

# Agricultural Science Wageningen in focus



Agricultural Science Wageningen in Focus.

This book was prepared by the Information Offices of the Agricultural University and the Division for Agricultural Research.

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## Preface

This book offers a glimpse behind the scenes of all that goes into giving 'Wageningen' its agricultural significance.

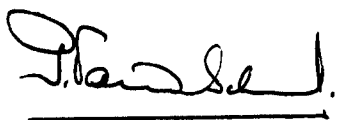
The twenty or more agricultural research institutes and the Agricultural University with more than sixty departments are known collectively throughout much of the world simply as 'Wageningen'. The name of the town is like a flag fluttering on the Dutch flotilla of agricultural sciences.

Research and education are fully in motion, always working on innovations and improvements in agriculture both in the Netherlands and elsewhere, especially in the developing 'Third World'.

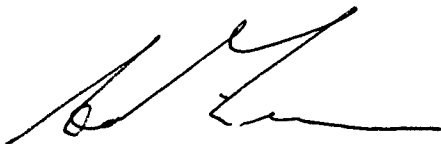
We hope that this book will help you to become more acquainted with 'Wageingen'. The text is especially intended to help you find your way around; the photographs give you an impression of the people connected with 'Wageningen', their work and their surroundings.

We trust that this book will strengthen our connections with you even further.

Wageningen, 31 July 1981



Ir P. van der Schans,  
President of the Executive Board,  
Wageningen Agricultural University



Dr ir D. de Zeeuw,  
Director of the Division for Agricultural  
Research,  
Ministry of Agriculture and Fisheries

## A bird's eye view of the Netherlands

When, having made a wide, sliding curve your plane lands at Schiphol, Amsterdam's airport, you will have already gained your first impression of the Netherlands. Green meadows with ditches, alternating with arable land; vast complexes of greenhouses; canals, rivers and lakes, an occasional patch of woodland; straight roads busy with traffic; ports, factories and houses, lots of houses.

The first impression, however superficial, gives a true picture of this country, that will be confirmed as you travel by bus, car or train. The Netherlands, this small country on the

North Sea coast where the Rhine has formed its delta, is very densely populated.

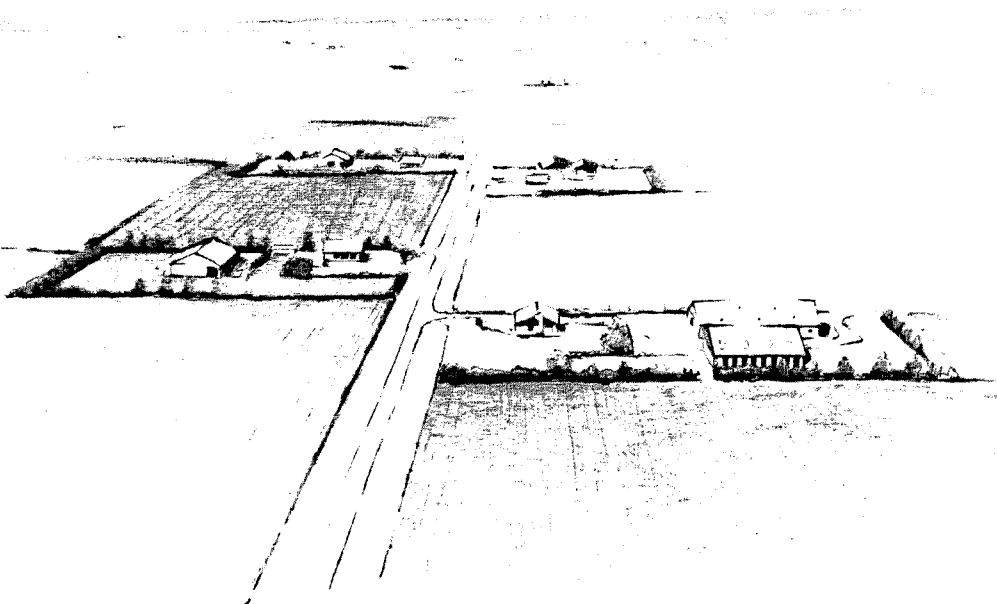
It is flat with only a handful of hills in the east and south, a lot of water (20%), a few forests (8%) and a few nature reserves (4%).

It has a wide range of soil types, various kinds of farming, and a moderately wet marine climate (the average temperature in summer is 17°C, in winter 3°C; it has an annual precipitation of 900 mm and 1600 hours of sunshine).

Fourteen million people live on an area of 34,000 km<sup>2</sup>, i.e. over 400 inhabitants per square kilometre, which makes it the most densely populated country in Europe.

Industry, trade and transport, agriculture and horticulture are the main means of livelihood.

Modern farms on the new polders.



The Netherlands is not a rich country, although it has some natural gas, but it is not poor either. Per capita national income in the Netherlands is about Dfl. 18,000 a year.

## Social and technical problems

The high population density and geographical location pose social and technical problems for the Netherlands. The percentage of the working population employed in agriculture has been declining over the last decades and is now only 5.3 per cent, while it was 17 per cent in 1950. Indirectly, however, agriculture is important for employment and for the economic position of the Netherlands. It has a substantial food industry, and agriculture supplies a very large proportion of its raw materials. The export value of farm products constitutes as much as 26 per cent of the total export value.

### Population density

The high population density causes a scramble for cultivated land (68 per cent of the total area). House-building and construction of industrial sites and roads usually occurs at the expense of agricultural land. The average annual decrease is 10,000 ha a year or 4 per cent of the total cultivated area.

The country has gained and is still gaining farm land by reclamation, the Lake IJssel Polders (*IJsselmeerpolders*), which have been being reclaimed since 1930, now cover an area of 160,000 ha, but reclamation possibilities are almost exhausted.

The population density also causes pressure on areas outside the urban agglomeration. Unfortunately, true natural areas have become a scarce commodity. Consequently, efforts to maintain the ecological balance and to conserve nature are increasing which occasionally causes tension between the interests of agriculture and nature conservancy.

### Recreation

All work and no play makes Jack a dull boy, and so recreation facilities must also be pro-

vided for these 14 million inhabitants, and this, too, sometimes conflicts with farming interests. The cultivated countryside of the Netherlands has many attractive aspects and offers opportunities for outdoor recreation; and we would like to keep it that way, but if we do, the farmers cannot always introduce the changes in their farm management that are economically necessary.

### Environmental hygiene

Environmental hygiene is another serious problem of a highly industrialized country. Ways of preventing the pollution of surface waters require a great deal of attention, and measures must be taken to remove or cleanse urban and industrial waste. Air pollution, especially in the industrialized coastal strip with its large ports, and alongside the motor-ways, damages the crops. The estuaries in Zeeland and the deep channel to Rotterdam (*de Nieuwe Waterweg*), allow infiltration of salty and brackish water far into the delta. The Rhine (*de Rijn*), sometimes called Europe's open sewer, is infamous for its pollution and salinization by industrial waste.

Despite the abundance of water in the Netherlands, salinization causes problems with the fresh water supply. The 5,000 horticulturalists in the Westland (the greenhouse area near the mouth of *de Nieuwe Waterweg*) are especially bothered by this. Their joint output is worth Dfl. 1.5 billion a year, some 70 to 80 per cent of this being exported. Fresh, clean water is indispensable for greenhouse cultivation.

Even agriculture itself contributes to environmental pollution. Intensive livestock holdings often cause annoyance due to the smell of dung and liquid manure.

