in all types.

Promotor: Prof. Dr A. J. P. Oort

E.

274. I. K. ABU YAMAN Natural control in cabbage root fly populations and influence of chemicals. 1960, pp. 8 + 58. Eng. a. Du. summ. Also published in Meded. LH 60 (1960) 1.

To facilitate studies on the natural and chemical control of *Hylemya (Erioi-schia) brassicae* (Bch.) in Holland, the bionomics and abundance of the Anthomyiid were investigated in 1959-9 in fields in which cauliflower was grown. The numbers of eggs and larvae were estimated by scrutiny of soil samples and emergence of adults was observed with soil traps. In 1955, the numbers of eggs laid by each of the three succeeding generations increased, but in the 1956-59 they decreased; in 1955, 1957 and 1959, larvae and pupae of the first generation were more abundant than those of the second, but in the intervening years the reverse occurred.

The numbers of adults emerging decreased towards the end of each season, through increase in the proportion of pupae that entered diapause or were parasitized. Mortality was high in larvae, and less than 10% of the eggs gave rise to pupae. *Aleochara bilineata* Gylh. and *Trybliographa (Cothonaspis) rapae* (Westw.) caused 5.5-38% mortality and miscellaneous insect predators 17%; mortality in newly hatched larvae was 78-79.5%, mainly through failure to become established on mature plants. Damage to the plant was determined both by density of larvae, and by the state of the crop; it was greatest in cool weather, which increased the fecundity of the flies and reduced plant growth. Reduction in the numbers of larvae by treatment of the plant base with insecticides, particularly aldrin and chlordane, was associated with a decrease in those of *A. bilineata* and miscellaneous predators, but it was not established whether this was due directly to insecticides or to the scarcity of *H. brassicae*.

Promotor: Prof. Dr J. de Wilde

Rev. Applied Entomol.

275. I. S. ZONNEVELD De Brabantse Biesbosch. Een studie van bodem en vegetatie van een zoetwatergetijdendelta / *The Biesbos of Brabant. A study of soil and vegetation of a freshwater tidal area.* 1960, pp. 12 + 397. Du. summ. (p. 1). Also published as VLO 65.20 (1960), serie Bodemkundige Studies No. 4 A, B and C.

Vegetation in an almost natural landscape influences soil formation. The reverse is also true. The author investigated soils and vegetation and their mutual relation in a region where human occupation had not yet disturbed natural vegetation. Initial soil formation was the main process involved and

may also have been the first stage of soil genesis in the older polders. Tidal movements and rivers caused sedimentation as a low tidal marsh, dissected by some big and many small creeks. During and after sedimentation soil formation started ('ripening'). Loss of water (physical ripening) caused shrinkage and subsidence, which could be measured by observations on water and humus content and grain-size distribution. Important was the 'water factor' n, distinguishing stage of ripening.

Chemical ripening was concerned mainly with the behaviour of Fe, Mn, S, CaCO<sub>3</sub>, K and organic matter. Changes in nature of these components were also used as ripening characteristics. Biological ripening started also with penetration of oxygen into the soil and controlled development of structures and homogenization. Soils were described and classified according to genesis. Geological history was reconstructed from old maps. Plant communities, their classification, development, importance in soil genesis, value as indicators of soil differences were extensively studied and the tidal river landscape was reconstructed.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

276. W. J. FEENSTRA Biochemical aspects of seedcoat colour inheritance in *Phaseolus vulgaris* L. 1960, pp. 8 + 54. Eng. a. Du. summ. Also published in Meded. LH 60 (1960) 2.

The influence was investigated of 2 gene pairs (V-v<sup>lae</sup> and Sh-sh) and a multiple allelic series of 3 alleles (C<sup>r</sup>-C-c<sup>u</sup>) on pigment synthesis in the seedcoat of *Phaseolus vulgaris*. All 12 homozygous combinations were examined in pure lines. These lines were obtained from F<sub>2</sub> offspring by visual selection. Each type possessed the basis gene P, which did not itself produce any colour but whose presence was needed for the activity of other genes influencing seedcoat colour.

As pigments 18 different flavonoid compounds were isolated and 15 of them identified.

The gene pair V-v<sup>lae</sup> controlled the number of hydroxyl groups in the B ring of the compounds formed. V probably acted on a precursor from which all these compounds were synthesized. The number of hydroxyl groups in the B ring proved to influence the action of other genes, determining the heterocyclic part of structure.

The multiple allelic series C<sup>r</sup>-C-c<sup>u</sup> controlled the formation of anthocyanins or flavonol glycosides. With c<sup>u</sup> none of these compounds was formed. The role also of C and C<sup>r</sup> could be traced. A hypothesis was put forward to explain the phenomena, not previously found in any plant species.

Sh controlled the formation of leuco-anthocyanidins and stimulated the production of anthocyanins and flavonol glycosides formed in the presence of C or C<sup>r</sup>. This was the first investigation in which a single gene had been found responsible for the production of leuco-anthocyanidins.

Promotors: Prof. Dr R. Prakken and Prof. Dr H. J. den Hertog

E.



277. M. A. SHARAFELDIN Factors affecting litter size in Texel sheep. 1960, pp. 8 + 62. Eng. a. Du. summ. Also published in Meded. LH 60 (1960) 3.

The effect of age of ewes and of different lambing years on fertility expressed as number of lambs born and surviving to 2 months per lambing has been studied in field data collected by the herdbook for Texel sheep in North Holland. The fertility of ewes was compared when first bred at about 8 months or at about 20 months of age and the effect of heredity on litter size was studied.

Hereditary effects were determined by the effect of type of birth of sire, dam and ewe on the fertility of ewes, by heritability of litter size, by the effect of sires on fertility of these female progeny and estimating the repeatability of litter size. Effect of age of ewe on fertility was studied.

Promotor: Prof. Dr Th. Stegenga

B.

278. L. A. M. ALI The amino acid content of Edam cheese and its relation to flavour. 1960, pp. 8 + 64. Eng. a. Du. summ. Also published in Meded. LH 60 (1960) 4.

A comparison between the quantities of the free amino acids occurring in Edam cheeses of different properties, and the amino acid composition of casein showed these patterns to be usually comparable. Various factors, such as pH and moisture content of the cheese, pasteurized or raw milk, and aseptically drawn or infected milk, hardly affected the amino acid pattern of the cheeses.

Free amino acids (e.g. glutamic acid) were found to contribute to the basic taste of Edam cheese. The intensity of this basic taste depended not only on the degree of protein degradation, but also on the presence or absence of other breakdown products, and on the consistency of the cheese.

There are however other important and more piquant flavour components since great differences often occurred in the taste of cheeses with the same amino acid pattern.

Promotor: Prof. Dr H. Mulder

v.d.H.

279. S. F. KUIPERS Een bijdrage tot de kennis van de bodem van Schouwen-Duiveland en Tholen naar de toestand vóór 1953 / *A contribution to the knowledge of the soils of Schouwen-Duiveland and Tholen according to the conditions prior to 1953.* 1960, pp. 8 + 192. Eng. summ. Also published as VLO 65.7 (1960), serie De Bodemkartering van Nederland, deel XIX.

By order of the State Service for Agricultural Restoration, the whole area of the Delta Islands of Schouwen-Duiveland and Tholen was mapped to obtain data on inundated soils. Beside soil maps and descriptions a review of the holocene geology was included. A reconstruction was made of post-Boreal incursions

and recessions, their periodicity and characteristics. Soil properties (CaCO<sub>3</sub> content, grain-size distribution) could be correlated with conditions during sedimentation.

Decalcification, a process that plays an important part in soil genesis in these tidal flats and tidal marshes, was studied by comparing polders of different age allowing for local effects. The rate of decalcification could be estimated to 1% in 80–90 years. The influences of fresh and saline seepage on the profile and of salt susceptibility were established. From trial harvests and data on farm rents, conclusions were drawn on the suitability of the soil types, but many other factors often caused irregularities.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

280. E. G. KLOOSTERMAN De pootaardappelteelt in de Veenkoloniën / *Seed-potatoes in the Peat Colonies*. 1960, pp. 8 + 160. Du., Eng. a. Ger. summ. Also published as VLO 66.2 (1960).

Natural conditions in the Fen Settlements (Veenkoloniën), a reclaimed peat-land area in the northeast of the Netherlands, are usually favourable for the production of seed potatoes. The soil and climate are right and there are few wingless aphids at the time of selection and field inspection.

There are many experienced and competent growers in the area; quite a lot of them produce seed potatoes for use entirely or mainly on their own farms.

Production is economically justified: seed potatoes can be fitted into the cropping plans of farms in the Fen Settlements in various ways. An analysis on one farm showed, that earning capacity of the enterprise could be improved by inclusion of seed potato production. Little criticism can be made of the results, especially for quality. It was found possible, both by choice of the seed stock and especially by the absence of wingless aphids, to get a healthy culture.

Certain cultural measures influencing the yields were capable of improvement as by use of sprouted tubers, preventing break-off of sprouts during planting, and increasing the number of plants per ha up to 50.000.

Promotor: Prof. Ir W. J. Dewez

Ov.

281. K. W. SMILDE The influence of some environmental factors on growth and development of *Sesamum indicum* L. 1960, pp. 8 + 70. Eng. a. Du. summ. Also published in Meded. LH 60 (1960) 5.

The influence of light and temperature on vegetative and reproductive development of sesame varieties was studied.

Stem growth and leaf production in growth chambers increased as average temperature was raised from 24° to 33°C; alternating day and night temperature were not beneficial. Lengthening the daylight period and extending daylight

with fluorescent light (intensity  $2000 \text{ erg sec}^{-1}\text{cm}^{-2}$ ) increased stem length, number of leaves and leaf size.

Seedlings were not sensitive to length of the photoperiod for 3 to 8 days after emergence, according to variety. A constant temperature of  $24^{\circ}$  to  $27^{\circ}\text{C}$  was optimum for early floral initiation.

Photoperiodic response was studied at photoperiods ranging from 5 to 24 h, consisting of a basic illumination of daylight supplemented by different periods of weak fluorescent light. The number of days to floral initiation and flowering was minimum with a photoperiod of 10–13 h, of which at least 8 h was daylight. The delay with photoperiods shorter than 10 h was mainly caused by restriction of photosynthesis. In most varieties flowers were eventually initiated even with photoperiods of 20–24 h. More flowers and capsules were produced as the photoperiod, irrespective of its composition, was lengthened from 6 to 20 h.

Promotor: Prof. Dr Ir C. Coolhaas  
(As Prof. Coolhaas was indisposed  
Prof. Dr Ir S. J. Wellensiek performed the duties).

Author

282. J. F. VAN RIEMSDIJK Economische aspecten van het bedrijfsgrootte-vraagstuk als onderdeel van het structuurprobleem in de landbouw / *Economic aspects of farm size as a part of the structural problem of agriculture*. 1960, pp. 208. Also published in Agricultural Economics Research Institute, The Hague (Neth.), Rapport 354.

It was studied whether an increase in farm size might improve the farm income and if so, to what extent and on which conditions. The background for this theme is given in the first section, emphasizing the forces which determine the trend of farm income. Inadequacy of farm size is thought to be the core of the parity problem in agriculture.

Section two deals theoretically with definitions and measures of farm size. Two measures are proposed, 'effective' size (= net value added per farm in one year) and 'normative' size (costs of the factor input involved). In section three the conventional theory of production economics is used to elaborate a scheme for the analysis of empirical data.

In the fourth section the author studies records of dairy farms over the period 1952–1958. The question of how size of dairy farms depends upon fixed factors such as area, labour and equipment could be reasonably clarified. The optimum size of dairy farms at that time was clearly outside the range of observations. Similar relationships are deduced in section five from studies on farm size made by other students or from earlier studies by the author.

The study concludes with an evaluation of the economic importance of several alternative ways of increasing farm size, both for the farmer and society.

Promotor: Prof. Dr Th. L. M. Thurlings

Kos.

283. J. VELDSTRA Onderzoekingen over de warmtedoorgang in een verticale pijpverdamper / *Investigations on heat transmission in a vertical tube evaporator*. 1960, pp. 8 + 84. Du. summ.

The influences were investigated of various operating parameters on heat transmission, i.e. the evaporative capacity, in a single vertical evaporator tube, fed with pure water.

With natural circulation, temperature level and difference had a pronounced influence, especially at lower values of these parameters (e.g. boiling temperature 40°C, temperature difference 15°C). The heat transmission coefficient  $k$  increased for increasing temperature level as well as for increasing temperature difference.

The influence of the apparent liquid level was very important and was more pronounced for lower temperature levels and smaller differences. For each set of operating temperatures an apparent liquid level existed, for which  $k$  was maximum. The apparent liquid level had a very big influence on circulation rate. Forced circulation induced higher values of  $k$  only if the forced circulation rate was much higher than the natural one. Because natural circulation was slow for low temperatures and small differences forced circulation was found to be advantageous in these conditions.

With forced circulation the influence of temperature difference on  $k$  was small and sometimes reversed. Due to decreased viscosity,  $k$  was higher at higher temperatures. The most important influence on  $k$  was exerted by forced circulation rate.

With flash evaporation  $k$  was generally slightly smaller than with forced circulation, except at high circulation rates, where  $k$  became equal for both systems.

Promotor: Prof. Dr Ir H. A. Leniger

Bev.

284. D. A. KRAAIJENGA Groeimetingen bij de tulpebol / *Growth measurements on the tulip bulb*. 1960, pp. 8 + 54. Du. a. Eng. summ. Also published in Meded. LH 60 (1960) 8.

Tulips did not require a specific soil, if pH was not below 6.5 and water supply was sufficient. Influence of weather conditions was studied by comparing bulb production in different years and areas. Low temperatures after planting and during winter, a gradual increase in spring, sunshine in April and early May, were most favourable. Cold during May and June caused some extension of growth and increased bulb productions.

Records of daily weather conditions and growth yielded no correlation with radiation and temperature and with precipitation, except after drought. Increase in circumference was positively correlated with the length of period with a limited evaporation and transpiration. Growth therefore took place during the night while dry and hot days decreased bulb size.

In conclusion the most favourable conditions for bulb production were an

early winter and a long cool spring, and circumstances limiting transpiration of the crop. Of these environmental conditions only evaporation could be influenced and for this purpose shelter belts of conifers were recommended.

Promotor: Prof. Dr Ir S. J. Wellensiek

F.

285. E. ALVARES VEGA Moelijkheden en mogelijkheden van de bloembollenteelt in Israel / *Difficulties and possibilities of flower-bulb production in Israel*. 1960, pp. 10 + 186. Du. summ.

Results were reported of several methods of culturing tulips, hyacinths, daffodils and gladiolus in different climates of Israel. Because of extremely hot summers, insufficiently cool winters and distance to export markets, commercial outlets, especially for flower production, were limited.

Even with winter plantings in shade, buds of tulips were blasted, flowers were inferior on short stems and decreased bulbs were small.

Hyacinths flowered well in the first year, but formed small bulbs. Daffodils yielded flowers and bulbs reasonably to well but only for the local market. Daffodils were much better adapted to prevailing winter temperatures and similar results were expected with paperwhites, irises, lilies, anemones and hippeastrum, especially in bulb production. Gladiolus gave the best and most promising results for commercial export of flowers in winter and of corms round the year, through the excellent light and temperature. Problems discussed and partly solved were diseases, timing in relation to dormancy and photoperiod, and water supply. Special winter and summer varieties could be distinguished, without any relation to the original grouping as early, middle and late flowering cultivars. Planting depth was decisive for pattern of growth and development; 15 cm was usually optimum.

Promotor: Prof. Dr Ir S. J. Wellensiek

F.

286. J. W. MINDERHOUD Grasgroei en grondwaterstand. Onderzoekingen over de betekenis van de grondwaterstand voor komkleigrasland / *Growth of grass and ground-water level. Investigations into the importance of the ground-water level for basin-clay grassland*. 1960, pp. 200. Du. a. Eng. summ. Also published as Proefstat. Akker- Weidebouw, Publ. 15.

Results were discussed of experiments on watertable with permanent grassland and arable crops on river clay and on peat soil (grassland only). It is concluded that plant growth is affected by watertable in two ways: through the water supply and through the nitrogen supply. These factors derive from the water and air contents of the soil, which depend on watertable. A high moisture content promotes water supply of the plant but limits air content, thus promoting the bacterial denitrification of mineral nitrogen in the soil.

Grassland may respond to watertable in different ways. During drought water supply may be the determining factor and the highest gross yield will occur with high watertable. But with abundant rainfall the highest yields will occur with a low watertable since nitrogen supply is then the determining factor.

Through changeable weather an optimum watertable could only be found during brief periods. In the long run the best results (also through risk of poaching) for clay grassland can be expected with a low watertable (100 cm or more) and with surface irrigation during drought.

Promotor: Prof. Ir M. L. 't Hart

Author

287. K. M. SEN Studies on the influence of some auxin herbicides on grass-seed crops. 1960, pp. 8 + 70. Du. a. Eng. summ. Also published as VLO 66.11 (1960).

Applications of 2,4-D or MCPA may cause malformations in the initiated leaves of both grasses and cereals, during vegetative stages of development. 2,4,5-TP also caused malformations in stems and leaves, but only after the plants started to shoot. By their strong tillering the reaction of grasses to auxin herbicides was more complicated than that of cereals. The spraying effect was assessed primarily by the number of sprouts influenced in the harvested haulms. When the grasses were most susceptible varied, probably through differences in tillering during cold weather and a different number of sprouts developing after treatment, thus causing a difference in the percentage of sprouts affected, and through differences in photoperiod for ear initiation. All grasses studied required different periods of cold or short days to reach the stage of ear initiation. The moment of ear initiation, varying between species, corresponded with the end of the susceptible period of the vegetative parts and was usually correlated with the severity of leaf abnormalities.

The susceptibility of inflorescences to MCPA and 2,4-D was closely related to that of the leaves. 2,4,5-TP disturbed the structure of the inflorescences mostly later during shooting. Application of all the chemicals to grasses after forming 3-4 tillers in autumn did not decrease seed yield. But application after winter may do so. The germination decreased only after application during late developmental stages of the inflorescence.

Promotor: Prof. Ir M. L. 't Hart

E.

288. J. H. A. BOERBOOM De plantengemeenschappen van de Wassenaarse duinen / *The plant communities of the Wassenaar dunes near The Hague*. 1960, pp. 8 + 136. Du. a. Eng. summ. Also published in Meded. LH 60 (1960) 10.

The plant communities on about 1800 ha of dunes were studied before any consequences could be observed of percolation since 1955 of fresh water stored

underground for mains supply. Classification was by the French-Swiss and sometimes the Scandinavian sociological system. Some difficulties of classification by the French-Swiss method were discussed.

The floristic composition, distribution of the communities and their mutual relations were considered. Chapters cover the broad plant formations, arranged according to succession.

New sub-alliances introduced were *Erodio-Koelerion albescentis* (slightly open dune vegetation on usually limy substrate) and *Luzulo-Koelerion albescentis* (closed dune grasslands, later in the succession; topsoil often leached of lime).

New associations described were *Erodium glutinosum-Phleum arenarium*-assn. (dune district as far as N. France), *Jasione montana* var. *Litoralis-Phleum arenarium*-assn. (Netherlands and German Friesian Isles), *Didymodon recurvirostris - Tortella flavovirens*-assn. (small associations mainly of cryptogams on northern faces of limy banks), *Ranunculus bulbosus - Trifolium striatum*-assn. (moderately grazed or ruderal influenced; completely leached soil; old dunes), (sub-assn. *Koeleria albescens* on grounds used for drying fishing nets), *Hippophaë rhamnoides-Sambucus nigra*-assn. and *Crataegus monogyna-Betula pubescens*-assn.

Promotor: Prof. Dr H. J. Venema

E.

289. S. K. SHARMA A comparative study of the training of agricultural advisory personnel in the Netherlands and India. 1960, pp. 184. Eng. summ.

Various aspects, in particular the training of extension workers, were compared of the agricultural advisory services in the Netherlands and India. In 1870 some agricultural agents were appointed in the Netherlands.

In India it was not until 1928 that the importance of extension workers was emphasized. A scheme was then drawn up to improve villages. After that several campaigns and schemes, such as the Grow More Food Campaign, were launched. However the total agricultural situation did not significantly improve. In 1952 the Grow More Food Enquiry Committee was appointed and later in the same year the Community Development Programme was inaugurated with 55 Community Projects. To facilitate financing and rapid extension of the development programme throughout India the National Extension Service was established in 1953. The class and caste systems seriously impeded its activities.

In the Netherlands farmers organizations and village leaders were of great use in promoting agricultural advisory work and education. In both countries various officers at state, district and village level are responsible for co-operation in agricultural development work. Some weaknesses in the training of agricultural advisors in India were emphasized. Improvements were suggested.

Promotor: Prof. Dr R. A. J. van Lier

P.

290. D. W. STOLP Bodemvocht en groenteteelt op een hoge zandgrond / *Plant and moisture relationships with vegetable crops on a light sandy soil*. 1960, pp. 10 + 236. Du. summ. after each chapter. Eng. summ. Also published as VLO 66.16 (1960).

The research concerned the effect of drying out of soil on the yield of a number of vegetables and the practical use of irrigation.

From the extensive literature published in various countries on this aspect of irrigation research, a series of soil moisture conditions for vegetables (early potatoes, carrots, broad beans, beet root, endive, lettuce, cauliflower, dwarf beans, Scottish kale, Savoy cabbage, spinach and strawberries) was achieved on a trial plot of rather drought-susceptible soil by preventing natural precipitation by removable glass-covers and by irrigation with mobile sprinkler booms. These conditions varied in the limit of drying measured as percentage soil moisture on a weight basis and expressed as average moisture tension (pF), either constant for the entire growing period or varied at different stages of crop development (sensitive period experiments). In other experiments drying of the soil was slowed down by small daily irrigations based on estimated evaporation in the previous 24 hours or at a fixed amount.

The yield and crop quality was strongly correlated with the average pF, however sometimes as optimum curve for parts of the growing period.

Promotor: Prof. Ir F. Hellinga

Author

291. P. J. A. L. DE LINT An attempt to analysis of the effect of light on stem elongation and flowering in *Hyoscyamus niger* L. 1960, pp. 8 + 60. Eng. a. Du. summ. Also published in Meded. LH 60 (1960) 14.

The shooting of *Hyoscyamus niger* was studied as a reaction to radiation with coloured or white light in various combinations of intensity and duration. Research into the reaction to very short photoperiods became possible by continuing treatments with weak light not longer than 6 or 10 days, and then to keep the plants in LD of white light until shooting.

The data presented were interpreted as follows. *Hyoscyamus* would grow vegetatively if floral induction (an accumulative and autonomous process comprising flower bud initiation and a shooting impulse) were inhibited, also if stem elongation underlay formative inhibition (suppression of etiolation). Thus, vegetative growth may be due either to unsuitable photoperiod, primarily inhibiting floral induction, or to unsuitable light quality, primarily causing formative inhibition of stem elongation.

The formative inhibition was due to the production of an inhibitor precursor, which became active principally in darkness, after a light period. In the dark, the precursor would be gradually converted into an inhibitor which itself had no measurable persistence but took immediate effect as an inhibition. In longer maintained darkness the plant was no longer inhibited, no more than during



light. The inhibition by short photoperiods increased with time of radiation as in a formative light action. Near-infrared may be assumed to antagonize inhibition by inactivating the precursor.

Promotor: Prof. Dr E. C. Wassink

Author

292. TH. P. M. DE WIT The Wageningen Rice Project in Surinam. A study on the development of a mechanized rice farming project in the wet tropics. 1960, pp. 294. Eng. a. Du. summ.

This polder of 6000 ha in the coastal plain of Surinam was intended for Dutch farmers but was provisionally operated as a large-scale undertaking by the government-supported Foundation for the Development of Mechanized Agriculture in Surinam. Rice was to be grown in the rainy season, dry annual crops in the dry season, and leys were to be put down for cattle raising. Through unsuitability for dry crops and animal husbandry, only rice was grown with a second rice crop on a quarter of the area in rotation. A pumping station provided both for irrigation and drainage. Drainage was important in reclamation. The operations which had to be carried out were described. Tillage consists of a combination of ploughing, harrowing, levelling and puddling. The crops suffered from various pests and diseases and imperfect irrigation. The fields were often too wet for machine-harvesting.

Rice farming was on farm units of from 200 to 600 ha with 25 ha per worker.

Yields averaged 2600 kg paddy per ha sown. In 1956 and 1957 production costs, excl. management overheads and interest, were Sf 330 per ha planted but were not considered normal due to various initial difficulties. A minimum future cost price was estimated at Sf 250/ha. So far the project had been run at a loss, also through falling world market prices of rice.

Promotor: Prof. Ir J. H. L. Joosten

L.A.

293. J. W. VAN HOORN Grondwaterstroming in komgrond en de bepaling van enige hydrologische grootheden in verband met het ontwateringssysteem / *Ground-water flow in basin clay soil and determination of some hydrological factors in relation with the drainage system*. 1960, pp. 8 + 136. Du. summ. after each chapter. Eng. summ. Also published as VLO 66.10 (1960).

The basin clay soil occupying an extensive area between the great rivers in the Netherlands is characterized by a profile with a highly permeable surface layer (20 cm) over a poorly permeable second layer (50 cm,  $K = 0.05$  metre/day) and a highly permeable subsoil ( $KD = 1$  metre<sup>2</sup>/day). In this profile, a deep discharge in vertical direction through the second layer and in horizontal direction through the subsoil takes place. A shallow discharge in horizontal direction may occur, through the surface layer. There is surface run-off under

special conditions.

The occurrence of shallow discharge is determined by the relation between precipitation rate and infiltration capacity of the second layer. When the watertable remains below the top of this second layer, infiltration occurs in unsaturated soil, since infiltration capacity exceeds or practically equals the hydraulic conductivity of the second layer. But when the watertable reaches the top of the second layer, infiltration capacity becomes equal to the discharge rate of the drainage system in the highly permeable subsoil. The lower the initial watertable in the subsoil at the start of a rainy period, the longer the rain has to infiltrate into an unsaturated soil.

Good drainage can be achieved under the rainfall of the Netherlands with an adequate system of ditches and tile lines only if in the highly permeable subsoil, so reducing radial resistance. Otherwise trench drains must be used.

Promotor: Prof. Ir F. Hellinga

Author

294. J. W. VAN LIESHOUT Invloed van het bodemmilieu op ontwikkeling en activiteit van het wortelstelsel / *Effect of soil conditions on development and activity of the root system*. 1960, pp. 8 + 92. Du. a. Eng. summ. Also published as VLO 66.18 (1960).

The purpose of the study was to elucidate the function of roots under different natural conditions. A  $\text{KH}_2^{32}\text{PO}_4$  solution was injected in the soil and the  $^{32}\text{P}$ -uptake was estimated periodically in leaves or stems. After necessary corrections the root activity in the different layers of a soil profile could be estimated.

In deep humous sandy soils about 30% of the total root activity in the layer 0–80 cm occurred in the layer 40–80 cm; in shallow soils this figure was about 10%. In all profiles the 0–20 cm layer contributed about 50%.

The root mass accorded with root activity but its difference between the layers was much smaller. The effect on yield was clearest in dry years.

Deeper and more intensive cultivation increased root activity and mass in the subsoil but the effect on the yield was small, depending on the type of crop and environmental conditions.

In wet soils the root activity and mass decreased with increasing depth. In dry soils the root activity in the subsoil became higher than it was in the topsoil but did not prevent a reduction in yield.

Promotor: Prof. Dr A. C. Schuffelen

Ja.

295. J. BEKENDAM Inductie van mutaties bij rijst door röntgenbestraling / *Induction of mutations in rice by X-rays*. 1961, pp. 8 + 68. Du. a. Eng. summ. Also published in Meded. LH 61 (1961) 1.

The experiments described were intended to supply the Surinam rice-breeder with material for selection with mutations induced by X-rays and to find the most efficient way of procuring these mutations. The experiments used two of Surinam's commercial rice varieties, Nickerie and Holland.

The monogenic recessive chlorophyll mutations segregating in young  $X_2$  seedlings at the 2-leaf to 4-leaf stage were used as test mutations to investigate the frequency of factor mutations. X-rays induced useful mutations. Some  $X_2$ -mutants which seemed of little use to the breeder, segregated at  $F_3$  to yield further useful mutations.

The author drew several conclusions on method. By harvesting only the  $X_1$  head of the main stalk and the  $X_1$  heads of several of the first-formed primary stalks, which mutate independently of each other, the breeder would probably get the largest possible yield of factor mutations. For this purpose the breeder should set his plants so closely that only these stalks will develop. From the  $X_1$  heads only those with a fertility of 80–100% need be harvested. Useful mutations should be selected in  $X_2$  and in offspring of all lines related to  $X_2$  mutants.

Promotors: Prof. Dr Ir C. Coolhaas and Prof. Dr Ir J. C. Dorst d.H.

296. J. BUTIJN Bodembehandeling in de fruitteelt, Deel I, II and III / *Soil management in fruit culture. 1, 2, 3.* 1961, pp. 12 + 404. Du. summ. in Part 1 and 2. Eng. summ. in Part 3. Also published as VLO 66.7 (1961).

Part 1 discusses the influence of a number of physical factors, particularly moisture conditions. The most important of the trials were on the effect of soil moisture on fruit-trees, in particular on growth of shoots and fruits, fruit set and initiation of mixed buds. The watertable was of significance for the water supply necessary for rooting; standards were given for optimum humidity. The water and air balance of sample plots in an orchard with different soil profiles were estimated and differences were compared with the reactions of fruit trees. Finally water consumption and the optimum water table were considered.

Part 2 considers how soil chemistry influenced the trees. Critical values for the relation  $K/Mg$  were given as a measure of Mg deficiency. The influences of soil humidity, calcium status, nitrogen dressing and soil cover or soil vegetation on Mg deficiency were also studied. A number of soil factors or groups of soil factors were involved in the occurrence of iron deficiency. Standards were derived for zinc content of leaves, and some factors involved in zinc deficiency were detected. N deficiency was also studied.

How the standards derived could be applied to soil management in practice is indicated in the final chapter.

Promotors: Prof. Ir F. Hellinga and Prof. Dr A. C. Schuffelen H.

297. R. BEST Some aspects of photoperiodism in rice (*Oryza sativa* L.) 1961, pp. 16 + 88. Du. summ. (p. XI), Eng. summ after each chapter.

Photoperiodism was studied in 417 rice varieties of which 28, selected by differences in photoperiodic response, were studied in more detail. The plants were usually grown under 16 different photoperiods ranging from 5 to 24 h. In detailed experiments the types of response to short and long days were studied and each developmental stage of the plant from germination until grain maturation was examined separately. Particular attention was given to the juvenile phase, photoperiodic induction, reproductive development, varietal classification, and the construction of response curves. Response was plotted as time from sowing to floral initiation on the ordinate against photoperiod used on the abscissa. These curves gave much information on photoperiodic response of the varieties used.

Much detailed work was devoted to specific light effects such as: the perception of the photoperiod, the effects of alternating, increasing and decreasing photoperiods, light intensities, wave-length dependence, interrupted light and dark periods. The experimental data were used to interpret the photoperiodic response of rice plants grown in natural daylengths. Seasonal changes in cloudiness (monsoons) shortened twilight and daylength, thereby markedly affecting the time of flowering in very sensitive varieties.

Promotor: Prof. Dr Ir C. Coolhaas

Author

298. H. G. KRONENBERG Het risicodragende karakter van de tuinbouwproductie / *The hazardous nature of the horticultural production*. 1961, pp. 8 + 104. Du. a. Eng. summ. Also published as VLO 67.2 (1961).

Production in horticulture is always uncertain with many climatic hazards over normal production risks. Climatic conditions in the Netherlands were analysed. These conditions could be improved by greenhouses and shelter screens. The problems and risks were studied in apple, carrot and chrysanthemum. With apples night frost during blossoming reduced the crop once in three years by up to 70%. Hail too may cause serious damage. The fruit-grower had a chance of a serious loss of at least 8.8% every year.

Winter carrots in frames had 10% change of a 50% loss. Storing carrots in the open as 'underthatchers' (under straw in the open) was never safe and the loss may be 20 to 100%.

In open ground average day temperature and the minimum night temperature influenced the chrysanthemum crop. Excess rain may detract from the bloom quality.

It was difficult to calculate or estimate possible losses in horticultural production; a grower cannot foretell weather conditions. Detailed knowledge of growth conditions was also lacking.

A skilled man limits his risks. But skill is both an economic as well as a

technical conception; it is possible to eliminate risks but costs can be too high. Practical horticulture seldom takes precautions against rare events which cause slight damage: such damage is considered normal. If, however, an event occurs only seldom but can cause great damage a grower should lay store for such occasions.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

299. S. EL-SAMMAN. The biological value of proteins in mixed grass hays. 1961, pp. 8 + 84. Eng. a. Du. summ. Also published in Meded. LH 61 (1961) 3.

Biological values of protein in grasshays cut in two years and at different times of the year were estimated in 9 trials with groups of 2 to 4 male Texel lambs, by different methods: 1) the method of Thomas and Mitchell: a) assuming a value of 3.438 for metabolic faecal protein or b) using values estimated by pepsin-HCl digestion of the faeces; 2) different modifications of the nitrogen balance index method.

Protein-poor and moderate-protein diets were used with, respectively, 3.2–7.6 and 7.3–10.3% crude protein in dry matter. The average biological value of all hays in the low-protein diets was 89.3 and 89.9 and in the moderate-protein rations 77.8 and 75.7 (methods 1a and 1b resp.). Method 2 gave lower values, between 44.4 and 90.6. Biological value of protein in autumn hays was lower than in spring hays. Differences in composition of protein and non-protein N and heating in the stack may be partly responsible.

Promotor: Prof. Dr E. Brouwer

Wi.

300. H. N. HASSELO The soils of the lower eastern slopes of the Cameroon Mountain and their suitability for various perennial crops. 1961, pp. 8 + 68, Du. summ. (Eng. summ. of the last chapter).

On the eastern slopes of the Cameroon Mountains soils occurring below the 100-metre contour were surveyed on a scale 1:25,000. Most soils are young marine clay soils used for growing bananas, oilpalms, cocoa, rubber and tea. At some places there are lava streams from the mountains.

A more general soil survey was made of the younger and older volcanic soils above the 100-metre contour line and a map, scale 1:100,000, was produced.

The relative age of the various volcanic deposits could be estimated after completing the study of the origin, genesis and distribution of marine soils, that cover volcanic deposits in the lower part of the plain.

The discovery of beach walls at different levels formed as a result of differen-

ces in sea-levels and gradual rise of the land, helped to solve various soil problems. Most soils are K-deficient, especially young volcanic soils.

Promotor: Prof. Dr Ir C. H. Edelman

Bu.

301. H. A. SISSINGH Componenten van het fosfaat in de grond welke betrokken zijn bij de fosfaatvoorziening van de plant / *Components of the phosphate in the soil as related to the phosphate supply of plants*. 1961, pp. 130. Du. a. Eng. summ.

The phosphate supply of a plant largely depends on the amount of phosphate which can be released from phosphate reserves into the soil solution. The behaviour of exchangeable soil phosphate and the best method of estimating the isotopically exchangeable fraction was studied in pot experiments with oats and experiments with soil suspensions.

The kinetics of phosphate ions in soil suspensions were discussed. The results of the experiments indicated the course of the exchange of phosphate ions between the solution and the solid reserve. The isotopically exchangeable soil phosphate appeared to be heterogeneous in composition.

The quantity of isotopically exchangeable soil phosphate (L- and E-values) was calculated on the assumption that isotopic balance had been reached in the experiments at least for a certain part of the soil phosphate. For the L-value (determined in pot experiments) the consequences were studied of a lack of equilibrium.

Finally the quantities of phosphate absorbed by oat plants were compared with those withdrawn by ion exchangers from soil suspensions (of a soil with the same phosphate reserve).

Promotor: Prof. Dr A. C. Schuffelen

E.

302. E. C. M. RODERKERK Recreatie, recreatieverzorging en natuurbescherming in de Kennemerduinen / *Recreation, provision of recreational facilities and nature protection in the Kennemer dunes near Haarlem, the Netherlands*. 1961, pp. 224. Du. a. Eng. summ.

Type, nature and behaviour of visitors seeking recreation in the Kennemer Dunes National Park were studied to try to define their recreational needs.

The influence of the visitors on nature was examined. The area is undulating with a diverse landscape and is easily accessible to all types of traffic. The vegetation demonstrates innumerable variations of the calcareous dunes and the moist dune valleys. The establishment of a large lake gave a rich variety of birds.

The annual number of visitors steadily increased since opening. In 1959 there were 465,000. More than half the visitors cycled. Paddling pools attracted many

children. In 1959 30% of the campers came from abroad. Half of Dutch campers were only week-enders, two thirds of them from Amsterdam, but only half of the camping holiday-makers came from there. A sixth of both week-enders and holidaymakers came from Haarlem. About two thirds and three quarters of the respective groups camped as family groups.

The influence of recreational activities upon landscape, fauna and flora was appreciably less than that of water catchment, plantation, myxomatosis among rabbits and hunting requirements. Several measures were taken to protect landscape, flora and fauna.

Promotor: Prof. Dr Ir J. T. P. Bijhouwer

E.

303. C. J. SCHIPPER *Het caseinaatphosphaatcomplex van melk / The caseinate phosphate complex of milk.* 1961, pp. 142. Du. summ.

The properties of the complex of calcium phosphate and caseinate were studied by both analytical and synthetic methods. The first approach, based on a great number of analyses of milk from individual cows, demonstrated that the composition of the complex (ratio of the various components) was widely variable, and that also Mg, Na, K and citrate were part of it. Also the cation-binding capacity of casein was studied and found to depend on several factors. By simultaneous titration at constant pH of calcium hydroxide and phosphoric acid, a complex phosphate was precipitated (relation Ca/P about 1.4), which is neither an orthophosphate, nor a hydroxy-apatite. If this titration was in caseinate solutions, a 'complex' could be synthesized. Its properties were in most respects according to those of the complex of milk. Although no definite answer could be given to the problem of the kind of bond between caseinate and phosphate, some existing hypotheses could be ruled out. The complex phosphate has distinct ion-exchange properties.

Promotor: Prof. Dr H. Mulder

W.

304. M. I. FAHMY *The influence of clay particles on the hydraulic conductivity of sandy soils.* 1961, pp. 10 + 90. Eng. a. Du. summ.

The relation between hydraulic conductivity and size of the sand particles and clay content was investigated in artificial mixtures of sand and clay and in natural soils, in four different ways in the laboratory and field.

In the artificial mixtures coarse aggregates of illitic clay hardly influenced conductivity. In fine sand, fine-clay aggregates caused a rectilinear decrease in conductivity with increasing clay content, but in coarse sand the curve was concave, because clay aggregates first block the bigger pores which in coarse sand were most important for water movement.