Plant protection products can poison the surface waters and the flora and wild life; heating of greenhouses causes air pollution; some industries that process agricultural products (e.g. the potato starch industry) pollute rivers and canals; the fertilizer industry causes air pollution. There are plenty of problems waiting for solutions.

## **Energy**

In the last few years, the energy supply has been added to this list of serious problems. The Netherlands has a stock of natural gas, but it is becoming depleted fairly quickly (estimates say that it will have been depleted by the year 2000). Arable farming and horticulture also use energy for the manufacture of fertilizers, for farm machinery, and for the heating of greenhouses.

On the other hand, arable farming invests energy in vegetable products and it may be possible to reclaim energy from farm waste. Whichever way you look at it, the energy problem has its effects on the farming industry and efforts are being made to reduce consumption and to find alternative sources.

## **Economic and social problems concerning agriculture**

In addition to these general social problems, there are the economic and social problems that have a direct bearing on agriculture. Since the Second World War holdings have become larger, for economic reasons, at the expense of many small farms. Expansion, which has been accompanied by mechanization and a decline in the number of farmers, presents problems to the retiring farmers as well as to those who remain in business. Solutions must also be found for farmers' sons, many of whom can no longer find employment in agriculture. They will have to break with tradition and be trained for jobs outside agriculture.

Expansion also entails changes in the economic factors. Capital investment on Dutch holdings has increased sharply. The importance of the labour factor has declined comparatively. Together, these two factors have made the net farm output more than 2.5 times greater than in 1950, in spite of the decline in the area under cultivation.

## **Economy**

The market for farm products is seldom stable and continually demands readjustment of production to the market. Membership of the European Economic Community (E.E.C.) has

put the market mechanism on to an international scale. This, in fact, is nothing new for the Dutch agricultural industry, because the time when it produced only for the local market lies far in the past; the turning point was about 1900. Changing ideas about the influence of nutrition on human health have also resulted in changes in production.

All this calls for economic research, planning and forecasting. Moreover, the Government has a major influence on the agricultural market mechanism and needs many statistical and other data as a basis for its policy.

All these aspects requiring research should not allow us to neglect the technical aspects of agriculture. Soil and fertilization, land development, improvement of plants and farm animals, animal nutrition, crop protection and animal health care, buildings and implements, food provision and human nutrition are all areas requiring study and research.

## **Development of agriculture in Third World countries**

So far, only the agricultural problems of the Netherlands have been discussed, but agricultural research must also concern itself with the problems of the developing countries. Traditionally, Dutch agricultural scientists have a great deal of experience in research into farming in tropical regions. Before the Second World War, more than half the graduates of the Agricultural University in Wageningen found employment in tropical agriculture. This tradition is being continued, though differently than in the past. For almost all the disciplines we have mentioned, research into farming in the temperate zones has its counterpart in research into farming in the tropics. To the best of its ability, the Netherlands tries to contribute to the development of agriculture in Third World countries.

Recognizing the problems is the first step towards their solution and research is responsible for finding these solutions.

Three basic conditions must be fulfilled before satisfactory results can be achieved:

– there must be enough money and skilled manpower for research to be done,

- good planning is required enabling priorities to be set,
- the organizational structure should allow flexible solutions to the problems.

The following chapters deal with these aspects of agricultural research in the Netherlands in more detail and explain why a major part of this research is concentrated in Wageningen.

## The basis of agricultural research

The birth of organized agricultural research in the Netherlands can be dated exactly. On 1st February 1877 the first Government Agricultural Research Station was opened in Wageningen. It was housed in a few classrooms of what is now the main building of the Agricultural University. Agricultural research had been done previously, but had been based on private enterprise, chiefly of estate owners. The research had little scientific background, or at any rate was not conducted with scientifically justified methods.

Although agricultural research in the Netherlands can boast a century's tradition, it was not the first country to do organized agricultural research. Other countries preceded us, but the Netherlands was among the pioneers. It should be borne in mind that, in general, the birth of empirical agricultural science dates back to the middle of the 19th century.

It is rather remarkable that the director of the first experimental station was not a Dutchman but a German: Dr. Adolf Mayer. In those days, the Netherlands did not have any agricultural scientists.

### Starting period

The early period of agricultural research in the Netherlands was characterized by analytical research, particularly analytical control research the aim of which was to protect the farmers against fraudulent practices by sup-



The director of the first Dutch agricultural research station, Prof. Adolf Mayer, with his wife.

pliers of fertilizers, seeds and feed. Later, it was followed by controlling the products of the farming industry itself; controlling the presence of plant diseases or harmful insects in or on vegetable products, testing the quality of milk, butter and cheese, and inspecting meat and other foodstuffs.

In addition to Government institutions engaged mainly in control research, inspection research or other analytical research, industrial and farming organizations also founded research institutions consisting of industrial circles and farmers organizations.

By about 1915, more experimentally oriented agricultural research had got under way. This applied research was mainly directed at the specifically agricultural problems of soil and fertilization, plants and animals and processing. It developed its own typically agricultural research methods: trial plot techniques, soil research, breeding methods, feed research and research into plant protection products.

At first, regional research stations were set up where all branches of research were brought

together, but later institutes specializing in particular branches of research, such as soil fertility, breeding, animal nutrition, soil mapping and crop protection, were preferred.

Horticultural research has partly retained its regional character. Horticultural research stations are still to be found in those regions that are centres of horticulture, but that does not alter the fact that more centralized horticultural research is being conducted in separate institutes or departments in Wageningen.

### The concentration in Wageningen

Why Wageningen of all places? Was it mere coincidence or was it intentional that the concentration of agricultural research has developed in this little old town, situated closely behind the dyke on the northern bank of the Rhine? The town has a church dating back to the 12th century, a town hall and a regional market and for a long time with a population

made up of craftsmen and cigar makers. A century ago there was nothing to indicate that Wageningen was to grow into an agricultural research centre of international standing.

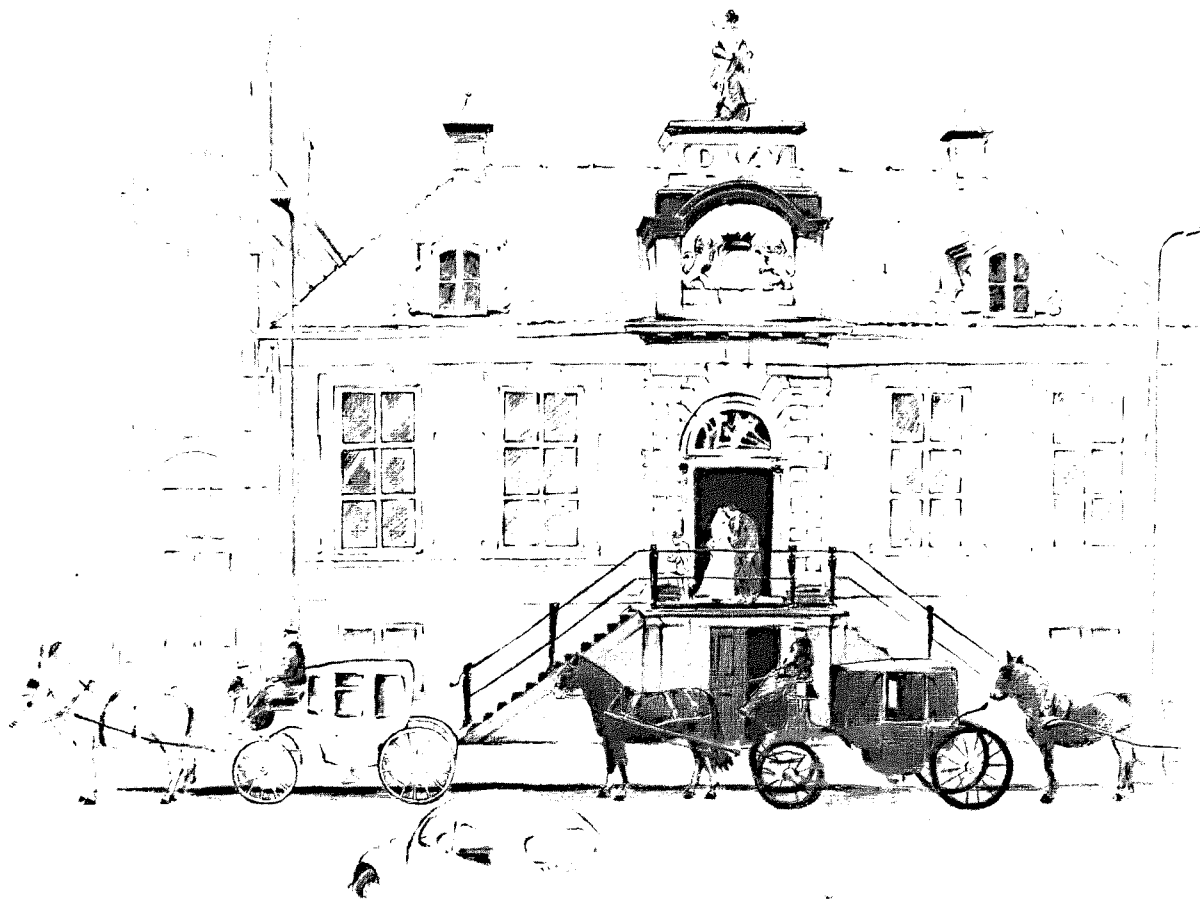
The foundation of this centre was laid in 1873; when—more or less by chance—a municipal agricultural school was established there. In 1876 that school became a Government Agricultural School, to which a department of the Government Agricultural, Horticultural and Forestry College was added in 1904. This College was to be the basis for the Agricultural University (1918).

As already mentioned, Wageningen got its first agricultural research station in 1877, which at that time belonged to the school, but became independent in 1892. When more institutes, which were to occupy themselves with branches of research (and no longer with regional problems) were established, it was only natural that

The inhabitants of Wageningen skating on the flooded and frozen banks of the Rhine.







Wageningen Town Hall, built in 1698. One of the few historical buildings to survive the Second World War.

these should cluster around the nucleus already present in Wageningen.

In the meantime, however, Wageningen had begun to suffer from lack of space and therefore, in 1974, a second concentration of research stations and experimental farms was started in Lelystad (East Flevoland).

Wageningen lies more or less in the centre of the Netherlands with different types of soil and holdings in its vicinity: with grassland farming, arable farming and fruit growing on the clay soils, mixed farming on the fertile sandy soils, and forestry and sheep farming on the moorlands of the poor sandy soils. Even tobacco farming used to be practised here. In other words, a wide variety of holdings, which influenced the preference for Wageningen, particularly at the beginning.

But things could have turned out differently had it not been for the gradual expansion of the nucleus for practical considerations. Undoubtedly, the fact that the Agricultural University is the only institution for scientific agricultural education in the Netherlands, and therefore occupies a key position, has contributed to this.

## Intensification and expansion of scope

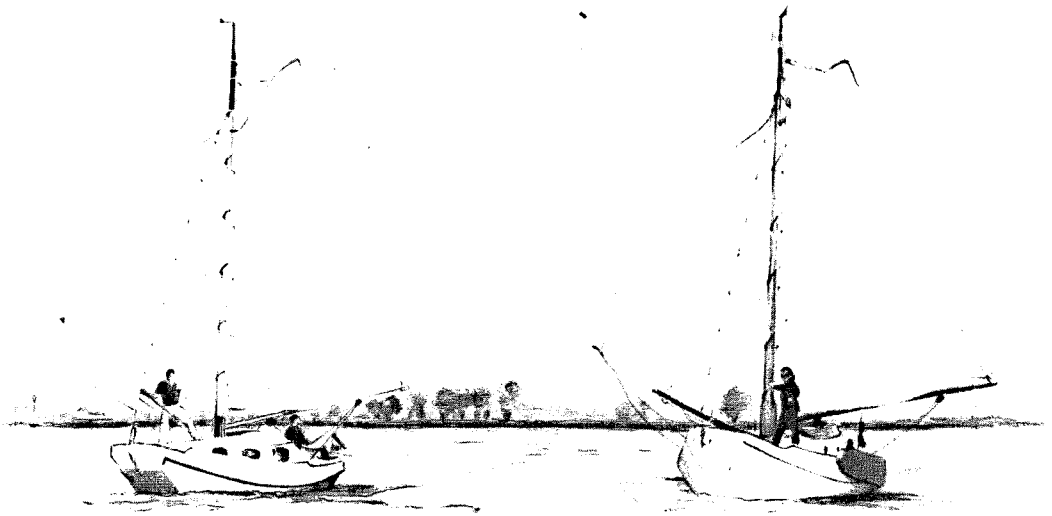
Specialization gradually increased along with the number of agricultural research institutes.

The number of research workers grew and they became more specialized. They were no longer just agriculturalists with a broad general knowledge of agriculture, but also biologists, chemists, geologists, physicists and technologists. A growing influence of the basic subjects (biology, chemistry, physics, mathematics, etc.) on agricultural research made itself felt. As a result more basic research was needed. This basic research is mainly done at the Agricultural University, but some of the institutes are also either entirely or partially involved in this kind of research.

In spite of this specialization, the aim of overall agricultural research has remained almost the same. Research was—and to a major extent still is—directed at creating conditions for optimum farm output, both quantitatively and qualitatively (per hectare, animal or man year).

We see a shift taking place because the sphere of activities has widened. Gradually, the concept 'agriculture' has been given a broader interpretation and now also covers the storage and processing of farm products (e.g. food technology) as well as consumption, i.e. hu-

Sailing on the Rhine near Wageningen.



man nutrition. Research in the field of social sciences has also received a new impetus from the Agricultural University as well as from the foundation of the Agricultural Economics Research Institute (LEI) in the Hague. It should be observed, however, that from of old the Dutch concept agronomy ('*landbouwkunde*') has covered problems of agricultural economics. Even at the beginning of the 19th century the word '*landhuishoudkunde*' was part of our language. Nowadays it could be interpreted as 'agricultural economics', but originally this concept covered a lot more.

### New aspects

Two aspects of agricultural research in the Netherlands have increasingly come to the fore in the last decades. The first is the impact of numerous social developments on agricultural research and the contribution of agricultural research to solving social problems. The second aspect is that—partly as a result of this—hardly any research can be conducted in seclusion.

A multidisciplinary or interdisciplinary set-up of research projects is becoming more and more necessary, which means that research projects are implemented jointly by different specialists.

### Current organizations for agricultural research

Owing to these developments and shifts in agricultural research in the Netherlands from the beginning until the present time, the organizational set-up has also undergone changes. Nowadays, agricultural research in the Netherlands takes place in the following groups of institutions:

- research institutes for supporting agricultural policy. These are mainly financed by the Ministry of Agriculture and Fisheries and are concerned mainly with applied research;
- agricultural stations and health services financed largely by the Ministry of Agriculture and Fisheries;
- research institutes financed by the Organization for Applied Scientific Research (TNO) in the Netherlands, with contributions from the farming industry. This is also applied research;

- departments of the Agricultural University, with pure research;
- institutes, clinics and laboratories of the Faculty of Veterinary Medicine of Utrecht University, with partly pure and partly applied research;
- research institutes (including control stations) and research organizations financed by the farming industry, with almost exclusively applied research.