In subsoil of natural marine sands with little clay the same relation proved

to exist between conductivity and the coarseness of the sand, as in clay-free sands but at a lower level. The influence of clay in reducing conductivity was similar in all coarse and fine sands. Small amounts of clay reduced conductivity considerably more than larger amounts, which agreed with the effect of adding fine clay aggregates to coarse artificial mixtures.

Field results from three methods yielded a table giving the relation.

Promotor: Prof. Dr Ir A. J. Zuur

Zu.

305. A. F. EL KHOLI An experimental study of the influence of the micro-elements on the uptake of macroelements by plants. 1961, pp. 80. Eng. a. Du. summ.

Since trace elements are generally involved in enzymic reactions taking place within the plant an imbalance in the trace nutrient supply could be expected also to affect the uptake of major elements by roots and their translocation through the plant.

Pot experiments with ascending doses of trace nutrients were carried out with oats, tomatoes and lucerne as test crops. Yields and the chemical composition of the crops were estimated. A significant effect of Zn was found on the yield of oats, while the yield of tomatoes was affected by B and Fe.

Consequently also varying amounts of major nutrients were removed by test plants from the culture medium. Uptake of N by oats and lucerne increased with B supply. But high levels of iron reduced the uptake of P in all three test crops. The total uptake of K, Mg and Na was also affected by interactions of various trace elements but no uniformity was found in reactions of the crops tested.

This absence of uniformity suggested that the observed effects were not caused by changes in the uptake mechanism but were due to differences in the general physiological condition of the plant.

Promotor: Prof. Dr A. C. Schuffelen

Ros.

306. A. J. H. VAN ES Between-animal variation in the amount of energy required for the maintenance of cows. 1961, pp. 8 + 116 + app. 8 (inserted). Eng. a. Du. summ. Also published as VLO 67.5 (1961).

To measure any between-animal differences in requirement of energy for maintenance of cows 38 metabolic balance trials were performed with 13 dry Friesian cows in their 7th month of pregnancy, on the same rations. For 6 of the cows measurements were also taken in the 9th month of pregnancy. A detailed description was given of new respiration chambers used and of techniques. The results of 237 balance trials with cattle with an energy balance between + 4000 and - 4000 kcal. described in the literature, were analysed statistically. In



this material between-animal variation in metabolizable energy for maintenance, corrected to the same bodyweight, reached about 11% and within some breeds 8–10%. In the author's trials, variation in Friesians was 4–8% similar to results of published trials. For both sets of data a reliable figure for between-animal variation needed exclusion of such factors as differences in ration, date of measurement and pregnancy. From the author's trials utilisation of metabolizable energy for growth of foetus, foetal membranes and udder was about half of that for fattening if it was assumed that pregnancy had no influence on maintenance requirement.

Promotor: Prof. Dr E. Brouwer

Author

307. F. F. R. KOENIGS The mechanical stability of clay soils as influenced by the moisture conditions and some other factors. 1961, pp. 16 + 172. Du. a. Eng. summ. Also published as VLO 67.7 (1961).

To test whether flocculation is a prerequisite for granulation and a water-stable structure or whether drying (close contact) is sufficient, homoionic suspensions were prepared from pure sodium, potassium, calcium or magnesium montmorillonite, illite or kaolinite and from the respective soil clays. Forms other than Na were prepared from Na suspensions without drying; the ultimate salt concentration was below flocculation value.

Suction-moisture curves were established and reswelling (pF 1 after positive pressure) was studied. Sodium clays except latosol swelled again completely after drying; potassium clays, except pure montmorillonite, swelled again completely up to high suctions; calcium and magnesium clays showed partial reswelling; latosol none, except with Na at high pH; pure illites swelled again but the soil clays behaved like soil montmorillonite. Inversion shaking was used to estimate the stability of granules formed by complete or partial water desorption. The stability of calcium and magnesium clays, and soil clays depended slightly on salt concentration; with Na or K, stability depended strongly on salt concentration, except in potassium illite soil clay; stability of all latosols decreased with salt concentration. The stability test was also employed to estimate the destruction caused by working the soil at different water contents. The phenomena observed could be explained by MADELUNG forces between parallel planes of clay minerals at short distance and by edge to plane attraction.

Promotor: Prof. Dr A. C. Schuffelen

Author

308. P. J. C. KUIPER The effects of environmental factors on the transpiration of leaves, with special reference to stomatal light response. 1961, pp. 8 + 50 (Notice inserted). Eng. a. Du. summ. Also published in Meded. LH 61 (1961) 7.

The transpiration of cut leaves (bean, tomato, *Hyoscyamus*) in potometers was studied as affected by light intensity, leaf temperature and air humidity, with special attention to stomatal light response. Fick's diffusion law could be applied to evaporation of water and to transpiration of leaves. Evaporation was found to be proportional to  $V\alpha$  ( $V$  = wind velocity),  $\alpha$  being 0.76 in turbulent air. Transpiration rate increased rectilinearly with light intensity below  $5 \times 10^4$  erg sec.<sup>-1</sup> cm<sup>-2</sup>, mainly through increase in leaf temperature by radiation with incandescent light, containing much infrared radiation; with fluorescent tubes, sodium lamps, or high-pressure mercury vapour lamps, transpiration increase was mainly due to increase in stomatal opening. Stomatal resistance to diffusion could be exactly determined by measurements on transpiration, leaf temperature and air humidity. Transpiration increases at higher light intensities (saturation) were entirely due to increase in leaf temperature.

Regulation of transpiration by small changes in stomatal resistance to diffusion was most pronounced at small stomatal apertures. In normal air, the stomatal response to light depended on photosynthesis of the guard cell chloroplasts (use of CO<sub>2</sub>) and the response of the guard cells to CO<sub>2</sub> (stomatal feed back, causing fluctuations in the degree of stomatal opening).

Promotor: Prof. Dr E. C. Wassink

E.

309. H. S. M. FAHMY Persistence of DDT and Parathion residues on a plant surface as influenced by weather factors. 1961, pp. 8 + 64. Eng. a. Du. summ. Also published in Meded. LH 61 (1961) 6.

The decay of DDT and parathion deposits under the influence of temperature, rain and ultraviolet radiation was described. Temperature and solar radiation were the main factors limiting the residual effect. High mean temperatures were more important than high maxima.

DDT residues were more persistent than parathion residues. A fraction of the parathion residue persisted for many days indicating the presence of parathion inside leaf tissues.

In the laboratory at high temperatures losses mainly occurred within the initial period of exposure; at moderate temperatures initial losses were much less but continued at a higher level over a longer period. Parathion residues were more temperature-sensitive than DDT residues.

DDT deposits showed a linear decrease with rain; the parathion residues decreased geometrically at first, then slowly. Losses were not proportional to rainfall.

Ultraviolet radiation was very effective in reducing the DDT and the parathion residue within a few hours. Moistening generally had a protective effect against radiation.

Promotor: Prof. Dr J. de Wilde

An.

310. P. K. SCHENK Biologie en bestrijding van *Urocystis gladiolicola* Ainsw. op gladiolen / *Biology and control of Urocystis gladiolicola* Ainsw. on gladioli. 1961, pp. 8 + 104. Du. a Eng. summ. Also published in *Tijdschr. Planteziekten* 67 (1961) 313-416 and as Lab. Bloembollenonderz., Publ. 149.

Symptoms, method of infection, course of the disease, influence of environment and the control of smut in *Gladiolus* were described. In the first year (S1) spores adhering to scales of corms and cormels or present in the soil caused infection, generally without conspicuous symptoms. The optimum soil temperature for infection was 20°C, the maximum about 24° and the minimum below 12°. Latent mycelium could be seen microscopically in the flesh of lifted corms with or without macroscopically visible symptoms (sori).

During storage at 13°-20° (in S1B) the mycelium grew slowly to the top of the corm.

In the second year (S2) symptoms appeared in parts above soil, only if the soil was cooler than about 20° and the mycelium reached the apical buds in time. At 24° the mycelium remained latent in the corms giving rise to apparently healthy plants. At 28° the fungus in the mother corm was inactivated and offspring was completely free of pathogen. A dip in an organic Hg fungicide before planting killed smut spores present in or on the corm's scales. Mycelium in the corm's flesh was killed in hot water (30-60 min at 47°), by prolonged soaking or anaerobic treatment or by dry storage at 34° for several weeks. Complete control in corms could thus be obtained by combining treatment with hot water and disinfection before planting.

Dry spores survived 30 min. at 60° but were killed after soaking in water at 53°C. As cormels could stand more heat than corms, 24-h soaking in water followed by hot-water treatment for 30 min. at 53° or 55° gave complete control.

Promotor: Prof. Dr Ir J. P. H. van der Want

Author

311. D. GROENVELD Investment for food. 1961, pp. 12 + 146. Du. summ. (p. XI) a. Eng. summ. (p. 100).

Groenveld attempted to show the magnitude of investments in agriculture, which were necessary to meet the increasing world demand for food. The formula  $S = K/Y (\Delta N + \Delta H)$  was assumed as a description that for a community the proportion of national income saved and invested must equal the product of proportional increase in population plus increase in income per head, and of the capital coefficient. Thus ensued the problem of allocating investments in agriculture and other sectors of the economy. In private investment decisions involved many people. For public investment decisions were usually central. But public complemented private investment. The figures for future demand for food were based on population size and estimated population growth, income per head and expected increase of it and income elasticity

of food costs. Changes in supply through rise in production from an increase in productivity were distinguished from changes through enlargement of agricultural area. Extrapolation of production from the period 1950–60 until the year 1980 showed that investments in Asia (other than China and the Soviet Union), Africa and Latin America should be about 10% higher to keep pace with demand for agricultural products. Groenveld believed the solution could be to raise public investment, which he then estimated to be about the same size as the private investments.

Promotor: Prof. Dr Th. L. M. Thurlings

Kr.

312. J. H. G. TICHELER Étude analytique de l'épidémiologie du scolyte des graines de café, *Stephanoderes hampei* Ferr., en Côte d'Ivoire / *Analysis of the epidemiology of the coffee berry borer, Stephanoderes hampei (Ferr.), in the Ivory Coast*. 1961, pp. 8 + 50, Fr. a. Du. summ. Also published in Meded. LH 61 (1961) 11.

After discussion of the distribution of the insect and of its taxonomic classification, demonstrating the synonymy of *S. hampei* (Ferr.) and *S. coffeae* Haged., an attempt was made to analyse the factors playing a role in the epidemiology of the pest.

Of climatic factors temperature favoured speed of development, slowing it down when the berries ripen and accelerating it after harvest, thus leading to a rapid exhaustion of available food supply. The rainfall distribution determined the growth cycle of the coffee berries and the relative humidity affected the incidence of fungal parasites of the beetle.

The quantity of food available provided for the yearly fluctuations in attack. The suitability of the berries for food depended on their maturity, which could be distinguished by the beetle. Characteristics of the berries provided possible resistance factors.

Of the predators man was the most important. Regular picking prevented the outbreak of an epidemic. The bionomics and importance of a hitherto unknown Bethyloid parasite of the beetle, *Cephalonomia stephanoderi* Betrem, were given. The flight muscle degeneration in the adult female beetle was described.

Promotor: Prof. Dr J. de Wilde

Author

313. J. P. M. VAN DER WOLF Virusoverdracht en vectorbestrijding in poot-aardappelgewassen / *Virus transmission and vector control in seed potatoes (Solanum tuberosum L.)*. 1961, pp. 88. Du a. Eng. summ. Also published in Pflanzenschutz-Nachrichten 'Bayer' 17 (1964) 3, Ger., Eng., Fr. and Span. editions.

The extensive literature concerning leafroll virus, virus Y and their vector *Myzus persicae* Sulz. was surveyed. The relations between virus, aphid and plant were discussed. In virus spread, endogenous infection (spread of virus within the field whereby virus diseased plants act as sources of infection) was distinguished from exogenous infection (virus introduced in the crop from outside by winged aphids). The main object of field experiments in seven years was to check the spread of virus in potato crops by spraying systemic aphicides. This vector control eliminated endogenous leafroll infection entirely.

The exogenous infection, was mostly far less extensive and was partially eliminated. Prevention by vector control of the spread of virus Y in potato crops gave varying results.

Endogenous infection by wingless aphids could indeed be eliminated entirely.

The endogenous and exogenous infections, sometimes so important, often mainly caused by winged non-potato aphids, when making their feeding punctures on the host plant without colonizing it, was however only partially eliminated. Yet vector control with aphicides was successful where in a crop virus-diseased plants occurred, which showed the symptoms of infection only after a considerable time.

Promotors: Prof. Dr Ir J. P. H. van der Want and Prof. Dr J. de Wilde Author

314. M. HAFEZ MOHAMMED Seasonal fluctuations of population density of the cabbage aphid, *Brevicoryne brassicae* (L.), in the Netherlands, and the role of its parasite, *Aphidius (Diaeretiella) rapae* (Curtis). 1961, pp. 8 + 104. Eng. a. Du. summ. Also published in *Tijdschr. Planteziekten* 67 (1961) 445-548.

*Brevicoryne brassicae* (L.) had 4-14 generations in the year, it overwintered in the egg stage on cruciferous plants and reached a peak of abundance on brussels sprouts in July, rapidly declined and increased again in September-October. The mid-season decline proved to be due to increased mortality rather than to reduction of reproduction or to migration.

Abiotic factors and biotic factors, entomophagous fungi, predators and parasites, *Aphidius rapae*, (Curtis) were all involved.

*A. rapae* was an internal parasite, only one adult emerged from each host. The parasite overwintered as a last-instar-larva inside the host. The adults emerged in spring. There were 5-11 generations a year each lasting 14-16 days. Eggs were deposited singly and at random in infested aphids. Half-grown nymphs seemed to be preferred to other stages and wingless to winged.

Parasitism eliminated reproduction completely if it occurred early in the host development but not necessarily if it were delayed until the fourth instar or later. Host development was always delayed.

Parasitism caused only a small proportion of total aphid mortality though it sometimes reached 80-90% of the stem-mothers on overwintered brussels

sprouts. Hyperparasites, like *Charips ancycocera*, reduced effectiveness. Also the slower development of *A. rapae* than of *B. brassicae* reduced its effectiveness.

Promotors: Prof. Dr J. de Wilde and Prof. Dr H. Klomp

An.

315. P. WALSTRA Enige gewichtsanalytische methoden ter bepaling van het vetgehalte van melk en melkproducten / *Gravimetric methods for the determination of the fat content of milk and milk products*. 1961, pp. 4 + 70. Du. a. Eng. summ. Also published in Meded. LH 61 (1961) 8.

The fat content of milk and milk products was estimated mostly by fast and simple, though often empirical methods, and reference to more absolute standard methods was necessary. Some of these reference methods were studied to obtain a complete picture of the exactitude, repeatability, utility and limitations of the various methods applied to various products. Special emphasis was laid on the recovery of fat and fat-like substances and on the contamination of the collected fat by non-fatty components and artefacts. The Röse Gottlieb method proved appropriate for most products. For cheese, the Schmid Bondzynski Ratzlaff method was recommended, but for most other products this method or its modifications were unsatisfactory. The Weibull method could not be recommended.

Promotor: Prof. Dr H. Mulder

Author

316. J. W. MENDER De invloed van koper, ijzer en mangaan bij het ontstaan van koelhuisgebreken van boter / *The influence of copper, iron and manganese on the development of cold-storage defects of butter*. 1961, pp. 6 + 80. Du. a. Eng. summ. Also published in Meded. LH 61 (1961).

It was found that the natural copper content of milk was high during the first weeks of lactation (up to 150 m $\mu$ g/kg) after it had been low during the first days after calving. In about one or two months the copper content went down to the normal level of about 20–40 m $\mu$  g/kg.

The development of cold-storage defects of butter was not influenced by the natural copper content of milk. The addition of minute quantities of copper salts to the milk (e.g. 20 m $\mu$  g/kg) caused pronounced oxidation defects in the resulting butter during storage. No effect resulted from addition of iron or manganese, nor did these metals interact with copper.

In the manufacture of butter with good keeping quality, avoiding any contamination with copper appeared to be essential.

Promotor: Prof. Dr H. Mulder

V.

317. Miss THEODORA F. S. M. VAN SCHAIK De betekenis van gezinsgrootte en geboortenummer voor de voeding en de voedings- en gezondheidstoestand van schoolkinderen / *The significance of family size and ranking-number with regard to dietary intake and nutritional and health status of school children*. 1961, pp. 182. Du. a. Eng. summ. Also published in *Voeding* 23 (1962) 104-274.

The study from September 1958 to June 1960 in the municipalities of Tilburg, in Brabant, and Leeuwarden, Sneek and Franeker in Friesland was on 480 children 8 years old from the lowest income classes and included children ranking second in a small family, and children ranking second and fifth in a large family.

The survey covered food pattern, haematological analysis, somatometric data, bone age and bone density, and environment to detect any differences in nutrition and health between the three groups.

Differences were most frequently pronounced in Tilburg between children ranking second in a small and large family. In Leeuwarden, Sneek and Franeker food intake and health of children ranking fifth in large families were poorer than in the other groups. Family size and ranking-number were both important determinants of nutritional status but social and economic conditions and household management also played a role.

Promotors: Prof. Dr C. den Hartog and Prof. Dr Ir M. J. L. Dols Author

318. B. BENVENUTI Farming in cultural change. 1961, pp. 36 + 470. Eng., Fr. a. Du. summ. Also published as *Bibliotheca Sociologia Ruralis* (Van Gorcum & Comp. N.V., Assen), No. 1.

The main purpose was to find the influence of cultural pattern on farm management. Benvenuti did not compare various regional patterns of culture; within one rural community, Winterswijk, he succeeded in explaining differences in farm management by the gradual replacement of a traditional pattern of culture by a modern one. The study is an important technical contribution to rural sociology through the novel method of measuring the patterns of culture. It was demonstrated that the modern farmer kept up with the modern rate of progress both in farm management and also in many other aspects of life. The pattern of culture had an impact on a very broad range of social phenomena as well as influencing the way a farmer organized his farm.

Promotor: Prof. Dr E. W. Hofstee

No.

319. G. B. STAAL Studies on the physiology of phase induction in *Locusta migratoria migratorioides* R. & F. 1961, pp. 12 + 124. Eng. a. Du. summ. Also published as LEB-Fonds Publ. 40 and as *Meded. Lab. Entomol.* 72.

External conditions such as lack of food and the consequent population density control the swarming of the migratory locust. The transformation is of metabolism and larval development as well as of behaviour. The proportions of body parts and the pigmentation change. As insect development is regulated by juvenile hormone and moulting hormone, there was also the possibility that they were involved in phase polymorphism.

The possibility of endocrine control was studied in some types of migratory locust by removing or implanting glands, by cutting nerves and by rearing under different conditions. For the surgical studies a technique was developed for routine operations on large numbers of second-instar larvae and for rapidly measuring the volume of endocrine glands. The green pigmentation of the solitary and the yellow of the gregarious imago was controlled by the juvenile hormone. Body proportions were also thus controlled independent of metamorphic regulation. Moulting hormone had a spectacular effect on development, moulting and body proportions. The studies may be of use in locust control with insect hormones.

Promotor: Prof. Dr J. de Wilde

Author

320. A. P. G. POYCK Farm studies in Iraq. (An agro-economic study of the agriculture of the Hilla-Diwaniya area in Iraq). 1962, pp. 8 + 100. Du. summ. Also published in Meded. LH 62 (1962) 1.

For a scheme of land improvement, an agro-economic survey was carried out in the Hilla-Diwaniya area in Iraq during 1958-9. After presenting general economic setting, the methods of obtaining the farm data were discussed. A classification was given of the areas studied. The economic data were compiled and analysed under the following main headings: population, land use and cropping pattern (including cultivation practices), livestock production, tenancy conditions, the farming unit, farmer's income, dietary habits and food intake.

Some general relations in subsistence farming were tested for the agriculture of the Hilla-Diwaniya area. By regression analysis the relation was analysed between farm size and labour force, between yield of barley and farm size, net income and farm size and between gross and net income and labour force.

Promotor: Prof. Ir J. H. L. Joosten

Lu.

321. W. SUIJSEMA Bloei van sering aan afgesneden takken / *Flowering of lilac on cut branches*. 1962, pp. 8 + 58. Du. a. Eng. summ. Also published in Meded. LH 62 (1962) 2 and as Lab. Tuinbouwplantenteelt, Publ. 222.

Investigations were described on the forcing of cut branches of *Syringa vulgaris* cv. Mad Stepman. Flower buds were initiated between approximately 21 June and 15 September. The stages of initiation were described and photo-



graphed. Flower buds were in summer rest from the beginning of June; this rest changed to winter rest with decreasing temperatures in September–October. Winter rest was shorter with low temperatures after the time of deepest rest (15–31 October). Winter rest could be broken artificially by 4 weeks at  $-1^{\circ}\text{C}$ .

Temperatures just above zero had a smaller rest-breaking effect, which decreased further if temperature rose to at least  $8^{\circ}\text{C}$ .

Outdoor rest was broken after 3 weeks temperatures below  $8^{\circ}\text{C}$ .  $\text{GA}_3$  (a gibberellin) did not break winter rest. After rest-breaking the base of cut branches had to be disinfected for 6 hours with 0.02% Scabex (organic mercury). Thereafter the buds could be brought into flower in a solution containing  $\text{AgNO}_3$  0.003 and oxytetracycline sulphate 0.003 (bactericides), cladox filtrate 5 (fungicide),  $\text{Ca}(\text{NO}_3)_2$  0.2, sucrose 3, boric acid 0.01, citric acid 0.02–0.01 and glycerol 0.1–0.2%.

Optimum temperatures during forcing were approximately  $24^{\circ}$ – $26^{\circ}\text{C}$ , gradually decreasing to at least  $18^{\circ}\text{C}$  during development of the racemes.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

322. L. A. H. DE SMET Het Dollardgebied. Bodemkundige en landbouwkundige onderzoekingen in het kader van de bodemkartering / *The Dollard area. Pedological and agricultural investigations connected with soil survey.* 1962, pp. 14 + 292. Eng. a. Ger. summ. Also published as VLO 67.16 (1962), serie De Bodemkartering van Nederland, deel XX.

The soil survey of the Dollard area was made to solve certain agricultural problems, especially those arising in the older polders. For these studies the value of the soils for different crops was assessed.

The region consists of Pleistocene and Holocene sediments. Its geological history could be compared with those of the other marine landscapes. Dating of the Holocene sediments proved that the first incursion was slightly younger than in the west of the Netherlands. In the 15th and 16th century the sea inundated a vast area of peat and two types of sediments were deposited. After the 16th century successive dikings took place, giving the Dollard its final form.

Loss of  $\text{CaCO}_3$  was 1% in 100 years, a lower figure than stated by older theories, which supposed a uniform  $\text{CaCO}_3$  content for newly reclaimed polders.

The suitability of these soils was studied by the 'determination-of-arrangement' method; in this method soils were grouped in sequence according to suitability for a range of crops, allowing also for non-soil factors. Drainability and possibilities of soil improvement were studied and mapped.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

323. H. DOING Systematische Ordnung und floristische Zusammensetzung Niederländischer Wald- und Gebüschgesellschaften / *Classification and floristic composition of woodland and shrub communities of the Netherlands*. 1962, pp. 12 + 86. Du. (p. IX) a. Eng. summ. (p. 73).

A new classification and description was given of woodland vegetation in the whole Netherlands. The principles were based on the French-Swiss system, although its disadvantages were avoided as much as possible. All species occurring in the communities were arranged in a set of 70 sociological groups, groups of species related by sociological affinities. The system evolved from the arrangement of these groups; the use of particular characteristic and differential species was avoided. For all groups, and for all species within the groups, a certain sequence was adopted, allowing comparison of all tables of associations and sub-alliances. Besides the floristic composition criteria other than characteristic, companion, casual or transgradient species were used for classification, such as structure and dynamics of the community and nature of adjacent and substituting communities. The woodland and shrub communities were separated into two chief formations.

Each association was reviewed according to habitat, area, geomorphological and dynamic position, importance for nature conservancy, landscape architecture, and forestry, its structure, floristic composition, sub-division (subassociations, geographic variation within the Netherlands) and seasonal aspects. Communities containing much *Rubus* were omitted.

Promotor: Prof. Dr H. J. Venema

E.

324. A. I. LABIB Potato proteins. Their properties and nutritive value. 1962, pp. 14 + 106. Eng., Du. a Arab. summ.

Physical and biological investigations were carried out on the nitrogenous substances in the potato tuber. The importance of the potato as a food was considered in the introduction. By paper electrophoresis proteins in potato tuber sap could be separated into at least six fractions. The protein patterns were characteristic for the four potato varieties studied.

A study was made of the nitrogen and amino acid distribution of potato tubers and the influence of storage on it.

For assessment of the nutritive value of the crude protein fraction of the potato it was concluded that a microbiological assay with *Terahymena pyriformis* W. was generally suitable as an index of biological value.

The nutritive value of the nitrogen of potato was not only dependent on amino acid composition of the protein but also largely on the free amino acids.

Promotor: Prof. Dr C. den Hartog

Gr.

325. J. G. TH. HERMSEN *Bastaard-necrose bij tarwe / Hybrid necrosis in wheat*. 1962, pp. 12 + 130. Du. a. Eng. summ. Also published as VLO 68.5 (1962).

Hybrid necrosis in wheat was shown to be based on two complementary genes  $Ne_1$  and  $Ne_2$ . Variation in degree of necrosis proved to depend on multiple alleles. The existence of weak, moderate and strong alleles of  $Ne_1$  and  $Ne_2$  could be demonstrated. The degree of necrosis was shown to depend also on environment. Normally lethal plants could even produce seed under artificial environmental conditions.

The author studied the sources of the necrosis genes and their distribution. The genotypes of wheat available were determined by test crosses while their origin was found where possible. The frequent use of certain carrier varieties as parents had contributed to the spread of necrotic genes.

All wheat varieties, selections and species studied (about 500) were classified into 3 genotype classes ( $Ne_1$ -carriers,  $Ne_2$ -carriers, non-carriers) with indication of the strength of the necrosis gene. In designing a wheat-crossing programme a breeder could thus ascertain whether the first filial generation would become necrotic and usually also the allelic combination of the first filial generation.

The occurrence of carrier and non-carrier lines in several varieties was shown to provide sometimes the possibility of avoiding necrosis.

Promotor: Prof. Dr Ir J. C. Dorst

d.H.

326. M. T. G. MEULENBERG *Vraaganalyse voor landbouwprodukten uit tijdreeksen (met een toepassing op de slamarkt) / Analysis of demand for agricultural products from time-series data (with reference to the lettuce market)*. 1962, pp. 8 + 134. Du. summ. after several sections. Eng. summ. Also published in Meded. LH 62 (1962) 3.

The study provides a critical evaluation on the theory of demand analysis and an empirical appraisal of the Dutch lettuce market.

A chapter on economic demand theory gives a critical survey of possible models of the demand function, their properties and usefulness for empirical research. The next chapter discusses some characteristics of agricultural products and markets of importance for a correct specification of the demand function. Chapter four discusses some statistical methods of estimating the demand function. This treatment is based on the use of vector spaces in statistical problems as developed by Kuiper (1952). Chapter five examines some well known demand studies made in the USA. In particular it was observed that in almost all studies the elasticities estimated by the limited-information method were greater than those estimated by the least-squares method.

Chapter six analyses the Dutch lettuce market. The many quantitative results on the influence of different factors on price and demand for lettuce showed that

expansion of lettuce production would be profitable only during the period November–March when export opportunities were good.

Promoters: Prof. Dr Th. L. M. Thurlings and Prof. Dr N. H. Kuiper Author

327. S. S. APTE Dormancy and sprouting in gladiolus. 1962, pp. 8 + 48. Eng. a. Du. summ. Also published in Meded. LH 62 (1962) 5.

The onset, level and disappearance of dormancy in corms and cormels of summer-flowering gladiolus cultivars were studied in relation to environmental conditions and reevaluated as an ecological adaptation. The cormels were more deeply dormant than their sister corms, which were most dormant when formed at higher temperatures and in longer photoperiods. The depth of dormancy therefore varied from year to year and from cultivar to cultivar. Dormancy disappeared during dry storage at all temperatures between 6° and 27°C but quickest at 6° or 10°C. These low temperatures were essential to keep cormels out of dormancy. Dormancy was not broken at any single temperature in moist soil; temperatures alternating between 10° and 22° were necessary. Sprouting of the cormels varied with the state of their shell and size. No correlation was found with respiration although CO<sub>2</sub> production of cormels with broken shells was 6–16 times as high as in intact cormels. The different depths of dormancy at planting were maintained throughout a long period in moist soil at 20°C. Plants grown from cormels stored at different temperatures produced the same numbers of corms and cormels, if the plants were the same age and were spaced alike.

Promotor: Prof. Dr Ir S. J. Wellensiek

F.

328. J. VAN BRAGT Chemogenetical investigations of flower colours in *Cyclamen*. 1962, pp. 8 + 44. Eng. a. Du. summ. Also published in Meded. LH 62 (1962) 4, and Lab. Tuinbouwplantenteelt, Publ. 223.

Flower pigments in cyclamen species, cultivars and crosses between cultivars were investigated to provide a basis for the description of cultivars and for breeding work. By paper chromatography, 14 anthocyanins and 8 flavonol glycosides were isolated. Two leuco-anthocyanins were found. The results of the analysis of flower-colouring flavonoids in wild species and cultivars were listed in tables. Analysis of the chemistry and genetics of crosses between cultivars confirmed the presence of genes *W*, *F*, *S* and *M*. Additional data were found on their effect in biosynthesis of flavonoids. Three new genes were detected: *X*, determining the glycosidic pattern of a flavonol glycoside, *Y*, determining the glycosidic pattern of an anthocyanin, and *Z*, determining the distribution of flower pigment.

A hypothesis on the effect of the genes in the biosynthesis of the flower-colouring flavonoids was proposed.

Promoters: Prof. Dr Ir S. J. Wellensiek and Prof. Dr H. J. den Hertog Author

329. L. H. A. HINDI The effect of skips on the grain yield of the adjacent hills in trials with maize hybrids under different conditions. 1962, pp. 8 + 34. Eng. a. Du. summ.

Experiments were carried out with maize during 1959–61 to find the effect of skips (gaps) on adjoining hills and some factors influencing this effect. The effect of skips was influenced by the size and shape of skips, the type of stand, nitrogen fertilizer, the maize hybrids and the weather.

There was an increase in the yield of hills adjoining a skip in the same row and in adjacent rows. The effect of a skip on the direct neighbour in the row was very high.

The present study clearly demonstrated that both size and shape of the skip had to be considered.

Hybrids differed widely in response to skips, stand and nitrogen levels.

The use of adjustment formulae based on the oversimplified concept of a constant adjustment percentage of compensation for the loss of yield due to skips generally led to erroneous conclusions.

The 'normal plant method' of adjustment gave the best estimate of plot yield.

Promotor: Prof. Dr Ir J. C. Dorst

d.H.

330. I. NAHAL Contribution à l'étude de la végétation dans le Baer-Bassit et le Djebel Alaouite de Syrie / *Contributions to the study of the vegetation of the Baer-Bassit and the Jebel Alaouite of Syria*. 1962, pp. 6 + 165. Fr., Eng., Du. a. Ital. summ. Also published in *Webbia* 16 (1962) 2: 477–641.

The Baer-Bassit and Alaouite Mountains are in north-west Syria. The Jebel Alaouite is composed of Jurassic and Cretaceous calcareous rocks, running north-south and culminating on 1580 m. The Baer-Bassit is hilly country with green rocks.

The climate is of Mediterranean type. Soil genesis and classification and degradation by the action of man were studied. Nahal related soil characteristics to the vegetation. The flora already showed its most prominent traits in the Pliocene. The pluvial periods during the Quaternary influenced its distribution; their effect was still visible.

Directions were worked out for the rational management and exploitation of the forests of *Pinus brutia* Ten., still in good condition, and the re-establishment of remnant forests of *Abies cilicica* (Ant. et Ky.) and *Cedrus libani* A. Rich.

The work closed with a synsystematic and synecological study of the most important tree association of Syria, the *Pistacieto-Quercetum calliprini*. The importance of the progressive and regressive phases of photodynamic successions for the forester was pointed out.

Promotor: Prof. Dr H. J. Venema

E.

331. M. K. M. T. HIGAZY Shortening the juvenile phase for flowering. 1962, pp. 8 + 54. Eng. a. Du. summ. Also published in Meded. LH 62 (1962) 8.

Higazy tried to determine whether the duration of the juvenile phase for flowering was a fixed character or whether it could be influenced by external growth factors.

*Lunaria biennis* was chosen as a cold-requiring biennial, *Silene armeria* as a long-day plant and *Salvia occidentalis* as a short-day plant. In *L. biennis* photosynthesis shortened the juvenile phase. In general young plants could not be vernalized and especially in dim light remained completely juvenile. Older plants after either bright light or dim needed relatively little cold. There was an intermediate transitory stage, requiring more cold the younger the plants, especially after dim light. Incomplete vernalization resulted mainly in lateral flower buds, which was explained by leaf vernalization. Soil moisture, N, P and K hardly shortened the juvenile phase. Gibberellic acid (GA) lowered the percentage of generative plants in every age group for bright light after vernalization during 12 weeks, and hence tended to maintain juvenility. GA accelerated however the realization of flower bud formation after both bright or dim light.

The short juvenile phase of *S. armeria* could be reduced by 18 to 27 days of bright light. GA reduced it only a little, especially with bright light. *Salvia occidentalis* tended to flower more if propagated vegetatively than from seed. Light intensity had no influence and GA only a slight influence.

So factors promoting vegetative growth and prolonging active growth would shorten the juvenile phase of herbaceous plants.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

332. W. A. P. BAKERMANS Bewaring van voederbieten. I. Onderzoekingen over de betekenis van de grond, de bemesting en enkele andere cultuurmethoden voor de bewaarbaarheid van voederbieten / *Storage of fodder beets I. Investigations into the importance of soil, fertilization and some other cultivation methods on the keeping qualities of fodder beets*. 1962, pp. 12 + 138. Du. summ. after each chapter. Eng. summ. Also published as VLO 68.10 (1962).

The following conclusions from experiments can be mentioned.

True pathogenous fungi and bacteria are of minor importance in storage. Clamp rot consists mainly of infection by secondary fungi and bacteria. The

resistance of beets to these fungi depends on storage condition and on conditions during growth. Temperature and humidity are of importance during the storage of beets. If the temperature is below  $-3^{\circ}\text{C}$ , beets freeze; if it is too high, respiratory losses are high and the beets soon start rotting. Beets desiccate easily and the storage quality of desiccated beets is poor.

Harvesting and cultural methods should be directed to the storage of well ripened, healthy and undamaged beets in the clamp. Beet rot usually begins at damaged places, therefore deep topping, damaging and wounding of beets should be prevented. Storage quality is improved by early sowing and late harvesting. N, K, Mg and Na dressing showed a more distinct effect on the keeping qualities than on the beet yield. P and B dressings, however, did not affect the storage quality.

On sandy soils in the Netherlands the storage quality and the yield may often be improved by rational fertilization.

Promotor: Prof. Ir M. L. 't Hart

Author

333. S. R. H. SHAH Studies on wind protection, 1962, pp. 10 + 114. Eng., Fr. a. Du. summ.

Directives were drafted for different aspects of wind protection and shelterbelts. An analysis was made of the effects of wind and protection on crop yields, and the establishment of shelterbelts was discussed. The respective increases in yield of bean and maize crops, in the protected zone of the windbreak in the experimental field, were only 12 and 17% in 1960 by accumulation of moisture behind the windbreak, through excessive rainfall and partial rotting of the bean plants. For maize a height and width of windbreak of 2 m and 6 m, respectively, was too small.

In a wind tunnel in a greenhouse the yield of bean seed was 67% higher in the protected zone. In pot experiments the respective yields of bean seed and dry weight of maize plants increased by 28% and 11%.

The optimum shelterbelt design was estimated by models in a wind tunnel. Shelterbelts mainly improve temperature, transpiration rate and soil moisture conservation, and also prevent mechanical injury of plants. This results in an increased photosynthetic surface and a better relation shoot/root. The Shamin shelterbelt model proved best for large areas, the Ali and Usman models for smaller ones. The planning, administration and management of shelterbelts were discussed.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

334. B. MARIS Analyse van aardappelpopulaties ten dienste van de veredeling / *Analysis of potato populations as an aid in breeding*. 1962, pp. 16 + 208. Du. a. Eng. summ. Also published as VLO 68.8 (1962).

A method was worked out for roughly predicting time of ripening of seedlings a few weeks after sowing. The method was tested by growing seedlings for several consecutive years and the clonal generations were studied and analysed for many other characters. Descriptions included both specific characters and general impression of the whole clones at various stages in successive years. The data were used to evaluate the practice of breeders of maintaining selection only on material which visually conforms to most of their objectives.

To avoid or diminish the risk that many valuable clones would be lost the author suggested as a more rational procedure to raise fewer first-year seedlings, to classify these seedlings according to foliage length as a means of estimating approximate maturity in an early stage and to discard only the poor clones instead of retaining only the 'good' ones, until a sufficient number of tubers is available for trials which are statistically sound.

Promotor: Prof. Dr Ir J. C. Dorst

d.H.

335. P. F. J. VAN BURG *Interne stikstofbalans, produktie van droge stof en veroudering bij gras / Internal nitrogen balance, production of dry matter and ageing of herbage and grass.* 1962, pp. 14 + 132. Du. a. Eng. summ. Also published as VLO 68.12 (1962).

The effects of nitrogen supply and growth period on yield and quality of herbage were studied. It was shown that internal nitrate content was a good measure of the nitrogen status of herbage. Maximum output from grassland could not be obtained if internal nitrate concentration in the herbage remained below about 100 mmol per kg dry matter. This figure held for dressing with ammonium nitrate, limestone and calcium nitrate. It did not apply to application of ammonium sulphate except where conditions favoured nitrification. Ageing was accompanied by a decrease in total N and an increase in crude fibre. In young herbage, crude fibre decreased with N dressing (if yield had not yet increased considerably by fertilizer), but increased in old herbage when the yield had been increased considerably by fertilizer. At one yield level, crude fibre always decreased with increasing rates of nitrogen. Both growth period and nitrogen fertilizer affected the botanical composition of herbage and the morphological composition of the herbage components. Grass leaf had more crude fibre than dandelion leaf and leaves were lower in crude fibre than stems.

Promotor: Prof. Ir M. L. 't Hart

Author

336. A. J. HAVINGA *Een palynologisch onderzoek van in dekzand ontwikkelde bodemprofielen / A palynological investigation of soil profiles developed in cover sand.* 1962, pp. 4 + 168. Du. a. Eng. summ.



The relation was studied between vegetational development and soil formation in the Pleistocene cover sands in the Netherlands, particularly whether forests, rather than heaths, were early involved in the formation of podsol soils. The pollen content of profiles of various podsoles and some gleys were examined, all lying below layers of drift sand and peat of various ages. Beyerrinck's palynological method had to be extended with a study of the significance of sand diagrams. In an undisturbed podsol pollen decreased in concentration roughly geometrically from the sand surface downward.

A relation could be observed between the length of the vertical distribution of pollen (pollen profile) and the depth above, in which the original stratification of the Eolian cover sand had entirely disappeared.

It was concluded that most of the pollen permeated before podsolisation, during the biologically very active stage of the homogeneous forest profile. The lowest part of the pollen profile, already fixed, constantly 'grew' on the top through addition of continually younger spectra; in later degradation stages illuviation of pollen could also become significant. A paucity of tree pollen in the whole spectrum could occur after various types of vegetation and after certain conditions of soil moisture.

During the Boreal, Atlantic and Fagus-Carpinus period both homogeneous forest profiles and podsol profiles occurred under diverse vegetation. During each of these periods homogeneous forest profiles were degraded to new podsol profiles.

Promotor: Prof. Dr Ir C. H. Edelman

E.

337. A. M. M. F. MONIB The calcium-paracaseinate-phosphate-complex under conditions similar to those in cheese. 1962, pp. 8 + 76. Eng. a. Du. summ. Also published in Meded. LH 62 (1962) 10.

The complex of calcium-paracaseinate-phosphate is the matrix substance of cheese. The changes it undergoes during maturing determines many characteristics of the finished product.

The preliminary studies of the effect of pH and sodium chloride on the swelling and solubility of the paracasein-complex did not reflect the actual situation in cheese. This was the result of using a diluted cheese extract or suspensions of a few grams of paracasein complex in a large volume of water, instead of using concentrations occurring in cheese.

The experiments demonstrated that the peptizing effect of salt on the paracasein complex was enormously influenced by the ratio of paracasein complex to water. In diluted suspensions which showed significant peptization, the concentration of calcium was very much lower than in cheese. The peptization of the paracasein complex however was much reduced by calcium. The results of this study revealed that swelling in the reconstituted cheese was fairly limited, when pH and calcium and sodium chloride contents were similar to the actual

condition in cheese, and that relatively small variations in the conditions mentioned caused no real change in the swelling.

Promotor: Prof. Dr H. Mulder

v.d.H.

338. P. A. SCHIPPERS Investigations about the possibility to measure quality characteristics of cooked potatoes by instrumental methods. 1962, pp. 10 + 114. Eng. a. Du. summ.

Instrumental methods were developed to evaluate several properties of cooked potatoes: mealiness, softness (consistency), sloughing (disintegration), dryness, (coarseness of) structure, yellowness, discoloration and falling apart. Advantages (and some disadvantages of instrumental methods over sensory ones were discussed. There was little relation between specific gravity and texture.

Mealiness was measured by the stickiness after mashing, and softness by resistance of the potatoes to pressure by a metal bar driven into the potato. For sloughing no mechanical method seemed suitable. Fibrousness was estimated by staining xylem. A quick and sufficiently accurate method for measuring colour was described. The results of the method of estimating discoloration varied but were promising. Limitations of the methods were discussed. Suggestions were made for further research to fill gaps in knowledge of the physical and chemical background of quality.

Promotor: Prof. Dr C. den Hartog

Author

339. G. P. TERMOHLEN Onderzoekingen over kurkwortel van tomaat en over de kurkwortelschimmel / *Studies on corky root of tomato and the corky root fungus*. 1962, pp. 8 + 74. Du. a. Eng. summ. Also published in *Tijdschr. Plantenziekten* 68 (1962) 295-367, as Meded. IPO 281 and as Proefstat. Groenten en Fruitteelt onder glas, Naaldwijk, Publ. 99.

Termohlen proved that corky root was caused by a fungus, which was readily isolated and cultivated. The fungus did not sporulate but several isolates made sclerotia on agar. Its features on nutrient medium were described. The fungus had not been named. Isolates varied greatly in pathogenicity. The pathogen remained in the soil as mycelium in root debris and possibly also as sclerotia.

Besides the tomato several other Solanaceae were susceptible to corky root. From *Physochlaena orientalis* and cucumber the pathogen could be isolated; these plants, however, did not show any symptoms and were thus carriers. Rotation experiments with cucumber and some other crops alternating with tomato had but little effect on the inoculum potential of the soil

Control was by steaming the soil or disinfecting it with chloropicrin. DD had no effect.

All cultivated varieties of tomato so far tested were susceptible. *Lycopersicum glandulosum*, *L. peruvianum* and *L. hirsutum* were highly resistant. Crosses to obtain resistant tomato varieties were made. The first filial generation of the crossing *L. esculentum* with *L. hirsutum* was resistant and suitable as a root stock for the tomato but it was susceptible to eelworm infestation.

Promotor: Prof. Dr A. J. P. Oort

O.

340. J. H. LABUSCHAGNE Churning in the absence of air. 1963, pp. 10 + 78. Eng. a. Du. summ.

The phenomena of aggregation and disruption of fat globules in cream subjected to viscous flow were studied, and special care was taken to exclude air bubbles. In classical churning processes the incorporation of air was essential, but it was clearly shown that also in the absence of air rapid and efficient churning was possible. Churning was shown to be satisfactory at a fairly narrow range of shearing rates; higher and lower rates led to excessive churning times, or to abnormal butter formation and high fat content in the buttermilk. The experiments were performed in a cylindrical vessel in which a concentric solid cylinder could be rotated at different speeds. The influence of shear rate (cylinder velocity, annular clearance and cream viscosity), temperature, fat content, acidity and fat globule size were studied in relation to churning time and efficiency. Partly empirical equations were derived, describing the relations. A churning time of a few seconds and a fat content in the buttermilk below 1% could easily be achieved.

Promotor: Prof. Dr H. Mulder

W.

341. J. KORTLEVEN Kwantitatieve aspecten van humusopbouw en humusafbraak / *Quantitative aspects of increase and decrease in humus*. 1963, pp. 8 + 110. Du. a. Ger. summ. Also published as VLO 69.1 (1963).

Some common expressions on humus were current that were not based on exact or quantitatively analysed data.

To achieve a desirable humus content, it was necessary to know the relation between supply of humus and humus content, here studied, and the relation between humus content and productivity.

A field trial begun in 1911 to compare complete fallow with normal exploitation indicated two axioms: from a supply of crude organic matter a certain constant part became humus each year; from humus in soils a certain constant part was mineralized each year.

If supply was equal each year it was possible to derive the following formula for the rise or fall in humus content:

$$y = y_m - (y_m - y_0) (1 - K_2)^t,$$

where  $y$  = humus content,  $y_m$  = humus content at ultimate equilibrium,  $y_0$  = initial humus content,  $K_2$  = rate of mineralization (see axiom 2), and  $t$  = time in years. Further  $y_m = \frac{K_1}{K_2} x$ , where  $K_1$  = rate of humification (see axiom 1), and  $x$  = supply with raw organic material.

These formulae were tested in the few available experiments, suitable for the purpose (which did not include the classical Rothamsted fields).  $K_1$  was 0.4; thus 40% of the supply becomes humus each year.  $K_2$  had values between 0.015 and 0.02; from this it followed that 2% of the humus was yearly mineralized. No difference was yet found in the value of either coefficients for different organic materials and in different soils.

Promotor: Prof. Dr A. C. Schuffelen

Author

342. A. W. VAN DEN BAN Boer en landbouwvoorlichting. De communicatie van nieuwe landbouwmethoden / *The communication of new farming practices in the Netherlands*. 1963, pp. 16 + 280. Eng. summ. Also published as VLO 69.3 (1963).

Literature was reviewed on the communication of new farming practices stressing the effects on the cultural pattern of the farmers and the function of personal influence. Three villages differing in contacts with urban culture and in adoption of new practices were studied empirically. An analysis was made of the advisory media used by the farmers.

Mass media created awareness of and interest in new practices but farmers did not adopt them without personal contacts with people they could trust. Most of these contacts were with other farmers but the most influential farmers had frequent contacts with extension officers, especially in high-adoption communities. A revision of the hypothesis of two-step flow of communications was suggested. Factor analysis of 15 major variables demonstrated that adoption of new practices was mainly related to social status and contact with extension. Group norms had considerable influence on the adoption level of group members. Suggestions were made for the extension service.

Promotor: Prof. Dr E. W. Hofstee

Author

343. R. BERGSMA Op weg naar een nieuw cultuurpatroon. Studie van de reactie op het moderne cultuurpatroon in de Dokkumer Wouden / *Towards a new pattern of culture. Inquiry into the reaction to the modern pattern of culture in the Dokkumer Wouden*. 1963, pp. 12 + 228. Du. a. Eng. summ. Also published as Bibliotheca Sociologica Ruralis (Van Gorcum & Comp. N.V., Assen) No. 2.

Bergsma made a sociological inquiry into the nature of the many rural changes and the factors promoting or retarding them.

Rural culture in the Dokkumer Wouden did not change fragmentarily but the social changes formed a pattern. Multivariate analysis yielded a measure of the acceptance of the modern pattern of culture. On this basis important factors which influenced progressiveness, were age, farm size, the influence of local and religious groups, and the role of local leaders. The author examined the interrelations of these five factors.

Promotor: Prof. Dr E. W. Hofstee

No.

344. J. F. DE BEER Influences of temperature on *Arachis hypogaea* L., with special reference to its pollen viability. 1963, pp. 8 + 82. Eng. a. Du. summ. Also published as VLO 69.2 (1963).

The influence was investigated of temperature on growth and development of groundnut, cv. Schwarz 21, Mallorca and Ukraine. Except where stated, all conclusions refer to Schwarz 21. Seed germination was not seriously influenced between 24° and 33°C, although the higher temperatures favoured germination and seedling development (Mallorca needed lower temperatures). Constant 33° gave longest stems, most leaves, greatest area of foliage and so higher dry weights of aerial plant parts, but decreased pod production. At 24° vegetative growth was less, despite larger leaves and more pods. The optimum seemed to be 28°.

The change from 24° to 33° and from 33° to 24° at various developmental stages showed vegetative growth and flowering complementing each other. Together, however, they competed with fruit set. At 33° the calyx tube was longer and so was the distance travelled by the pollen to effect fertilization. Warmth 36–96 h before flowers opened decreased pollen number and viability. Flowers did not last so long. Vegetative growth was more promoted than generative growth. These observations together probably largely explain the poor setting of fruit at high temperatures.

Pollen viability seemed influenced by day and hour of sampling but not by boron sprays.

Promotor: Prof. Dr Ir J. D. Ferwerda

E.

345. Miss ANNIE S. N. LIEM De invloed van auxine, tryptofaan en enige anorganische zouten op de infectie van *Nicotiana glutinosa* met tabaksmozaïekvirus / *The influence of auxin, tryptophane and some inorganic salts on the infection of Nicotiana glutinosa with tobacco mosaic virus*. 1963, pp. 8 + 80. Du. a. Eng. summ. Also published as VLO 69.4 (1963).

The number of necrotic spots arising on leaves of *Nicotiana glutinosa* after inoculation with tobacco mosaic virus was less than in controls without additives, if the water in which the leaves floated had  $\beta$ -indoleacetic acid (IAA),  $\alpha$ -naphthylacetic acid (NAA) or 2,4-dichlorophenoxyacetic acid (2,4-D) in correct concentrations, added 16 h before (IAA also after) inoculation. This reaction occurred always in weak light but not always in strong light. D-tryptophan, but not DL and L isomers, caused a similar effect in only half the tests. *In vitro* IAA did not inactivate the virus.

IAA, NAA and 2,4-D all decreased the osmotic pressure of the leaf sap of plants in weak light. IAA also decreased the conductivity of the sap of floating leaves by exosmosis. Leaves of plants in strong light had higher osmotic pressure, but if both leaf types were floated on water, the difference in osmotic pressure disappeared. Yet water absorption seemed not to be directly related to the decrease in osmotic pressure with IAA.

A mixture of  $\text{Ca}(\text{NO}_3)_2$ ,  $\text{KNO}_3$  and  $\text{MgSO}_4$  increased osmotic pressure and number of necrotic spots, although less with IAA than without it.  $\text{Ca}^{2+}$  increased and  $\text{K}^+$  and  $\text{Mg}^{2+}$  decreased number of spots. Perhaps phosphate-buffer enhanced auxin production, so masking the influence of the applied IAA.

Probably IAA stimulated synthesis of enzymes and specific nucleic acid, so using up compounds needed for virus synthesis.

Promoters: Prof. Dr Ir J. P. H. van der Want  
and Prof. Dr M. H. van Raalte

E.

346. P. J. ENTE Een bodemkartering van het tuinbouwcentrum De Streek / *A soil survey of the horticultural centre De Streek*. 1963, pp. 12 + 194. Eng. summ. Also published as VLO 68.16 (1963), and as serie De Bodemkartering van Nederland, deel XXI.

Problems of shrinkage and soil improvement and the reallocation of this canal-rich horticultural area lacking normal roads led to this soil survey. Geologically, the region consists mainly of marine sediments. After deposition of the Old Marine clays and sands, the West Frisian Marine Clay (I and II) was deposited (1900–1200 B.C.). A recession followed and peat grew on some sites. Inversion of this landscape and lake-filling gave West Friesland its final shape and settlement became possible (1200 A.D.). Since then horticulture has developed gradually. Typical for this area are numerous man-made soils, constructed with humus-rich mud from the canals.

The evaluation of the soils was carried out by studying of soil moisture (pF curves). It was concluded that there was more relation between moisture content at pF 4.2 and lutum content than between field capacity (pF 2.0) and lutum content. Future shrinkage after drainage was calculated from bulk densities. Vegetational and settlement history were reconstructed.

A special study on the unusual relation between the low-lying position of West-Friesland and former sea levels showed that it was due to compaction of

older sediments and possibly greater tidal ranges during the West Frisian Marine Clay sedimentation.

Promotor: Prof. Dr Ir C. H. Edelman

v.d.B.

347. M. S. RAOUF Continuous mixing of solids. 1963, pp. 8 + 74. Eng. a. Du. summ. Also published in Meded. LH 63 (1963) 4.

The most important literature on theoretical aspects of mixing solids was reviewed.

Only when the mixed materials showed no segregation it was possible to analyse the mixing process quantitatively. In this case the mixture could be described by the 'χ' Square test. Longitudinal mixing could be studied by estimating the spread in residence times.

In two common types of mixers the mixing was studied of two kinds of granular materials, differing only in colour of granules. (Colour had no influence on mixing.)

In a continuously operating semi-technical 'Spaans' screw and ribbon mixer the mixing proceeded rapidly but irregularly. The minimal mixer length necessary for apparent completion of mixing decreased at higher speeds of rotation. The performance of a more widely pitched screw and ribbon element was slightly better. The spread in residence times was appreciable. Longitudinal mixing was slightly more intensive at higher speeds of rotation, wider screw and ribbon pitches and greater mixer lengths.

In a mixer consisting of a simple, rotating, slightly inclined, partially filled, hollow cylinder mixing proceeded more gradually. Mixing was 'diffusive'. The mixing rate increased with increased rotational speed, increased wall roughness and decreasing feed rate. Longitudinal mixing proved to be very limited.

Promotors: Prof. Dr Ir H. A. Leniger and Prof. Dr N. H. Kuiper

Bev.

348. J. F. WIENK Photoperiodic effects in *Vigna unguiculata* (L.) Walp. 1963, pp. 8 + 82. Eng. a. Du summ. Also published in Meded. LH 63 (1963) 3.

Lengthening of daylight with fluorescent light (intensity 6000 erg/sec/cm<sup>2</sup>) from 6 to 24 h for 15 days increased stem length, internode length, number of leaves and leaf size in 16 varieties of cowpea. Four varietal types of growth habit could be distinguished. Experiments on vegetative growth were mainly with varieties whose growth was inhibited in short days (SD) before the onset of flowering (not reversed by subsequent long days (LD)), whereas in LD growth continued for at least 6 to 7 months. The SD stimulus was perceived by the leaves and its effect increased with number of leaves. Preceding LD treatment decreased or nullified sensitivity to SD. The inhibitive effect of SD on stem elongation could partly be overcome by gibberellic acid or dimmer light. In

SD a diurnal change of temperature from 30°C during day to 20° at night (less at 15°) favoured stem elongation. It was suggested that in SD growth inhibitors and in LD growth promoters were produced.

The cowpea flowered only in SD, except the variety Early Red which showed an ambi-photoperiodic reaction. Photoperiods from 8 to 11 h proved to be optimum to initiate inflorescence. Photoperiodic influences on development and flowering of the inflorescences were also investigated, as well as those of position and removal of leaves. The practical value of the results for growing cowpeas was assessed.

Promotor: Prof. Dr Ir J. D. Ferwerda

E.

349. J. KOOPS Koelhuisgebreken van boter / *Cold storage defects of butter*. 1963, pp. 12 + 194. Du. a. Eng. summ. Also published as Versl. Ned. Inst. Zuivelonderzoek 80.

Cold-storage defects of butter originate from the oxidation of unsaturated fatty acids. Phospholipids are much more susceptible to oxidation than is butter fat; oxidation starts with phospholipids.

By the Warburg-method oxygen absorption of butterfat and of phospholipids were measured under different conditions. With decreasing pH, oxygen consumption increased appreciably, and copper accelerated the rate of oxidation. It was observed that oxidation of the phospholipids started with the cephalin fraction. From a study of the composition of the membrane of the fat globule and its susceptibility to oxidation, further conclusions could be drawn on the influence of pH, addition of copper and other ions, addition of protein, influence of temperature and addition of anti-oxidants.

Finally, studies on copper distribution in milk constituents under different conditions allowed a satisfactory explanation of a number of observations on the arisal of cold storage defects in butter.

Some practical measures to prevent defects through cold storage were discussed.

Promotor: Prof. Dr H. Mulder

V.

350. J. H. VAN ROON Invloed van eiwitbestanddelen der tarwe op de vetresorptie bij darmpatiënten / *Influence of protein constituents of wheat on fat absorption by patients with intestinal disorders*. 1963, pp. 76. Du., Eng. and Ger. summ.

Water-insoluble proteins in wheat gluten, their probable heterogeneity and the toxicity of wheat proteins in the occurrence of intestinal diseases affecting fat absorption were reviewed.

Gliadin was broken down by pepsin and trypsin to a peptide mixture. In



continuance of an investigation of the coeliac disease by other research workers, fractions were isolated from this peptide mixture and tested for toxicity in patients with idiopathic steatorrhoea.

An acid peptide fraction obtained by adsorption on acid aluminium oxide was toxic. Disulphide bonds between peptide chains proved not to be responsible for this toxicity. Probably it was a mixture of a small group of related peptides containing about 35 amino acids.

Promotor: Prof. Dr C. den Hartog

Gr.

351. J. KEESTRA Melkbaarheidsonderzoek bij het zwartbonte vee in Friesland / *Examination of the ease of milking of Friesian cattle in Friesland*. 1963, pp. 12 + 154. Du. a. Eng. summ. Also published as VLO 69.5 (1963).

Various aspects of the ease of milking of more than a thousand cows were studied with a Gascoigne individual-quarter milking machine (pulsation ratio 3:1, pulsation rate 60 cycles per minute). Progeny groups from 17 bulls used in artificial insemination (420 heifers) were recorded twice and 75 cows on 9 different farms were tested on 16 occasions during lactation.

Wide variation existed in peak flow ( $\bar{x} = 2.13$ ,  $\sigma = 0.70$ , C.V. = 33%) and average flow ( $\bar{x} = 1.70$ ,  $\sigma = 0.58$ , C.V. = 34%). From paternal half-sib correlations, high heritability estimates of  $0.65 \pm 0.11$  and  $0.56 \pm 0.10$  were found for these features. Selection on peak flow could be especially effective. An accurate progeny test could be based on a sample of 25 daughters, while individual cows (bull dams) could be tested very accurately with 4 test milkings (repeatability 0.7). A correction for a standard milk yield of 7 kg was necessary for comparison.

There was a sufficient variation in percentage milk in fore quarters  $\bar{x} = 43.5$ ,  $\sigma = 6.05$ , but heritability was lower ( $0.26 \pm 0.28$ ). No significant correlation was found with peak flow, machine time and quantity of stripping. Selection on this character was of minor importance.

The average stripping yield by hand was 361 ml with wide variation, but very low heritability ( $0.12 \pm 0.24$ ). Selection on this character was almost impossible.

Promotor: Prof. Dr Th. Stegenga

Po.

352. W. P. GROBBELAAR Responses of young maize plants to root temperatures. 1963. pp. 8 + 72. Eng. a. Du. summ. Also published in Meded. LH 63 (1963) 5.

The effect of root temperatures on growth, water uptake and ion uptake of the maize single cross  $K_{64r} \times E_{184}$  has been studied during the early vegetative phase in culture solution in temperature-controlled rooms. A root temperature

range of 5°–40°C with 5°C increments, a constant air temperature of 20°C, and a constant light intensity were employed throughout.

The optimum temperature range for root growth was found to be 20°–30°C (distinctly less at 35°C, mainly by less seed-root growth), that for shoot growth 25°–35°C. The influence of root temperature on shoot apices was also estimated. Leaf initiation and elongation were most rapid between 25° and 35°C, as also the total leaf length per plant. The longest ultimate individual leaf size was however reached between 15° and 25°C. An attempt was made to explain the influence of temperature on content of dry matter and water-soluble carbohydrate in roots and shoots. Root temperature influenced the relation root/shoot. An analysis of the net assimilation rate, transpiration rate and rate of ion uptake and proportional growth revealed interesting relations. The differences in proportional growth were associated with the proportional leaf area per plant. Root temperature did affect the uptake of  $\text{NO}_3^-$ , P, K, Ca and Mg. The influence of the internal diffusion pressure deficit on growth rate was also considered.

Promotor: Prof. Ir M. L. 't Hart

E.

353. M. D. ABDALLAH Interaction of some organophosphorus compounds in susceptible and resistant houseflies (*Musca domestica* L.). 1963, pp. 8 + 98. Eng. a. Du. summ. Also published in Meded. LH 63 (1963) 11.

The effect of tri-ortho-cresylphosphate (TOCP) on poisoning by parathion and paraoxon in susceptible and resistant houseflies (*Musca domestica* L.) was investigated.

TOCP influenced the penetration of parathion and paraoxon, and this could explain the contradictory results of both an antagonistic and synergistic effect of TOCP on parathion and paraoxon poisoning, described in the literature.

Studies were also carried out on inhibition of cholinesterase (ChE) and aliesterase (AliE) from susceptible and resistant houseflies by TOCP, parathion or paraoxon *in vivo* and *in vitro*.

TOCP proved to be a poor ChE inhibitor, but 50% of AliE in susceptible and 15% in resistant houseflies were inhibited by this compound.

It was concluded that at least 2 aliesterases were present in houseflies, one sensitive to inhibition by organophosphorus compounds, and the other one almost insensitive. *In vitro* TOCP protected ChE against inhibition by parathion or paraoxon.

The importance of these findings for the explanation of resistance to organophosphorus compounds in insects was extensively discussed. It was concluded that penetration was an important factor in resistance of houseflies to parathion and paraoxon.

Promotor: Prof. Dr J. de Wilde

d.K.

354. T. TALSMA The control of saline groundwater. 1963, pp. 8 + 68. Eng. a. Du. summ. Also published in Meded. LH 63 (1963) 10.

A study was made of the effect of the watertable, water-conducting properties of the soil, climatic factors and groundwater salinity on the salinization of soils in the Murrumbidgee Irrigation Areas, Australia.

Average daily capillary flow rates were calculated from measured salinization (by sampling) for each month between May 1960 and October 1961. Potential gradients were calculated from suction measurements by tensiometers. Field percentages of available water varied from 8 to 14% for the soils studied. Good agreement was found between values for hydraulic conductivity measured by the augerhole method and capillary conductivity calculated from chloride accumulation (measured monthly sampling).

The agreement between field data and the theory of steady-state flow through unsaturated soils was satisfactory when no limit was set on evaporation by the moisture-conducting properties of the soil. Where potential evaporation exceeded the maximum possible flow, evaporation from the soil was equal to, or less than the predicted maximum flow through the profile. Reduction of evaporation under these conditions was caused either by the establishment of a natural mulch or by the appearance of a salt crust at the surface.

It was concluded that 'critical depth' of watertable corresponded to the watertable at which the flow rate through the soil profile was reduced to about 0.1 cm day<sup>-1</sup>. Generally the watertable should be kept lower in soils of intermediate texture than in either finely or coarsely textured soils.

In the fine-textured soils of the Murrumbidgee Area the salinity hazard was markedly reduced if the watertable was kept at about 120 cm below the surface (bare soil) far below the root zone.

Promotor: Prof. Dr W. R. van Wijk

Der.

355. G. H. GERMING Opkweek en teeltresultaten van kunstmatige belichte tomatenplanten / *The raising and cropping of artificially-illuminated tomato plants*. 1963, pp. 8 + 62. Du. a. Eng. summ. Also published in Meded. Inst. Tuinbouwtechniek 53.

The effect of artificial illumination during the seedling stage of tomatoes was studied, mainly with plants raised exclusively in artificial light.

The dry weight at the time of planting out and the number of leaves below the first trusses, in this sequence, were the most important criteria for the quality of young tomato plants.

In the illuminated chambers daily production of dry matter increased with brightness from 12.10<sup>3</sup> erg cm<sup>-2</sup> sec.<sup>-1</sup> total radiation up to 24.10<sup>3</sup> erg cm<sup>-2</sup> sec.<sup>-1</sup> from TL 65W 'white' fluorescent lamps and with the length of photo-period from 16 to 24 h. The increase in daily production of dry matter was associated with a reduction in production of dry matter per unit light energy: as

illumination increased, it was used less efficiently, especially if the photoperiod was longer than 16 h per day.

Effects of light and temperature on the leaf number were examined. Results of various cropping experiments demonstrated the importance of illumination during the raising period.

The physiological and practical consequences of the results were discussed.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

356. A. VARGA Tuinbouwkundige toepassingen van gibberellazuur / *Horticultural applications of gibberellic acid*. 1963, pp. 10 + 84. Du. a. Eng. summ.

The initiation of new flower buds in *Pelargonium zonale* Ait. was strongly inhibited by  $GA_3$ . The duration of development of the initiated umbel was diminished and the stalk of the umbel elongated. The winter dormancy of the flower buds of *Convallaria majalis* started earlier with a dry or warm cultivation and by  $GA_3$  during the growth or during storage.  $GA_3$  was not able to break winter dormancy of the buds without previous cold treatment.

After castration and  $GA_3$  treatment of some varieties of pears many treated flowers set fruit parthenocarpically. After night frosts in 1960 and 1962 a considerable fruit set was obtained from severely frosted flowers after  $GA_3$  treatment of pears. Thus night frost damage to pears could be controlled with  $GA_3$ .

The induction of parthenocarpy in apples with  $GA_3$  did not succeed, neither after castration or after night frost. A possible improvement is the use of other gibberellins, especially  $GA_4$ . The presence of seeds in the fruit proved necessary until the June drop. Undesired effects of  $GA_3$  may be a decrease in the number of flower buds or abnormal fruit shape.

The growth of the heads of unchilled roots of Belgian chicory was strongly stimulated by  $GA_3$ .  $GA_3$  treatment increased the number of male flowers in cucumber, favoured the bolting of spinach, hastened the ripening of tomato fruits, but did not favour the growth of the fruits of *Solanum melongena* and *Capsicum annum*.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

357. J. A. HUYSKES Veredeling van witlof voor het trekken zonder dekgrond / *Breeding of witlof chicory for forcing without cover soil*. 1963, pp. 8 + 72. Du. a. Eng. summ. Also published in Meded. Inst. Veredeling Tuinbouwgewassen 202.

Forcing of Belgian endive without covering soil could improve work efficiency. Existing varieties gave loose instead of well closed heads. To improve this, a study was made of factors determining head formation, with covering soil. Roots should be exposed to a certain amount of cold, if they were to form a

good head. The later the variety, the more cold was required. Roots to be forced without covering soil needed extra cold. Varieties must be bred for this purpose.

The breeder could use the need for cold as a criterion in selection for earliness and to improve the uniformity of his varieties. The length of the core was negatively correlated with the need for cold. This character was also of use in testing of varieties. The result of early forcing could be improved by previously cooling the roots.

Practical trials on forcing without covering soil and selection for core length confirmed the results of the research.

Promotor: Prof. Dr Ir J. Doorenbos

Author

358. J. W. WOLDENDORP The influence of living plants on denitrification. 1963, pp. 6 + 100. Eng. a. Du. summ. Also published in Meded. LH 63 (1963) 13.

A study was made of the N cycle in permanent pastures. Between 10 and 40% was lost when labelled  $\text{NO}_3^-$ , was added. The losses by denitrification were stimulated by living roots, which decreased the  $\text{O}_2$  level in the rhizosphere and excreted organic compounds which could act as hydrogen donors during  $\text{NO}_3^-$  reduction. Experiments with sterile plants demonstrated that *Pseudomonas* and *Achromobacter* species could use the root's excretory products as hydrogen donors. *Bacillus licheniformis* and some other *B.spp.*, which could denitrify in pure culture, could not utilize these compounds. Amino acids stimulated denitrification by *Pseudomonas aeruginosa* and the rate-limiting reduction from nitrate to nitrite.

*B. licheniformis* was not an obligate denitrifier; the presence of  $\text{NO}_3^-$  was only indispensable and a high nitrate reductase activity was only found if glycerol was the hydrogen donor.

Conditions in the soil were not suitable for  $\text{NO}_3^-$  reduction to  $\text{NH}_3$  by *B. licheniformis*.

Promotor: Prof. Dr Ir E. G. Mulder

D.

359. M. DEL POZO IBÁÑEZ The effect of cutting treatments on the dry matter production of *Lolium perenne* L. and *Dactylis glomerata* L., 1963, pp. 10 + 74. Also published as VLO 69.17 (1963).

The effect of cutting treatments on grass production was studied both in the field and in experiments under controlled conditions. Cutting limited the increase in dry matter for a certain time. Thereafter dry weight of plants continued to increase at the same proportional rate as in undisturbed plants. The relation leaf blade dry weight/total dry weight was constant for vegetative grasses.

When this ratio was reduced by cutting, the production of leaf dry matter increased over that of other plant parts, until the initial relation was restored.

The distribution of increases in dry matter over herbage and the rest of the plant was the same before and some time after cutting. Different levels of cutting had no effect on proportional increase in dry matter production.

A cutting height of 5 cm was optimum for herbage production after a single cut and 10 cm for repeated cuttings.

Vernalized plants gave more herbage dry matter at the first cut; vegetative ones at subsequent cuts.

With *Lolium* tillering stopped for a certain period after cutting, whose length decreased with increase in reserves or cutting height. These factors had no effect on tillering of *Dactylis*.

Promotor: Prof. Ir M. L. 't Hart

Ov.

360. S. A. EI-NAGA KASSAB On maternal and some other influences on birth weight, growth and hair coat in two Dutch cattle breeds. 1964, pp. 10 + 86. Eng. a. Du. summ. Also published in Meded. LH 64 (1964) 1.

Birthweight was very important for growth until 12 months of age, particularly in bull calves which were heavier fed than heifer calves. Correlation between birthweight and bodyweight in bull calves was  $\pm 0.5$ .

The early first calving of heifers in the Netherlands (24 months of age) decreased birthweight of the first calf considerably, being 5 kg less than of calves born of cows. This difference in calfweight increased to 24 kg at 12 months of age. Autumn calves were at birth 2.5 kg heavier than spring calves. This difference increased in the first year of life to 48 kg, presumably through the difference in environmental conditions.

Average weight, diameter and length of calves' hair at birth fluctuated between years. The sire had a definite influence on coat characters of offspring. The cattle breeds used in this study, Friesian and the Meuse-Rhine-Yssel, differed in coat type: the Friesians had a thinner shorter fibre with less medullation. The differences between coat types at birth were not significant.

Promotor: Prof. Dr Th. Stegenga

St.

361. K. DILZ Over de optimale stikstofvoeding van granen / *Optimum nitrogen nutrition of cereals*. 1964, pp. 8 + 136. Du. a. Eng. summ. Also published as VLO 641 (1964).

Oats grown in culture solution showed an 'active' mineral uptake, which after ripening of the panicles benefited the newly formed tillers only. Ripening of the plants after interrupting nutrient supply depended on the stage of floral development. The longevity of a cereal was governed by the demand for assimilates by

the inflorescences from the assimilating organs and the continuous supply of nutrients to these organs. Further experiments yielded the postulate that N supplied to a given organ led to protein synthesis, enabling this organ to accumulate and retain assimilates and withstand the drain on assimilates imposed by younger organs.

Distribution and redistribution of dry matter and  $^{15}\text{N}$ -labelled N over different plant parts and the effect of environment on nitrogen utilization and redistribution was studied.

Pot trials and concurrent field experiments with ample and continuous supply of N showed that maximum yield was attained with the same yield composition, pattern of N uptake and the same dry matter production per unit N uptake. At maximum yield, as a basis for comparison, N uptake by cereals in the field was 120–150 kg N per ha, for Mitscherlich pots 1800–3000 mg N per pot. In most pot trials N level was far below that of field experiments.

Promotor: Prof. Dr A. C. Schuffelen

Author

362. G. MARINCOWITZ Follikel-stimulerende hormoon en interstisieelstimulerende hormoon in die hipofisevoorlob van die ooi en die voorkoms van oestrus en ovulasie / *Follicle-stimulating hormone and interstitial-cell-stimulating hormone in the anterior pituitary gland of the ewe and the incidence of oestrus and ovulation*. 1964, pp. 8 + 100. Du. a. Eng. summ. Also published in Meded. LH 64 (1964) 6.

In the Netherlands, separate activities of FSH and ICSH in the pituitary, morphological changes in ovaries and vaginal smears were examined in Texel ewes during the oestrus cycle. Both FSH and ICSH content of the pituitary decreased very sharply in late dioestrus. Immediately after ovulation, FSH content increased again but ICSH not before the end of luteinisation. Times of oestrus in Dorper sheep, (a non-wool mutton breed) and in the Merino (with good quality wool) were determined during grazing on mixed Karroo veld in South Africa. The relation between age or fleece type and oestrus was studied in the Dorper. Maiden ewes had a limited breeding season. Mature ewes, especially those of intermediate fleece type, exhibited oestrus throughout the year. Merino sheep had a limited breeding season as judged by oestrus and by ovarian morphology. The difference in length of breeding season between Dorper and Merino sheep seemed to be of great practical importance.

Promotors: Prof. Dr E. Brouwer and Prof. Dr Th. Stegenga

Wi.

363. H. OM AGRAWAL Identification of cowpea mosaic virus isolates. 1964, pp. 6 + 78. Eng. a. Du. summ. Also published in Meded. LH 64 (1964) 5.

Five isolates of the beetle-transmitted cowpea mosaic virus were studied. The symptoms produced by each on a number of hosts were described. The occurrence of amorphous inclusion bodies in the epidermal cells of infected cowpea and pea plants was reported. A purification procedure was described. Three peaks were invariably associated with the purified virus in the analytical ultracentrifuge, the sedimentation coefficients of these components being 58, 100 and 119 S after separation. The components could be purified by density-gradient centrifugation. The top component was not infective; the middle component was far more infective than the bottom component. Purified preparations showed, by electron-microscopy, polyhedral particles of about 25 m $\mu$  diameter. Negative staining of the preparations with phosphotungstate revealed empty particles, and of particles apparently containing nucleic acid. An icosahedral model with 60 subunits and 5:3:2 axial symmetry was most compatible with the structure of the particles seen on the electron-micrographs. On the basis of homologous and heterologous serological reactions the five isolates could be divided into two groups. They proved also to be serologically related to bean pod mottle virus and to an isolate of red clover mottle virus.

Promotor: Prof. Dr Ir J. P. H. van der Want

v.d.W.

364. F. YOSHIDA Interrelationships between potassium and magnesium absorption by oats (*Avena sativa* L.) 1964, pp. 10 + 104. Eng. a. Du. summ. Also published as ARR 642 (1964).

Interactions in Mg and K uptake were studied especially in relation with the following factors affecting ion uptake, a. the mechanisms of absorption of both ions involved, b. the relationship between absorption of the ions and their concentrations in the nutrient solution, c. the relationship between absorption of the ions and their ratios in the nutrient solution, particularly K: Mg, and the effects of H, Ca, N and P on the absorption of K and Mg.

These factors were examined in long and short experiments. Results were tested for correspondence with the carrier theory and the adsorption theory of ion absorption. Both theories proved useful in explaining the characteristics of ion absorption in oats. The possibility of a system of adsorption before absorption of ions through a carrier system was considered but was not further explored in this study. The mathematical models for a combination of the two systems were similar to those employed for the carrier theory.

In both tops and roots of oat plants grown in the long-term experiment, Mg and K contents were inversely correlated. This antagonism could be explained as competition for carrier sites common for both ions. Mg absorbed by the root mechanism common for Mg and K was not transported into tops in the short-term experiment, when plants had low ratios of K:Mg.

Promotor: Prof. Dr A. C. Schuffelen

v.D.



365. T. A. LIE Nodulation of leguminous plants as affected by root secretions and red light. 1964, pp. 90. Du. a. Eng. summ. Also published as LEB Fonds Publ. 42.

Nodulation of bean plants, *Phaseolus vulgaris* L., in water culture was poor during hot sunny weather in the greenhouse. It did not improve when indoleacetic acid, kinetin,<sup>1</sup> gibberellic acid, purines and pyrimidines, yeast and soil extract were added. Nodulation was enhanced by adding used culture solution of nodulated pea or bean plants or an extract of root nodules. The active substance was soluble in water and ether and was inactivated by heating at 80°C. During purification it was observed that the active fractions strongly absorbed ultraviolet light at about 260 m $\mu$ .

Light quality also influenced nodulation of plants grown in light cabinets: nodulation was good in red and poor in blue light. If the shoot was radiated with far-red light (about 730 m $\mu$ ) for a few minutes at the end of the photo-period, there were fewer nodules and this effect could be counteracted by subsequent radiation with red light (about 660 m $\mu$ ). These results suggested that nodulation was controlled by the phytochrome system.

The hypothesis was put forward that a kinetin-like substance was involved in the formation of root-nodules.

Promotor: Prof. Dr Ir E. G. Mulder

Author

366. I. I. AL-AZZAWI Supplementation of plant protein with amino acids for broiler production. 1964, pp. 8 + 118. Eng., Du. a. Arab. summ.

A diet of sesame oilmeal, maize and barley supplemented with adequate lysine 0.50–0.78 (in total 1.18%–1.23% of the diet) was a suitable diet for fast growing chickens to produce broilers weighing approximately 1 kg in 7 weeks. The average feed intake per unit gain in the 7th week was 2.149 for chickens which had received plant protein and high energy level and 2.312 for those which had received about 2700 kcal. The gain achieved with sesame, corn and barley was approximately 95% of that with the best animal-protein diets used in the Netherlands. Adding up to 10% of sesame oil did not improve weight but it did improve feed efficiency and produced good quality meat. The response of pullets to lysine was better than that of cockerels. The plant protein varied in value, so it was much more accurate to deal with the digestible value than the crude value.