There are also other institutions engaged in agricultural research, e.g. the National Service for the IJssel Lake Polders ('*de Nationale Dienst voor de IJsselmeerpolders*'), but this booklet will be confined to what is relevant to 'Wageningen'. This means that in the main it is sufficient to give a description of research at the three organizational units: the Agricultural University, the institutes where the Agricultural Research Division of the Ministry of Agriculture and Fisheries has regulating authority and the National Council for Agricultural Research, of which the Agricultural Research Division and the Agricultural University are the principal partners.

## Research at the Agricultural University

Of course the main purpose of the Agricultural University is to train students, and to prepare them for functions in society requiring university graduates, and for functions in education and research. In order to fulfil this primary aim, research work is essential. The staff of the Agricultural University spend roughly 30 to 35 per cent of their time on research.

The departments, organizational units based on a classification into disciplines or sections of disciplines, constitute the basis of the organization of the Agricultural University. Within the limits of their financial possibili-

ties and the number of staff, these departments have a fairly large degree of independence in determining their research programmes. In the last few years, however, efforts have been made to bring about a more co-ordinated policy, not only within the Agricultural University itself but also in interaction with the agricultural research institutes (which will be discussed in the next chapter).

A permanent committee for research programmes stimulates this development and tries to bring about a research policy. With this in mind, a project administration has been created for the larger projects within the Agricultural University.

### **Research allied to education**

The research conducted by the staff members of the Agricultural University can be distinguished into three groups. One is concerned with education, another with the development of a particular field of science ('pure' science) and a third with finding solutions to social problems in the Netherlands as well as in the developing countries ('applied' science). It is, in fact, impossible to draw a sharp dividing line between these three functions of research at the Agricultural University.

The aims of research for education are to obtain teaching material and to enable students to participate in research work, which provides them with experience in setting up and conducting scientific research. This 'educational research' mainly takes place in the last phase of the study, the stage preceding graduation.

Research conducted by graduate assistants in order to obtain a Ph.D. in agricultural science after a thesis has been defended, lies in the same sphere. Although this research is supervised by a professor, the graduate student usually conducts it independently. Most of the subjects for these theses belong to the third group, i.e. research with social relevance. A small number of subjects can be called 'innovation research'.

### **Non-education allied research**

In addition to research connected with teaching, the scientific and technical staff members at the Agricultural University also conduct re-

search on their own initiative or at the request of third persons (e.g. in co-operation with the agricultural research institutes or for projects in developing countries).

The majority of these research projects are also concerned with finding solutions to socially relevant problems. About a quarter of the projects fall into the category 'basic research'. The contribution of the departments of Organic Chemistry, Genetics, Plant Physiology, Experimental Animal Morphology and Cell Biology, Molecular Biology, Molecular Physics and Physical and Colloid Chemistry to basic research is relatively large. Their projects show, however, that these subjects have been selected with a view to applying the knowledge and opinions gained to the activities of other departments which do have social relevance.

The Humanities and Socio-economic sciences are mainly concerned with socio-economic problems such as efficient marketing, determination of prices and quality, improvement of nutrition and the quality of home economics, demographic trend and the socio-economic development of places, areas and countries including the developing countries.

The Biology, Geology, Meteorology and Climatology departments are concerned with problems connected with preservation, development and use of soil, water, natural vegetation and related natural resources, protection against harmful biotic and abiotic factors and efficient improvement of production and quality. Interdisciplinary activities occur in the Landscape Architecture, Land Development, Physical Planning and Nutrition departments. The Food Technology department approaches socio-economic problems using the methods of the Physics and Chemistry disciplines; the Home Economics and Human Nutrition departments approach technical problems from a socio-economic angle.

Research into a wide range of subjects is conducted within the framework of the Agricultural University. Their common feature is that all projects fall within the disciplines of education.

## Research at the institutes

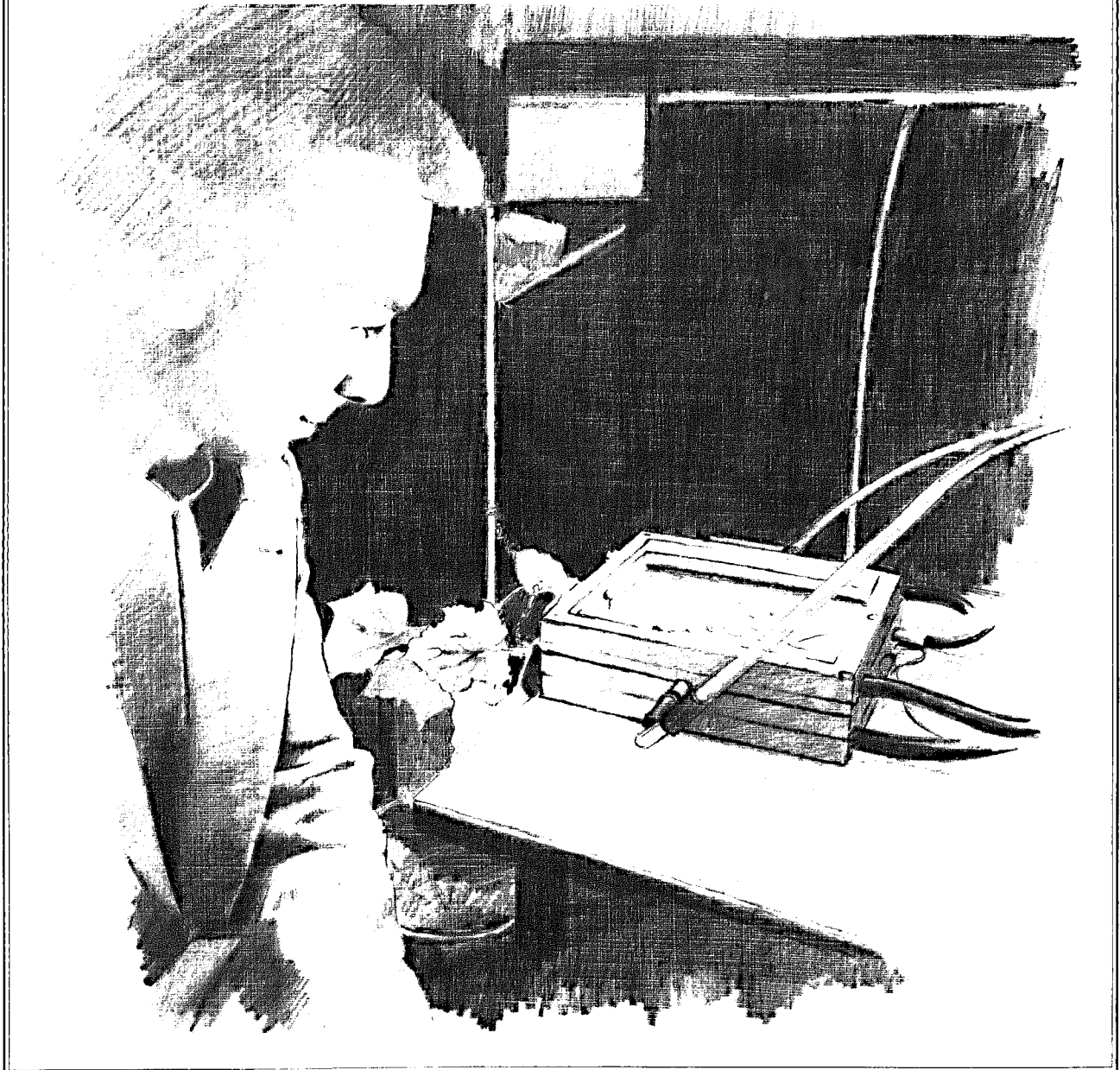
The unwary visitor who tries to find his way about in 'Wageningen' is soon bewildered. In the old town centre, surrounded by the canal, only the administration centre and central offices of the Agricultural University '*hoofgebouw*' in the Salverdaplein are to be found.