The high methionine content of sesame should inspire the agricultural offices in the Middle East to encourage farmers to produce soya bean, to make a high quality feed for broiler production. Soya bean lacked methionine, but it was rich in lysine and would make a good combination with sesame. In practice in

the Middle East the supplement of lysine would diminish the cost of high quality feed by about 22.5%, if it was used instead of animal protein.

Promotor: Prof. Ir S. Iwema

Author/Ri.

367. J. D. DORGELO De koloniën van de Maatschappij van Weldadigheid (1818–1859). Een landbouwkundig en sociaal-economisch experiment / *The settlements of the Benevolent Society (1818–1859). An agricultural and socio-economic experiment*. 1964, pp. 10 + 230. Du. a. Eng. summ. Also published in Van Gorcum's Historische Bibliotheek No. 74 (1964).

The Benevolent Society of the Netherlands was founded in 1818 as a private society to improve the situation of the poor. The Society bought vast areas of waste land on the borders of the provinces of Drenthe, Upper Yssel and Friesland. By reclamation and agriculture the Society offered means of subsistence to some thousands of people who migrated from the towns to live in the free pauper settlements.

From existing literature and the archives of the Society the author described the agricultural composition of this development project, including the method of reclamation, size of farms, crop rotation and other aspects of farm management, yield figures, labour and tenancy conditions, and educational organization.

The introductory chapter briefly describes poverty in the Netherlands about 1815 and the structure of traditional agriculture in Drenthe. Also some demographic details are mentioned about the population of the settlements. Development after the reorganization of 1859 is summarized in the last chapter.

Promotor: Prof. Dr B. H. Slicher van Bath

Author

368. L. BRADER Étude de la relation entre le scolyte des rameaux du caféier, *Xyleborus compactus* Eichh. (*X. morstatti* Hag.), et sa plante-hôte / *Study of the relation between the coffee twig beetle, Xyleborus compactus Eichh. (X. morstatti Hag.) and its host plant*. 1964, pp. 10 + 110. Fr., Eng. a. Du. summ. Also published in Meded. LH 64 (1964) 7.

The mutual relation between the coffee-twig beetle, an ambrosia beetle, and the coffee plant was analysed as an example of the relation between insect and host plant. By boring passages in the twigs of the coffee plant, the beetle killed the twigs. Control was hindered by the feeding of the beetle only on a fungus, *Ambrosiella xylebori* Brader, which was the chief cause of death. Other plants were also infested and acted as a source of infestation for coffee plantations.

The relation between beetle and coffee plant was influenced by: a scent stimulus attracting the females to the plant; a scent stimulus which caused them to remain or fly off; a flavouring influenced whether the entrance passage was

bored; the completion of the entrance passage depended on the nutrient reserves of the female and on the structure of the plant tissues; the boring of the brood passage depended whether the ambrosia fungus grew and growth of the ambrosia depended on the sugar content of the plant (positive relation); the number of eggs laid depended on the growth conditions for the ambrosia. Selection of less infested varieties of coffee seemed the best means of control.

Promotor: Prof. Dr J. de Wilde

Author

369. G. W. ANKERSMIT Voltinism and its determination in some beetles of cruciferous crops. 1964, pp. 8 + 60. Eng. a. Du. summ. Also published in Meded. LH 64 (1964) 8.

The influence of some token stimuli (photoperiod, temperature and food) on the annual cycle of univoltine insects (*Ceuthorrhynchus assimilis* Payk., *C. pleurostigma* Marsh., spring and autumn races, and *Psylliodes chrysocephala* L.) was studied. The reproductive diapause of *C. assimilis* and the spring race of *C. pleurostigma* was not affected by the photoperiods studied. In the autumn race of *C. pleurostigma* and *P. chrysocephala*, the summer diapause was induced by long days and oviposition in the autumn by short days. The different responses to photoperiod in the 2 races of *C. pleurostigma*, races which were not geographically isolated, were sufficient to cause their reproductive isolation and so their maintenance. Both races were well synchronized with the annual cycles of their host plants.

Promotor: Prof. Dr J. de Wilde

Author

370. H. W. VAN GILS Bacteriology of activated sludge. 1964, pp. 104. Eng. a. Du. summ. Also published as IG-TNO Rep. No. 32 (1964).

The bacteriology and biochemistry of activated sludge grown in domestic waste water or fed with synthetic media were studied. The nature of the flocs was investigated by determining morphological and physiological characteristics of many strains isolated.

Predominant bacteria were Achromobacteraceae, further in sludge grown in domestic waste water Pseudomonadaceae and coryneform bacteria, and in sludge grown in waste water from synthetic media Micrococcaceae and large oval encapsulated coccoid bacteria.

Bacterial flocs were not formed readily by many of the strains tested in pure culture. Addition of  $\text{FeCl}_3$  or  $\text{CaCl}_2$  sometimes stimulated flocculation. Variation in C/N relation of the substrate had no effect.

Biochemical activities of activated sludge and of some strains in pure culture were studied in Warburg respirometers. Domestic activated sludge readily absorbed organic acids and ethanol, whereas sugars and polyalcohols were taken

up slowly. The same held for pure cultures isolated from this sludge. Adaptation to sugar breakdown was stimulated by N compounds and particularly by amino acids.

Dissimilation was 10–20% for glucose and 30–40% for acetate. Rate of uptake for glucose and O<sub>2</sub> and dissimilation percentages were independent of substrate concentration, but proportional to sludge concentration. Almost 60% of added glucose was stored as polysaccharides by glucose-adapted sludge when no N was supplied. When ammonium sulphate was added only 25% of the glucose yielded polysaccharides. Endogenous respiration was higher, the higher the sludge load while addition of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> with the glucose caused a still higher endogenous respiration, presumably due to amino acid synthesis.

Promotor: Prof. Dr Ir E. G. Mulder

A.

371. J. A. DE BOKX Onderzoekingen over het aantonen van aardappel-Y<sup>N</sup>-virus met behulp van toetsplanten / *Detection of potato virus Y<sup>N</sup> by means of test plants*. 1964, pp. 84. Du. a. Eng. summ. Also published as Meded. IPO 342 (1964).

Studies were conducted to determine some of the physical and biological properties of a new strain of virus Y, called virus Y<sup>N</sup>. Different methods of preserving the virus *in vitro* and conditions affecting local lesion formation on detached leaves of the test plants *Solanum demissum* hybrid 'A6' and *Solanum demissum* 'Y' were studied. It was shown that detached leaves of these test plants produced also local lesions after inoculation with the potato viruses Y<sup>o</sup>, Y<sup>c</sup>, A, 'a.ucu.babont,' and with rattle and tobacco mosaic viruses. The effect of temperature on lesion formation was more obvious than the effect of light. The optimum incubation temperatures for virus Y and A were 24°–25°C and 19°–20°C, respectively. The suitability of the host 'A6' as a test plant for virus Y<sup>N</sup> was studied with infected potato plants at different stages of development. In leaves and parts of stems of plants with secondary infection, virus Y<sup>N</sup> was detected reliably. In tubers of those plants, virus Y<sup>N</sup> could reliably be detected directly after early harvesting with cut tubers as inoculum. In young tubers of primarily infected plants virus Y<sup>N</sup> could be detected shortly after harvesting if the period between inoculation and lifting was long. In tubers stored for a long period after harvesting, the virus could not reliably be detected. Testing the sprouts of the tubers for the presence of virus Y<sup>N</sup> was always consistent.

Promotor: Prof. Dr Ir J. P. H. van der Want

Author

372. Miss JOHANNE HEIJTING De invloed van temperatuur en licht op de groei en ontwikkeling van andijvie / *The influence of temperature and light on the growth and development of endive*. 1964, pp. 10 + 74. Du. a. Eng. summ. Also published as Lab. Tuinbouwplantenteelt, Publ. 250.

The two main factors for bolting and flowering of endive were temperature and light; their influence on both growth and development was investigated.

From experiments with successive dates of sowing, different raising temperatures and different growing conditions the following facts emerged: with increasing raising temperature, crop weight increased by delayed bolting; extra light during the seedling stage, or short day during the seedling stage, delayed bolting, but did not always increase crop weight; after the raising period, high temperature stimulated bolting and increased crop weight.

Low temperature (5°C) during germination or in the seedling stage promoted bolting and flowering; in short days, vernalization accelerated bolting considerably; in long days, it depended on the age of the plant at the time of vernalization. Interruption of seed vernalization by normal temperature delayed bolting. The effect of seed vernalization, if applied for a limited period, could be nullified by high temperature (35°C) immediately after vernalization.

In unvernialized plants grown at 35°C bolting was accelerated. Increasing day length promoted early bolting. The only flower-promoting action of short days had been observed when short days preceded vernalization.

Low light intensity promoted or inhibited bolting, according to other factors.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

373. S. C. BHARGAVA Photoperiodism, floral induction and floral inhibition in *Salvia occidentalis*, 1964, pp. 8 + 70, Eng. a. Du. summ. Also published in Meded. LH 64 (1964) 12, and as Lab. Tuinbouwplantenteelt, Publ. 255.

Day lengths of 2–4 h were suboptimal for flowering induction, those of 4–12 h optimal, those of 12.5–3 h supra-optimal, and those of 13.5 critical. The first sign of transition from a vegetative to a generative state was an abrupt increase in apical cell division. Preceding long days (LD), age of the plant and defoliation did not influence sensitivity to short days (SD).

The degree of inhibition of SD-induction by interruption or by subsequent uninductive light periods depended on their length and number. Interruption of darkness for 1 pair of leaves or the apex during SD-induction indicated that the main receptor was the leaf and not the apex. If 2 leaf pairs and the apex were in SD-treatment and continuous light interrupted it for the lowest pair, flowering was remarkably inhibited, even when the lowest pair was removed immediately after treatment. So the inhibition must be rapidly transported to the apex. This factor may also be present in the apex before SD-treatment. The morphological changes in the apex must be regulated by a competition between substances inhibiting and promoting flowering, both arising in the leaves and independently transported to the apex.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

374. TH. M. BERG Studies on poplar mosaic virus and its relation to the host. 1964, pp. 8 + 72. Eng. a. Du. summ. Also published in Meded. LH 64 (1964) 11.

An extended survey of poplar species and cultivars yielded data on susceptibility to poplar mosaic virus (PMV). Three symptom types were distinguished: two different leaf variegations and a necrosis on veins and leaf-stalks. This venal and petiolar necrosis and a diffuse leaf spotting caused considerable losses to clones of *Populus deltoides angulata*. Careful observations did not yield evidence for any relation between symptoms on a leaf and those on the shoot grown from its axillary bud the following season. As well as observations, results of inoculation tests on the local lesion host *Vigna unguiculata* with extracts from young sprouts grown from one-bud cuttings suggested an uneven distribution of PMV in diseased cuttings. A number of herbaceous hosts were found to be susceptible to PMV. Systematically infected leaves of *N. glutinosa* and *N. debney* proved suitable sources for further purification of the virus. The examination of highly purified virus preparations revealed a sedimentation coefficient of 165 S. By repeated immunization of rabbits with the virus, antisera were obtained with a titre of 1/2048. Investigations on the serological relationship between PMV and other viruses of about the same size and shape revealed that PMV belonged neither to the potato virus S group nor to the potato virus Y group.

Promotor: Prof. Dr Ir P. K. Schenk

Author

375. G. W. M. BARENDSE Vernalization in *Cheiranthus allionii* Hort. 1964, pp. 8 + 64. Eng. a. Du. summ. Also published in Meded. LH 64 (1964) 14.

The effect of vernalization in *Cheiranthus allionii*, a qualitative winter annual requiring cold, was studied in relation to external conditions, particularly temperature and day length. Both seed and plant vernalization may lead to flower formation. However, the vernalizability varied with the plant's age. There was a close relation between age, duration of vernalization and daylength after vernalization. In long days after vernalization seeds and older plants were most sensitive to vernalization, young plants being less sensitive. Short days after vernalization of either seeds or young plants diminished the effectiveness of vernalization but this disadvantageous effect was partly overcome by vernalizing for longer. Mature plants were day neutral after vernalization. Warmth (35°C) immediately after vernalization caused devernialization. However, warmth immediately before vernalization antagonized vernalization.

Only vernalized growing points and those derived from vernalized tissue attained a vernalized state.

The mechanism of vernalization was discussed in the light of the results with

*Cheiranthus allionii* and the different published theories. It was concluded that the immediate product of vernalization was immobile.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

376. J. VAN DER SPEK *Botrytis cinerea* als parasiet van vlas / *Botrytis cinerea* as a parasite of flax. 1965, pp. 8 + 146. Du. a. Eng. summ. Also published as VLO 651 (1965), Meded. IPO 368 and Meded. Afd. Fytopathol. 213.

After some introductory words on flax, different forms of the parasite *Botrytis cinerea* Pers. ex Fr. were compared. Use of differences in production of organic acids as done by van Beyma Thoe Kingma were not a satisfactory distinction between formae lini of *Botrytis*. The M, Sc and Sp growth forms, few isolated interforms, *B. bifurcata* Miller and *B. allii* Munn. all produced significant amounts of citric acid; the amount depended on isolation, temperature, nutrient medium and amount of CaCO<sub>3</sub> in the medium. Although the species was polyphagous, where it grew as a parasite was related to its growth form.

Stages discussed of the disease in flax were the juvenile phase (caused by infected seed, spread through the soil to other plants), an intermediate phase (during accelerated growth of the flax, the stem base was attacked by spores of the juvenile phase), and the flowering phase (spores from elsewhere or from the interphase).

Other topics were: environmental influences encouraging grey mould during the phases; ways of treating flax seed, research on seed infection (comparison of the Ulster and filter-paper method); differences in infectivity with environment; and finally chemical disinfection of seed and its toxicity to the plant.

Promotor: Prof. Dr A. J. P. Oort

E.

377. W. G. BEEFTINK De zoutvegetatie van ZW-Nederland beschouwd in Europees verband / *Salt marsh communities of the SW-Netherlands in relation to the European halophytic vegetation*. 1965, pp. 12 + 168. Eng. summ. Also published in Meded. LH 65 (1965) 1, in *Belmontia II. Ecology 10* (1965) and as Meded. Hydrobiol. Inst. afd. Delta-Onderzoek, Ierseke, 30.

The results were discussed of an ecological study of salt marsh vegetation along the estuaries of the rivers Scheldt, Meuse and Rhine (incl. the Eastern Scheldt) as a part of European halophytic vegetation.

Communities were classified by the Swiss-French system of Braun Blanquet. Special attention was devoted to a cybernetic approach to the vegetation and its habitat as accomplished in space and time.

Environmental aspects considered included the stable borders between the Arctic, Atlantic, Continental and Mediterranean climatic types along the West European coast, the ecological significance of tides, the origin of mud flats and

salt marshes, physical and chemical properties of the soil and their relation to sedimentation, and biotic factors.

salt marshes, physical and chemical properties of the soil and their relation to sedimentation, and biotic factors.

choice between intraregional and interregional classification could be based only on floristic relationships. Existing, mostly regional systems could be combined into a single classification scheme for the whole European halophytic vegetation.

Finally West European salt marsh communities, including tidal drift communities, were described, especially those of the south-west Netherlands.

Promotor: Prof. Dr H. J. Venema

E.

378. S. P. ERASMUS Vertraagde onverenigbaarheid bij die ent-kombinasie van tamatie op *Datura stramonium* / *Delayed incompatibility in tomato grafted on Datura stramonium*. 1965, pp. 8 + 44, Afrik. a. Eng. summ.

Glasshouse tomatoes grafted onto *Datura stramonium* could grow vigorously to 1 metre in height, then suddenly wilt and die. Several experiments under glass in spring, summer and autumn studied the nature of this delayed incompatibility. The results suggested that the wilting was caused by a gradually developing imbalance. To test this hypothesis plants were treated to give different distributions of growth between tomato graft and datura rootstock. Factors investigated were the fruit crop, assimilation surface, light energy, additional shoot development, a 'feeding' tomato shoot with about 8 leaves just above the graft union from which the apex and all other growing organs were removed.

It was concluded that if root growth was depressed more or stimulated less than shoot growth, the plant wilted. If root growth was stimulated more than shoot growth, wilting was prevented.

Erasmus investigated how increased suction tension influenced wilting in grafted plants grown in nutrient solution. The values for osmotic pressure of the solutions were raised 49 days after planting by different amounts of NaCl. The wilting in fruiting grafted plants was caused by the higher proportion of shoot to root.

Promotor: Prof. Dr Ir J. Doorenbos

E.

379. W. A. WIEBOSCH Jarowisatie bij enige groente- en aanverwante gewassen / *Jarovization of some vegetables and related crops*. 1965, pp. 12 + 130. Du., Eng. a. Ger. summ. Also published as Meded. Proefst. Groent. Volle Grond, Alkmaar, 30.

The influence of seed chilling on the flower and seed formation of some vegetable and related crops was studied. The seed was germinated and then



cooled almost to 0°C so that it was still suited to mechanical sowing, a prerequisite if the technique were to be used in practice. This treatment was here called jarovization as introduced by Lysenko for wheat. The object was to bring certain spring-sown crops to flowering and sufficient seed production in the same year.

Jarovization was only partly successful. Most of the crops under investigation still required a period of plant vernalization to behave as an annual. With beet (*Beta vulgaris* L.), black radish (*Raphanus sativus* L. var. *niger*), swede turnip (*Brassica napus* L. *napobrassica*), Belgian endive (*Cichorium intybus* L. var. *foliosum*) and some other species the jarovized crop ran completely to seed when an untreated crop of the same cv. sown on the same date yielded at least 15 to 20% early bolters.

The best sowing time for a full-grown seedcrop from jarovized seed was two, or, at most, three weeks later than from untreated seed.

Many species could not be vernalized sufficiently until the young plants reached a certain age (juvenile phase), if they were to form flowers in ensuing favourable conditions.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

380. F. A. M. DE HAAN The interaction of certain inorganic anions with clays and soils. 1965, pp. 8 + 168. Eng. a. Du. summ. Also published as VLO 655 (1965).

Interaction between anions and soil colloids was governed by 2 antagonistic processes, anion exclusion and positive anion adsorption. The predominantly negative charge on the colloids caused anion repulsion; positively charged sites and chemisorption resulted in positive adsorption.

Experimentally determined adsorption was the resultant of the 2 processes and yielded true net adsorption by correction for continuous anion exclusion.

Assuming the Gouy Chapman theory of the electric double layer, de Haan calculated exclusion as the apparent distance from the colloid surface free from anions of different valency. The method was valid for systems containing monovalent and divalent cations and anions with an approximation for trivalent anions, and was extended to interacting double layers.

The product of apparent distance of exclusion and of the colloid's specific surface was the volume of exclusion ( $V_{ex}$ ), the same as the experimental adsorption value. Thus anion exclusion measurements yielded values for the colloid's specific surface.  $V_{ex}$  was determined by a tracer method for  $Cl^-$ ,  $SO_4^{2-}$ , and  $PO_4^{3-}$ , and by potentiometric titration for  $Cl^-$ . Adsorption of different anions could be determined simultaneously.

Theoretical derivations were confirmed in experiments with fairly pure clays and in 12 Dutch soils, with special attention to phosphate adsorption. The cor-

rection for anion exclusion allowed refined measurements of anion adsorption and explained the bonding mechanisms between anions and soil colloids.

Promotor: Prof. Dr Ir G. H. Bolt

Author

381. A. G. VOORHOEVE Liberian high forest trees. A systematic botanical study of the 75 most important or frequent high forest trees, with reference to numerous related species. 1965, pp. 12 + 416. Also published as ARR 652 (1965).

From the Liberian rain forest 75 important tree species were systematically described. In the introduction reasons for choice of species and nomenclature were set out. History and literature of the botanical exploration of Liberia were surveyed. Physiography, geology, soils and climate of lowland rain forest were discussed.

The evolution and situation of the vegetation cover, especially of forest, in Liberia were sketched. The primeval rain forest hardly existed any longer; most of the forest area seemed to be secondary. Two vegetational zones were distinguished, the evergreen forest and the humid semi-deciduous forest. In the first zone in the high forest, species were mainly of the sub-family *Caesalpinioideae*. In the fourth chapter determinative keys for leaf and field characteristics were established, for trees with a chest-height diameter of (as a rule) more than 40 cm.

Finally the 75 species were described, arranged in 23 alphabetical families, within which species were also arranged alphabetically. Voorhoeve included field notes and, for the most important commercial wood species, forestry data in the descriptions.

Promotor: Prof. Dr H. C. D. de Wit

E.

382. D. BOUMA Growth changes of plants following the removal of nutritional stresses. 1965, pp. 10 + 98. Eng. a. Du. summ.

Differential changes in leaf area of plants were used to assess the fertility status of soils. For this method subterranean clover plants were raised in solutions with different levels of nutrients and transferred either into complete solutions or to solutions lacking one of the elements. Response of plants to addition of nutrients was measured by the increase in leaf area over a 7-day period after transfer. In field experiments quantitative relationships were investigated between differences in leaf area as measured by application of the above technique and responses of clover yields to fertilizers containing P or S. Highly significant correlation coefficients were found for both elements.

The uptake of these nutrients during the experiment seemed to be related to their functions in the metabolism of the plant. During the first 3 days of re-

covery from P stress, the uptake and translocation of P into the aerial parts of the plant were rapid. Between the 3rd and the 7th day a redistribution of P into newly developed leaves took place and only a little P was taken up from the solution. On the contrary the uptake of S continued during the whole experimental period, which fact suggested, that S compounds in solution were more accessible to meet demands for new growth than S present in other plant parts.

Promotor: Prof. Dr A. C. Schuffelen

Ros.

383. C. L. M. VAN EIJNATTEN Towards the improvement of maize in Nigeria. 1965, pp. 10 + 120. Eng. a. Du. summ. Also published in Meded. LH 65 (1965) 3.

Approximately 600,000 tons of maize were produced annually in Nigeria. Maize was the main grain crop in southern Nigeria and its production in the middle belt was rapidly increasing. Most of the crop was eaten as dry grain, a little before maturity. A preference was recorded for floury varieties of maize in southern Nigeria. This preference depended on the greater yield of flour per unit weight of grain in the floury varieties over flint and dent varieties. Grain type, plant height, time to maturity and grain colour allowed distinction of four local maize types.

Some of the newly introduced maize types from Central America outyielded the local varieties by a wide margin: 1200–1500 lb per acre for the local varieties and 2500–3000 lb for the introduced ones. Once, this difference proved to be due to greater longevity of the top leaves of an introduced variety.

Information on the agronomy, distribution and utilization of maize was used to draw up aims for a Nigerian maize breeding programme. One of the aims, a yellow flint maize of medium duration, was achieved in a synthetic variety ES1 through an intravarietal gametic selection for combining ability. Later observations showed that advanced-stage inbred lines from several sources should be utilized.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

384. H. D. W. VAN TUIL Organic salts in plants in relation to nutrition and growth. 1965, pp. 8 + 84. Eng. a. Du. summ. Also published as ARR 657 (1965).

Nutrient elements applied to the soil not only give crop production but cause certain interactions with chemical constituents of the plant. Studies on four different plants, perennial ryegrass, sugar-beet, poplar and birch, demonstrated that regardless of difference in natural environment, each plant needed an optimum organic salt content as a condition to achieve optimum growth.

The total amount of organic salts present in tissue and the relative proportion of the individual organic salts could easily be influenced by application of cer-

tain nutrient elements. The total organic salt content required for optimum growth was about 1000 m-equiv. per kg dry matter for herbage of perennial ryegrass, 3500 m-equiv. in young leaves of sugar-beet plants, 1100 m-equiv. in poplar leaves and 550 m-equiv. in birch leaves.

The uptake of ammonium nitrogen led to decrease of organic salt content in plant tissue. This is probably not due to utilization of nitrogen in a plant but to competition between other cations and ammonium during nutrient uptake.

Promotor: Prof. Dr A. C. Schuffelen

Author

385. J. W. LACKAMP Een onderzoek naar variabiliteit en vererving van het ruw-eiwit gehalte in Engels raaigras / *Research on variability and heredity of crude protein content in perennial ryegrass*. 1965, pp. 8 + 120. Du. a. Eng. summ. Also published as VLO 656 (1965).

Raising the protein content by breeding of grasses forms a contribution to raising grass quality (in which digestible protein is a valuable nutrient).

A strong correlation proved to exist between time of heading and chemical composition. Protein content as a qualitative property was much influenced by environmental conditions.

A theory of Schwarze and Schwanitz based on physiological considerations existed that selection for higher protein content, combined with high protein yield, should be performed only under such environmental conditions that this combination is physiologically possible.

Genetic differences in protein content among plants with the same physiological rhythm were found. These differences showed a clear interaction with environment. They were heritable. The reaction of genotype on environment was also heritable. Phenotypic variability of a certain genotype was enormous. It many times exceeded differences between genotypes, even if these were extremes. Behind the phenotypic negative correlation between protein and carbohydrates there seemed to be a negative genotypic correlation.

Many protein rich genotypes were less productive and less vigorous.

Cumulative selection was not hopeful.

The theory of Schwarze and Schwanitz based on the theoretical physiological observation tested here did not hold.

Promotor: Prof. Ir M. L. 't Hart

Author

386. A. M. EL ZARKA Studies on *Rhizoctonia solani* Kühn, the cause of the black scurf disease of potato. 1965, pp. 12 + 74. Eng. a. Du. summ. Also published in Meded. LH 65 (1965) 5.

Following a discussion of the nomenclature of *R. (Corticium) solani*, 15 isolates from potato were divided into 3 groups on cultural characters. Growth

was not suppressed by the incorporation of oxytetracycline or streptomycin in the media. None of the isolates was very pathogenic; the majority induced light to moderate infection and showed no correlation between type of isolate and pathogenicity.

The fungus was isolated from soil by inserting pieces of jute stem fixed on steel entomological pins for easy recovery. *C. solani* could be recovered after only 12 h, and was isolated on either cherry agar or water agar. On cherry agar 49 morphologically distinct types were recognized from naturally infected soil. The pathogen withstood severe winter conditions and persisted in soil for at least 9 months. No correlation was observed between degree of pathogenicity in potato and on other hosts.

Promotor: Prof. Dr A. J. P. Oort

Rev. Applied Mycol.

387. A. W. DE JAGER Hoge afvoeren van enige Nederlandse stroomgebieden / *Peak runoff in small river basins in the Netherlands*. 1965, pp. 8 + 168. Du. summ. after each chapter. Eng. summ. Also published as VLO 658 (1965).

The relation between precipitation and runoff hydrographs during winter periods with heavy rainfall showed an almost constant base flow and high peaks of runoff.

Hydrographs of various basins were analysed by runoff characteristics, in which the following parameters occurred: the percentage of the total area contributing to peak runoff; the reservoir coefficient of this temporary runoff, as developed by Kraijenhoff van de Leur for groundwater flow and here used in general for estimating the transformation of rainfall into runoff; the size of the almost constant base flow.

For each of the catchment areas, varying in size from 30 to 8000 ha, the reservoir coefficient, derived in various periods, was constant, depending partly on average slope of the terrain.

Proportion of precipitation constituting peak runoff was not constant during the whole winter but was, up to a maximum, largely determined by the amount of preceding rainfall. This maximum coincided approximately with the area where the watertable rose in wet periods close to soil surface, causing gley symptoms in the soil profile, and corresponded to the area with ditches.

Promotor: Prof. Ir F. Hellinga

Author

388. H. JONKERS On the flower formation, the dormancy and the early forcing of strawberries. 1965, pp. 8 + 60. Eng. a. Du. summ. Also published in Meded. LH 65 (1965) 6 and as Lab. Tuinbouwplantenteelt, Publ. 265.

It was investigated whether successful forcing of strawberries could start before 15 January. To study flower initiation the influences of daylength and

temperature were traced for early, mid season and late cultivars, particularly the early Deutsch Evern. After leaf area had reached a minimum 14–18 short-day cycles of 8h of light and 16h of darkness at 18°C initiated flowering of this cv. Probably a short cold period (e.g. 5°C) removed the light inhibition, and a longer period caused accumulation of a substance stimulating elongation and inhibiting flower initiation. After short-day treatment of parent plants the floral stimulus was not transported to daughter plants.

No absolute dormancy was observed. The term relative dormancy was preferred. Fairly prolonged chilling promoted truss elongation, but in autumn fairly brief cold could do this if supplemented with long-day treatment and spraying with gibberellic acid (GA<sub>3</sub>).

The rate of plant development was mainly influenced by cv., later forcing and warmth. Prolongation of chilling and of day length, and spraying with GA<sub>3</sub> caused no acceleration. Yield was influenced by cv. and the time when forcing commenced. The prospects for early forcing were determined by all measures promoting the efficient use of assimilatory light.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

389. P. E. RIJTEMA An analysis of actual evapotranspiration. 1965, pp. 8 + 108. Eng. a. Du. summ. Also published as ARR 659 (1965).

The main interacting factors determining the actual evapotranspiration from crops were analysed.

The apparent diffusion resistance of the crop was introduced because of the geometry of the evaporative surface. Its relation to light intensity and to suction in the leaves had been estimated for grass.

The precipitation intercepted by the crop increased evapotranspiration when the diffusion resistance of the crop was not zero.

The relation between capillary conductivity and suction was discussed. The relation between diffusion resistance of the crop and the soil physical conditions was calculated with a flow model.

A mathematical model of the factors determining evapotranspiration was derived. The possibility of relating evapotranspiration from crops and evaporation from a free water surface was discussed, and the transfer of such a relation from one area to another different in climate was considered.

Promotor: Prof. Ir F. Hellinga

Author

390. H. J. EGGINK Het estuarium als ontvangend water van grote hoeveelheden afvalstoffen. Afvoer van het veenkoloniale afvalwater naar de Eems / *Discharges of large amounts of waste water into an estuary. Discharge of sewage from the Fen Settlements into the River Ems.* 1965, pp. 12 + 144. Du. a. Eng.

summ. Also published as Meded. Rijksinst. Zuivering Afvalwater, Voorburg, 2 (1965).

In the Fen Settlements in the north of the Netherlands straw-board factories and potato-flour mills discharged large amounts of waste water (estimated at 420 tons of BOD<sub>5</sub> (biological oxygen deficiency) per 24 h during the autumn working season of the potato-flour mills) largely into canals, causing severe water pollution. A radical solution might be to pump the wastes through a pipeline to the Ems estuary about 30 km away. Some of the polluted canal water was already discharged into the estuary.

A study was made of how discharge of all the waste would effect the oxygen status of the estuary. This was done by relating waste discharge, distribution of BOD, and distribution of O<sub>2</sub> content over several years, and by calculating the expected distribution of oxygen if the sewage was discharged by pipeline.

Finally salt content, BOD<sub>5</sub>, oxygen content and other properties of the estuary water were measured on a boat over more than five years. Further factors included in this study were the rate of decay of the organic matter in the estuary water, the ratio between BOD<sub>C+N</sub> and BOD<sub>5</sub> and the coefficient of re-aeration.

Measured and calculated data agreed well, showing that calculated values for oxygen condition were reliable. Since calculated values were satisfactory, discharge of all the sewage of the Fen Settlements into the Ems estuary could be advised.

Promotor: Prof. Dr Ir E. G. Mulder

Mu.

391. P. C. VAN DEN NOORT *Omvang en verdeling van het agrarisch inkomen in Nederland 1923–1963 / Extent and distribution of agricultural income in the Netherlands, 1923–1963.* 1965, pp. 12 + 164. Du a. Eng. summ. Also published as VLO 667 (1965).

Van den Noort investigated whether agriculture in the Netherlands always functioned efficiently. He analysed information on the extent and distribution of agricultural income separately for 1923–1940 and 1949–1963. For this purpose the relations between economic factors were examined and clarified by mathematical formulae both existing and specially developed.

Before the War the course of the agricultural income was much more fitful than that of the national income and the decline in agriculture during the years of depression was much greater than in the total national economy. After the War fluctuations remained great, while expansion after 1952 was much slower in agriculture than in the rest of the economy.

Productivity in agriculture increased in both periods much faster than income per unit 'factor input' (the total of production factors in agriculture). After the net price had decreased, consumers profited considerably from the technical progress. These events and the increase in capital per man-year of labour decreased the quantity of labour, more than the total 'factor input'. This was

important for a better labour distribution in the national economy.

Sector and functional distribution of income in agriculture were distinguished. The first indicated the role of agriculture in the national income, particularly as to its industry, and was closely bound up with the sector labour distribution. The second one indicated division over the production factors labour and capital (including soil). To study these last factors the course of rentprices and salaries was traced.

In considering the income parity in agriculture the agricultural policy after the War proved to have fulfilled its aims, and agriculture of the Netherlands was shown as a whole to have functioned efficiently.

Promotor: Prof. Dr J. Horring

E./Koo.

392. M. T. EL-IBRASHY A comparative study of metabolic effects of the corpus allatum in two adult *Coleoptera*, in relation to diapause. 1965, pp. 8 + 66. Eng. a. Du. summ. Also published in Meded. LH 65 (1965) 11.

Two problems were studied: a) Whether a lower titre of the corpus allatum hormone had a different influence on the tissues of an adult insect with a diapause mechanism than on those of one without a diapause. b) Whether the metabolic effects of the corpus allatum hormone were caused mainly by its indirect influence upon an organ, e.g. the ovary, or by general influence on the metabolism as a whole. For the research two adult *Coleoptera* were used: the Colorado beetle (*Leptinotarsa decemlineata* Say) with a diapause mechanism and the yellow mealworm beetle (*Tenebrio molitor* L.) without such a mechanism. By tracing the influences of allatectomy or of castration on the respiration it was concluded that in both species the hormone had a gonadotropic influence in females and in ♂ and ♀ Colorado beetles also a general influence on the metabolism (direct on the basal resting respiration of active insects and probably indirect on their respiration by forced action through the central nerve system).

Further hypotheses were drafted about the location of the diapause mechanism (the flight muscles and the fat body?) and the function of the corpus allatum in the fat metabolism (probably mainly to speed the making of fatty acids unsaturated).

Promotor: Prof. Dr J. de Wilde

E.

393. L. J. J. VAN DER KLOES Bodemkundige aspecten van de teelt van enige tuinbouwgewassen / *Soil requirements for the growth of some horticultural crops*. 1965, pp. 8 + 114. Du. a. Eng. summ. Also published as VLO 665 (1965).

Soil requirements were studied for some economically important horticultural crops: apples, tulips, roses and cucumbers.

Soil profiles were described, the chief characteristics being the granular, the



hydrological and the structural profile.

Root-system profiles were prepared, as a means to characterize the rooting intensity in the soil as well the nature and condition of the roots. A connection was established between the root-system profile and other soil factors described in the field at several sites. Since also a qualitative relation was found between the root-system profile and the growth results, the root profile could be used for advice on soil management.

A deep and intense root development improved the crop. The structural and hydrological profiles provided information where rooting was restricted.

An intermediate layer of inferior structure, frequently occurring in the upper part of the profile, had to be improved by mechanical or biological methods. However, subsoils of favourable structure should not be disturbed by ploughing. In general more attention should be paid to drainage, since excess of water often limited root development.

Promotor: Prof. Dr Ir P. Buringh

Bou.

394. S. SLAGER Morphological studies of some cultivated soils. 1966, pp. 8 + 144. Eng. summ. after several chapters. Du. summ. Also published as ARR 670 (1966).

A study was made of those morphological and physical soil properties considered to govern root development.

A deep and wide-branched root system was shown only to develop in a soil containing a permanent heterogeneous pore system, formed by biological activity in the profile. Therefore a distinction was made between biogenic structures having a relatively heterogeneous pore-size distribution and physicogenic and geogenic structures with a more homogeneous one.

To demonstrate the effect of differences in management on soil structure in originally similar profiles, three types of land use were compared. Use as arable land proved to give rise to the formation of compacted surface soils with physicogenic structures. Here, mechanical forces leading to degeneration of structure were not compensated by biological regeneration. The same soil under horticulture was, however, shown to have a high biological activity, through added organic manure, and to yield very porous surface soils.

Land, used as pasture, proved to have intermediate properties in this regard. Only with sufficient drainage this favourable biological effect was found. Methods, developed to study the occurrence of biopores, were applied in some small soil surveys. It was suggested to include the biopore concept in both soil suitability and classification studies.

Promotor: Prof. Dr Ir P. Buringh

Bou.

395. M. HASAN KHAN The role of agriculture in economic development. A case study of Pakistan. 1966, pp. 12 + 164. Du. summ. Also published as ARR 674 (1966).

The author divided his work into a theoretical part and a part with empirical information about Pakistan. The theoretical part comprises a framework for analysis of the economic development of an agricultural society. The second part describes the basic features of the Pakistan economy and the causes of backwardness in agriculture. Governmental efforts to stimulate economic development and the possibilities of a self-sustained growth were also considered. The economic structure of Pakistan illustrated the dualism typical of underdeveloped communities. To avoid stagnation, growth must be induced. The Pakistan government played an important role in the development of agriculture, by the planning and execution of two five-year plans. The results were mainly expressed as improvement in the agricultural infrastructure and the reorganization of important sectors of agriculture. Improvement was also achieved in those factors essential for self-sustained growth. Finally a new development plan of the government was reviewed. The author doubted whether its objectives could be reached within the time fixed.

Promotor: Prof. Dr Th. L. M. Thurlings

Kr.

396. W. G. SOMBROEK Amazon soils. A reconnaissance of the soils of the Brazilian Amazon region. 1966, pp. 8 + 304. Eng., Port. a. Du. summ. Also published as ARR 672 (1966).

The study deals with soils of the Brazilian part of the Amazon basin. Most soils are Latosols, some with soft or hardened plinthite. The Latosols are characterized by a latosolic B horizon as defined in Brazil.

Plinthite, its formation and morphology were extensively described. Five main types of hard plinthite were distinguished. The rather uniform soils of the Amazon Planalto proved to be mainly Kaolinitic Yellow Latosols.

Various intergrades toward Groundwater Laterites and Red Yellow Podzolic soils were shown to exist.

Special attention was given to the relation between the soil conditions and vegetative cover. The mean gross timber volume and the presence of specific tree species were discussed.

The suitability was assessed of the soils for agricultural production, especially vegetables, cash crops and some perennials such as oil palms.

Promotor: Prof. Dr Ir P. Buringh

Bu.

397. M. FLACH Nutmeg cultivation and its sex-problem: an agronomical and cytogenetical study of the dioecy in *Myristica fragrans* Houtt. and *Myristica*

*argentea* Warb. 1966, pp. 12 + 88. Eng., Du. a. Indon. summ. Also published in Meded. LH 66 (1966) 1.

Indonesia produced 60%, Grenada 40% of the 5600 tons of nutmeg (the dry shelled seeds) and 1400 tons of mace (the dry arillus) of the tropical rain forest tree *Myristica fragrans*. Restriction of male flowering trees to 10% and spacing at 9 metres would rise yields per ha sharply above the usual 800 kg nutmeg and 160 kg mace, at 2000 fruits per female tree.

In Grenada air-layering and approach-grafting, although expensive, were developed for practical use. In New Guinea the tree showed a 1:1 segregation into a female-only flowering sex, with strong correlation between production and stem girth, and a male-flowering sex, mostly bearing also female flowers and fruits.

Investigations for a visible chromosomal sex mechanism showed 44 (2n) nearly isodiametric chromosomes (0.4–1.0  $\mu$ ) and 'non-localized' centromeres. Breakage of chromosomes by X-rays produced persistent fragments, proving nutmeg to be the first dicotyledon with diffuse centromeres.

The hypothesis was developed that nutmeg had four pairs of sex chromosomes. The heterogametic female had four facultative nucleolar sex chromosomes, in meiosis orientated by the nucleolus. The variation in female flowering was explained by partial failure of orientation. If proved, the hypothesis offered possibilities for sexing young seedlings and improvement by breeding.

Promotors: Prof. Dr Ir J. D. Ferwerda and Prof. Dr R. Prakken      Author

398. A. J. FLACH Ritproduktie van landbouwverkeer in graslandgebieden / *Trip production of rural traffic in grassland areas*. 1966, pp. 8 + 124, Du. a. Eng. summ. Also published as VLO 678 (1966).

To construct a system of rural roads needed insight into the relations between the extent of rural traffic and land use, the purpose of traffic movements, the period when it takes place and the kind of vehicles used.

Rural traffic started and ended in land and farm buildings and may remain in the area or go beyond it. It may be part of farm operation or social traffic for maintenance of social relations between farmers and other people. Farm-bound traffic consisted of external functional traffic and social traffic.

A linear relation was introduced relating annual average daily traffic volume (AADT) of internal functional traffic per 100 ha accessible grassland to density of land use, which was a function of the mean size of holdings. The mean working-day farm-bound traffic during October-March was highly correlated with the number of accessible farms.

The effect was discussed of quality of roads and the length of routes on choice between an indirect route and a direct route in strip parcelled areas. The

weighted length of the unmetalled parts of a route was approximately 2.5 to 3.5 times the absolute length.

Promotor: Prof. Ir F. Hellinga

Author

399. J. W. DE ZEEUW Analyse van het afvoerverloop van gebieden met hoofdzakelijk grondwaterafvoer / *Hydrograph analysis of areas with prevailing groundwater discharge*. 1966, pp. 8 + 140. Du. a. Eng. summ. Also published in Meded. LH 66 (1966) 5.

A model was developed for the precipitation-discharge relation in permeable areas, where surface runoff played only a minor part or none at all in the total discharge volume. The model primarily consisted of a small number (1–4) of negative exponential functions including, if necessary, one for surface runoff, the others for different types of groundwater flow.

The parameters in the model were of 3 types: the constants in the exponents, called *reaction factors*, expressed in  $\text{time}^{-1}$ ; the time-variant reduction factors to be applied to function outputs (the inputs for each function being the full effective precipitation); and usually a subtractive quantity. The hydrograph for an area was calculated by summing per calculation interval the reduced outputs of all functions discerned in the discharge pattern of that area, minus the subtractive.

Values for parameters as well as the number of functions integrally depended on the shape of the hydrograph measured over 2–3 complete years without previously considering physical conditions within the area, thus avoiding the introduction of other unnecessary complications. The best possible result could only be a statistical conformity between calculation and observation as, for hydrographs over long periods, errors in precipitation measurement prevented precise fitting.

The reaction factors could be interpreted physically as belonging to hydrologically homogeneous subareas. The reduction factors represented the proportional areas of them. The subtractive represented deep-seepage loss from the entire area.

Promotor: Prof. Ir F. Hellinga

Author

400. M. A. J. VAN MONTFORT Statistische beschouwingen over neerslag en afvoer / *Statistical considerations on precipitation and discharge*. 1966, pp. 8 + 102. Du. a. Eng. summ. Also published as LEB-Fonds Publ. 44.

Data on daily precipitation over about 80 years at 24 places in the Netherlands were available in two forms: in chronological order and per month as frequency distributions of precipitation amounts of one and more days.

The negative binomial distribution was fitted to these frequency distributions

and the trend of the parameters was related to the number of days and to the correlation coefficient of the successive amounts of precipitation. The usefulness of truncate negative binomial distribution was examined.

The distribution of maximum precipitation in a period of 1, 2 and 3 days within a month accorded well with the double exponential distribution; the parameters within each month were related to distance from the coast.

In an agrohydrological model with variable intensity of discharge and variable maximum moisture deficit, the differences were studied in some agrohydrological criteria calculated with the observed series of precipitation data or with the frequency distribution only.

Promoters: Prof. Ir F. Hellinga and Prof. Dr Ir L. C. A. Corsten      Author

401. A. D. ADAMSE Bacteriological studies on dairy waste activated sludge. 1966. pp. 80. Eng. a. Du. summ. Also published in Meded. LH 66 (1966) 6.

Dairy-waste activated sludge was examined for bacterial composition and response to different conditions. Strains isolated were classified mainly into three groups: predominantly coryneform bacteria (largely *Arthrobacter*), some Achromobacteraceae and a small groups of Pseudomonadaceae. Experiments with representative strains of the three groups confirmed the ultimate predominant position of *Arthrobacter*.

Two thirds of the bacteria gave a neutral reaction on Hugh and Leifson media, and more than half were not proteolytic. The activated sludge showed a ready accumulation of polysaccharides under certain nutritional conditions.

Dissimilation of the carbohydrate of the substrate started immediately after adding substrate to an aerated activated sludge suspension. This was demonstrated by a drop in pH, through accumulation of acid intermediates, and a sharp decrease of dissolved O<sub>2</sub>. Dissolved O<sub>2</sub> was estimated by a stirrer-cleaned oxygen electrode. When dissolved O<sub>2</sub> was still available, acetic acid accumulated; when O<sub>2</sub> was exhausted, lactic acid formed.

Dissimilation of the proteins usually started after the carbohydrate was exhausted and lasted longer. This meant that there may be an important discrepancy between the original and the actual C/N relation of the substrate.

Experiments with *Sphaerotilus natans* and *Arthrobacter* strains, and published data yielded an explanation of the mechanism of bulking of activated sludge.

Promotor: Prof. Dr Ir E. G. Mulder      Author

402. A. R. EL-BOUSHY Egg shell quality and microstructure as affected by vitamin C, other feed additives and high environmental temperatures. 1966, pp. 4 + 80. Eng. a. Du. summ. Also published in Meded. LH 66 (1966) 7.

The effects of climatic stress on egg formation (weight, shape, formation period, clutch size and blood calcium) and shell quality were estimated in White Leghorn and White Plymouth Rock hens. Constant environments were used with 85°F 75–80% r.h., 75–77°F 50–60% r.h. and 55°F 50–60% r.h. as well as a fluctuating environment with 10 h (day) 85°F 75–80% r.h. and 14 h (night) 65–70°F 50–60% r.h. The effects of dietary vitamin C (50 or 100 mg/kg feed), NaHCO<sub>3</sub> 2.1% and antibiotics were also tested.

The author concluded the following. Fluctuating temperature had no effect. In heat-stressed hens vitamin C improved the diminished shell quality and raised blood calcium.

At 75°F vitamin C and NaHCO<sub>3</sub> increased egg weight and shell quality. Combinations of antibiotics improved egg and shell weight. Microscopy of ground sections of the shell showed that heat diminished shell thickness and impaired the crystal structure of the calcified shell; vitamin C addition improved shell thickness.

Promotor: Prof. Drs A. M. Frens

Wi.

403. G. C. MEIJERMAN Betekenis van een aantal cultuurtechnische factoren voor de ontwikkelingsmogelijkheden van veenkoloniale akkerbouwbedrijven / *Significance of some cultural factors in the scope for development of arable form in fen settlements*. 1966, pp. 8 + 171. Du. a. Eng. summ. Also published as VLO 686 (1966).

The author investigated the possibilities for arable farms in the old fen settlements of the north-eastern Netherlands after various improvements such as in the quality of the soil and the layout. By linear programming, calculations were made for farm models differing in soil quality, accessibility of farm buildings and land for heavy transport, field size, field distance and width of the fields, and in labour force and mechanization.

Farms with machines usual for the area gave insufficient scope, even under the most favourable circumstances. For reasonable incomes further mechanization was necessary. To attain maximum profit from this and from improvements as in layout, the area per man should be increased considerably.

A level of mechanization with an investment of f 75,000 in machinery gave good results, if the accessibility of farm buildings was improved, fields enlarged and an area per man was above 25 ha. However, the best results could only be attained with areas per man of about 40 ha. If so the farms could also provide higher wages and take higher costs for land than then. A still heavier mechanization without any contracting work demanded very large farms.

The accessibility of the farm building and the field sizes had an especially important effect on the evolution possibilities of the farms. In establishing im-

provement plans for this area, these factors should be taken more into account than any increase in the number of public roads.

Promotor: Prof. Dr Ir J. F. van Riemsdijk

Author

404. B. DEINUM Climate, nitrogen and grass. Research into the influence of light intensity, water supply and nitrogen on the production and chemical composition of grass. 1966, pp. 8 + 92. Eng. a. Du. summ. Also published as Meded. LH 66 (1966) 11.

The investigations referred to indoor and field experiments, carried out with *Lolium perenne*.

With an increasing light intensity yield of dry matter, the contents of dry matter, water-soluble carbohydrate and 'rest' (residue) increased; those of nitrate, crude protein, ash and crude fibre decreased.

A rising temperature caused some yield increase, dry matter content hardly changed, crude protein and water-soluble carbohydrate diminished and so sometimes did the ash content whereas crude fibre and 'rest' increased.

Water shortage decreased yield of dry matter and increased contents of dry matter, nitrate, crude protein and ash. Water-soluble carbohydrate, crude fibre and rest were usually reduced.

Nitrogen dressing stimulated yield of dry matter, nitrate, crude protein and ash, and sometimes the crude fibre. Contents of dry matter, water-soluble carbohydrate and 'rest' contents decreased.

Light and N both increased yield of dry matter, but counteracted each other in the chemical composition.

Crude fibre and 'rest' in fresh matter were positively correlated with water consumption per g fresh matter. Some informative experiments with *Brachiaria ruziziensis* gave similar results. It was suggested, therefore, that high temperature, and low nitrogen supply might be the chief explanation for the low nutritive value of grass in the tropics.

Promotor: Prof. Ir M. L. 't Hart

Ov.

405. G. W. WIERINGA On the occurrence of growth inhibiting substances in rye. 1967, pp. 68. Eng. a. Du. summ.

The cause of the decreased food intake and lower growth rate of animals fed on rye was investigated. With rats it was proved that the causative agent was soluble in petroleum ether and acetone. The growth inhibitor was identified as a mixture of 5-n-alkyl resorcinols with odd numbered side-chains of 15-23 C atoms, and of smaller amounts of 5-alkenyl resorcinols.

No difference in growth inhibition could be detected from the wheat resorcinols found by Wenckert et al. But the effect of synthetic 5-n-pentadecyl resorcinol

was only 50–60% of that of the grain resorcinols, however. This could not be due to alkenyl resorcinols in wheat and rye, because hydrogenation of the grain resorcinols did not alter the growth inhibition.

A fluorometric method for the analysis of 5-alkyl resorcinols was developed. By this method and thin-layer chromatography the alkyl resorcinols could be found in the pericarp. So the resorcinol content of rye proved to be proportional to the surface area of the grain and thus dependent on grain size.

Young rats were more susceptible to grain resorcinols than older ones. The decreased food consumption of resorcinol-fed rats was not caused by any unappetizing taste of rye oil or rye resorcinols.

The growth of pigs on rations containing 50% rye oil or an equivalent amount of rye oil, was 11–12% lower than on a 50% barley ration. No differences in harmfulness could be detected between fresh rye and rye stored for a year.

Promotor: Prof. Ir S. Iwema

Author/E

406. J. E. PARLEVLIET The influence of external factors on the growth and development of spinach cultivars (*Spinacia oleracea* L.). 1967, pp. 12 + 76, Eng. a. Du. summ. Also published in Meded. LH 67 (1967) 2.

Influences of genotype (cultivar), temperature, light intensity, gibberellic acid ( $GA_3$ ) and daylength on stem elongation and flowering of spinach were investigated. Most cultivars reacted quantitatively to long days (LD) both for stem and flower formation. Daylength requirements varied from almost day-neutral to LD.

Cold, 2–8°C, decreased daylength requirement; 9–12° only accelerated stem growth. All cvs reacted similarly to temperature. Dimmer light decreased daylength requirement, especially in later cvs.  $GA_3$  accelerated stem growth strongly, flower-formation only slightly.

There was no juvenile stage for temperature or daylength response. Regression of flower formation may occur in a qualitatively LD cv after transfer to SD. Flower formation was most inhibited with photoperiods of 6–10 h; it increased with shorter or longer photoperiods. A qualitative LD cv as 'Nobel' remained vegetative only in SD, if stem growth was inhibited. In SD differentiation in axillary primordia and the consequent formation of flower clusters occurred much slower than in LD and stopped early unless caulescent tissue grew at low temperatures, dim light or  $GA_3$ , in accordance with the hypothesis of Chailakhyan that both gibberellins and floral stimulus were needed for stem growth and flower differentiation, respectively, of LD rosette plants. Formation of both hormones would depend on daylength.

Cvs were earlier where they required shorter daylength and where they grew faster. By studying the influences of temperature, vernalisation, light intensity and  $GA_3$  on yields, through their influence on developmental rate and growth



rate, several practical conclusions could be drawn about optimum sowing date.

Promotor: Prof. Dr Ir S. J. Wellensiek

E.

407. D. B. W. M. VAN DUSSELDORP Meerdimensionale overheidsplanning; de overheidsplanning van Suriname in de periode 1952-1964, getoetst aan een relatiemodel / *Multidimensional administrative planning*. 1967, pp. 10 + 216. Du. a. Eng. summ. Also published in Meded. LH 67 (1967) 1.

The comprehensive and often intricate working of government was conceived as 'multidimensional administrative planning'. A relation model of this process was constructed and the results of planning by the Surinam Government between 1952 and 1964 were tested on this model.

In defining this concept a distinction was made between the planner, the person or organisation carrying out the planning, and the planned, the community, region or level of the socio-economic structure to which the planning relates.

The relational model was intended to express non-mathematical relationships between different variables as pattern-relationships. Components of administrative planning were traced and four groups of dimensions (levels, sectors, facets and phases) were distinguished. Interrelations of these dimensions were considered. Three national plans, a regional plan and a local plan were analysed, after which two sector plans and an evaluation report were discussed. Until then administrative planning had extended only to some parts of the planned. Many interrelations were only discerned later and so were not systematically considered in the planning process. The relational model leaving scope to do so, will have to be adapted to each situation.

Promotor: Prof. Dr R. A. J. van Lier

P.

408. T. SCHNEIDER Nachtvorst en microklimaat. In het bijzonder in jonge bosaanplant / *Frost and microclimate, in particular in young forest plantation*. 1967, pp. 8 + 82. Du. a. Eng. summ. Also published in Meded. LH 67 (1967) 4.

In forestry frost may cause considerable damage. A purpose of this publication was to consider whether any of the many methods of preventing frost were suitable for forestry. Much of the research was devoted to a description of the microclimate and the relation between the physical phenomena occurring in the lowest air layers during inversion conditions.

The different terms of energy balance were estimated or calculated with special attention to net long-wave radiation, the soil heat flux and the heat flux in the air. After an introduction on turbulence and convection, the turbulent transfer in neutral and thermally stratified conditions was discussed. The thermal

stability indices and the transport coefficients for heat and momentum proved to be important parameters. Measured and calculated windspeeds and air temperatures were compared for different weather conditions.

After a short review of recent literature on frost damage and frost resistance in plants, different methods of preventing frost were presented and explained. An application of passive methods was demonstrated by the measurements at different sites in the Netherlands and Tunisia.

Promotor: Prof. Dr D. A. de Vries (TH Eindhoven)  
(After the death of Prof. Dr W. R. van Wijk 1.3.1967)

Author

409. A. K. MINKS Biochemical aspects of juvenile hormone action in the adult *Locusta migratoria*. 1967, pp. 12 + 84. Du. (p. IX) a. Eng. summ. (p. 246). Also published in *Arch. Néerl. Zool.* 17 (1967) 175-258.

The present study deals with the actions of juvenile hormone in the adult African migratory locust (*Locusta migratoria*). Juvenile hormone (JH) was known to be essential for a completely normal yolk development in the oocytes of most female insects. No egg production was possible if the *corpora allata* (small spherical organs near the cerebral complex, which excrete JH) were extirpated. The general metabolism of such 'allatectomized' insects was strongly modified.

To find whether JH directly influenced respiratory metabolism, experiments *in vitro* with mitochondria isolated from flight muscles and fat body were used. No relation existed between JH action and oxygen consumption *in vitro*. However, a positive effect of JH on oxidative phosphorylation was evident.

Several aspects of the reproductive metabolism of normal and allatectomized adult *Locusta* were then compared. Production of yolk protein in the fat body was dependent on JH. It did not regulate whether these proteins could be produced at all, but which proteins could be formed at a certain moment.

This fundamental study was published at a time when practical application of insect hormones for pest control might become a reality. An increase in knowledge of the biochemical and physiological action of these hormones within the insect was essential.

Promotors: Prof. Dr J. de Wilde and  
Prof. Dr D. Stegwee (University of Amsterdam)

Author

410. R. L. M. PIERIK Regeneration, vernalization and flowering in *Lunaria annua* L. in vivo and in vitro. 1967, pp. 10 + 72. Eng. a. Du. summ. Also published in *Meded. LH* 67 (1967) 6.

*Lunaria annua* L. is a species with a juvenile phase and requiring cold for flowering. An annual flowering mutant was obtained with ethyl methane sul-

phonate. Experiments with shoot and leaf cuttings showed that juvenility was not a character of the whole plant. The juvenile phase was shortened by regeneration of cotyledon cuttings of very young plants.

The effectiveness of vernalization in leaf cuttings closely depended on regeneration of buds before or during vernalization.

Rejuvenation through regeneration is identical with juvenility. Flower induction *in vitro* in petiole segments of vegetative plants was effective, but only when buds were formed before or during vernalization. Cell divisions were considered to be a prerequisite to reach a certain stage of regeneration. Only from that stage could the low temperature act.

Flower bud initiation *in vitro* in explants from the main axes of flowering *Lunaria* plants was influenced by different plant factors and by almost all environmental factors normally affecting growth. The disappearance of the flowering state was considered to be not directly due to meiosis or fertilization, but to plant regeneration.

Promotor: Prof. Dr Ir S. J. Wellensiek

Author

411. R. W. DEN OUTER Histological investigations of the secondary phloem of Gymnosperms. 1967, pp. 8 + 120. Eng. a. Du. summ. Also published in Meded. LH 67 (1967) 7.

An anatomical study of secondary phloem of the different species of Gymnosperms showed that three categories could be distinguished, which may represent three evolutionary stages. These three categories were:

*Pseudotsuga taxifolia* type, to which belong many Pinaceae (while the other Pinaceae species belong to a subtype, e.g. the *Tsuga canadensis* subtype);

*Gingko biloba* type, to which belong the Cycadaceae, Araucariaceae and many Podocarpaceae and Taxaceae;

*Chamaecyparis pisifera* type, to which belong the Cupressaceae, Taxodiaceae and the rest of the Taxaceae and Podocarpaceae.

The phylogenetic sequence of the axial system and the reduction of the phloem rays starts in the *Ps. taxifolia* type with an almost uniform axial system and ray-albuminous cells, and a complex heterogeneous phloem ray, differentiating through the *G. biloba* type to the *C. pisifera* type, which has a highly specialized axial system with phloem-albuminous cells and a simpler, reduced homogeneous phloem ray. The reduction of the phloem rays parallels the differentiation of the axial system.

Promotor: Prof. Dr A. L. Stoffers

Previously supervised by Prof. Dr H. J. Braun

(earlier at Wageningen, then at Freiburg in Breisgau, Germany)

Author

412. A. C. ZEVEN The semi-wild oil palm and its industry in Africa. 1967, pp. 8 + 178. Eng. a. Du. summ. Also published as ARR 689 (1967).

The oil palm (*Elaeis guineensis* Jacq.) is of great importance to the people of West Tropical and Equatorial Africa. This palm is there a major food crop under semi-wild conditions and since the end of the 18th century a principal commercial crop. In the first chapters the centres of diversity, natural habitats, domestication and natural and farmer's selection of the oil palm are discussed. The main part deals with the semi-wild palm groves, their classification, yield and ways of increasing yield. Botanical, phytopathological, economic and sociological factors concerning these palm groves were investigated.

The main conclusion was that as the human population increased, the standard of living would fall more and more, unless better agricultural methods were introduced for the oil palm and other food and commercial crops. One such method is the replacement of palm groves by farmer's and commercial plantations of the oil palm and other perennial crops, and by arable land. This would be an expensive undertaking and would need sufficient knowledge of the work and much concern from the government and farmers.

Promotor: Prof. Dr Ir J. D. Ferwerda

Author

413. M. S. ABDALLAH The Resedaceae. A taxonomical revision of the family. 1967, pp. 12 + 132. Du. summ. (p. IX). Also published in Meded. LH 67 (1967) 8.

For this study 17,000–20,000 specimens were scrutinized of Mueller's material (Monographie, 1857, revised 1868). The number of genera here distinguished remained the same (6), but the number of species was a bit less (60). Among the many additions and changes necessary, some species were scrapped, also new ones established, the limits of some genera and of many species were improved or amended, some names were revised, new keys to genera and species were compiled. All species were illustrated in detail.

Aspects of the family *Resedaceae sensu lato* discussed, were morphology, taxonomy, geography, biology and economics. Genera were treated alphabetically, and selected references were added. All conclusions were explained and for each genus a key to species was made. Each species was described, and references, characteristics, geographic distribution, a number of selected herbarium specimens and synonyms were listed. An explanation was given for any synonymy. Notes on each species relate to nomenclature, history of the species, life cycle or ecological features and, so far as known, its importance to man.

Promotor: Prof. Dr H. C. D. de Wit

E.

414. D. PETERS Potato leafroll virus, its purification from its vector *Myzus persicae*. 1967, pp. 108. Eng. a. Du. summ. Also published as LEB-Fonds Publ. 45.

Experiments were described on the purification of potato leafroll virus (PLRV) from its vector *Myzus persicae*. Preliminary experiments demonstrated that much non-viral material had to be removed from aphid macerates to obtain a pure virus preparation. This was achieved by a multistep procedure, in which the aphid macerates were emulsified with chloroform at pH 5.0. The virus present in the interphase between the chloroform and water phases was extracted from the interphase, and concentrated by high-speed centrifuging. The virus suspension obtained was subjected to a phase system of butoxy-ethanol, ethoxy-ethanol and 2.5 M phosphate buffer pH 7.5, and centrifuged in a sucrose density gradient column.

A fairly pure virus preparation was obtained when the material from the infective zone of the gradient was concentrated at 90,000 g for 3 h. Particles with a diameter of 23  $\mu$  and with a hexagonal outline were found in each preparation by electron-microscopy. The PLRV isolate purified was free of any contaminating virus when its biological purity was tested. One of the PLRV isolates used in the preliminary experiments, was contaminated with other, presumable persistent, viruses. Their properties and some studies on their host range were described. These viruses were referred to as virus-like particles.

Promotors: Prof. Dr Ir J. P. H. van der Want and Prof. Dr J. de Wilde Author

415. Y. A. AFIFI Genetical and some environmental influences affecting the level of leucocyte counts in the milk of cows. 1967. pp. 10 + 84, Eng. a. Du. summ. Also published in Meded. LH 67 (1967) 11.

The progeny groups of different sires varied widely in white-cell count in milk, even after exclusion of all cows which had suffered from mastitis. The sire had a demonstrable effect on white-cell count in milk, especially during the second half of lactation. Heritability estimates of white-cell count in milk showed that values for the fourth lactation were higher than those for heifers. But at the end of lactation heritability values for 4th lactation cows and heifers were nearly equal (about 0.40). The daughter groups with high average white-cell counts mostly showed frequent mastitis. There was a high phenotypic and genetic correlation between clinical mastitis and white-cell count. Within seasons for cows which, so far known, had never mastitis, very high and very low producers had higher white-cell counts than other cows. White-cell counts increased remarkably with advancing lactation. A relation between white-cell count and ease of milking could not be demonstrated.

Increasing milking vacuum over 40 cm mercury pressure, especially at the end of lactation, or increasing pulsation to over 50 per min. tended to increase white-

cells. Milking routine (man/machine ratio) affected white-cell count in the end of lactation. More cows per milker increased the number of white-cells.

Promotor: Prof. Dr Th. Stegenga

Author

416. G. J. KRAAIJ Verspreiding van bloedgroepen in het Nederlandse zwart-bonte rundvee. Een onderzoek naar de frequenties van de bloedgroepen en naar enige factoren, die de frequenties beïnvloeden / *Distribution of blood groups in the Dutch black and white cattle breed. A study on the frequencies of blood groups and on some factors influencing the frequencies.* 1967, pp. 10 + 128. Du. a. Eng. summ. Also published in Meded. LH 67 (1967) 12.

Blood groups are genetically determined components of the red blood cells. In cattle there were 13 loci known to determine blood groups and some of these loci had large series of alleles. There were also 14 other loci known to determine proteins and enzymes in blood and milk of cattle.

The author examined how the distribution of blood groups in the Dutch Friesian population had been influenced by the restrictions of breeders. He found that parent cattle were paired independently of blood group. In offspring there was no selection for a certain phenotype until the end of the first year.

There were clear differences in the frequency of some genes between adult bulls and cows. The gene for blood group A was less frequent in bulls and that for blood group F was less frequent in cows. This occurred in some foreign breeds of cattle.

The distribution of blood groups over the population was not even. There were differences in gene frequency between breeding areas and in the breeding areas there were large differences between artificial insemination stations. Differences within farms and within breeding pedigrees were even greater. These differences could be ascribed largely to the use of one or only a few sires.

Promotor: Prof. Dr Th. Stegenga

Author

417. A. M. ABOU DAHAB Effects of light and temperature on growth and flowering of carnation (*Dianthus caryophyllus* L.). 1967, pp. 10 + 68. Eng. a. Du. summ. Also published in Meded. LH 67 (1967) 3.

Both a long photoperiod and strong illumination strongly promoted growth and flowering. These conditions diminished the number of leaf pairs below the flower and promoted growth of flower buds from initiation to bud emergence from the leaves. The subsequent phases to anthesis were little affected by photoperiod and light intensity. Other characters such as stem length, stem diameter, leaf length and width, flower diameter and petal number were affected more by strength than by duration of illumination.

Flower induction was promoted by cold (5°C). But as soon as the flower had

been initiated, its development was promoted by warmth.

Carnations were planted the year round at two-week intervals. The shortest time between planting and harvest was 4 months, after planting in April, the longest 8 months, after planting in September. Treatment at 5°C for three weeks reduced the time to the first crop when plants were started between July and November and increased it in plantings between January and June. There was no residual effect of cold on the second crop.

Promotor: Prof. Dr Ir J. Doorenbos

Author

418. H. TEN HAVE Research and breeding for mechanical culture of rice in Surinam. 1967, pp. 12 + 310. Eng. summ. after each chapter. Du. summ. (p. XI). Also published as ARR 690 (1967).

Ten Have described the results of research on cultural practices and breeding work, on the very heavy clay soils of the Prince Bernhard Polder and the Wagingen Project during the years 1952 to 1965. The chapters are: Introduction, Surface and underground drainage, Tillage and seedbed preparation, Sowing, The optimum seed rate, Water management, Weed Control, Fertilizers, Control of diseases and pests, The cropping system, Effect of harvesting date on some characteristics of the grain, Research into some quality characteristics of the grain, and Breeding.

Much attention was given to the problems inherent in the cultivation of two rice crops per year and to the development of varieties with a favourable response to nitrogen. This extensive study is not confined to mechanical culture of rice but also provides much valuable information on the more conventional methods of growing rice in the tropics.

Promotor: Prof. Dr Ir J. D. Ferwerda

Author

419. J. VAN DER BOON Analyse van de bodemvruchtbaarheid volgens de proefplekkenmethode bij een meerjarig tuinbouwgewas, de aardbei op zandgrond / *Analysis of soil fertility by sample plots with a perennial market-garden crop, strawberries on sands*. 1967, pp. 10 + 214. Du. a. Eng. summ. Also published as VLO 691 (1967).

The study had two purposes: to test the feasibility of the stratified random-plot method in a perennial market-garden crop; to gain a better insight into the ecological requirements of the strawberry, particularly to improve the use of fertilizers. Already known soil factors could be more closely put onto a quantitative basis for their effect on yield, for instance winter and summer watertable, humus content, pH, P, K and Mg status of the top soil and thickness of humic layer. Farmyard manure was clearly beneficial. The harmfulness of diseases came out more clearly than expected. Wind shelter was necessary to obtain a good

crop. Close study of the crop and soil can show previously unknown factors, as here with Cu for the strawberry.

But in the main it cannot be said that the plot method was a complete success for a perennial crop. Many influences could hardly be distinguished. In particular it was not possible to distinguish correlative soil complexes representing soil types which could be described from the profile and which could be of use in forecasting yield.

Promotor: Prof. Dr A. C. Schuffelen

Author

420 H. A. LUNING Economic aspects of low labour-income farming. 1967, pp. 8 + 137. Eng. a. Du. summ. Also published as ARR 699 (1967).

Conflicting views on the relevance of economic theory, as developed in the West, to low-income peasant societies had been advanced ever since Boeke's time.

Recent literature pointed out that available economic theories did not seem to fit the behavioral motivation, assumed in economic logic. The value was questioned of the tenet of profit-maximization and the usefulness of marginal analysis, especially with redundant labour and disguised unemployment in low-income farming. The productivity of labour as a determinant of wage formation was emphasized. After a review of wage theories, a theoretical structure was presented of the border line of underemployment and its impact on the level of remuneration in low-income farming.

Relevant hypotheses were tested by multiple regression analysis, using the Cobb Douglas production function. Field studies were carried out among peasant farmers in Northern Nigeria and in Surinam. The indication was that labour's remuneration was in accordance with its productivity. Absorption of labour into the agricultural economy was shown to be crucial in developmental strategy. For each area of study such a strategy was designed with estimated production functions.

Promotor: Prof. Ir J. H. L. Joosten

Author

421. Y. S. RIJPKEMA De invloed van bedrijfsfactoren op het ontstaan van acetonemie (acetonurie) en slepende melkziekte bij melkkoeien / *The influence of farm management on the development of acetonemia (acetonuria) and ketosis in dairy cows.* 1968, pp. 10 + 148. Du.a. Eng. summ. Also published in Meded. LH 68 (1968).

About 140 farms, where dairy cows had clinical signs of ketosis or acetonuria, were studied to find out whether farm management had any influence on the occurrence of these phenomena and whether outbreaks could be prevented by practical measures in this field.



The results did not indicate that there was any connection between general factors of management (such as kind of soil, and rate of stocking) and the induction of ketosis. They did not support the suggestion that outbreaks were usually associated with only a few types of ration or a small number of fodder combinations. But there were indications for a relation between feeding value of the ration and development of acetonuria and ketosis.

Consequently this relation was further studied. Considerable influence could be exercised against development of acetonuria and ketosis in cows, particularly with the ration given during the first days and weeks after calving. The ration during the dry period, in particular during the last two weeks, seemed to be of importance only in that feeding value and composition of the daily ration during that period must allow rapid adjustment of the ration to the cow's milk yield after calving.

Promotor: Prof. Drs A. M. Frens

Author

422. G. HEKSTRA *Selectieve teelt van tulpen gebaseerd op produktie-analyse / Selection while growing tulips by analysis of production*. 1968, pp. 8 + 80. Eng. summ. Also published as VLO 702 (1968).

In tulip cultivation many stocks of good producing varieties in course of time showed a decrease in production of large marketable bulbs. Meanwhile the number of small bulbs in these stocks increased. This phenomenon was investigated. It was attributable to three causes: contamination of the stock by either foreign material ('thieves') or mutants originating from the variety itself ('wild'); a wrong temperature treatment of the planting material; differences in production between the several bulb types growing at different places in the mother bulb.

The newly produced bulbs were named, after the scale of the mother bulb in whose axil they were formed, as A, B, C, and D for the fleshy scales (from inside to exterior) and H for the dry tunic. The production pattern of all types and grades was studied during three years. Especially the A and H bulbs were superior to the others in productivity. Second were B bulbs, followed by C and D. This productivity was not concerned with weight increase but to growth of the main bulb and offset number, which should not be too high.

Based on these results a selection scheme was proposed to eliminate all bulbs inferior in productivity. This scheme was the basis for tulip cultivation with selection in the meantime, so that productivity of the stock stayed maximum.

Promotor: Prof. Dr Ir J. Doorenbos

Author

423. J. J. F. E. DE WILDE *A revision of the species of Trichilia P. Browne (Meliaceae) on the African continent*. 1968, pp. 4 + 208. Du. summ. Also

published in Meded. LH 68 (1968) 2 and in *Belmontia*, serie 1 (Taxonomy) Fasc. 9 (1968).

The plant genus *Trichilia* (Meliaceae) as occurring in continental Africa was revised taxonomically. Eighteen species were distinguished. Each species was illustrated with a detailed drawing and distribution maps were given of each species in Africa.

Botanical descriptions were made and supplemented with ecological and biological data, historical information and miscellaneous notes relevant to botanical research in its widest sense.

The flowers in *Trichilia* were found to be most probably unisexual. Some problems of plant geography were indicated and some were solved. Amendments were made in the taxonomy of this very large, pantropical genus.

*Trichilia* was shown to be of some importance because of its wood and because of its occurrence as a wide spread component of tropical high forest.

The work was based on field observations, the study of herbarium material and on literature. The revision filled a long-standing gap in information on *Trichilia*.

Promotor: Prof. Dr H. C. D. de Wit

d.Wi.

**Abstracts of dissertations, prepared at the Agricultural University of Wageningen, The Netherlands, but defended at other universities, 9 March 1918–9 March 1968**

These abstracts have been numbered E1 to E73. First come those of Dutch universities arranged alphabetically by name of city where the universities are situated (Amsterdam, Delft, Groningen, Leiden, Rotterdam, Utrecht). Thereafter follow two from abroad, Oxford and Illinois. Each group is arranged chronologically.

#### **Amsterdam, Municipal University / Gemeentelijke Universiteit**

E1. Miss MARIANNE PINKHOF Untersuchungen über die Umfallkrankheit der Tulpen / *Studies on topple disease of tulips*. Thesis Amsterdam, 1930, pp. 20 + 154. Du. (p. IX) a. Ger. summ. (p. 285). Also published in *Recueil Travaux bot. neerl.* 26 (1929) 135-288.

Toppling of tulips is a physiological disorder occurring only when tulips are forced in the glasshouse. After waterlogging of part of the flower stem, the stem part shrivels, then the flower and the stem part above the waterlogging zone topple over. Frequently there are exudates on the infiltrated stem part in which sucrose and monose sugars could be detected. The sugar concentration of the exudate varied but proportions of sucrose and glucose were equal. Exosmosis of fluid into the intercellular spaces between the cells could be caused by an increase in permeability but no such increase could be detected. The osmotic value of the diseased cells was higher than normal, so most probably exosmosis was caused by an abnormally high osmotic value. Warmth and humidity in the glasshouse stimulated the incidence of topple but warmth was the greatest stimulator. Tendency to topple varied. An attempt was made to associate the tendency with the sugar composition of the tulip bulb.

Promotor: Prof. Dr Th. Weevers

Supervisor: Prof. Dr E. van Slogteren

K.

E2. Mrs BETSY DUBEL-MULDER Reacties van derivaten van 3,5-diaethoxy-pyridine. Een nieuwe bereidingswijze voor derivaten van 2,2-dipyridyl / *Reactions of derivatives of 3,5-diethoxypyridine. A new method of synthesis of derivatives of 2,2-bipyridine*. Thesis Amsterdam, 1950, pp. 66. Eng. summ.

In 3,5-diethoxypyridine there is a contrast in the effects of the hetero atom and ethoxy groups on the reactivity towards electrophilic and nucleophilic attack of carbon atoms 2 and 6. So a diversity of reactions of 3,5-diethoxypyridine and its derivatives substituted at position 2 or positions 2 and 6 could be expected.

Interesting data on the course of conversions of this type were collected, published contradictory results were clarified and structures of some compounds still in doubt could be established unequivocally. Syntheses of substances with remarkable physiological properties were established.

A striking result was obtained when treating 2,6-dibromo-3,5-diethoxy-py-

ridine with bromine in the presence of ferric bromide at room temperature. Instead of the formation of 2,4,6-tribromo-3,5-diethoxypyridine, quantitative production of 6,6'-dibromo-3,3',5,5'-tetra-ethoxy-2,2'-bipyridine was observed. In heterocyclic chemistry this coupling of 2 nuclei under such unusual and mild conditions was exceptional.

Promotor: Prof. Dr J. P. Wibaut  
Supervisor: Prof. Dr H. J. den Hertog

d.He.

E3 P. BRUIN Over addities aan alkenen onder invloed van donkere elektrische ontladingen / *Additions to alkenes induced by silent electrical discharges*. Thesis Amsterdam, 1951, pp. 76. Du a. Eng. summ.

The occurrence of free radicals during reactions *in vitro* and *in vivo* is widespread. Fundamental information was needed on the general chemistry of free radicals, such as relationships between the structure of substrates and the reactivity order towards radicals and the influence of method of radical generation on product formation.

Reactions were described induced by silent electrical discharges, presumably initiated by the generation of radicals. Radicals could be obtained in this way at every desired temperature and possibly in higher concentration than by other methods.

Pilot experiments on the action of  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{H}_2\text{S}$ ,  $\text{HCl}$  and  $\text{HBr}$  on ethylene, propene and butene-1 were carried out. Typical results were as follows.

Ethylene, propene and butene-1 were converted quantitatively at room temperature into bromoethane, 1-bromopropane and 1-bromobutane, respectively.

With an excess of steam at  $90^\circ$ – $95^\circ$  ethylene yielded, but not quantitatively, only a mixture of ethanol, ethanal and butanol-1; butanol-1 was the main product. Propene reacted analogously.

The results were interpreted on basis of the intermediate formation of radicals, although polar processes, occurring in the excited state of molecules or ions, could not be excluded.

Promotor: Prof. Dr J. P. Wibaut  
Supervisor: Prof. Dr H. J. den Hertog

d.He.

E4. C. R. KOLDER Halogeenverplaatsingen tijdens reacties van halogende-  
rivaten van aromatische hydroxyverbindingen / *Migration of halogen atoms  
during reactions of halogen derivatives of aromatic hydroxy compounds*. Thesis  
Amsterdam, 1954, pp. 86. Du. a. Eng. summ.