Outside this old centre, however, agricultural research institutes are scattered about every-

where; all with their own abbreviated titles that only make sense to insiders! Many start with the letter I: IAC, IBVL, ICW, ILOB, ILRI, IMAG, IPO, ITAL, IVT. Some institutions are called '*instituut*' (institute), some are called '*centrum*' (centre), and others '*stichting*' (establishment) or '*dienst*' (service).

Some buildings house one or more '*vakgroepen*' (departments) of the Agricultural University, others house only institutes for agricultural

In Wageningen, about 1200 research scientists are working on further developments for Dutch agriculture.



research while still others accommodate institutes as well as departments of the Agricultural University.

In addition, there are 'Rijksinstituten' (Government Institutes) and institutes belonging to the Organization for Applied Scientific Research ('TNO-instituten').

Total running expenses of agricultural research can be estimated at Dfl. 200 million, Dfl. 150 million of which is borne by the Ministry of Agriculture and Fisheries (this amount does not include the expenses of the Agricultural University). The bulk of this money is controlled by the Agricultural Research Division, and a smaller amount by the Farm Development Directorate. The Ministry also finances research at the Agricultural University, but the university manages its funds autonomously.

The distribution of total running expenditure of agricultural research is as follows:

Departmental Directorates		
68%	24 institutes	
	9 experimental stations	
	2 control stations	
	54 regional experimental stations	
Agricultural University		
15%	60 departments	
Nutrition Organization TNO		
11%	4 institutes	
Veterinary Faculty (Utrecht)		
6%	9 institutes	
	4 clinics	
	2 laboratories	

### Management of the institutes

The preceding section having dealt with research at the Agricultural University, this section will be largely confined to the institutes under the jurisdiction of the Agricultural Research Division. These are called '*de instituten*' (the institutes) in the Wageningen lingo, and 17 of them are in Wageningen.

These institutes have an unusual form of management: they are '*ministeriële stichtingen*' (ministerial establishments), which means that

they are establishments constituted by or on behalf of the Minister of Agriculture and Fisheries, which makes them subject to Government regulations and rules as regards financial, material and personnel policies.

On the other hand, each has a Board which determines the work-plan and controls its implementation. This rather unique organization form has the advantage that the farming industry is co-responsible—through representatives on the boards—for the implementation of research programmes and that in certain cases part of the research at the institutes can be financed by the agricultural industry.

The Agricultural University also has its representatives on the Boards, with the purpose of promoting good co-operation between the Agricultural University and the scientific institutes.

### Central services

Such a large research organization needs some central services. Therefore, a few service institutions—in the form of establishments—have been created for basic biological research, the development of equipment, statistical processing of research results, literature information, management of experimental farms, etc.

The International Agricultural Centre (IAC) could also be included among these. This centre is concerned with the co-ordination of agricultural expertise in the Netherlands for the developing countries, with sending out experts and with advising on development projects. The IAC also organizes many courses for agriculturists from developing countries either at the Centre in Wageningen or in the countries themselves.

## Organization of applied research

In principle, the organization of applied agricultural research may be set up along two lines.

The first possibility is to classify the different branches of agriculture, such as arable farming and grassland farming, animal husbandry, horticulture and forestry and then to make a further sub-classification into institutes for cereal growing, potato growing, vegetable crops, ornamental crops, cattle, pigs, poultry, etc. Another possibility is to make a classification according to subject, such as an institute for soil science, soil fertility, crop protection, animal nutrition, social and economic questions, planning, land division, etc.

Since the establishment of the first agricultural research station in 1877, these principles have prevailed alternately. As a result, the two types of institutions occur side by side.

Curiously enough, this interweaving of 'branches' and 'subjects' in agricultural research in the Netherlands does not result in a chaotic programming of research. This is mainly due to the fact that personal relationships are intensive and fraternal and that people are kept well-informed of the work of colleagues through the numerous working groups, committees and teamwork.

The advantage of a small country is that everybody knows everybody else and it is very easy to keep in touch personally. Many consultations in agricultural research are spontaneous. Other favourable factors are that the Netherlands has only one all-embracing agricultural faculty, the Agricultural University, and that agricultural research has close ties with only one Ministry, the Ministry of Agriculture and Fisheries.

The organizations are embedded in co-ordinating structures ensuring a good distribution of tasks and sound planning.

It has already been pointed out that the Agricultural University is also represented on the Boards of the research institutes, thus maintaining contact. In addition, there are numerous cross connections between the researchers of different institutes in the form of bilateral contacts, working groups, investigation committees and secondment of researchers from one institute to another. During the last few years, these cross connections have multiplied

as a result of the fact that the problems to be solved are of an increasingly multidisciplinary nature.

At a higher echelon are the meetings between the policy directors of the Ministry of Agriculture and Fisheries and the directors of the institutes. The broad outlines that are significant for overall research are discussed at these meetings. In turn, the directors pass this policy on to the staff of their institutions at their staff meetings.



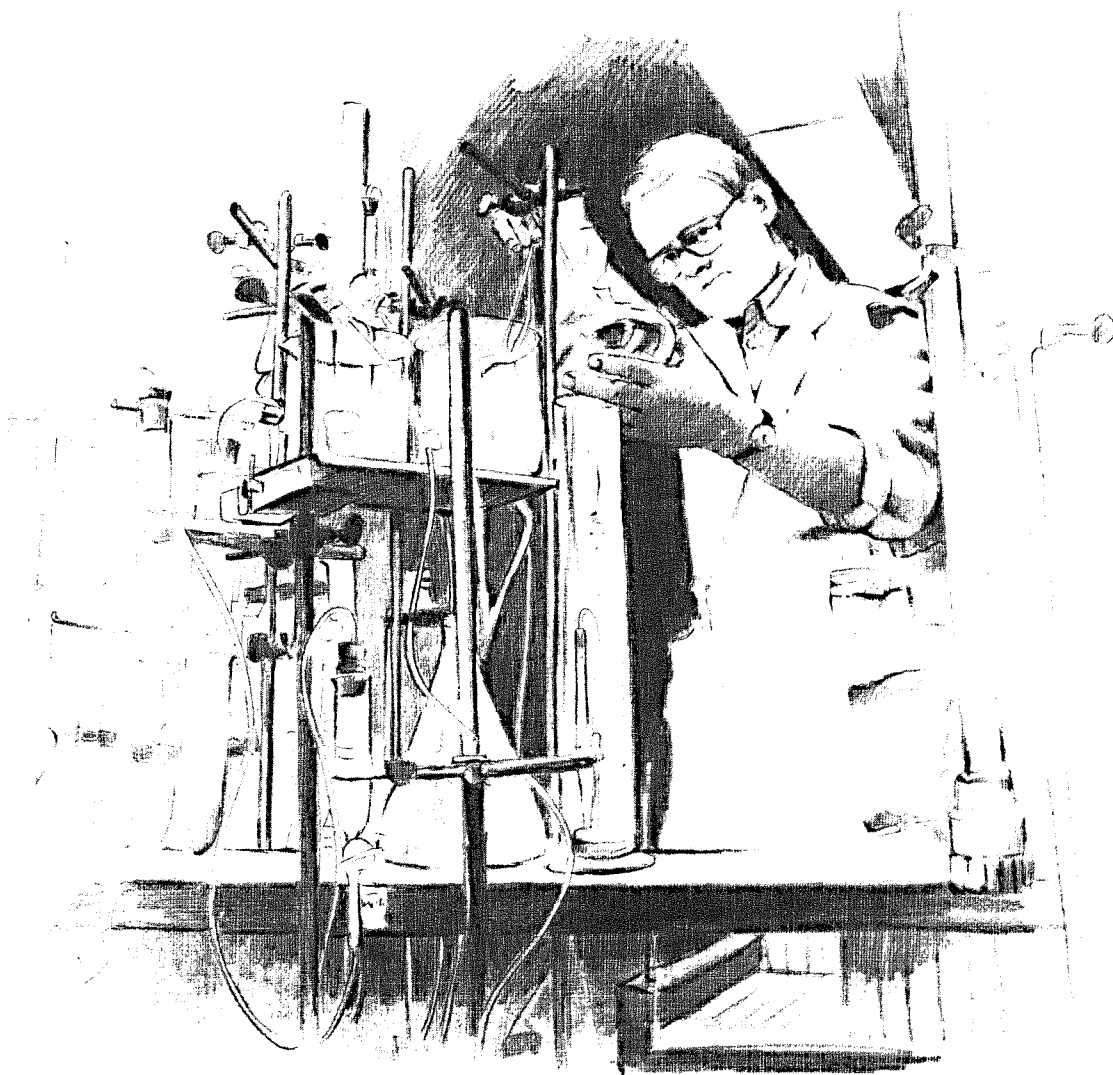
### **National Council for Agricultural Research**