When investigating the reactivity of halogen derivatives of 2,4-dihydroxypyridine it was found that the 3-bromo derivative of this substance was converted

into the 5-bromo compound by heating with HBr acid and both 3 and 5 bromo derivatives were converted into 3-chloro-2,4-dihydroxypyridine by heating with HCl. Migrations also occurred during chlorination or nitration of 3-bromo-2,4-dihydroxypyridine.

An elaborate study on the mechanism of these migrations was made. The 5-chloro-2,4-dihydroxypyridine was synthesized and its reactivity compared with that of the other halogenodihydroxypyridines. The behaviour of analogous halogen derivatives of 2-ethoxy-4-hydroxypyridine, 4-ethoxy-2-hydroxypyridine, 2,4-diethoxypyridine and metadihydroxybenzene was studied. The exchange of halogen in 3 and 5 derivatives of bromo-2,4-dihydroxypyridine was established with radio-active bromine incorporated in HBr.

The migrations in the 3 and 5 derivatives (whose structure showed some analogy to that of uracil derivatives) indicated a satisfactory mechanism which also supplied important information on the mechanism of the other reactions studied.

Promotor: Prof. Dr J. P. Wibaut

Supervisor: Prof. Dr H. J. den Hertog

d.He.

E5. H. BLOKSMA Het suspensie-effect. De betekenis van de electrometrische bepaling van ionen-activiteiten in suspensies / *The suspension effect. The significance of the electrometric determination of ion activities in suspensions.* Thesis Amsterdam, 1955, pp. 124. Du. a. Eng. summ. Also published in *J. Colloid Sci.* 12 (1957) 40-51, 135-143.

Electrometric estimations of ion activities, for example of pH, are generally carried out by means of an electric cell with a liquid junction between a salt bridge and the solution or dispersion to be tested. The electrochemistry of this liquid junction in colloidal systems, as soil suspensions, was studied.

The first part shows that, contrary to previously published reports, a liquid junction in a single glass capillary tube with a diameter of 0.2 mm is not a useful model for the liquid junction in a soil suspension.

A theoretical equation for the electromotive force of a cell with liquid junction contains ion mobilities in the transition layer between salt bridge and suspension. Mobilities of ions in solution are precisely known; however, little information is available on the mobilities of adsorbed ions in this transition layer. Self-diffusion experiments in clay pastes showed that mobilities of adsorbed Na ions were 0.3 to 0.4 times the mobility of these ions in solution. Electromotive force values in clay suspensions could be explained if the mobility ratio for adsorbed K ions was about 0.2. Possible causes for the lack of quantitative agreement were discussed.

Promotor: Prof. Dr J. A. A. Ketelaar

Supervisor: Prof. Dr A. C. Schuffelen

Author

E6. W. T. BINNERTS Het jodiumgehalte van melk / *The iodine content of milk*. Thesis Amsterdam, 1956, pp. 8 + 153. Du. a. Eng. summ. Also published in Meded. LH 56 (1956) 4.

A literature survey revealed that if precautions were taken in sampling, the I content of bulked cow's milk reflected the I intake of the average animal. The number of animals should be sufficiently large, sampling data should be well defined, farms or creameries should be selected with a limited supply area of well defined soil type, and a reliable method should be used to estimate the traces of I. With these precautions, a clear geographical resolution and a well defined seasonal variation was obtained. Statistical treatment of the results from 200 creameries in four distinct areas yielded average I contents of 9.7, 13.8, 21.1 and 34.3 mg per litre in August and of 20.6, 32.1, 48.8 and 83.5 in January. These differences were highly significant ( $P < 0.001$ ). Marine clay always had a positive influence in I content, sometimes contrary to nearness to the sea. The area with the lowest I contents was identical with the goitre area in man and animals (Pasma, Wiertz). Therefore in the Netherlands simple iodine deficiency was the most probable cause for the development of goitre.

A final chapter discusses I intake in man by consumption of cow's milk.

Promotor: Prof. Dr Ir M. J. L. Dols

Supervisor: Prof. Dr E. Brouwer

Author

E7. P. A. DE VILLIERS Die inwerking van p-tolueensulfonielchloried op piri-dien-N-oksied / *Action of para-toluenesulphonyl chloride on pyridine-N-oxide*. Thesis Amsterdam, 1958, pp. 66. Afrik. a. Du. summ.

Pyridine-*N*-oxide is a highly polarizable substance which can react with both electrophilic and nucleophilic reagents.

Reactions starting with the addition of positive toluenesulfonyl to the oxygen atom of the *N*-oxide were systematically studied. Complicated reaction mixtures were obtained and carefully analysed. They consisted of the *para*-toluenesulphonate of 3-hydroxypyridine, *N*-(2-pyridyl)-pyridone-2, *N*-(2-pyridyl)-5-chloropyridone-2 and 2,3-dipyridyl-ether together with small amounts of *N*-(4-pyridyl)-pyridone-2 and pyridine.

The mechanism of this process was further elucidated by the action of 2, 3 and 4 derivatives of pyridyl-*para*-toluenesulphonates on pyridine-*N*-oxide and of 2-pyridyl-*para*-toluenesulphonate on some halogen and alkyl derivatives of pyridine-*N*-oxides were investigated.

The combined results of these experiments allowed the construction of a reaction scheme, by which the occurrence of all reaction products could reasonably be explained.

Promotor: Prof. Dr H. J. den Hertog

Supervisor: Prof. Dr H. J. den Hertog

d.He.

E8. J. H. GROBLER Initial phase ion uptake by plant roots and the interpretation of root potentials. Thesis Amsterdam, 1959, pp. 2 + 96. Eng. a. Du. summ.

Two phases in the process of ion uptake by plant roots were distinguished: initial rapid adsorption and a slower accumulation. The rapid initial phase was considered nonspecific and physico-chemical. The distribution of cations in the initial phase was studied in short-term uptake experiments and by stripping the adsorbed ions with a solution of ammonium nitrate.

The easily exchangeable fractions of cations adsorbed from mixed solutions of chlorides of that cations are determined by specific adsorptive forces. Therefore the interpretation of root potentials was reconsidered.

With higher concentrations of single salt solutions deviations from a modified Donnan system were found, in accord with the mobility ratios of cation and anion of the salt in the solution. This effect was studied at various ratios of K:Ca and K:Mg. In a steady state, production of organic acids inside the root and combination of ions in the medium with specific carrier sites in the root plasm could explain the observed potentials as diffusion potentials. The calculated diffusion potentials were in agreement with estimated root potentials.

The significance of root potential for ion uptake needed further study.

Promotor: Prof. Dr A. C. Schuffelen

Supervisor: Prof. Dr A. C. Schuffelen

J.

E9. H. C. VAN DER PLAS Sulfonering van pyridine en van pyridinederivaten, waarin de stikstof door volumineuze alkylgroepen is afgeschermd / *Sulphonation of pyridine and pyridine derivatives, in which nitrogen is screened by bulky alkyl groups*. Thesis Amsterdam, 1960, pp. 2 + 76. Du. a. Eng. summ.

The study was on the sulphonation of pyridine and its derivatives in which N was screened by bulky alkyl groups. Treatment of pyridine at 320° with anhydrous H<sub>2</sub>SO<sub>4</sub> in the presence of Hg SO<sub>4</sub> for 9 h yielded not only the 3-sulphonic acid but also pyridine-4-sulphonic acid and a considerable amount of pyridone-4.

This 4-substitution was a remarkable contrast to the high-temperature halogenation, previously found to occur at position 2. To explain the results of the sulphonation, a mechanism was advanced in which the 3-sulphonic acid was formed in a kinetically controlled reaction and the 4-sulphonic acid in a thermodynamically favoured process. It was proved that pyridone-4 was obtained from pyridine-4-sulphonic acid by irreversible hydrolysis.

In contrast, the sulphonation of 2,6-di-tert-butylpyridine with SO<sub>3</sub> occurred under very mild conditions (-10° without catalyst for 4 h). The structure of the sulphonation product was proved by chemical methods to be 2,6-di-tert-butylpyridine-3-sulphonic acid and not the 4-sulphonic acid, as had been suggested in the literature. High reactivity towards SO<sub>3</sub> was also found with the



2-methyl, 2-ethyl and 2-isopropyl derivatives of 6-tert-butylpyridine, the 3 or 5 sulphonic acids being formed. These results accorded with evidence on effective steric influences of methyl, ethyl, isopropyl and tert-butyl groups, here preventing the formation of a complex which deactivated the nucleus for electrophilic attack.

Promotor: Prof. Dr H. J. den Hertog  
Supervisor: Prof. Dr H. J. den Hertog

d.He.

E10. G. POL Enige correlaties tussen verschillende bestanddelen van de aardappel bij variatie in samenstelling als gevolg van de bemesting / *Some correlations between different constituents of the potato in variation in composition caused by fertilizers*. Thesis Amsterdam, 1960, pp. 8 + 90. Du. a. Eng. summ. Also published in Meded. LH 60 (1960) 6.

The influence of different fertilizers on the composition of potatoes were studied in field trials.

Each series consisted of gradually increasing amounts of calcium nitrate and in two of the three series green manure and farmyard manure, respectively, were also used, the last on a ploughed-up ley.

The potatoes were analysed for dry matter, starch, reducing sugars, sucrose, total proteins, true protein, glutathione, ascorbic acid, riboflavine, niacin and pyridoxine. The activities of the enzymes amylase, tyrosinase and peroxidase were also ascertained.

Analyses were carried out at harvest. Samples were stored at 4°C and re-examined after different periods of storage.

The correlations found were tested statistically; an ample discussion was given of the results.

Promotor: Prof. Dr C. den Hartog  
Supervisor: Prof. Dr C. den Hartog

Gr.

E11. J. C. ZADOKS Yellow rust on wheat, studies in epidemiology and physiologic specialization. Thesis Amsterdam, 1961, pp. 8 + 188. Eng. a. Du. summ. Also published in *Tijdschr. Plantenziekten* 67 (1961) 257-263, as Meded. IPO 256 and as Meded. Lab. Fytopathol. 193.

The life cycle of yellow rust (*Puccinia striiformis* West.) was described in detail. Its physiologic specialization was examined and the concept of field races introduced. Field races were identified by reaction of mature plants. The influence of weather was studied by field trials. Finally, yellow rust epidemics were

described in quantitative terms and subjected to mathematical analysis by logistic transformation.

Promotor: Prof. Dr A. J. P. Oort  
Supervisor: Prof. Dr A. J. P. Oort

Author

E12. M. VAN AMMERS De reactiviteit van pyridine-*N*-oxide ten opzichte van electrofiële reagentia / *The reactivity of pyridine-N-oxide towards electrophilic reagents*. Thesis Amsterdam, 1961, pp. 6 + 46. Eng. summ.

It would be expected that as a result of its polarizability pyridine-*N*-oxide could react with electrophilic reagents along different lines according to the conditions.

The sulphonation, mercuration and bromination of pyridine-*N*-oxide was studied.

Sulphonation of pyridine-*N*-oxide with fuming sulphuric acid and  $\text{HgSO}_4$  at high temperatures yielded the 3-sulphonic acid and only small amounts of the 2 and 4 isomers. No conditions could be found diverting the sulphonation along different lines of substitution. However, the course of the mercuration and bromination could be influenced by changing the reaction medium.

When pyridine-*N*-oxide was mercurated with mercuric acetate at  $130^\circ\text{C}$ , 2-mono-substituted products were obtained; mercuration with mercuric sulphate at  $120^\circ$  yielded both the 2-substituted derivative and a fair amount of the 4-isomer. Treatment of pyridine-*N*-oxide with mercuric sulphate at  $120^\circ$  in the presence of  $\text{H}_2\text{SO}_4$  gave, together with a 2-substituted product, a considerable amount of the 3-substituted isomer.

On brominating pyridine-*N*-oxide with a mixture of  $\text{Br}_2$ , 90%  $\text{H}_2\text{SO}_4$  and  $\text{AgSO}_4$  at  $190^\circ$ , a mixture of 4-bromo and 2-bromo derivatives was formed. However, the bromination with  $\text{Br}_2$  in fuming  $\text{H}_2\text{SO}_4$  ( $\text{SO}_3$  content 65%), yielded both 2-bromo-pyridine-*N*-oxide, and 3-bromopyridine-*N*-oxide.

To explain the 3-substitution in these electrophilic reactions, deactivation of the 2, 4 and 6 positions of the nucleus of the *N*-oxide was supposed to take place by proton addition in acid media or complex formation with the  $\text{SO}_3$  in the fuming sulphuric acid.

Promotor: Prof. Dr H. J. den Hertog  
Supervisor: Prof. Dr H. J. den Hertog

d.He.

E13. A. S. RODRIGUES PEREIRA Physiological experiments in connection with flower formation in Wedgwood iris (*Iris* cv. 'Wedgwood'). Thesis Amsterdam, 1962, pp. 10 + 45. Du. (p. IX) a. Eng. summ. (p. 134).

The first signs of transition from the vegetative to the reproductive state in the shoot apex of Wedgwood iris was an increase in cell division in the rib meristem,

about 10 cell layers below the median tunica and a disappearance of the zonation pattern, characteristic for the vegetative phase. Transition was slow and gradual. After a few weeks at 13°C bulbs became reproductive. During these weeks the respiration rate of the bulb increased, afterwards it again decreased. The maximum was about 50% over the initial value. This course of respiration was restricted to the bud, oxygen uptake remaining constant in the scales.

Bulbs stored for 9 weeks at 25.5°C and those stored for 3.5–4 weeks at 13°C formed two new leaf primordia. The content of carbohydrates, dry material and water of the buds was almost equal in both samples. The carbohydrate content of the bud at a given vegetative stage was independent of temperature and of the period of storage of the bulbs. If the bulbs were kept at 13°C, the shoot apex reached the reproductive stage in the course of the next 14 days. During this period, the increase in carbohydrate content proceeded at the same rate as before without a sudden change.

Neither the increase in soluble nor that in insoluble carbohydrates was correlated with the appearance of the reproductive stage. It could be shown by adding sucrose to the culture medium, that the content of soluble carbohydrates in the excised vegetative bud could be raised to the level of that in the bud in the intact bulb at the transition stage, while the shoot apex remained vegetative.

Although bulbs stored at 25.5°C never became reproductive, a limited floral induction occurred at this temperature. It seemed that the conditions for flower induction, which arose also at high temperatures, could not there be realized because an inhibition became more important.

Floral induction was promoted by primordial leaves and by a factor present in the scales. The scale factor agent could diffuse from the cut surface of the scale to the excised bud through an agar bridge.

Promotor: Prof. Dr A. W. H. van Herk

Supervisors: Prof. Dr E. C. Wassink  
and Prof. Dr A. W. H. van Herk

Author

E14. M. J. PIETERSE Intramolekulêre omskakelings by aminerings van halogeenpiridien en etoksihalogeenpiridien / *Intramolecular re-arrangements in aminations of halogenopyridines and ethoxyhalogenopyridines*. Thesis Amsterdam, 1962, pp. 66. Du. a. Eng. summ.

Evidence in benzene chemistry suggested that a study of the reactions of halogenoarenes with strong bases might help to elucidate the mechanisms of the action of nucleophiles on derivatives of arenes.

The amination of 2, 3 and 4 halogen derivatives of pyridines and some of their ethoxy derivatives with potassium amide in liquid NH<sub>3</sub> at -33° was studied. The 3-bromo, 3-iodo and 3-chloro derivatives of pyridine and the corresponding 4-isomers gave, in high yield, a mixture of 3-amino and 4-amino derivatives of pyridine. The ratio of the two amino compounds was independent of the nature of the halogen atom. These results established the occurrence of a

common intermediate in these reactions, viz. 3,4-dehydropyridine.

If 2-chloro, 2-bromo and 2-iodo derivatives were treated with the same reagent only 2-aminopyridine was formed. This result did not elucidate the mechanism of this reaction. Perhaps 2-amino-pyridine might have been formed in a classical addition-elimination reaction but the occurrence of intermediary 2,3-dehydropyridine could not be excluded, because the addition of  $\text{NH}_3$  to this intermediate would be one-sided, yielding only 2-aminopyridine.

The generation of rearranged amino products during the amination of the ethoxy derivatives of 3 and 4 isomers of bromopyridine indicated the intermediate formation of ethoxy derivatives of both 3,4 and 2,3 isomers of dehydropyridine. 3,4-Dehydropyridines were generated from starting substances, allowing the splitting off of  $\text{HBr}$  from carbon atoms 3 and 4; 3-bromo-4-ethoxypyridine might yield the intermediate 2,3-dehydro-ethoxypyridine and finally 2-amino-4-ethoxypyridine. Quite unexpectedly, 2-bromo-6-ethoxypyridine yielded 4-amino-6-ethoxypyridine as well as the 2-amino compound. A mechanism for this remarkable *meta* rearrangement was not then suggested.

Promotor: Prof. Dr H. J. den Hertog

Supervisor: Prof. Dr H. J. den Hertog

d.He.

E15. J. MAAS Syntheses van azacyclische oxyazijnzuren met groeiregulerende werking, in het bijzonder de inwerking van diazoazijnester op azacyclische alcoholen en aethers / *Syntheses of azacyclic hydroxyacetic acids possessing growth-regulating activity, especially reactions of ethyl diazoacetate with azacyclic alcohols and ethers*. Thesis Amsterdam, 1963, pp. 10 + 94. Du. a. Eng. summ.

A series of heterocyclic analogues of growth-regulating compounds of the phenoxyacetic acid type were prepared, containing the pyridine, pyrimidine, quinoline, *isoquinoline* and quinazoline nucleus. Obvious preparative methods such as treatment of hydroxyhetarenes with chloroacetic acid proved to be unsuccessful: hydroxypyridines yielded *N*-pyridonylacetic acids instead of the desired pyridoxyacetic acids. Instead of the *N*-derivatives the *O*-compounds could be synthesized by reacting hydroxy or alkoxy derivatives of azacyclic compounds with diazoacetic ester or by converting azacyclic halogen compounds with the sodium compound of ethyl glycolate.

The azacyclic hydroxyacetic acids possessed potential growth-regulating and herbicidal properties. Their activity was promoted by introducing one or more halogen atoms into the molecule: the activity of 3,5-dichloro-2-pyridoxyacetic acid equalled that of 2,4-D. Activity was enhanced by a N atom in the nucleus *ortho* in relation to the side chain but diminished by a second N atom. Thus, 2-quinoloxoacetic acid had a high activity, whereas 2-quinazoloxoacetic acid

had none.

The mechanisms of the methods of preparation were discussed.

Promotor: Prof. Dr H. J. den Hertog

Supervisors: Prof. Dr H. J. den Hertog

d.He.

E16. A. VAN KAMMEN The occurrence of infectious virus ribonucleic acid in the ribosomal fraction from tobacco mosaic virus infected tobacco leaves. Thesis Amsterdam, 1963, pp. 8 + 72. Eng. a. Du. summ. Also published in Meded. LH 63 (1963) 12.

The occurrence of infectious ribonucleic acid (RNA) not yet surrounded by virus protein in tobacco leaves infected with tobacco mosaic virus (TMV) was studied. The possibility that it plays a role in virus protein synthesis was considered. Special attention was paid to the ribosomal fraction from infected leaves as it was supposed that this fraction would be involved in virus protein synthesis. The purification of ribosomes from leaf homogenates was tried and several properties of the ribosomes were studied such as the sedimentation behaviour, the chemical composition, the influence of  $Mg^{2+}$ , the stability and the ability to incorporate amino acids. TMV particles contaminating the ribosomal fraction from TMV infected leaves could be eliminated by adding an excess of TMV antibodies without destructive effects on the ribosomes. The concentration of TMV in the ribosomal fraction and, subsequently, the degree to which TMV particles had been removed from the ribosomes was estimated by particle counting with the electron-microscope. After eliminating TMV, infectious RNA could be demonstrated in the ribosomal fraction. It was first detectable 24 h after infection and reached a maximum of 0.12  $\mu\text{g}/\text{mg}$  ribosomal RNA 40–60 h after infection. The increase of this infectious viral RNA occurred just before the rapid synthesis of virus particles started, suggesting that the free viral RNA in the ribosomal fraction determined the rate of virus synthesis.

Promotor: Prof. Dr Ir J. P. H. van der Want

Supervisor: Prof. Dr Ir J. P. H. van der Want

Author

E17. Miss JEANNE DIJKSTRA The early events of tobacco mosaic virus infection in *Nicotiana glutinosa* L. Thesis Amsterdam, 1964, pp. 4 + 84. Eng. a. Du. summ. Also published in Meded. LH 64 (1964) 2.

The early stages of infection by tobacco mosaic virus (TMV) in leaves of *Nicotiana glutinosa* were studied by two methods: biological assay and radiation with ultraviolet (UV) light. The role of residual infectivity (infectivity of virus left on the surface of leaves after it has been applied and subsequently rinsed) and the effect of inhibitors of infection was established. The duration of time before newly formed virus could be detected in epidermal cells of leaves inoc-

ulated on the lower surface was then investigated. The presence of newly formed virus could be established about 16 h, at temperatures between 18° and 22°C, and 8 h, at 28° and 31°, after inoculation. When TMV nucleic acid (NA) was used as inoculum, the increase in local lesions on the assay leaves due to newly formed virus occurred approximately 2 h earlier than with complete TMV. Effects of radiation were studied at different times after inoculation with intact TMV and its NA. Radiation of lower surfaces of leaves immediately after inoculation with TMV usually resulted in a higher percentage survival of infective centres than did radiation applied one or two h after inoculation.

Promotor: Prof. Dr Ir J. P. H. van der Want  
Supervisor: Prof. Dr Ir J. P. H. van der Want

Author

E18. J. H. AAFJES Over vluchtige vetzuren in het bloed en over de pathogenese van acetonaemie bij runderen / *Volatile fatty acids in blood and pathogenesis of ketosis in cattle*. Thesis Amsterdam, 1965, pp. 8 + 82. Du. a. Eng. summ. Also published in Meded. LH 65 (1965) 8.

The volatile fatty acids acetic, propionic and butyric acid were estimated in rumen fluid and blood of cows by gas chromatography. Values in rumen fluid of a fistulated cow, in 9 per litre, were acetic  $4.58 \pm 0.60$ , propionic  $1.39 \pm 0.29$  and butyric acid  $1.39 \pm 0.18$  (44 estimates). For 7 cows in the first weeks of lactation on a ration with 10% too little starch equivalent, these contents were significantly lower:  $4.81 \pm 0.44$ ,  $1.29 \pm 0.16$  and  $1.04 \pm 0.18$  respectively (70 samples). Some cows had a slightly high level of ketone bodies in blood. Simultaneous blood samples of the underfed cows contained in mg per litre,  $64.3 \pm 29.3$ ,  $1.11 \pm 0.26$  and  $1.19 \pm 0.41$  respectively. Blood values of the fistulated cow were  $70.5 \pm 23.6$ ,  $1.37 \pm 0.71$  and  $1.27 \pm 0.71$ . The volatile fatty acids in blood were primarily determined by total amounts produced in the rumen. Under normal conditions rumen levels were almost constant. This did not mean that the composition of the ration could not influence these levels.

Promotor: Prof. Dr E. Brouwer  
Supervisor: Prof. Dr E. Brouwer

Wi.

E19. L. P. T. M. ZEVENHUIZEN Function, structure and metabolism of the intracellular polysaccharide of *Arthrobacter*. Thesis Amsterdam, 1966, pp. 8 + 80. Eng. a. Du. summ. Also published in Meded. LH 66 (1966) 10.

Arthrobacters, bacteria of the Corynebacteriaceae, may contain a total carbohydrate content of 50–70% in their cells, when cultivated in a carbohydrate-rich medium with N low to carbohydrate. This total carbohydrate content consisted of two fractions: cell-wall polysaccharides, comprising 20–30% of the dry weight of the cells; and intracellular polysaccharide up to 30% of dry weight.

The intracellular fraction was used as a substrate for endogenous respiration and as a C source for protein synthesis. It usually accumulated under conditions of growth inhibition (nutrient depletion or inadequately buffered culture medium).

Structure of the intracellular polysaccharide analysed by periodate oxidation and methylation indicated a highly branched glycogen-like compound (mean chain-length  $\overline{CL} = 7-9$ , mean outer chain-length  $ECL = 4-5$ , and mean inner chain-length  $\overline{ICL} = 2-3$ ). The branching enzyme of *Arthrobacter* was studied in detail to find an explanation for the deviating properties of the *Arthrobacter* glycogen. Its properties were similar to those of other organisms (animal and yeast) yielding glycogens of normal chain-lengths.

The branching characteristics of the *Arthrobacter* glycogens were explained by the lower activity of the debranching enzyme. This was confirmed by a direct determination of the debranching activity in a cell-free extract of *Arthrobacter*.

Promotor: Prof. Dr Ir E. G. Mulder  
Supervisor: Prof. Dr Ir E. G. Mulder

Author

E20. Miss JUDITH A. ZWARTZ Characterization of potato varieties by electrophoretic separation of the tuber proteins. Thesis Amsterdam, 1967, pp. 8 + 140. Du. a. Eng. summ. Also published in Meded. LH 67 (1967) 9.

In recent years samples of 72 Dutch potato varieties were analysed by electrophoresis. In early experiments the paper electrophoretic method of Grassmann and Hannig was used. There were 6 distinct protein bands and they were distinct for each variety.

Later electrophoresis in agar gel by Wieme's method revealed 12-15 bands, some migrating towards the cathode and some to the anode.

The varietal specificity of the bands was maintained even if growth conditions such as soil type, level of nitrogen fertilization or environment were varied. Maturity of the tubers caused some variation increasing the cationic fractions at the expense of the anionic fractions. Potato peelings behaved more like immature tubers so that peeling of the tubers before analysis prevented this complication.

Thus potatoes can be distinguished within 24 h whereas examining sprouts may take weeks or months, according to the season.

Promotors: Prof. Dr C. den Hartog and Prof. Dr J. Kok  
Supervisor: Prof. Dr C. den Hartog

Author

E21. C. VERMANDE Onderzoekingen over sulfietcellulose uit stroo / *Investigations on sulphite pulp from straw*. Thesis Delft, 1945, pp. 202. Du. a. Eng. summ. Also Eng. summ. in *Chem. Weekbl.* 37 (1940) 37.

Preliminary trials at Wageningen showed that digestion of straw by the acid sulphite process was feasible, as a way of getting starting material for the manufacture of rayon. During the war this process was carried out on a technical scale in the papermill at Velsen and studied further in the laboratory of that mill. Semitechnical experiments at Delft showed that this strawpulp could be bleached into a good white paper. Samples of the crude technical pulp and of the semitechnically bleached pulp were included in the book. Typical digestions were carried out with an acid liquor containing 1.0% CaO and 4.5% SO<sub>2</sub> at a temperature of up to 140°C for 5 h.

Fibre extraction was excellent, despite the SiO<sub>2</sub> content of straw. The yellow pulp contained at best 8% lignin. Consequently Cl consumption for a full bleach was high. Pentosans were mostly dissolved. The pulp contained much short fibre. Elimination of these elements improved the Cl consumption and the papermaking qualities markedly. Pulp was also made separately from the internodes, nodes, ears and the remains of leaves; micrographs, analysis and papermaking qualities were given. Internodes were a much better starting material than the other parts. The lignin remaining in the pulp could be effectively removed by boiling with dilute NaOH at 100°C for 0.5–1 hour; 3% NaOH (calculated on oven-dry pulp) was enough, Cl consumption being lowered accordingly. The mechanical quality of paper made solely from this acid-digested pulp remained unsatisfactory. Trials with rye straw yielded a bright white pulp with a chemical composition corresponding to that of commercial wood-pulp for the manufacture of rayon.

Promotor: Prof. Ir E. L. Selleger

Supervisor: Prof. Dr H. J. C. Tendeloo

Author

E22. J. C. DE MAN Over aardappelvezel en haar toepassing bij het ensilieren van gras / *Potato pulp and its application in ensilage of grass*. Thesis Delft, 1957, pp. 142. Du. a. Eng. summ.

The lactic acid fermentation of stored potato pulp was studied, in relation to its use as a silage additive, stimulating acidification and improving the preservation of grass. Silages were made in anaerobic preserving jars, kept at 20°C. A new method for estimating soluble carbohydrates was developed; starch and cell wall carbohydrates were quantitatively estimated by paper chromatography.

Sucrose stimulated lactic acid formation. Therefore polysaccharases and polygalacturonase were added. The galacturonic acid formed by the last enzyme was indeed fermented. The principal substrate of the pulp fermentation was



shown to be galactose formed from cell wall substances. Some uronic acid, no doubt galacturonic acid, was also fermented. From soured pulp homo- and heterofermentative lactobacilli were isolated. Some homofermentative strains were able to ferment galactan. All identified bacteria were *Streptobacterium casei* Orla-Jensen, which formed lactic acid in sterilised pulp. Galacturonic acid was only fermented by heterofermentative strains.

Silages were primarily judged on the amount of ammonia present. Preservation of protein of ensiled grass was mostly improved by addition of pulp. Chopping the grass-pulp mixture or increasing the content of dry matter also improved silage. No large differences were found between miniature and large silos. In a grass-pulp mixture 50% pulp was deemed sufficient, and addition of polysaccharases was often beneficial. Finally the advantages of crushing grass were considered.

Promotor: Prof. Dr P. A. Roelofsen

Supervisor: Prof. Dr H. J. C. Tendeloo

E.

E23. P. J. BRUIN On the theory of multicomponent distillation at minimum reflux. Thesis Delft, 1961, pp. 8 + 94. Du. summ. Also published in Meded. LH 61 (1961) 9.

The mathematical basis was analysed of the calculation of the state, known as minimum reflux, in multicomponent distillation. The study was entirely theoretical and was restricted to the widely used model of constant relative volatilities and constant molal overflows. Only ideal columns, operated with a total condenser and a total reboiler, were considered.

The separations were represented by the points of a space with three dimensionless parameters, commanding the column performance, as orthogonal coordinates. From this geometrical representation theorems were derived for problems of uniqueness and consistency of calculations of minimum reflux. Some obscurities and misinterpretations, existing in distillation literature over this subject, were clarified. The mathematical derivations were elucidated by quantitative examples relating to a representative system of ten components.

Promotors: Prof. Dr W. R. van Wijk and Prof. Ir H. Kramers

Supervisor: Prof. Dr W. R. van Wijk

Author

**Groningen, State University / Rijksuniversiteit**

E24. J. HOFSTEE De oplosbaarheid van het aardappelglobuline (tuberine) / *The solubility of potato protein (tuberin)*. Thesis Groningen, 1949, pp. 4 + 76. Du. a. Eng. summ.

Colloids of potato protein were studied chemically.

The insoluble fraction of potato protein, characterized by an isoelectric point at pH 4.4, was not a pure protein fraction but contained varying amounts of P and some fatty material could be extracted.

An attempt was made to remove these impurities by treating the protein fraction with lime. The residual protein fraction was practically free from P.

Its isoelectric point was at pH 5.8 instead of 4.4.

The two fractions were compared as colloids and by analysis.

In contrast to the original 'impure' fraction, the new fraction was soluble and did not darken on drying.

Some arguments were put forward for the view that this new fraction was the purified protein fraction.

An attempt was made to reconcile the influence of other constituents of potato juice, especially electrolytes, on the solubility of protein.

In studying the precipitate obtained after lime treatment, an interesting compound was encountered which might be a precursor of the blackening substance discolouring most preparations of potato protein.

Promotor: Prof. Dr J. J. Hermans

Supervisor: Prof. Dr H. J. C. Tendeloo

Author

E25. Tj. H. VAN ANDEL Provenance, transport and deposition of Rhine sediments, Thesis Groningen, 1950, pp. 10 + 130. Eng. summ.

More than 40 cross-sections were sampled from the active Rhine channel and its tributaries between Strassburg and the Dutch border. Quantitative analyses were made of the heavy mineral content and the grain size. Three zones were distinguished by heavy mineral composition. The minerals of the upper Rhine are derived from Swiss rocks. The tributaries had little influence on composition there. Between Bingen and Bonn tributaries supply large quantities of coarse volcanic minerals. The influence of grain size on mineral composition was strong there. The content of volcanic minerals first decreases in the lower course; further downstream it increases again through erosion of valley deposits.

The influence of tributaries on the mineral composition is not determined by the size of its drainage area but by the content of heavy minerals in the transported sediments. The influence was usually small. A river predominantly transports locally eroded older sediments; in the Rhine there are Pleistocene sands.

Abrasion of the heavy minerals during transport in rivers can be neglected.

Promotor: Prof. Dr Ph. H. Kuenen

Supervisor: Prof. Dr D. J. Doeglas

Do.

E26. C. KRUIT Sediments of the Rhone Delta. Thesis Groningen, 1955, pp. 8 + 156. Eng. summ. Also published in Verhand. Kon. Geol. Mijnbouwk. Gen., Geol. Ser. Deel 15, No. 3.

The aim was to describe and distinguish the sedimentary environments of delta deposits. The deposits on land and off shore were mapped. Several hand and auger borings were made. Samples were tested for grain size and microfauna.

The courses of abandoned and active river channels, and former coast lines were distinguished. Active aggradation only occurs near the mouths of active river channels and in bays outside the reach of waves. The rest of the coast is strongly eroded. The slope of the sea bottom is steep near the mouth of active channels. In front of abandoned channels submarine platforms have been formed by abrasion. Wave erosion only occurs in water shallower than 15 metres. The grain size diminishes rapidly from the coast to deeper water.

Three environments could be distinguished by microfauna: fresh to slightly brackish; brackish to strongly saline; purely marine. Six new species were described.

The results of analytical and field data were shown on profiles and a three-dimensional panel.

Promotor: Prof. Dr Ph. H. Kuenen

Supervisor: Prof. Dr D. J. Doeglas

Do.

E27. G. C. VEGTER Over vrije radicalenreacties geïnitieerd door donkere elektrische ontladingen / *Free-radical reactions initiated by silent electrical discharges*. Thesis Groningen, 1957, pp. 72. Du. a. Eng. summ.

Previous studies (see Abstr. E3) showed that alkenes reacted smoothly with HBr or H<sub>2</sub>O when passed through a Siemens ozoniser with an internal diameter of 0.4 cm.

Reactions of saturated and unsaturated organic compounds with hydrogen chloride were studied.

Alkenes seemed to add first chlorine, and liberate hydrogen from hydrogen chloride, whereupon the radicals formed dimerize or take up hydrogen from the reagent. Thus, from ethylene and HCl a mixture of 1,4-dichlorobutane and chloroethylene is formed.

Chloroalkanes were converted by hydrogen abstraction into chloroalkyls which radicals dimerize to branched dichloroalkanes; 1-chloropropane yielded mainly 1,4-dichloro-2,3-dimethylbutane. Analogous reactions proceeded when reacting acid chlorides or ester with HCl. Methyl propionate yielded dimethyl-,  $\alpha,\alpha$ -dimethylsuccinate and the esters of  $\alpha$ -methylglutaric acid and of adipic acid.

Interpretation of the reaction mechanism was based on existing knowledge of free-radical reactions.

Promotor: Prof. Dr J. F. Arens

Supervisor: Prof. Dr H. J. den Hertog

d.He.

E28. S. J. D. VAN STRALEN Warmteoverdracht aan kokende binaire vloeistofmengsels / *Heat transfer to boiling binary liquid mixtures*. Thesis Groningen, 1959, pp. 8 + 82. Eng. summ. Also published in Meded. LH 59 (1959) 6.

The conditions and factors were surveyed, which were of importance for the regions of convection and nucleate boiling of a boiling curve. Special attention was paid to the behaviour of the nucleate boiling peak flux.

Reproducible boiling curves on electrically heated horizontal platinum wires were obtained for water-methylethylketone and water-1-butanol mixtures, boiling at atmospheric and at subatmospheric pressures.

The peak flux was estimated in relation to liquid composition for a number of binary systems including water-acetone, water-methylethylketone, water-ethanol, water-1-propanol, water-1-butanol, water-1-pentanol, water-1-octanol, and some organic systems. The ambient pressure was varied from 0.10–170 bar (a.).

Most strikingly, a maximum value of the peak flux (up to a factor of 3 in comparison to water) occurred at a certain low concentration of the more volatile component. Consequently, two maxima were observed for water-1-butanol and water-1-pentanol. This important effect, which was practically independent of the properties and conditions of the heating surface, was shown to be due to a simultaneous maximum slowing down of the growth rate of individual vapour bubbles ('boiling paradox'). The corresponding concentration could be derived from equilibrium data only.

Promotor: Prof. Dr W. R. van Wijk

Supervisor: Prof. Dr W. R. van Wijk

Author

E29. Miss MARIA H. DEINEMA Intra- and extra-cellular lipid production by yeasts. Thesis Groningen, 1961, pp. 8 + 54. Du. a. Eng. summ. Also published in Meded. LH 61 (1961) 2.

A study was made of the formation of lipids by yeast cells. Two of the six species tested, *Lypomyces starkeyi* and *Rhodotorula gracilis*, produced only intracellular lipids; the other four, *Rhodotorula graminis*, two strains of *Rhodotorula glutinis* and *Candida bogoriensis*, also formed extracellular lipids. The main fatty acids in the intracellular lipids were always palmitic and oleic acids. The extracellular lipids contained acetic acid (about 50%), palmitic, oleic and unidentified higher fatty acids.

Glycerol was the alcoholic component of the lipids of *Lipomyces starkeyi*, *Rhodotorula gracilis* and *Candida bogoriensis*. In *Rhodotorula graminis* and *Rhodotorula glutinis*, glycerol and sorbitol were the alcoholic components of the intracellular lipids, whereas the extracellular lipids contained sorbitol and a trace of a C<sub>5</sub> polyalcohol.

Promotor: Prof. Dr Ir E. G. Mulder  
Supervisor: Prof. Dr Ir E. G. Mulder

Author

E30. L. M. SCHOONHOVEN Diapause and the physiology of host-parasite synchronization in *Bupalus piniarius* L. (Geometridae) and *Eucarcelia rutilla* Vill. (Tachinidae). Thesis Groningen, 1962, pp. 4 + 64. Eng. summ. Also published in *Arch. Néerl. Zool.* 15 (1962) 111-174 and as *Meded. Lab. Entom.* 78.

Schoonhoven studied the termination of the pupal diapause in *Bupalus piniarius* (L.) and the mechanism that synchronized the development of this Geometrid and that of its Tachinid parasite, *Carcelia obesa* (Zett.) (*Eucarcelia rutilla*, auct.). Neurosecretory material was found on the brains of diapausing pupae of *B. piniarius*. 'Permanent' pupae were usually obtained by removing the brain, within a day after the pupal moult, from pupae chilled at 3°C, but the number able to develop after removal to 25°C increased when the period of chilling before the operation was lengthened; the brain apparently secreted the hormone in pupae chilled for a long time, but either did not do so, or did so only in small quantities, during short or medium periods of chilling. Diapause was thus terminated by chilling, which evidently facilitated the release of the brain hormone into the haemolymph after transfer to 25°C. Chilling also terminated diapause in the parasite. Similar submaximal chilling periods applied to infested and uninfested host pupae initiated development in a larger proportion of parasites than of uninfested host pupae.

Synchronous activation of host and parasite was maintained when development of the host in diapause was accelerated by parabiosis with a developing pupa. Early decerebration of the host usually prevented development of the parasite; removal of the head and prothorax of the host prevented development of both partners if it was performed shortly after transference to 25°C. At this temperature, the larval parasite resumed growth early in the development of the host and left the latter some eight days before the adult host would have emerged. Evidence was presented favouring the concept that the parasite was activated by a hormone, probably the prothoracic-gland hormone, associated with adult development of the host, to which it seemed to respond more readily than did the host itself.

Promotor: Prof. Dr J. de Wilde  
Supervisor: Prof. Dr J. de Wilde

Rev. Applied Entom.

E31. Mrs ELISABETH M. GRUYS-CASIMIR On the influence of environmental factors on the autumn migration of chaffinch and starling: a field study. Thesis Groningen, 1965, pp. 5 + 104. Eng. summ. (p. 269). Also published in *Arch. Néerl. Zool.* 16 (1965) 2: 175-279.

The chaffinches (*Fringilla coelebs*) studied were of Scandinavian origin and were observed on their migration to Britain and Ireland. They were easily deterred by open landscapes and, especially, the sea.

Several characteristics of migration were studied: the volume and dispersion of broad-front and seaward migration, the flying-height and the extent to which the birds were diverted at the edge of the polders and sea. Correlations between these characteristics and the weather were calculated. It was concluded that chaffinches migrated preferably on cold clear days, and, for a flight over the sea, preferred a following wind.

The influence of weather on the direction of migration was investigated. The standard direction was assessed as the mean direction in the early morning, on days without rain or fog and a wind speed < 4 metres/sec., in a homogeneous landscape. On days with a higher wind speed, and towards the end of the morning wind direction had an influence on mean direction; birds tended to fly more into the wind.

Variations in volume of migration in the course of the day and from day to day were discussed.

Promotor: Prof. Dr H. Klomp

Supervisor: Prof. Dr H. Klomp

Author

E32. H. VAN DIJK Zuurgroepenanalyse en kationenbinding bij huminezuren / *Acid group analysis and cation binding of humic acids.* 1965, Thesis Groningen, pp. 12 + 176. Du. a. Eng. summ.

Humic acids were isolated from different soils and also prepared synthetically from polyhydroxybenzenes.

Methods for acid group analysis of humic acids were fully discussed. Results of potentiometric, conductimetric and high-frequency titrations in aqueous and other media were described. The curves for potentiometric titrations in water and for conductimetric and high-frequency titrations in dimethylformamide demonstrated the poly-dibasic character of the humic acids. Approximate values for the ratio of stronger and weaker acid groups (presumably carboxylic and phenolic hydroxyl groups) were derived.

The nature and strength of the bond between metal ions and humic acids were studied mainly by potentiometric titration with potassium hydroxide in presence of various metal ions. Metal humates could be classified as polynuclear chelates. The metal ions were exclusively, or almost exclusively, bound to negatively charged groups ( $-\text{COO}^-$  and  $-\text{O}^-$ ) of the humic acids. The order of bond strength was given. It was assumed that with increasing pH metal humates of the

first transitional series, gradually changed into hydroxyl complexes, protons being removed from water molecules covalently bound to the metal ions.

Promotor: Prof. Dr H. J. C. Tendeloo  
Supervisor: Prof. Dr H. J. C. Tendeloo

Author

**Leiden, State University / Rijksuniversiteit**

E33. Miss MARIA P. DE BRUYN OUBOTER *Tylenchus devastatrix* Kühn uit narcis en hyacinth / *Tylenchus devastatrix* Kühn from narcissus and hyacinth. Thesis Leiden, 1930, pp. 10 + 104.

Ring disease of hyacinths and eelworm disease of daffodils had been assumed to be caused by biological races of the nematode *Tylenchus devastatrix* Kühn. This assumption was based on observations that the specialized eelworm population of hyacinth did not attack daffodils and vice versa daffodil eelworm did not attack hyacinth.

If a constant morphological difference were found between the two races, they would be better considered as different species.

Biometric studies of different organs and parts of the body revealed such morphological differences. Comparisons were statistically analysed and a positive correlation was demonstrated for differences in a number of morphological characters. The genetical background to the observed differences needed further studies.

Two possible reasons were suggested why eelworm disease in daffodils suddenly occurred about 1910, whereas the disease in hyacinth was already known for a much longer period. The daffodil eelworm may have arisen by mutation either from the hyacinth eelworm or from a race of the eelworm parasitic on some other plant.

An extensive survey of similar studies among other plant pathogens was presented.

Promotor: Prof. E. D. van Oort  
Supervisor: Prof. Dr E. van Slogteren

Author

E34. H. J. DE FLUITER De bloedluis, *Eriosoma lanigerum* (Hausm.), in Nederland / *The woolly aphid*, *Eriosoma lanigerum* (Hausm.) in the Netherlands. Thesis Leiden, 1931, pp. 12 + 126. Du. summ. Also published as LEB-Fonds Publ. 8 and in *Tijdschr. Plantenziekten* 37 (1931) 201–330.

Synonymy, popular names, geographical distribution, food plants, economic status and the developmental cycles of the woolly aphid in America and in Europe were discussed. The author's work in 1928–30 and techniques on the lifecycle of the aphid and the biology of the various forms were described. Both

sexual and parthenogenetic winged forms occurred.

Sexual types were numerous; they usually produced both sexes, but sometimes females only and occasionally males only. Sometimes the progeny included larvae with a long proboscis as well as sexuals.

Winter eggs were obtained; foundation larvae hatched in early spring but failed to infest American elm, Dutch elm or apple. The sexuparous generation was therefore of no importance for dispersion. Wingless parthenogenetic young were successfully established on hawthorn (*Crataegus oxyacantha*) and on a pear seedling but apple was the only natural food plant.

Young larva hibernated on either aerial or underground parts of the apple-tree. Morphology was described of wingless parthenogenetic types, nymph, winged sexual and parthenogenetic types, and differences in their progeny and the foundation larva.

Promoters: Prof. Dr H. Boschma

Supervisor: Prof. Dr W. K. J. Roepke

Author

E35. J. A. BAAK Regional petrology of the southern North Sea, Thesis Leiden, 1936, pp. 128. Du. summ.

After the investigation of Edelman (1933) into the origin of the beach and dune sands along the Dutch coast line, Baak started a study of nearly a thousand sand samples from the whole area of the southern North Sea. It was the first sedimentary petrological analysis of a large sedimentation basin.

The analysis of the heavy fractions revealed the existence of five sedimentary petrological provinces, which were sometimes distinct and sometimes mixed to form the various North Sea sediments. Baak prepared a map showing the regional distribution of the mineral assemblages. His A group, of Finno-Scandinavian origin, covers a large region in the northern part of the area mapped. The Holland group (H group) occurs along the coasts of Holland and Belgium and consists of a mixture of material of Finno-Scandinavian and Rhine origin. The North Hinder group, which in its purest form was found in the neighbourhood of the Hinder Banks, occurs off the coast of Holland, and consists mainly of sands brought down by the Pleistocene Rhine. To the west of the Hinder group off the River Thames, the bottom of the North Sea was shown to be covered by reworked Tertiary deposits, still uncovered. Further north, along the English coast, Baak found the sediments of his E group that were derived mainly from the adjacent land.

Baak's study made an important contribution to knowledge of the younger Pleistocene and Holocene depositional history of the southern North Sea basin.

Promotor: Prof. Dr B. G. Escher

Supervisor: Prof. Dr Ir C. H. Edelman

Not.



E36. Miss JOHANNA A. D. VERHOOP Chemische en microbiologische omzettingen van ijzersulfiden in den bodem. Een geobiologische studie / *Chemical and microbiological transformations of iron sulfides in the soil. A geobiological study.* Thesis Leiden, 1940, pp. 10 + 116. Eng. summ.

In soils with iron compounds FeS could be formed under anaerobic conditions by sulphate-reducing micro-organisms. The transformations of FeS in soils and muds under aerobic and anaerobic circumstances were studied.

Experiments showed that natural black muds discolour, when exposed to air, in the same way as artificial black muds, which could be made from light coloured clay by adding FeS. The FeS in artificial black mud was almost quantitatively transformed into Fe(OH)<sub>3</sub> and elementary S. The rate of discolouring increased gradually when the temperature was raised from 4°–100°C.

Under aerobic conditions, FeS was transformed into Fe(OH)<sub>3</sub> and S by a rapid purely chemical reaction.

The S was readily oxidized to H<sub>2</sub>SO<sub>4</sub> by micro-organisms in the soil. These processes account for the discoloration and acidification of black soils and muds when exposed to air.

Under anaerobic conditions FeS<sub>2</sub> (pyrite) was formed by a slow reaction between FeS and S. The presence of micro-organisms and organic matter was not essential for reaction. When a soil containing FeS<sub>2</sub> was exposed to the air acidification occurred, here by chemical oxidation of FeS<sub>2</sub>.

Promotor: Prof. Dr A. E. van Arkel

Supervisor: Prof. Dr H. J. C. Tendeloo

Author

E37. G. CARRIÈRE In de kern gesubstitueerde oxanilzuren / *Nucleus-substituted oxanilic acids.* Thesis Leiden, 1941, pp. 50. Du. summ.

The manufacture and properties of the following (previously unknown) oxanilic acids were described: *m*-methyloxanilic acid, *o*- and *m*-bromo-oxanilic acid and *m*-methoxy oxanilic acid.

The dissociation constant (*k*) at 25° in water for twelve oxanilic acids were: oxanilic acid 1.21. 10<sup>-2</sup>; *o*-methyloxanilic acid 1.33. 10<sup>-2</sup>; *m*-methyloxanilic acid 1.08; *p*-methyloxanilic acid 0.94; *o*-chloro-oxanilic acid 1.73; *m*-chloro-oxanilic acid 1.31; *o*-bromo-oxanilic acid 2.71; *m*-bromo-oxanilic acid 2.62; *p*-bromo-oxanilic acid 1.49; *o*-methoxyoxanilic acid 1.07; *m*-methoxyoxanilic acid 1.24; *p*-methoxyoxanilic acid 1.00.

Promotor: Prof. Dr H. J. C. Tendeloo

Supervisor: Prof. Dr H. J. C. Tendeloo

Author

E38. D. A. DE VRIES Het warmtegeleidingsvermogen van grond / *The thermal conductivity of soils*. Thesis Leiden, 1952, pp. 8 + 74. Du. summ. after chapter I and IV. Eng. summ. Also published in Meded. LH 52 (1952) 1.

A method was developed for calculating the thermal conductivity of a moist granular material in relation to thermal conductivities and the volume fractions of its constituents, and the shape of the granular particles.

The theoretical values were compared with published experimental data and the author's measurements. The agreement between measured and calculated values was generally better than 10%.

Chapter 1 contains theoretical considerations on the calculation of the thermal conductivity and the electric permittivity of granular media. Existing theories were analysed and extended.

Chapter 2 deals with the influence of water vapour distillation on heat transfer.

Chapter 3 describes a non-stationary method, developed by the author, for measuring the thermal conductivity of soils, both in the laboratory and *in situ*. Results were given of field measurements and of laboratory measurements on sand at temperatures ranging from 20° to 75°C.

Chapter 4 develops a method for calculating the thermal conductivity of soils. Results were compared with experimental data.

Promotor: Prof. Dr H. A. Kramers

Supervisor: Prof. Dr W. R. van Wijk

Author

E39. H. VELDKAMP A study of the aerobic decomposition of chitin by micro-organisms. Thesis Leiden, 1955, pp. 8 + 48. Eng. a. Du. summ. Also published in Meded. LH 55 (1955) 3.

Chitin occurs so widely in nature, that there must be some extremely effective processes of chitin breakdown which prevent its staggering accumulation.

In this investigation 50 strains of chitin-decomposing bacteria were isolated from soil; among these organisms were representatives of the following genera: *Achromobacter*, *Flavobacterium*, *Chromobacterium*, *Bacillus*, *Cytophaga* and *Pseudomonas*. Among 23 strains of actinomycetes isolated from soil, which could decompose chitin, there were representatives of the following genera: *Streptomyces*, *Micromonospora* and *Nocardia*. In all the soils the majority of the population of chitin-decomposing micro-organisms were actinomycetes.

A direct analysis of chitin breakdown indicated N-acetylglucosamine, glucosamine and acetic acid as intermediary products. The presence of glucose could not be demonstrated. Besides these products two unknown products of

hydrolysis were detected chromatographically in culture fluids of both strains studied.

Promotor: Prof. Dr T. H. van den Honert

Supervisor: Prof. Dr J. Smit

Kor.

E40. G. WIERTZ Schildklieronderzoek bij nuchtere kalveren uit verschillende delen van Nederland / *A study of the thyroid gland in newborn calves from different parts of the Netherlands*. Thesis Leiden, 1957, pp. 4 + 88. Du. a. Eng. summ. Also published in Meded. LH 57 (1957) 6.

Thyroid glands of new-born calves were collected from different regions. Their weight, microscopical structure and I content were studied. Average weight was 14.8 g (fixed gland). Of 584 glands, 36 were considered too heavy. Histological activity was graded 1 to 4. The average activity was 2.75. Of 627 glands 248 were judged overactive. I content averaged 0.479 mg/g fixed gland and 6.615 mg/whole gland. After studying regressions between the different criteria normal values for thyroid glands in new-born calves were thought to be: 14.8–24 g in weight; 2.62–2.88 for histological activity; 0.2 or 0.3–0.477 mg and 4–6.615 mg for proportional and absolute content of I, respectively. Distinct regional differences in thyroid status were seen, generally according with regional differences in I content of cow's milk by Binnerts and with goitre distribution in man.

In 45 new-born calves ossification of sesamoid bones in the legs was predominantly correlated with general development. After elimination of this correlation P values for the correlations between ossification, and thyroid activity or proportional thyroid I content approached significance.

Promotor: Prof. Dr C. J. van der Klaauw

Supervisor: Prof. Dr E. Brouwer

Author

E41. G. A. KOOY Het veranderend gezin in Nederland / *The changing family in the Netherlands*. Thesis Leiden, 1957, pp. 244.

This book is typically a product of the study-room. The author attempted to sketch the sociological picture of change characteristic for marriage and the nuclear family in the Netherlands since the 19th century. More specifically, the study has been written from the institutional approach (marriage and family were entities ruled by collective values and norms). Meanwhile, the psychological aspect of marriage and the family was not neglected. The empirical material, which might enable the author to draw conclusions about family change, were sought in publications of different kinds: sociographic studies, publications containing population statistics, even novels. One main conclusion was the in-

creasing vulnerability of the Dutch family; another was its greater stability than in several other Western countries.

Promotor: Prof. Dr R. A. J. van Lier  
Supervisor: Prof. Dr R. A. J. van Lier

Author

E42. G. A. KAMERBEEK Respiration of the iris bulb in relation to the temperature and the growth of the primordia. Thesis Leiden, 1962, pp. 8 + 80. Eng. Summ. Also published in *Acta Botanica Neerl.* 11 (1962) 331-410.

After lifting, the respiration rate of iris bulbs decreased sharply at high temperatures such as 25° and 30°C. After about 3 weeks the rate became constant and low, and could remain so for months. Iris bulbs (Wedgwood and Van Vliet) could be stored at these temperatures for a year without losing their viability. The development of the central growing point in the bulb was heavily retarded under these circumstances.

If the bulbs stored at 30° or 25° were transferred to lower or higher temperatures, respiration increased. At lower temperatures the increase was greatest at 15°C, and a new equilibrium was reached after a few days. The increase in respiration was related to the incipient growth of the central growing point. Both, the increased respiration and the incipient growth could be reversed by returning the bulbs to higher temperatures of 25° or 30°C.

In bulbs transferred from 30° to higher temperatures, for instance 40°C, respiration increased as well, but no equilibrium was reached, though the effect was reversible. The effect of high temperature was not related to the growth of the shoot.

The controlling mechanism of respiration was as yet unknown. It was not likely that sugar as a substrate limited the respiration process, nor that a low oxygen concentration inside the bulb was limiting factor. Transitional effects with sudden changes in temperature were described, and a remarkable increase and subsequent decrease in respiration rate after removal of the membranous tunics surrounding the bulbs.

Promotor: Prof. Dr A. Quispel  
Supervisor: Prof. Dr Ir P. K. Schenk

Author

E43. J. L. VERHOEKS Photosynthesis and carbohydrate metabolism of healthy and leafroll diseased potato plants. Thesis Leiden, 1965, pp. 10 + 90. Eng. a. Du. summ. Also published as LEB-Fonds Publ. 43.

Photosynthesis of discs of potato leaves was estimated with Warburg manometers with different light intensities and 1.26% CO<sub>2</sub> to find the effect of infection with leaf-roll virus.

Total carbohydrate, starch, sucrose, fructose, glucose, chlorophyll, phospho-

rus in the discs and their fresh and dry weights were estimated. At all light intensities photosynthesis per unit area was less in diseased than in healthy discs. Dehydration of the protoplasm was considered a more important cause than the lower content of chlorophyll and the higher content of carbohydrate. The dehydration was demonstrated by the low moisture contents and the high content of non-acid soluble phosphorus. The types of carbohydrates were the same in healthy and diseased leaves, but despite the high absolute contents, diseased leaves had a lower proportion of starch and a higher proportion of hexose, especially fructose, in total carbohydrates.

This phenomenon was interpreted as a withdrawal of part of the accumulated sugar from active metabolism, as demonstrated by the daily fluctuation in carbohydrate. There arose an inert sugar fraction, not in normal balance with starch, and differing from the active fraction in the high proportion fructose.

As the same quantitative differences occurred when healthy leaves accumulated carbohydrate, they were ascribed to the carbohydrate accumulation and not directly to infection.

Promotor: Prof. Dr E. C. Wassink

Supervisors: Prof. Dr E. C. Wassink and Prof. Dr Ir T. H. Thung Lin.

E44. R. J. MARTENS Inwerking van kaliumamide in vloeibare ammoniak op halogeenpyridinen, halogeenpyridine-N-oxiden en derivaten van deze verbindingen / *Reactions of potassium amide in liquid ammonia with halogenopyridines, halogenopyridine-N-oxides and their derivatives*. Thesis Leiden, 1966, pp. 96. Eng. summ.

Previous studies on reactions of halogenopyridines with potassium amide in liquid  $\text{NH}_3$ , proceeding chiefly through 3,4-dehydropyridine were extended.

An attempt was made to find evidence for the occurrence of the isomeric dehydro compound, 2,3-dehydropyridine or a derivative of it as an intermediate.

2,3-Dehydropyridine plays a role in the reaction of 2-chloro-3-bromopyridine with lithium amalgam in the presence of furan which yields quinoline as a final product. Evidence indicated that the *N*-oxide of 2,3-dehydropyridine was produced when 2-bromo-pyridine-*N*-oxide reacted with potassium amide. The same intermediate and not 3,4-dehydropyridine-*N*-oxide, appeared to be formed from 3-bromopyridine-*N*-oxide.

Studies on the possibility that derivatives of a third intermediate, 2,6-dehydropyridine, might be formed during aminations of 3-substituted 2-bromopyridines led to a remarkable discovery. When treated with potassium amide, 3-amino-2-bromopyridine was converted, in a yield higher than 80%, into 3-cyanopyrrole.

The mechanisms of the reactions recorded and of several other transformations (conversion of 3-fluoropyridine into bipyridine derivatives, aminations

probably proceeding through derivatives of 3,4-dehydropyridine-*N*-oxide were discussed.

Promotor: Prof. Dr H. J. den Hertog  
Supervisor: Prof. Dr H. J. den Hertog

d.He.

E45. H. W. VAN MEETEREN Ringveranderingen bij de inwerking van kaliumamide op enige derivaten van 4-chloorpyrimidine / *Ring transformations occurring in aminations of derivatives of 4-chloro-pyrimidine with potassium amide in liquid ammonia*. Thesis Leiden, 1967, pp. 96. Eng. summ.

During studies (see Abst. E44 Martens) on the behaviour of 2-substituted-4-halogenopyrimidines towards potassium amide in liquid NH<sub>3</sub> a ring transformation was shown to occur, the conversion of pyrimidines into spiro-triazines.

To elucidate the mechanism of this conversion, tracer techniques were used. 4-Chloro-2-phenylpyrimidine-4-<sup>14</sup>C was prepared and converted into 4-methyl-2-phenyl-spirotriazine, in which the position of the <sup>14</sup>C-label was established. Only position 4 was radio-active, clearly indicating that during the ring transformation, the bond between C<sub>5</sub> and C<sub>6</sub> broke; such a break was hitherto unknown in pyrimidine chemistry.

Introduction of a substituent into position 5 of 4-chloro-2-phenylpyrimidine could drastically change the course of the reaction with potassium amide. The 5-amino and 5-methyl derivatives yielded imidazole. The 5-methoxy and 5-ethoxy compounds, however, yielded open-chain products. Also in these reactions the use of <sup>14</sup>C-labelled pyrimidines was of great help in elucidating the mechanism. The experimental data thus far available gave sound evidence that the initial step in the reactions could be the addition of the amide ion to C<sub>6</sub> and not to C<sub>4</sub>, the carbon atom to which halogen was attached.

Promotor: Prof. Dr H. J. den Hertog  
Supervisor: Dr H. C. van der Plas

d.He.

**Rotterdam, Netherlands College of Economics / Nederlandsche Economische Hogeschool**

E46 A. J. WICHERS De oude plattelandsbeschaving. Een sociologische bewustwording van de 'overherigheid' / *Old peasant culture. A sociological awakening of 'overlordism'*. Thesis Rotterdam, 1965, pp. 16 + 286. Eng. summ. Also published as VLO 673 (1965).

The study was cultural-sociological; Americans might also style it cultural-anthropological. It was an effort to bring to consciousness the two types of experience one could have with farm populations in the Netherlands. One was the

experience that these populations were the same everywhere; the other than regional differences were still marked.

The experience of sameness led the author into an explanation of old rural culture as a response to general age-old circumstances of life. As found in the Netherlands it was a quite understandable and rational response. The experience of regional differences, usually known as mentality or folk character, led to the analysis of historical forces operating in an old agrarian society. The most powerful force was feudalistic conditions. They were called 'overherigheid' ('overlordism', see subtitle) and would have had a largely emotional effect which would mingle with the rational basic pattern.

The book contains great amounts of material to make clear what both experiences actually were. It ends by summing up why the real peasant is bound to disappear completely. The method followed to discover folk character might also further the study of national character.

Promotor: Prof. Dr E. W. Hofstee

Supervisor: Prof. Dr E. W. Hofstee

Author

**Utrecht, State University / Rijksuniversiteit**

E47. H. A. A. VAN DER LEK Over de wortelvorming van houtige stekken / *Root formation by woody cuttings*. Thesis Utrecht, 1925, pp. 10 + 330. Du. a. Eng. summ.

In the stem of *Ribes nigrum* numerous root primordia were shown to occur. Their position could be related to those of the bark rays and lenticels. This occurrence made polarity less clear. Often more primordia occurred apically in each internode, where nutrients were rapidly supplied by the ray system. Cuttings of one internode therefore were not polar. Cuttings of more internodes formed progressively less roots from basis to apex in similar conditions. Buds, especially if bursting, promoted root formation in the internode below, in light or darkness. Without favourable conditions this formation may occur in much lower internodes.

Buds also influenced root formation in *Salix* and *Populus*. Root primordia were found in 8 *Salix* spp. and 4 *Populus* spp. but not in *S. caprea*, *S. aurita* and *P. alba*. *Salix* spp. had nodal or internodal root primordia; the nodal ones arose near the large rays where leaf bundles left the stem; the internodal ones arose near the rays next to the wood sectors, which corresponded with the bundles of the next higher leaf. With the *Populus* spp. internodal root primordia were of more importance than the nodal ones; the connections with rays were less clear.

*Vitis* had no already formed root primordia. Buds influenced quantity, position, nature and growth rate of roots.

The importance of phloem for regeneration was stressed. Transport of hormones was presumed. Both normal and regenerative roots formed from cell

groups connected with existing or new (callus) vessel bundles (endogenous). The origin of stems was exogenous.

Promotor: Prof. Dr F. A. F. C. Went

Supervisor: Prof. Ir A. M. Sprenger

E.

E48. Miss HELENA VINKENBORG Die Bedeutung des Acetaldehyds bei der alkoholischen Gärung / *The significance of acetaldehyde in alcoholic fermentation*. Thesis Utrecht, 1931, pp. 8 + 72.

First the anaerobic production of ethanol from malic acid by washed cell suspensions of the yeast *Schizosaccharomyces pombe* was described. Only L-malic acid was converted to ethanol. The stoichiometry of the reaction was studied by estimating the reaction products. One mole of ethanol and two moles of carbon dioxide were formed from one mole of L-malic acid. Attempts to study the fermentation in cell-free extracts, and to isolate possibly formed acetaldehyde with sodium sulphite were unsuccessful.

Secondly the role was studied of acetaldehyde in anaerobic breakdown of sucrose by commercial baker's and brewer's yeast. The stoichiometry of the sugar fermentation by baker's yeast in the presence of sodium sulphite, already elucidated by Neuberg, was confirmed by estimating the carbon dioxide evolved. Neither in the presence of sodium sulphite nor in the presence of alkali was fermentation of sucrose observed with dried yeast preparations or with a Lebedev juice of brewer's yeast. The conclusions of Neuberg on the roles of acetaldehyde and pyruvic acid in alcoholic fermentation were criticized.

Promotor: Prof. Dr W. C. de Graaff

Supervisor: Prof. Dr N. L. Söhngen

Mi.

E49. C. L. RÜMKE JR *Saccharum-Erianthus* Bastaarden / *Saccharum-Erianthus hybrids*. 1934, pp. 8 + 64, Du. summ.

Attempts to cross cultivated *S. officinarum* with the genus *Erianthus* succeeded only with *E. sara* (Roxb.) Rümke as pollen parent. A detailed comparative description supported the taxonomic identity of the latter species. The generic hybrid, resembling each parent in different respects, varied only in those characters for which cultivated *S. officinarum* clones were heterozygous.

*E. sara* ( $2n = 60$ ) had regular meiosis with 30 bivalents, and was very fertile. *S. officinarum* ( $2n = 80$ ) (EK 28) was far less fertile. Its meiosis showed in diplotene and diakinesis a varying number of univalents arranged in pairs, which were peripherally orientated in metaphase, and lagged behind during anaphase. In diakinesis primary multivalents were also observed. It was concluded that secondary associations at metaphase were not rare.

The hybrid individuals were almost infertile, only a few plants giving some



fertile pollen. The somatic chromosome number was always less than 70. At diakinesis there were primary multivalents in addition to the bivalents and unpaired univalents. Secondary association was much less frequent than in EK 28. Movement to the poles of bivalent members sometimes lacked synchrony. As with the parents, median constrictions were seen in root-tip chromosomes.

Promotor: Prof. Dr J. A. Honing  
Supervisor: Prof. Dr J. A. Honing

v.d.V.

E50. A. E. H. R. BOONSTRA *Physiologisch onderzoek ten dienste van de plantenveredeling / Physiological research for plant breeding*. Thesis Utrecht, 1934, pp. 6 + 100. Du. a. Eng. summ. Also published in *Meded. LH 38* (1934) 1.

Plant breeding may select material on morphological or physiological characteristics. For instance yield of cereals is a function of such morphological characteristics as tillering, number of grains in an ear and grain weight. Among physiological characteristics which had been used by breeders were resistance to diseases and pests, and hardness; these same improvements could be obtained with unimproved material by protecting the crops through spraying or growing under glass.

Boonstra suggested that the limited progress may be because breeders have considered only what the plant *is* and not what it *does*. The real causes of a higher yield may be higher efficiency in assimilation, transpiration and absorption of nutrients.

Trials showed that crops did indeed differ in physiological properties. For instance, the root system of one variety of pea (G.V.) was able to provide twice as much minerals and water to aerial parts than the root system of another variety.

Promotor: Prof. Dr F. A. F. C. Went  
Supervisor: Prof. Ir C. Broekema

Author

E51. R. PRAKKEN *Inheritance of colours and pod characters in Phaseolus vulgaris* L. 1934, pp. 8 + 118. Eng. summ. Also published in *Genetica* 16 (1934) 177-294.

The material derived from the cross between 'Fijne tros' (green stem, white flowers, white seed-coat; pp VV Sh.  $\hat{c}\hat{M}\hat{c}\hat{M}$  GG BB) and 'Wagenaar' (pink stem, pale pink flowers, yellowish seed-coat; PP vv shsh  $\hat{C}\hat{m}\hat{C}\hat{m}$  gg bb). Here P was the factor for colour, C the dark pattern factor and V the violet factor. Thus the seed-coat colour of P.C. vv ranged from yellowish to brown, depending on the orange factor G and the greenish brown factor B. Similarly P.C.V. ranged from violet to black. With cc (background colour only), P.cc vv-types

were paler versions of the P.C. vv-types and in P. cc V. the violet to black colours were represented only by corresponding tinges.

The  $F_1$  had violet stem and flowers (Pp Vv), but showed instead of a black seed-coat (Vv Cc Gg Bb), a black mottling on a brown background. This was due to a very closely linked local colour suppressor M, the  $F_1$  being  $\hat{C}m\hat{C}M$ .

The above colours appeared in the presence of the shiny factor Sh. Substitution by shsh made the C.-colours paler and less shiny, and with cc-types leaves a brown hilum ring only.

The pod character, strength of string, was studied mechanically and anatomically. Strong string was stst, the heterozygote roughly intermediate, and the expression of St. varied through modifier segregation. At least two loci govern toughness of the pod wall (also assessed by different methods).

Promotor: Prof. Dr J. A. Honing  
Supervisor: Prof. Dr J. A. Honing

v.d.V.

E52. H. RAMAER *Cytology of Hevea*, Thesis Utrecht, 1935, pp. 8 + 44. Eng. summ. Also published in *Genetica* 17 (1935) 193–236.

The species studied were *Hevea brasiliensis*, *H. spruceana*, *H. guianensis* and *H. collina*, along with the hybrids *H. spruceana*  $\times$  *H. brasiliensis* and *H. collina*  $\times$  *H. brasiliensis*. Counts at different stages of meiosis in pollen mother cells, and of root-tip mitosis, consistently gave  $n = 18$ . From early diplotene to diakinesis, chiasmata terminalized and their number decreased from 2–6 to 1–2.

In some cultivated clones of *H. brasiliensis* with partial or total male sterility, irregular meiosis with univalents and multivalents (mainly trivalents) was followed by degeneration of cells after tetrad or pollen grain formation. The same irregularities are found in the hybrid *H. spruceana*  $\times$  *H. brasiliensis*.

A *H. brasiliensis* clone (KN 220) with complete male and female sterility, was asynaptic in having no typical pachytene, whilst at metaphase the chromosomes were scattered in the cytoplasm. Outstanding was that the irregular first division was always followed by a regular second division, which always resulted in the formation of 'hexads' and 'octads'. Young pollen grains were produced but these always degenerated with the stamens.

Promotor: Prof. Dr J. A. Honing  
Supervisor: Prof. Dr J. A. Honing

v.d.V.

E53. F. J. M. OFFERIJNS *Meiosis in the pollen mother cells of some Cannas*. Thesis Utrecht, 1935, pp. 8 + 60, Eng. summ. Also published in *Genetica* 18 (1936) 1–60.

The purpose of this study was to describe and compare meiosis in pollen mother cells of some representatives of the genus *Canna*, to screen peculiarities

of chromosomal behaviour. The species studied were *C. humilis*, *C. lutea*, *C. discolor*, *C. glauca* (4 varieties), and the hybrid *C. glauca* × *C. discolor*.

All objects showed regular meiosis (9 bivalents, no multivalents in diakinesis and metaphase I), regular tetrad formation and only a minute fraction of sterile pollen.

Among his observations were that pairing between homologous chromosomes did not proceed simultaneously along the whole length, some threads being partly paired and partly unpaired. 'It is open to doubt, whether contact originates accidentally in any place or whether it is a regular process'. Chromomeres were clearly visible but complete counts were not feasible. In pachytene loops, four chromatids could sometimes be observed. In diplotene interstitial chiasmata were probably formed, which completely terminalized. The condensation of the bivalents during diplotene-diakinesis proceeded gradually and was not simultaneous.

Promotor: Prof. Dr J. A. Honing

Supervisor: Prof. Dr J. A. Honing

v.d.V.

E54. A. C. SCHUFFELEN De quantitative analyse met vlamspectra en hare nauwkeurigheid / *Quantitative analysis with flame spectra and its accuracy*. Thesis Utrecht, 1940, pp. 8 + 160. Du. a. Eng. summ.

The main object of the investigation was to study whether flame spectrography could be used on a routine-basis for analysis of plants and soils.

The experiments were carried out with a Lundegård flame spectrograph, using an acetylene-air flame and photographic detection. The spectral plate obtained was measured with a thermo-electric densitometer.

The experimental error was calculated from the errors resulting from different sources such as photometer, plate sensitivity, gas pressures and liquid flow, and conformed with experimental error for several elements in a single solution. In mixtures the errors were larger, caused by interferences, resulting from spectral coincidence, dissociation and viscosity.

Flame spectrography gave a reproducibility of about 10% for Na, K, Ca and Mn and 25% for Mg and Fe. The method was thrice as rapid and about a third of the cost of the previously used gravimetric procedures; it gave a permanent record in the form of the spectral plates.

Promotor: Prof. Dr N. Schoorl

Supervisor: Prof. Ir J. Hudig

v.d.We.

E55. J. J. LEHR De betekenis van borium voor de plant / *The importance of boron for the plant*. Thesis Utrecht, 1940, pp. 8 + 194. Du. summ. of Part I (p. 94) and Part II (p. 111). Eng. summ (p. 185).

To clarify the effect of B on plants a study was carried out with *Sinapis alba*.

Part I studies the role of B in the development of plants and its distribution within the plant. Different methods of estimating B in plant material were described. Plants grown in nutrient solutions showed a linear increase of B uptake within the range 50–200  $\mu\text{g}$  B/litre. Below this range linearity was still maintainable but at 50  $\mu\text{g}$  a reproducible bend was found in the curve relating B concentration and uptake. Below pH 7 uptake of B was not dependent on  $\text{H}^+$ ,  $\text{Ca}^{2+}$  and phosphate ions concentrations.

B content of different parts of plants showed the following sequence: older leaves > young leaves > stems > roots. B was involved in transport of carbohydrates and affected the stability of young cell membranes.

Part II contains data, discusses the B content of several Dutch soils and concludes that addition of B-containing fertilizers (chilean nitrate) or other B compounds would often be necessary to ensure sufficient B for root crops.

Promotor: Prof. Dr V. J. Koningsberger

Supervisor: Prof. Ir J. Hudig

Ros.

E56. R. LOOSJES pH-meting in suspensies / pH *Measurement in suspensions*. Thesis Utrecht, 1942, pp. 12 + 94. Eng. summ.

A theoretical basis was sought for electrometric estimation of pH in suspensions to explain de Bruijn's sol concentration effect and to obtain reliable values for ion activities in soil suspensions.

After a literature study of the suspension effect (the difference in pH between a suspension and the intermicellar liquid) a working hypothesis was developed starting from the thermodynamically established fact that a reversible electrode could not produce a suspension effect. The effect must be due to the liquid junction. So the electrical potential at the contact of a concentrated solution (KCl) and a dilute solution (intermicellar liquid) had to be estimated in a capillary system (the suspension). Only a single capillary was considered. By the capillary the normal diffusion potential between the two solutions was strongly modified (capillary effect). The experiments on this effect were described.

The suspension effect was particularly studied as a function of concentration and pH.

In a general discussion all experimental data corroborated the working hypothesis. From kinetics it was shown that observed pH after addition of a neutral salt to a concentrated suspension was equal to the pH of the layers nearest to the wall before the salt was added. Together with the pH of the intermicellar liquid it provided limits between which the average pH of the suspension must lie. Inversometric and analogous methods must determine the true mean  $\text{H}^+$  concentration (not the activity) in the suspension. So de Bruijn's sol

concentration effect, the membrane (diffusion) potential and other phenomena could also be explained.

Promotor: Prof. Dr H. R. Kruyt

Supervisor: Prof. Ir J. Hudig

E.

E57. A. J. ZWART VOORSPUIJ Onderzoekingen over glaselectroden / *Studies on glass electrodes*. Thesis Utrecht, 1943, pp. 8+ 90. Du. summ. Also published in *Recueil Trav. Chim. Pays Bas* 61 (1942) 531-538, and 62 (1943) 784-814.

The paper describes the properties of glass electrodes prepared from lithium calcium aluminosilicate glasses of various compositions. The influence of H ions and other cations (Na, K, Li, Ba, Ca) on the electrode potential was studied. Preliminary studies suggested that a suitable glass composition was Li<sub>2</sub>O 14, CaO 6, Al<sub>2</sub>O<sub>3</sub> 10 and SiO<sub>2</sub> 70%. Electrodes prepared from glass of this composition showed the properties of a hydrogen electrode at low pH ranges. At higher pH the hydrogen function was lost and the electrode acted as an electrode for the other cations studied, the best specimen according to the Nernst formula. A theory of the glass electrode was given based on the assumption that adsorption of ions at the glass surface was the chief function. Adsorption was supposed to follow the law of mass action. The theory allowed a quantitative explanation of the experimental results. Taking into consideration the results obtained from some other work on glass suspensions a satisfactory understanding of the working mechanism and behaviour of glass electrodes could be achieved.

Promotor: Prof. Dr H. R. Kruyt

Supervisor: Prof. Dr H. J. C. Tendeloo

Author

E58. H. C. J. OOMEN Polyploidy in *Canna*. Thesis Utrecht, 1948, pp. 8 + 54. Eng. summ. Also published in *Genetica* 24 (1949) 333-386.

The author tried to describe and explain morphological and physiological differences between diploid, triploid and tetraploid cannas. Pure lines of the diploids *C. aureo-vittata* and *C. humilis* (perhaps to be regarded as varieties of one species) were compared with 3 and 1 autotetraploid lines of spontaneous vegetative origin from these respective diploids. In addition  $2n \times 4n$  and  $4n \times 2n$  crosses were made. The former cross gave good seed-set but germination was poor; the latter cross gave few seeds but with good germination.

Morphologically and physiologically,  $3n$  and  $4n$  cannas are normal. The polyploids grow slower and flower about 3 weeks later. The author showed that pollen grains (with  $4n$  plants) and stomata ( $3n$  and  $4n$ ) were considerably larger (but the size of the chloroplasts remained the same). Increased cell size was also reflected by increased thickness of the leaf. As the ratio cell surface: cell volume became smaller with increasing polyploidy (ratios in pollen grains

were 1:0.79:0.63), a resulting change in metabolism might account for the change in some physiological features, such as osmotic value.

Promotor: Prof. Dr V. J. Koningsberger  
(Because of the ill-health of Prof. Dr J. A. Honing)  
Supervisor: Prof. Dr J. A. Honing

v.d.V.