The National Council for Agricultural Research (NRLO) has a very important co-ordinating function. This Council is nowadays composed of representatives of official and non-official bodies and institutions that are

somehow connected with agricultural research. This broad composition is connected with the very wide range of operations of agricultural research in the Netherlands. At present it comprises, among other things, land development, nature conservation and landscape management, the production and processing of foodstuffs of vegetable or animal origin, supply of the market and socio-economic aspects of these fields of research. Moreover, part of the research capacity is directed at contributing to development co-operation in the Third World. For this reason the Council, in addition to

representatives of the Ministry of Agriculture and Fisheries, also consists of representatives of other Ministries and social organizations, which enables various groups of society to exert an influence on agricultural research programmes. The Agricultural University and the Veterinary Faculty also supply board members to the Council. The Council is divided into departments, each having its own Board. The principal tasks of these Boards are to develop and formulate the main lines of research policy and to promote and implement research policy for their sectors.

In the research programme, a great deal of attention is paid to the processing of agricultural products.





The Council also has programme advisory committees at its disposal in which potential groups of consumers of research results are represented. These committees have a very important task, because they maintain good contacts between the agricultural industry and the research world. The industry promotes research by expressing what research is required, while research also provides incentives for the agricultural industry.

The co-ordination of research is firmly supported by the Research Projects Administration. This Administration contains substantial data about current research and the ways in which time and money are being spent.

Two aspects of the co-ordination of research still need mentioning: the flow of research results to society and co-ordination at international level.

### **Advisory Services**

The flow of research results to the consumer mainly takes place through the Agricultural Advisory Services and in particular through the 22 General Extension Services. These Extension Services assess the results for their practical application and give instructions to extension officers in the field, who in turn see to it that the consumers get to know the results that are relevant to them, either orally or on paper. Moreover, the Extension Services also approach the consumers directly by means of articles in professional papers, separate series of publications or by direct information to the interested parties.

### **International co-ordination**

International co-ordination of agricultural research within the European Community has been realized by means of common research projects. These projects are under the management of the Permanent Committee for Agricultural Research (CPRA). The institutes as well as the Agricultural University and the Veterinary Faculty participate in these projects. Co-ordination is facilitated because a project administration of agricultural research is also being introduced within the European Community, for which the Dutch Projects Administration served as a model.

Research for developing countries can only be effective if there is close co-operation with the national or international institutes in those countries. In 1978, Dfl. 5.4 million was spent on research projects directly aimed at developing countries, which is 2 per cent of the total gross costs of agricultural research. Efforts are being made to raise this percentage to 2.5 in 1981.

## **The future development of research**

It has already been mentioned that the objectives of agricultural research in the Netherlands have changed and expanded in the last few years. Currently, research is used to find scientifically justified answers to questions put by the Government and the farming industry on the policy to be pursued in the near and remote future. This means that agricultural research will have to be directed at today's and tomorrow's problems and will have to serve as an instrument for the preparation of that policy. With this in mind, long-term planning of research has become essential and at the same time, developments in society in the next few years will also have to be taken into account as much as possible.

A first long-term plan was drafted for the period 1972-1976; now a second long-term programme has been published for the 1977-1981 period. According to this programme, we must reckon with shifts that will occur between the various groups of problems covered by agricultural research.

Expansion of research capacity for the following subjects is expected:

- the world food situation and the developing countries,
- the development and management of rural areas in our own country,
- the socio-economic position of the agricultural population,
- the supply, processing, marketing and con-

sumption of agricultural products.

Because an increase in total research capacity will not be allowed, the research capacity of agricultural production will have to be diminished. These points will be explained using the long-term programme published for the 1977-1981 period.

### **Agricultural production**

The starting-point for agricultural production research is to restrain the growth of production while maintaining, and if possible improving, the quality of foodstuffs, raw materials and ornamental crops.

Rationalization of production also remains a subject for research.

A few examples of problems that will receive particular attention are:

- animal welfare,
- prevention of impairment of the environment,
- alternative forms of agricultural production,
- scarcity of raw materials and energy,
- binding of nitrogen in the air by means of microbiological processes.

### **Agricultural research for developing countries**

The Netherlands will try to support research in the developing countries themselves and expects these countries to appeal to the Dutch agricultural research organizations to support their research into cereals, potatoes, pulses and vegetables and in particular crop protection, plant improvement, plant breeding, water management, soil science and perhaps also mechanization, transport and storage.

### **The development and management of rural areas**

The many problems connected with the high population density in the Netherlands and the problems of environmental hygiene, nature conservation and recreation related to it have already been mentioned. These elements are reflected in the long-term research programmes. Much attention will be paid to water management and everything connected with it. The programme also provides for research into the relationship between agriculture and nature

conservation and management, agriculture and landscape, agriculture and recreation as well as into the prevention of environmental pollution.

### **The socio-economic position of the agricultural population**

This research deals with questions like adjustments of production to the changing demand for agricultural products, expansion, mechanization and decline in the number of workers in agriculture, adjustments of production technique due to energy policy and higher prices of raw materials, and planning.

### **The line-up from producer to consumer**

This research is concerned with the whole line-up from producer to consumer of agricultural products. It includes quality standards, adjustments to changes in food consumption habits and changes in the channels of distribution.

### **Agricultural education**

With the exception of education in rural home economics, which falls under the Ministry of Education and Science, all other agricultural education in the Netherlands falls under the jurisdiction of the Minister of Agriculture and Fisheries.

Agricultural (and horticultural) education is given at four levels, and usually pupils who have passed the final examination at one level can go on to a higher level.