E59. Miss BLANCHE D. E. GAILLARD Chromatografisch onderzoek naar de samenstelling van de polysacchariden uit de celwand in verband met de analyse van ruwvoeders / *Chromatographic characterisation of the polysaccharides of the cell-wall with regard to the analysis of roughages*. Thesis Utrecht, 1954, pp. 8 + 180. Du. a. Eng. summ. Also published in Meded. LH 54 (1954) 4.

After treatment of wheat straw with ethanol and benzene pectic substances, hemicelluloses and cellulose were successively isolated. After hydrolysis sugars in the pectic substances (about 1.6% of the straw) were identified. As pectin was decarboxylated by hydrolysis, it could only be estimated by precipitation as calcium pectate in fodders rich in pectin. Isolation of hemicelluloses required removal of lignin. Different methods of removing lignin, including 2 new ones, were compared. After hydrolysis the sugars in hemicelluloses were estimated by chromatography. The cellulose residue proved to be a mixture of cellulose and polymeres of arabinose and xylose. Complete analysis of wheat straw, oats, rye, barley, hays and artificially dried grass was possible with recoveries between 90–96%. Short cuts in the method and combination with estimation of soluble carbohydrates were possible. Part of the hemicelluloses may be enclosed in the cellulose skeleton and could only be liberated by NaOH. There may be a chemical bond between xylan and cellulose. Hydrolysis of holocellulose with dilute acid (0.1 N) allowed estimation of part of the hemicellulose that was not linked to cellulose molecules, leaving a residue of Cross Bevan cellulose.

Promotor: Prof. Dr J. A. C. van Pinxteren  
Supervisor: Prof. Dr E. Brouwer

Wi.

E60. H. N. STEIN De oxydatie van phloroglucinol: een studie van enige problemen der humificering / *The oxidation of phloroglucinol: a study of some problems of humification*. Thesis Utrecht, 1957, pp. 8 + 48. Du. a. Eng. summ. Also published in Meded. LH 57 (1957) 3.

The oxidation of phloroglucinol by  $K_3Fe(CN)_6$  in neutral aqueous solution was studied to clarify some problems of humification. Phloroglucinol differed from the usual model compounds (such as hydroquinone) because a quinone was no more likely to form as an intermediate than with many phenols occurring in nature.

During oxidation of phloroglucinol compounds of higher molecular weight

were formed; if the oxidation was carried out in the presence of certain amino acids (aspartic acid, tryptophan), the products contained N.

The mechanism of this oxidation involved intermediate free radicals. This followed from the kinetics of the reaction, indicating transfer of one electronic charge as the rate-determining step and from the observation that styrene, if present during oxidation, polymerized. The oxidation of 2,4-dimethylphloroglucinol showed the same characteristics. The stoichiometry of the reaction during the first stages supported the hypothesis that the rate-determining step was the first oxidation step.

The oxidation products were distinguished by a lower charge density in 0.01 N NaOH than the initial material; this was considered to be analogous to the disappearance of phenolic hydroxyl groups during humification.

Promotor: Prof. Dr J. Th. G. Overbeek

Supervisor: Prof. Dr H. J. C. Tendeloo

Author

E61. D. J. G. NOTA Sediments of the Western Guiana Shelf. Thesis Utrecht, 1958, pp. 2 + 98. Eng. summ. Also published in Meded. LH 58 (1958) 2.

To extend information on the sedimentation on an open shelf off the delta of a large river, samples and echo soundings were taken during two expeditions to the Orinoco shelf under the direction of Dr Tj. van Andel and Prof. Dr Ph. H. Kuenen. The author participated in the second expedition.

The submarine topography proved to be heterogeneous: in front of the mouth of the Orinoco river recent deposition forms a smooth surface; further south-east, terraces and ridges occur. A terrace at a depth of 12 fathoms is especially conspicuous. The topography of the shelf edge is very irregular.

The history of deposition in the area could be derived from extensive studies on lithology, mineralogy and grain size. The earliest period could be detected from stratification of cores at the shelf's edge. The second period with reef-like bodies and coarse staurolite-epidote-containing sands was dated by the <sup>14</sup>C method as Pleistocene. The deposition occurred while sea-level was lower. The 12-fathom level fell in the third period, with post-glacial deposits containing an epidote-hornblende association. Grain size and topography indicate a submerged tidal flat environment. The fourth and last period includes the present situation. Deposition only occurs in a narrow belt along the coast; the rest of the shelf is non-depositional.

Promotor: Prof. Dr D. J. Doeglas

Supervisor: Prof. Dr D. J. Doeglas

Do.

E62. A. K. CONSTANDSE Het Dorp in de IJsselmeerpolders; sociologische beschouwingen over de nieuwe plattelandscultuur en haar implicaties voor de planologie van de droog te leggen IJsselmeerpolders / *The village in the Ysselmere*

*Polders; a sociological study on changing rural culture and its implications for planning of Ysselmere Polders still to be drained.* Thesis Utrecht, 1960, pp. 296. Eng. summ. Also published as 'Van Zee tot Land' No. 31 (Tjeenk Willink, Zwolle).

This study is intended to provide sociological data needed as a guide for settlement planning in the new Ysselmere Polders. Part I describes desirable characteristics of new rural culture in general. Part II discusses some theories of settlement leading to the conclusion that policy may help to build a new rural culture which fits into the guide lines developed in Part I of the study. Part III contains an evaluation of the already existing Ysselmere Polders, particularly the North-East Polder. Finally an attempt is made to construct a model for a viable rural village.

Promotor: Prof. Dr E. W. Hofstee  
Supervisor: Prof. Dr E. W. Hofstee

Author

E63. M. J. FRISSEL The adsorption of some organic compounds, especially herbicides, on clay minerals. Thesis Utrecht, 1961, pp. 8 + 54. Eng. (p. 2) a. Du. summ. (p. 51). Also published as VLO 67.3 (1961).

The adsorption of certain organic ions, mainly herbicides, was studied by estimating adsorption isotherms on different clay minerals, under various conditions. Adsorption was highly dependent on salt concentration and pH. At very low pH adsorption was rather strong, at slightly alkaline pH, anionic substances were adsorbed negatively and non-ionic compounds moderately. Methylene blue was invariably strongly adsorbed, sometimes the charge of the clay mineral was reversed. To compare adsorption of organic ions with that of inorganic ions some experiments with  $^{131}\text{I}^-$  and  $\text{Cl}^-$  were included.

Several types of adsorption should be distinguished in reactions in aqueous medium. When the herbicides were adsorbed as ions, they were present in a diffuse layer. Sometimes this type of adsorption may be treated quantitatively, e.g. with the Gouy theory. Generally forces were not only Coulombic. Substituted triazines and ureides (weak bases) were mainly adsorbed as positively charged ions formed through association with protons. The calculated value of the negative adsorption of organic anions on the negatively charged clay surface proved to be in agreement with experimental values. The observed positive adsorption of organic anions on illite took place on the positively charged edges of the clay platelets. Organic acids may also be adsorbed in undissociated form.

In agriculture certain herbicides may accumulate in clays.

Promotor: Prof. Dr J. Th. G. Overbeek  
Supervisor: Dr Ir G. H. Bolt

Author/E.



E64. E. ABMA *Leiding en leden in landbouwcoöperaties / Management and membership of agricultural co-operatives*. Thesis Utrecht, 1962, pp. 190. Du. a. Eng. summ.

From a study of the literature on management in voluntary organizations and from a field study of about a thousand agricultural co-operative societies the author develops an analytical model of the management of voluntary associations.

The two variables used in this model to distinguish the relations between boards and members are the response of the boards to the wishes of the members, and the activeness of the members in the affairs of the association. Whereas most theories of leadership in voluntary associations, following Michel's famous 'iron law of oligarchy', allow for only two forms of government, democracy and oligarchy, Abma here distinguishes 'pseudo-oligarchy'. This is the form of government in which members are passive and do not participate, yet the leaders are responsive.

In most farmers' co-operatives in the Netherlands the members hardly influence the decisions of the leaders, yet to distinguish the management of co-operatives as oligarchies would do injustice to most of their leaders. The term pseudo-oligarchy describes the situation better.

Promotor: Prof. Dr E. W. Hofstee  
Supervisor: Prof. Dr E. W. Hofstee

Author

E65. G. F. BLOM *Het verband tussen de lipiden in het gras en de consistentie van de boter / The relation between the lipids of grass and the consistency of butter*. Thesis Utrecht, 1962, pp. 8 + 134. Du. a. Eng. summ. Also published in *Meded. LH 62* (1962) 9.

Professor E. Brouwer suggested that the consistency of butter during pasturing of cows was largely determined by the unsaturated fatty acids in the ingested grass. This hypothesis was tested in digestion trials with unsaturated fatty acids and by statistical comparison of butter consistency, and daily fat production per cow and fat content of the milk. Extraction and separation of grass lipids by silica gel chromatography were investigated, achieving a detailed method for isolation and determination of fatty acids in grass and faeces. From such an analysis in a digestion trial a considerable preference was found for the digestion of the unsaturated compounds eluted by benzene. Calculated coefficients for the regression between iodine value of milk fat, unsaturated fatty acids in grass, daily milk fat production and milk fat percentage agreed well with those actually found. This supported Brouwer's hypothesis. Data on refractive index, fat production per cow and milk fat content were analysed statistically for different regions of the Netherlands. Differences between actual

and calculated refractive indices of milk fat were related to soil type and type of farming. Lower indices tended to occur in dry years.

Promotor: Prof. Dr E. Brouwer  
Supervisor: Prof. Dr E. Brouwer

Wi.

E66. G. J. SAALTINK De ontwikkeling van *Fusarium oxysporum* in resistente en vatbare rassen van *Lupinus luteus* | *The development of Fusarium oxysporum in resistant and susceptible varieties of Lupinus luteus*. Thesis Utrecht, 1963, pp. 8 + 76. Du. a. Eng. summ. Also published in *Neth. J. Plant Pathol.* 69 (1963) 1 and as Meded. Lab. Phytopath. 203.

Host-parasite relations were studied in a susceptible and a resistant variety of *Lupinus luteus* L. and in *Fusarium oxysporum* Schlecht. f. *lupini* Sn. et Hans. An important part of these studies was the measurement of fungal growth inside the plant by a dilution plate method. In roots of susceptible plants the amount of fungus increased at a certain rate. In resistant plants fungus increased until 14 days after inoculation, then decreased until about day 35, thereafter the amount of fungus remained constant until flowering time when a large increase ensued. It was evident that a resistance mechanism operated in resistant plants from the beginning.

Experiments with grafted plants showed that difference in susceptibility was larger in roots of susceptible and resistant plants than in hypocotyls. The results also showed that the development of the fungus in the root was important for the development of symptoms. In different parts of the roots the fungus developed at different rates.

Histological observations were described on growth of fungus in xylem and the tissue reactions. Preliminary experiments were reported on the growth of the fungus in exudative sap, wilting of plants on filtrates from cultures, importance of phenols in the resistance mechanism and enzymic activity of the fungus on sterilized host substrate.

Promotor: Prof. Dr A. J. P. Oort  
Supervisor: Prof. Dr A. J. P. Oort

Author

E67. H. M. DEKHUIZEN The systemic action of dimethyldithiocarbamates on cucumber scab caused by *Cladosporium cucumerinum* and the conversion of these compounds by plants. Thesis Utrecht, 1964, pp. 8 + 76. Eng. a. Du. summ. Also published in *Neth. J. Plant Pathol.* 70 (1964), Suppl. 1. and as Meded. Lab. Phytopath. 210 and as Org. Chem. Inst. TNO, Utrecht, Publ. 125

Control of plant diseases by fungicides depends mainly on protection of the host surface against infection. As sometimes the effect of protective fungicides is unsatisfactory, the possibilities of systemic compounds receive increasing

attention. These substances enter into the plant and may interact in its metabolism or the plant may convert the chemical into other compounds.

The author studied the mechanism of systemic action of sodium dimethyldithiocarbamate (NaDDC) and related compounds on cucumber scab caused by the fungus *Cladosporium cucumerinum*. Information was obtained on uptake, translocation, distribution and conversion of NaDDC in cucumber seedlings. The occurrence of various fungicides in the plant after treatment with NaDDC was demonstrated by paper chromatography. To detect the fungicidal spots, chromatograms were sprayed with a conidial suspension of a fungus and incubated in a damp atmosphere until the paper chromatogram became covered by fungal growth except at spots containing fungicide. Plants proved to transform dimethyldithiocarbamate (DDC) ions into L-alanine and  $\beta$ -glucoside derivatives, and an unknown fungicidal derivative. The first compound was shown to be responsible for the systemic control of cucumber scab. L-DDC-alanine, however, cannot be used in practice, since it is antagonized by plant amino acids and is phytotoxic at higher concentrations.

The systemic action was studied of some dimethyldithiocarbamates not toxic to fungi with growth-regulating activity, such as carboxyl-DDC. It was assumed that there disease control was obtained by interference with the metabolism of the plant, causing an increase in resistance of the host plant to the pathogen.

Promotor: Prof. Dr A. J. P. Oort  
Supervisor: Prof. Dr A. J. P. Oort

De.

E68. B. H. BIJSTERBOSCH The electrical double layer on silver iodide in the presence of organic molecules. Thesis Utrecht, 1965, pp. 12 + 64. Eng. a. Du. summ. Also published in Meded. LH 65 (1965) 4.

Earlier studies (as by Lyklema) had shown that there was a close analogy between the electrical double layer at the interface of AgI and aqueous electrolyte solution and that at the interface of Hg and aqueous electrolyte solution. The possibility was studied that this analogy may extend to situations where organic molecules were present in the aqueous phase. The organic molecules used were ureum and some alcohols.

The relation relevant for these investigations between charge and potential was estimated by a potentiometric titration. The shift in the point of zero charge, through adsorbed organic molecules was estimated by the streaming potential technique.

The AgI and the Hg system showed the presumed close analogy. Observed differences between each system were quantitative rather than qualitative.

Adsorbed straight-chain alcohols seemed to be oriented perpendicular to the

surface, with their hydrophilic parts in the solution and their paraffinic chains on the AgI.

Promotors: Prof. Dr J. Lyklema and Prof. Dr J. Th. G. Overbeek

Supervisor: Prof. Dr J. Lyklema

Author

E69. H. J. VAN DEN HUL The specific surface area of silver iodide suspensions. Thesis Utrecht, 1966, pp. 10 + 78. Eng. a. Du. summ. Also published in Meded. LH 66 (1966) 2.

This study was intended to test the suitability of the negative adsorption method in estimation of surface area, especially for impermeable low area materials. Negative adsorption of co-ions from a charged suspension is described by the Gouy Stern theory. The dependence from both the concentration and the potential was corroborated experimentally. Surface areas can be calculated from a single estimate of concentration, without knowledge of the cross-section of the negative adsorbing ion.

The results agree within experimental error with capacity areas but are larger by a factor 3.3 than gas adsorption and permeability areas. The various results are consistent, so the difference must be physically significant. It is suggested that aggregation is the cause of a loss of surface area after drying. Dye adsorption and microscopy are shown not to be suitable for absolute estimates of area. It is concluded that surface areas should always be estimated by a method related to the particular application, e.g. wet surface areas should be determined by a capacity method or by negative adsorption, whereas the dry surface area may be determined by the B E T method.

Promotors: Prof. Dr J. Lyklema and Prof. Dr J. Th. G. Overbeek

Supervisor: Prof. Dr J. Lyklema

Author

E70. A. TH. VAN 'T KLOOSTER De toestand van calcium, magnesium en enkele andere mineralen in darminhoud en mest van herkauwers in verband met hun resorptie / *The state of calcium, magnesium and some other minerals in gut contents and feces of ruminants in relation to their absorption.* Thesis Utrecht, 1967, pp. 10 + 136. Du. a. Eng. summ. Also published in Meded. LH 67 (1967) 5.

Absorption of Ca and Mg and especially the state of these minerals in the intestinal tract of cows were studied. The methods used were outlined.

Undigested fibre particles in the gut adsorbed Ca and Mg to an important extent. Shortly after the death of cows extensive deterioration of the mucosa sets in.

Contents of K, Ca, and Mg in the rations were positively correlated with concentrations of the same minerals in the duodenal and ileal contents; no correlation was found however for Na.

In duodenal contents about 90% of the Ca and Mg and 73% of the P was ultrafiltrable. In ileal contents however only 12% of the Ca, 34% of the Mg, and 7% of the P was ultrafiltrable. These low values were probably due to the high pH there. It was shown that the activity of  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  in duodenal ultrafiltrates was about 90% of the activity of these elements in pure salt solutions with the same concentrations of these cations. In ileal ultrafiltrates these respective percentages were 63 and 78.

The electrical potential difference between blood and duodenal contents varied between +10 and +20 mv. Mean values between blood and chyme in the ileum were from +20.1 to +25.1 mv.

Absorption of Ca and Mg was closely restricted to the small intestine: Na and K were also absorbed from the large intestine.

Promotors: Prof. Dr E. Brouwer and Prof. Dr Th. de Groot

Supervisor: Prof. Dr E. Brouwer

Author

E71. J. H. W. LIJFERING Selectieve migratie. Een empirische studie van de samenhang tussen plattelandsmigratie en selectie naar intelligentie in Nederland / *Selective migration: an empirical study of the relation between rural migration and selection according to intelligence in the Netherlands*. Thesis Utrecht, 1968, pp. 8 + 140. Eng. summ. Also published in Meded. LH 68 (1968) 3.

To find how out-migration from rural areas affected the remaining population, Lijfering compared the intelligence as judged by headmasters with such characteristics as the migratory history, education and social class of former boys of rural primary schools, who had left school 20 years before.

Migrants were significantly more intelligent than non-migrants. But migrants to other rural areas or moving short distances were not. Education, occupation and improvement in social status between generations were tied more to intelligence than migration was. For categories with higher education, non-rural occupations and those which improved their status, intelligence was equal in migrants and non-migrants, although they had migrated extremely frequently.

More intelligent boys often had to migrate to the work they wanted but sometimes achieved a better career without migration, showing that migration depended on educational and occupational selection. The migratory frequency of the less intelligent boys was rather low. Lack of work other than in agriculture gave them poor chances. Unemployment was frequent in this category.

The social and economic situation of the whole of society had a great impact on rural migration. In the last decades two important changes were the pervasion of urban culture and enculturation down the social classes. As a result town and country had grown more alike so that the rural migration was now less relevant than before.

Promotor: Prof. Dr E. W. Hofstee

Supervisor: Prof. Dr E. W. Hofstee

Author

**Oxford University, United Kingdom**

E72. S. D. RICHARDSON The influence of the shoot system on root growth of certain forest tree seedlings. Thesis Oxford, 1955, pp. 250 + 224. Copies held by the Libraries of the University of Oxford, the University of Aberdeen Forestry Department, University College of North Wales Forestry Department and the Laboratory for Plant Physiological Research at Wageningen.

An investigation was described into the influence of the shoot system in seedlings of *Acer saccharinum* L. and *Quercus borealis maxima* (Marsh) Ashe on root development and growth rate. Specific differences in the role of carbon assimilation in root growth were found. Experiments designed to elucidate the relation between accessory growth factors and root development were carried out. Apart from photosynthesis, root development in *Acer saccharinum* is determined by at least two accessory growth factors; during the growing season, one is elaborated in the terminal meristem and controls root formation; the other is formed in the leaves and determines root elongation; in the absence of leaves it can be supplied by a humusrich soil.

For the award of D.Ph. (Oxon.)

Promotor: Prof. Sir Harry G. Champion, Oxford, United Kingdom

Supervisor: Prof. Dr E. C. Wassink

Author

**Illinois University (Urbana), United States of America**

E73. D. G. JACOBS The electrochemical behaviour of excised pea roots. Thesis University of Illinois, Urbana, Ill. U.S.A. 1958, pp. 130.

A method was developed for measuring the potential of roots immersed in a flowing solution. The method was used to study the Boltzmann distribution of ions along the root surface and its role in ion uptake.

Root potentials were not affected by metabolic processes as was shown by the low coefficient for temperature and the steady values reached after equilibration times of only a few minutes. Both the ionic concentration and the pH of the solution greatly influenced the root potentials measured.

The charge density on the plant root was calculated by Donnan or double-layer theory. No insight into the actual distribution of charges in space could be reached. Increased ionic strength of the surrounding solution led to an increase in the net negative charge on the plant root. The amphoteric nature of the root colloids could be shown by potential measurements in acid solutions.

Promotor: Prof. Dr J. E. Gieseking, Urbana (Ill.), U.S.A.

Supervisor: Prof. Dr A. C. Schuffelen

R.

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When the number is followed by an asterisk \*, there is a second promotor, whose name will be found under the abstract.

Unless otherwise said, the promotors are professors of the Agricultural University of Wageningen. No attempt has been made to indicate whether they are still in office.

**Dr J. H. ABERSON** Professor of Chemistry and Manuring Theory

J. A. Ezendam, 1921, 3

W. S. Smith, 1927, 32

D. Tollenaar, 1925, 17

C. K. van Daalen, 1928, 41

J. Th. White, 1926, 26

**Dr J. F. ARENS** Professor of Organic Chemistry, State University of Groningen; since 1960 professor of Organic Chemistry, State University of Utrecht

G. C. Vegter, 1957, E 27

**Dr A. E. VAN ARKEL** Professor of Inorganic Chemistry, State University of Leiden

Miss Johanna A. D. Verhoop, 1940, E 36

**Dr D. L. BAKKER** Professor of Animal Husbandry

P. C. Labouchère, 1927, 30

A. F. van der Scheer, 1941, 118

G. D. Nel, 1937, 99

**J. VAN BAREN** Professor of Mineralogy and Geology

H. Loos, 1924, 10

**Dr B. H. SLICHER VAN BATH** Professor of Agricultural History

J. F. van Oosten Slingeland, 1958, 241 J. D. Dorgelo, 1964, 367

**Dr J. H. BECKING** Professor of Forest Mensuration, Forestry Economics, Forest Management, and Silviculture and Forest Protection in the Tropics

F. E. Essed, 1957, 225\*

J. Luitjes, 1958, 251

J. G. P. M. Smeets, 1957, 229 (After the death of Prof. Dr G. Houtzagers.)

J. van Soest, 1959, 253

**Dr. H. A. J. M. BEEKMAN** Professor of Forest Mensuration, Forest Valuation and Forest Management

H. M. J. Hart, 1928, 43\*

H. E. Wolff von Wülffing, 1933, 78\*

Dr Ir A. H. BERKHOUT Professor of Forest Mensuration, Forest Valuation and Forest Management  
H. A. J. M. Beekman, 1920, 1

Ir J. A. VAN BEUKERING Professor of Tropical Agricultural Economics  
J. A. H. Hendriks, 1956, 214 (See also 244: L. H. Huizenga)

Dr A. H. BLAAUW Professor of Special Subjects in Plant Physiology  
W. Beijerinck, 1927, 33 A. van der Meulen, 1939, 114

Dr J. BLANKSMA Professor of Organic and Pharmaceutical Chemistry, State University of Leiden  
G. Carrière, 1941, E 37

Dr Ir G. H. BOLT Professor of Soil Chemistry and Soil Physics  
F. A. M. de Haan, 1965, 380

Dr H. BOSCHMA Professor of Systematic Zoology, State University of Leiden  
H. J. de Fluiter, 1931, E 34

Dr E. BROUWER Professor of Animal Physiology  
Tj. J. Huisman, 1946, 138 A. J. H. van Es, 1961, 306  
J. Weits, 1956, 201 G. F. Blom, 1962, E 65  
P. van der Wal, 1956, 213 G. Marincowitz, 1964, 362\*  
E. J. van Weerden, 1959, 254 J. H. Aafjes, 1965, E 18\*  
S. El-Samman M. H., 1961, 299 A. Th. van 't Klooster, 1967, E 70\*

Ir B. VAN DER BURG Professor of Dairy Science and Technology  
W. H. Chr. Knapp, 1927, 27 G. Posthumus, 1943, 125\*  
V. R. IJ. Croesen, 1931, 61\* P. van der Burg, 1946, 136  
A. Pasveer, 1941, 119 J. J. Post, 1949, 148  
C. Schiere, 1942, 121

Dr Ir P. BURINGH Professor of Tropical Soil Science  
L. J. J. van der Kloes, 1965, 393 W. G. Sombroek, 1966, 396  
S. Slager, 1966, 394

Dr Ir J. T. P. BIJHOUWER Professor of Horticultural and Agricultural Landscaping  
E. C. M. Roderkerk, 1961, 302

Sir HARRY G. CHAMPION, Kt, C.I.E., D. Sc. Professor of Forestry at the University of Oxford, United Kingdom  
S. D. Richardson, B. Sc., M. A.,  
1955, E 72  
For award of D. Phil. (Oxon.),

Dr Ir C. COOLHAAS Professor of Tropical Crop Husbandry  
 A. F. Schoorel, 1950, 150 N. C. Keulemans, 1959, 258  
 Th. M. Wormer, 1953, 179 L. D. Sparnaaij, 1959, 272  
 J. D. Ferwerda, 1955, 194 K. W. Smilde, 1960, 281<sup>1</sup>  
 E. J. Fortanier, 1957, 224\* J. Bekendam, 1961, 295  
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Dr Ir L. C. A. CORSTEN Professor of Mathematical Statistics  
 M. A. J. van Montfort, 1966, 400\*

Ir W. J. DEWEZ Professor of Field Crop Husbandry  
 G. Hamming, 1949, 149\* J. J. Jonker, 1958, 245  
 N. H. H. Addens, 1952, 173 E. G. Kloosterman, 1960, 280

Dr D. J. DOEGLAS Professor of Geology, Mineralogy and Petrology  
 D. J. G. Nota, 1958, E 61

Dr Ir M. J. L. DOLS Special Professor of Nutrition and Food Distribution,  
 Municipal University of Amsterdam (established by the Dutch Institute of  
 Human Nutrition)  
 W. T. Binnerts, 1956, E 6 Miss Theodora F. S. M. van Schaik,  
 1961, 317\*

Dr Ir J. DOORENBOS Professor of Horticulture  
 J. A. Huyskes, 1963, 357 A. M. Abou Dahab, 1967, 417  
 S. P. Erasmus, 1965, 378 G. Hekstra, 1968, 422

Dr Ir J. C. DORST Professor of Plant Growing and Breeding  
 C. Mastenbroek, 1952, 170\* J. Bekendam, 1961, 295\*  
 H. Lamberts, 1955, 192 J. G. Th. Hermsen, 1962, 325  
 C. A. Huijsman, 1957, 220 L. H. A. Hindi, 1962, 329  
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Dr Ir C. H. EDELMAN Professor of Mineralogy, Petrology, Geology and  
 Agrogeology; since 1955 Professor of Soil Science  
 F. A. van Baren, 1934, 83 J. S. Veenbos, 1950, 151  
 W. A. J. Oosting, 1936, 94 G. de Bakker, 1950, 156  
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 A. P. A. Vink, 1949, 147 H. C. de Roo, 1953, 180

<sup>1</sup> Prof Dr Ir C. Coolhaas approved the thesis but as he was ill at the time of the graduation, Prof Dr Ir S. J. Wellensiek presented Mr Smilde for his degree.



D. van Diepen, 1954, 184	F. Sonneveld, 1958, 248
J. Bennema, 1954, 187	I. S. Zonneveld, 1960, 275*
J. C. F. M. Haans, 1955, 191	S. F. Kuipers, 1960, 279
J. J. van der Eyk, 1957, 221	H. N. Hasselo, 1961, 300
P. K. J. van der Voorde, 1957, 222	L. A. H. de Smet, 1962, 322
A. Jongerius, 1957, 231	A. J. Havinga, 1962, 336
L. J. Pons, 1957, 237	P. J. Ente, 1963, 346

**Dr B. G. ESCHER** Professor of General Geology, Crystallography and Mineralogy; since 1 May 1950 Professor of General Geology, State University of Leiden

J. A. Baak, 1936, E 35

**Dr Ir J. D. FERWERDA** Professor of Tropical Crop Husbandry

J. F. de Beer, 1963, 344	A. C. Zeven, 1967, 412
J. F. Wienk, 1963, 348	H. ten Have, 1967, 418
M. Flach, 1966, 397*	

**Drs A. M. FRENS** Professor of Animal Physiology, including Human and Animal Metabolism

A. R. El-Boushy, 1966, 402	Y. S. Rijpkema, 1968, 421
----------------------------	---------------------------

**Dr J. E. GIESEKING** Professor of Soil Chemistry, University of Illinois, Urbana (Ill.), U.S.A.

D. G. Jacobs 1958, E 73

**Ir H. K. H. A. MAYER GMELIN** Professor of Field Crop Husbandry

D. de Waal, 1942, 122\*

**Dr W. C. DE GRAAFF** Professor of Pharmacography, Galenian Pharmacy, Applied Microbiology, related aspects of Food Science, and Pharmacy, Feed-stuffs Science and Toxicology for the veterinarian students, State University of Utrecht.

Miss Helena Vinkenburg, 1931, E 48

**Dr TH. DE GROOT** Extraordinary Professor of Animal Nutrition of the Large Domestic Animals, State University of Utrecht

A. T. van 't Klooster, 1967, E 70\*

**Dr G. GRIJNS** Professor of Animal Physiology

B. K. Boom, 1930, 51	M. J. L. Dols, 1935, 87
B. J. B. Groeneveld, 1932, 66	J. B. H. IJdo, 1936, 96
P. Schoorl, 1934, 82	J. B. van der Meulen, 1938, 110

**Dr D. VAN GULIK** Professor of Physics, Meteorology and Climatology

H. J. Frankena, 1932, 64

S. P. HAM Professor of Silviculture, Forest Protection, Forest Management and History of Forest Management in the East Indies

J. de Hoogh, 1925, 18

J. H. Becking, 1929, 47

F. Kramer, 1926, 22

J. A. van Steijn, 1933, 72

H. M. J. Hart, 1928, 43\*

Ir M. L. 'T HART Professor of Grassland Husbandry: since 1962 Professor of Field Crop and Grassland Husbandry

F. K. van der Kley, 1957, 228

P. F. J. van Burg, 1962, 335

I. M. Said, 1959, 264

W. P. Grobbelaar, 1963, 352

J. W. Minderhoud, 1960, 286

M. del Pozo Ibáñez, 1963, 359

K. M. Sen, 1960, 287

J. W. Lackamp, 1965, 385

W. A. P. Bakermans, 1962, 332

B. Deinum, 1966, 404

Dr C. DEN HARTOG Extraordinary Professor of Nutrition and Food Preparation

G. Pol, 1960, E 10

P. A. Schippers, 1962, 338

Miss Theodora F. S. M. van Schaik, 1961, 317\*

J. H. van Roon, 1963, 350

A. I. Labib, 1962, 324

Miss Judith A. Zwartz, 1967, E 20\*

G. W. Wieringa, 1967, 405\*

Dr Ir F. HELLINGA Professor of Land Drainage and Land Improvement

W. M. Otto, 1959, 252

P. E. Rijtema, 1965, 389

D. W. Stolp, 1960, 290

A. J. Flach, 1966, 398

J. W. van Hoorn, 1960, 293

J. W. de Zeeuw, 1966, 399

J. Butijn, 1961, 296\*

M. A. J. van Montfort, 1966 400\*

A. W. de Jager, 1965, 387

Dr A. W. H. VAN HERK Professor of Plant Physiology and Pharmacognosy, Municipal University of Amsterdam

S. A. Rodrigues Pereira, 1962, E 13

Dr J. J. HERMANS Professor of Physical Chemistry, State University of Groningen

J. Hofstee, 1949, E 24

Dr H. J. DEN HERTOOG Professor of Organic Chemistry

P. A. de Villiers, 1958, E 7

J. van Bragt, 1962, 328\*

W. J. Feenstra, 1960, 276\*

J. Maas, 1963, E 15

H. C. van der Plas, 1960, E 9

R. J. Martens, 1966, E 44

M. van Ammers, 1961, E 12

H. W. van Meeteren, 1967, E 45

M. J. Pieterse, 1962, E 14

**Dr E. W. HOFSTEE** Professor of Economic and Social Geography, and Social Statistics; since 1954 Professor of Empirical Sociology and Sociography, including Social Statistics

C. Rietsema, 1950, 152

J. Doorenbos, 1950, 154

A. Maris, 1951, 159

H. Meijer, 1951, 167

A. S. Tuinman, 1952, 176

W. H. Ubbink, 1955, 199

D. D. Miedema, 1956, 203

C. J. van Meel, 1957, 232

A. K. Constandse, 1960, E 62

B. Benvenuti, 1961, 318

E. Abma, 1962, E 64

A. W. van den Ban, 1963, 342

R. Bergsma, 1963, 343

A. J. Wichers, 1965, E 46

J. H. W. Lijfering, 1968, E 71

**Dr T. H. VAN DEN HONERT** Professor of General Botany, State University of Leiden

H. Veldkamp, 1955, E 39

**Dr J. A. HONING** Professor of General Genetics of Plants and Animals, Agricultural University Wageningen. Extraordinary Professor of Genetics, State University of Utrecht

G. Bremer, 1921, 4

J. C. Dorst, 1924, 9

W. de Mol, 1924, 11

F. E. Nijdam, 1932, 68

R. Prakken, 1934, E 51

C. L. Rümke, 1934, E 49

F. J. M. Offerijns, 1935, E 53

H. Ramaer, 1935, E 52

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**Dr J. HORRING** Extraordinary Professor of General and Agricultural Economics; since 1959 Ordinary Professor of Agricultural Economics (Agricultural Policy)

J. Sevenster, 1953, 178

P. C. van den Noort, 1965, 391

**Dr G. HOUTZAGERS** Professor of Forestry

B. Veen, 1951, 168

**Ir J. HUDIG** Professor of Chemistry and Manuring Theory

H. A. Middelburg, 1932, 63

G. H. A. Leijenaar, 1932, 67

P. M. H. H. Prillwitz, 1932, 69

R. H. J. A. Roborgh, 1935, 85

W. H. van der Marel, 1935, 86

A. L. S. Bär, 1936, 91

G. F. Hauser, 1941, 117

W. A. Nieuwdorp, 1945, 128

J. van Schuylenborgh, 1947, 141

J. J. Duyverman, 1948, 142

**Ir S. IWEMA** Professor of Animal Nutrition

I. I. Al-Azzawi, 1964, 366

G. W. Wieringa, 1967, 405\*

**Dr J. JESWIET** Professor of Plant Taxonomy, Dendrology and Plant Geography

J. T. P. Bijhouwer, 1926, 24

I. Rietsema, 1928, 39

F. H. Endert, 1928, 42  
E. Meijer Drees, 1936, 92  
W. Feekes, 1936, 97

G. Houtzagers, 1937, 101  
W. H. Diemont, 1938, 111

Ir W. DE JONG Professor of Animal Husbandry

S. A. F. El-Shimy, 1956, 202

R. D. Politiek, 1957, 218

Ir J. H. L. JOOSTEN Professor of Tropical Agricultural Economics

Th. P. M. de Wit 1960, 292

H. A. Luning, 1967, 420

A. P. G. Poyck, 1962, 320

Miss Dr L. C. P. KERLING Extraordinary Professor of Phytopathology,  
State University of Amsterdam, and Extraordinary Professor of Phytopathology,  
Municipal University of Utrecht

G. van den Ende, 1958, 250

Dr J. A. A. KETELAAR Professor of Physical Chemistry and Thermodynamic  
Chemistry, Municipal University of Amsterdam

A. H. Bloksma, 1955, E 5

Dr J. C. KIELSTRA Professor of Colonial Constitutional and Criminal Law,  
East Indian Agricultural Economics and East Indian Agrarian Law

C. L. van Doorn, 1922, 5

Th. G. E. Hoedt, 1930, 53

G. H. van der Kolff, 1925, 16

E. de Vries, 1931, 57

L. J. Vroon, 1928, 45

A. M. P. A. Scheltema, 1931, 60

H. Th. Hirsch, 1929, 50

Dr C. J. VAN DER KLAUW Professor of General Zoology

G. Wiertz, 1957, E 40

Dr H. KLOMP Professor of General Zoology

M. Hafez Mohammed, 1961, 314\*

Mrs Elisabeth M. Gruys-Casimir,  
1965, E 31

Dr J. KOK Professor of Galenian Pharmacology, Biochemistry and Toxicology,  
Municipal University of Amsterdam

Miss Judith A. Zwartz, 1967, E 20\*

Dr V. J. KONINGSBERGER Professor of Botany, State University of Utrecht

I. J. Lehr, 1940, E 55

H. C. J. Oomen, 1948, E 58 (Through  
the ill-health of Prof. Dr J. A. Honing)

Ir H. KRAMERS Professor of Physical Technology, Technical University of  
Delft

P. J. Bruijn, 1961, E 23\*

Dr H. A. KRAMERS Professor of Theoretical Physics and Mechanics, State University of Leiden  
D. A. de Vries, 1952, E 38

Dr H. R. KRUYT Professor of Physical Chemistry, State University of Utrecht  
R. Loosjes, 1942, E 56  
A. J. Zwart Voorspuij, 1943, E 57

Dr PH. H. KUENEN Professor of Geology and Palaeontology, State University of Groningen  
Tj. H. van Aniel, 1950, E 25  
C. Kruit, 1955, E 26

Dr N. H. KUIPER Professor of Mathematics  
Th. J. Ferrari, 1952, 171\*  
F. E. Essed, 1957, 225\*  
L. C. A. Corsten, 1958, 238  
M. S. Raouf, 1963, 347\*  
M. T. G. Meulenberg, 1962, 326\*

Ir J. H. THAL LARSEN Professor of Mechanics, Land Drainage, Land Improvement, Tropical Agricultural and Forestry Landscaping  
J. H. Engelhardt, 1928, 44

Dr Ir H. A. LENIGER Professor of Food Technology  
Tan Boe Han, 1958, 249  
J. Veldstra, 1960, 283  
M. S. Raouf, 1963, 347\*

Dr R. A. J. VAN LIER Professor of Empirical Sociology and Sociography of the Tropics and Subtropics  
G. A. Kooy, 1957, E 41  
R. van de Waal, 1959, 267  
S. K. Sharma, 1960, 289  
D. B. W. M. van Dusseldorp, 1967, 407

Dr J. LYKLEMA Professor of Physical and Colloid Chemistry  
B. H. Bijsterbosch, 1965, E 68\*  
H. J. van den Hul, 1966, E 69\*

Dr W. C. MEES R.AZN Professor of Economics, Statistics and Dutch Agrarian Law  
J. Hoogland, 1923, 7 (After the death of Prof. Ir S. Koenen, Professor of Agricultural Economics)  
G. Minderhoud, 1925, 15  
W. J. Drogen, 1927, 31  
J. H. F. Deckers, 1927, 36\*  
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<sup>1</sup> This thesis was prepared under the guidance of Prof. Dr H. J. Braun, now of the University of Freiburg in Breisgau, Germany.



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