#### **Elementary agricultural education**

Elementary agricultural and horticultural education is provided by 130 schools. These schools have 27,200 pupils. After primary school, they take a four-year course of full-time education with the emphasis on practical knowledge and skills. After this they either receive further training and education under an apprenticeship scheme, or they can go on to intermediate agricultural and horticultural education.



Students in Wageningen are also required to do practical work.

## Intermediate agricultural education

The Netherlands has 48 intermediate agricultural and horticultural schools with 11,600 pupils. Two of these schools also have a course on food technology. The course is either two or three years and students can then choose from a variety of jobs, including functions with the agricultural and horticultural advisory services. The sons of farmers and market gardeners often attend this type of school before settling as independent farmers or market gardeners themselves.

## Advanced education

Advanced agricultural education is provided by six agricultural colleges; two horticultural colleges, two colleges for food technology, a college for forestry and land management and a college for tropical and sub-tropical agriculture. The number of students receiving advanced agricultural education is 4,200.

All these courses, which last three or four years, include six months practical work. Entrance requirements are at least four years secondary education. Successful students are entitled to call themselves 'agricultural engineer' and bear the title 'Ing.'. They have a wide variety of middle and higher management posts within their reach, such as functions in the advisory services and research. Many are employed in projects in tropical or sub-tropical developing countries. They are also entitled to take examinations at Wageningen Agricultural University.

Those who have passed exams at pre-university level are also allowed to enter for examinations at this university.

## University agricultural education

The Agricultural University in Wageningen is the only one specializing in agriculture in the Netherlands. The word 'agricultural' should be interpreted in the broadest sense to include everything connected with soil, plants, animals, man and society.

## Agricultural education in Wageningen

Besides the Agricultural University there are two other educational institutions for 'agriculture' in Wageningen:

the Foundation for the Training of Analysts (STOVA) and the Diedenoot Academy (higher education in domestic science). Both co-operate with the Agricultural University.

## The Agricultural University

### General data

The Agricultural University was established under the Higher Agricultural and Veterinary Education Act of 15th December 1917. This Act became effective on 9th March 1918, and it is this date that is generally regarded as the date of establishment of the Agricultural University.

Nowadays, the Agricultural University is legally based on the Scientific Education Act of 1 January 1961 and on the University Management Reform Act 1970 (in Dutch: WUB). These are general Acts which apply to all universities in the Netherlands. Within the framework set by these Acts the Agricultural University has been an autonomous institution since 1968, and is under the control of the Ministry of Agriculture and Fisheries.

The Agricultural University had, in 1980, nearly 6,500 students, more than a quarter of them being women. Since 1975 there has been an annual intake of about 1100 new students. Education and research are supervised by about 135 professors (including part-time professors), about 25 part-time lecturers, and a further academic staff of at least 400.\*

The number of personnel is 2000; the total budget amounts to Dfl. 186 million (1980). There are 85 lecture rooms and 64 rooms for practical laboratory work.

\*The full-time professors usually head a department and direct education and research. They are assisted by academic staff members (lecturers), who are also employed on a full-time basis by the university. Some of the staff members have administrative functions.

Professors are called 'Crown Teachers', which means that they have been appointed by Her Majesty the Queen. The part-time professors have another function outside that at the Agricultural University.

Organizations, establishments or associations also have the power to nominate additional part-time professors whose subjects usually fall outside the normal programme of studies. They are appointed by the Crown but their salaries are not included in the budget of the Agricultural University.

The 25 part-time lecturers give special courses (such as foreign languages, project-planning, law).

### The organizational set-up

The summit of the governing organization of the Agricultural University is constituted by the University Council and the Executive Board. The former is authorized to arrange the affairs of the University and to govern it in so far as the Executive Board is not charged with this.

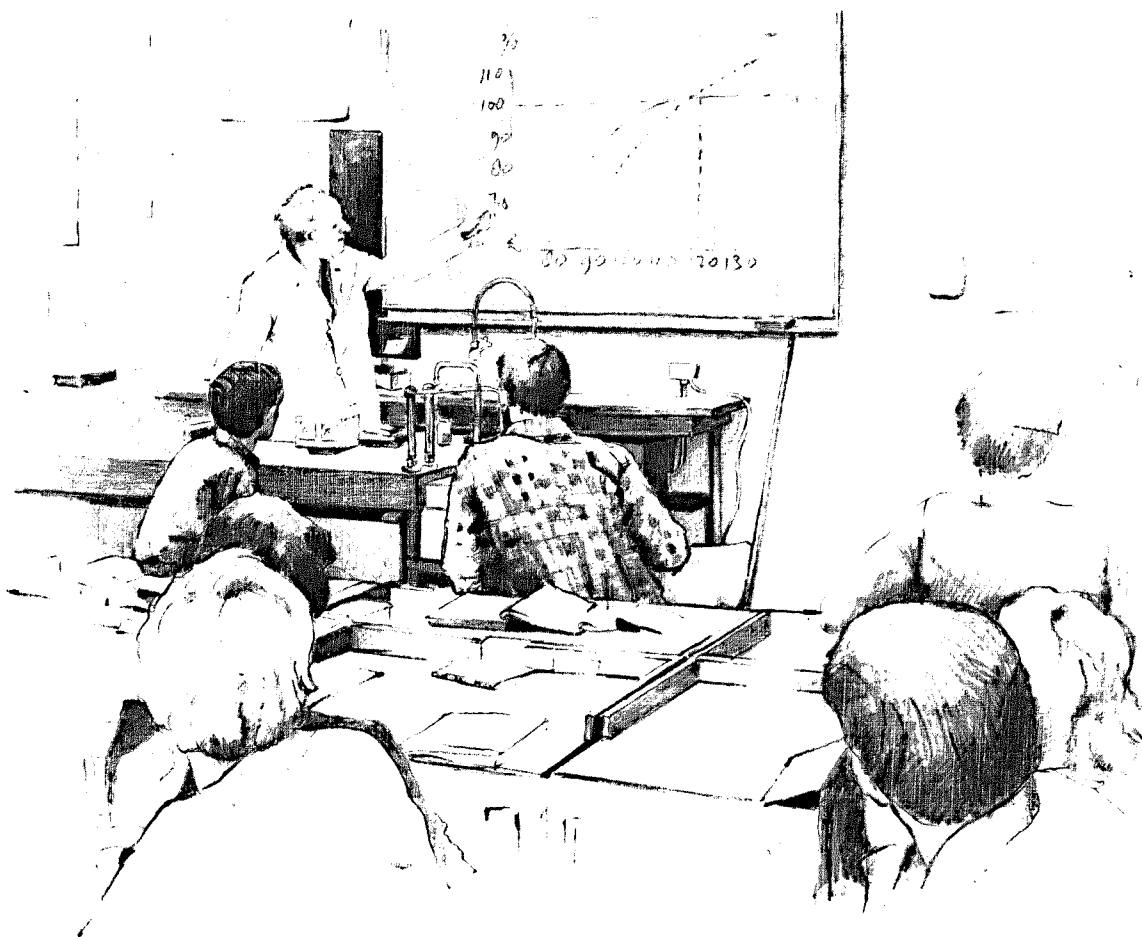
The Council is responsible for the drawing up of development plans, budgets and guidelines for the organization and co-ordination of education and for all academic matters. The Council is also concerned with student housing.

The Executive Board consists of three Board

members. Among its tasks are housing and finances of the University, appointments and discharges (except for the 'Crown Teachers') and supervision over all matters concerning the University.

A committee of Deans, consisting of the Rector Magnificus and six professors advise on education and research programmes. At the same time, this Committee forms the Board of the Faculty Council. The Faculty Council has, inter alia, the following tasks: the organization and co-ordination of education, establishing programmes of study and organizing examinations.

Laboratory work is an important part of the curriculum of the Agricultural University.



The smallest organization unit of education and research is the department, which co-ordinates the work of those who work in the same field of study. Each of the 60 departments has a Board of its own.

The Secretary of the Agricultural University is the liaison between the governing bodies and the administration and is also the head of the Office of the Agricultural University.

The University Management Reform Act has brought about a democratization of the governing bodies. The members of the University Council and the Faculty Council are elected by the whole university community from lists of candidates. These bodies are comprised of representatives of the three echelons of the university community, viz. the staff, technical and administrative personnel and students.

### Education

In general, the universities in the Netherlands are divided into several faculties.

The Agricultural University is an exception in that it has only one faculty, the Faculty of Agricultural Sciences. Nevertheless, there are many fields of study, which can be divided into two groups: the natural sciences (abbreviated N), and natural and social sciences (Dutch abbreviation: NM). It is also possible to graduate in biology (B).

No more than about half of the 22 curricula are related to agricultural science and associated subjects. At present, the Agricultural University has the following curricula:

Fieldcrops and Grassland N 10  
Tropical Crops N 11  
Horticulture N 12  
Plant Breeding N 13  
Plant Pathology N 14  
Forestry N 15  
Animal Husbandry N 20  
Land and Water Use N 30 and NM 21  
Tropical Land and Water Use N 31  
Agricultural Engineering N 32  
Soil Science and Soil Fertility N 33  
Food Technology N 40  
Human Nutrition N 41

Sewage Treatment/Environmental Hygiene N 42  
Molecular Sciences N 43  
Economy NM 10  
Landscape Architecture NM 20  
Sociology of Western Areas NM 30  
Rural Sociology of Non-Western Areas NM 31  
Home Economics NM 40  
Biology B

The whole study is divided into three periods, with an examination at the end of each period. The first is called the '*propaedeuse*', the second the '*kandidaat*' period, the third the '*doctoraal*'. The study also includes a six months' period of practical work.

The academic year lasts from 1st September to 31st August and is divided into two semesters.

### Propaedeutic examination

At the start of his study the student need not decide which curriculum he wants to follow, but must choose a propaedeutic examination in the natural sciences (N), social sciences combined with natural sciences (NM) or biology (B). Officially, the propaedeutic period takes one year and familiarizes the student with a number of basic subjects and with academic work in general. Practical work is designed to train the student in handling methods of analysis.

### 'Kandidaat' examination

The programme of studies consists of a system of graded choices. The propaedeutic period is followed by the period before the '*kandidaat*' examination, which takes two years. At the beginning of the period the student chooses his curriculum and in the second half he can choose from a number of specializations and add a few individually chosen subjects. The student's choice of subjects must be submitted to the examining board in question for approval. After the '*kandidaat*' examination follows a six month period of practical work to prepare the students for their future jobs. Many students spend this period abroad, e.g. in tropical countries. Students are required to make a report at the end of this period.

## 'Doctoraal' examination

After having written a report about his practical work, the student has reached the '*doctoraal*' stage of his study. He then chooses the subjects in which he wants to graduate, subject to the approval of the board of examiners. There are usually two, three or four main subjects and, as there is ample choice, the student may choose those subjects that are most suitable to his needs.

If he wishes to specialize, he will choose only two main subjects. If he prefers a more general study he will choose a broader basis. In either case, before graduation he will have to conduct at least one investigation of his own and write a thesis on it.

Throughout the study, much attention is paid to practical laboratory work, field experiments, excursions, discussions, working groups for projects, conductive surveys and giving colloquia on specialized subjects.

This final examination, the '*doctoraal*' examination, earns the student the degree and title of '*ingenieur*' (abbreviated: ir.). The annual number of graduates is about 400.

The '*propaedeuse*' examination is equivalent to the preliminary examinations in an English University. The '*kandidaat*' examination has no real equivalent and its only function is to admit students to their '*doctoraal*' which is **the final degree equivalent to a M.Sc.**

**Graduates with a '*doctoraal*' degree can then go on to gain a Doctor's degree in Agricultural Sciences which is equivalent to a Ph.D.**

## Graduating

Most students conclude their study by obtaining the diploma of agricultural engineer. Some continue their study as 'graduate-assistants' in order to obtain the degree and title of Doctor in Agricultural Sciences. Also, many staff members of the Agricultural University, besides their normal work, are busy writing a dissertation for their Doctor's degree. The third category of graduates working for a Doctor's degree, are those doing research at the institutes. About 10 per cent of the graduates obtain a Doctor's degree.

Like all other universities, attending lectures is not obligatory at Wageningen. If the students

think they can acquire the subject-matter to be studied for an examination in any other way they are free to do so. Practical work is, however, obligatory, and the duration of one's studies is restricted to a certain period.

## Post Graduate Education

Graduates of the Agricultural University and the Agricultural Colleges can extend or refresh their knowledge by following courses of the Post Graduate Education (PAO) Foundation. Since the end of 1975 this type of education has been one of the tasks of the Agricultural University required by law.

## The future development of the Agricultural University

Wageningen Graduates are found not only in the Netherlands but all over the world. The present generation comprises professors, government ministers, managers of companies, institutions and banks, farmers and market gardeners, research workers, Members of Parliament, teachers, advisory officers and functionaries with national and international organizations. It is a justifiable question to ask whether Wageningen University produces graduates who are so all round that they qualify for all these functions without further training or experience, but the answer to this question cannot be a simple yes or no.

The current programme of studies shows that it offers many possibilities and has a broad basis, but it will be clear that a student can only acquire knowledge on, at the most, a few items of the whole curriculum. Moreover, this knowledge is certainly not always the specific knowledge required for these or other functions. Of course, many graduates find jobs within their own subjects, but a look at the careers of others shows that many have ended up in different positions than their studies would have led one to expect. The roots of this must lie deeper, and are to be found in the ori-

gin and growth of the Agricultural University. When the Agricultural University became a fact in 1918, the curriculum was simple and directed at the scientific approach to agricultural problems in the Netherlands and the (tropical) colonies it had in those days. The graduates were expected to be able to analyse, investigate and solve practical agricultural problems. The emphasis was on results with practical applicability rather than on theoretical solutions with scientific value.

### Expansion and intensification

Gradually, and particularly since 1950, the curricula have expanded and become more intensified: the original number of five curricula has increased to 22, the number of students has risen from 200 to 6500, while the number of professors has grown from 30 to 135. This evolution has given rise to the question of whether the original educational basis should not be abandoned in favour of a theoretical basis. Pressure by the Government to shorten the duration of studies in university education, has promoted this question even more, as have the efforts to give professional and university education a common basis. The emphasis on training for a profession would have to fall on practice, while university education would have to be directed more at the pursuit of knowledge as such.

The fact that the problems to be solved are not only spread over a wider field of knowledge but have also become more complicated and the fact that solutions require more refined specialistic knowledge have also enhanced this trend.

### 'Functional' people

There are also counter-currents, however. Graduates as well as students have continued to press the Agricultural University for an education that supplies 'functional' people, i.e. people who are able to recognize social problems and solve them in a socially acceptable way. They must be fully aware of the multi-faceted structure of these problems and be able to seek solutions by co-operating with others.

In a report published recently, 'Agricultural

University where to now?' (LH, *waarheen?*, 1977) about the future development of the Agricultural University, the requirements that the students must satisfy are formulated as follows:

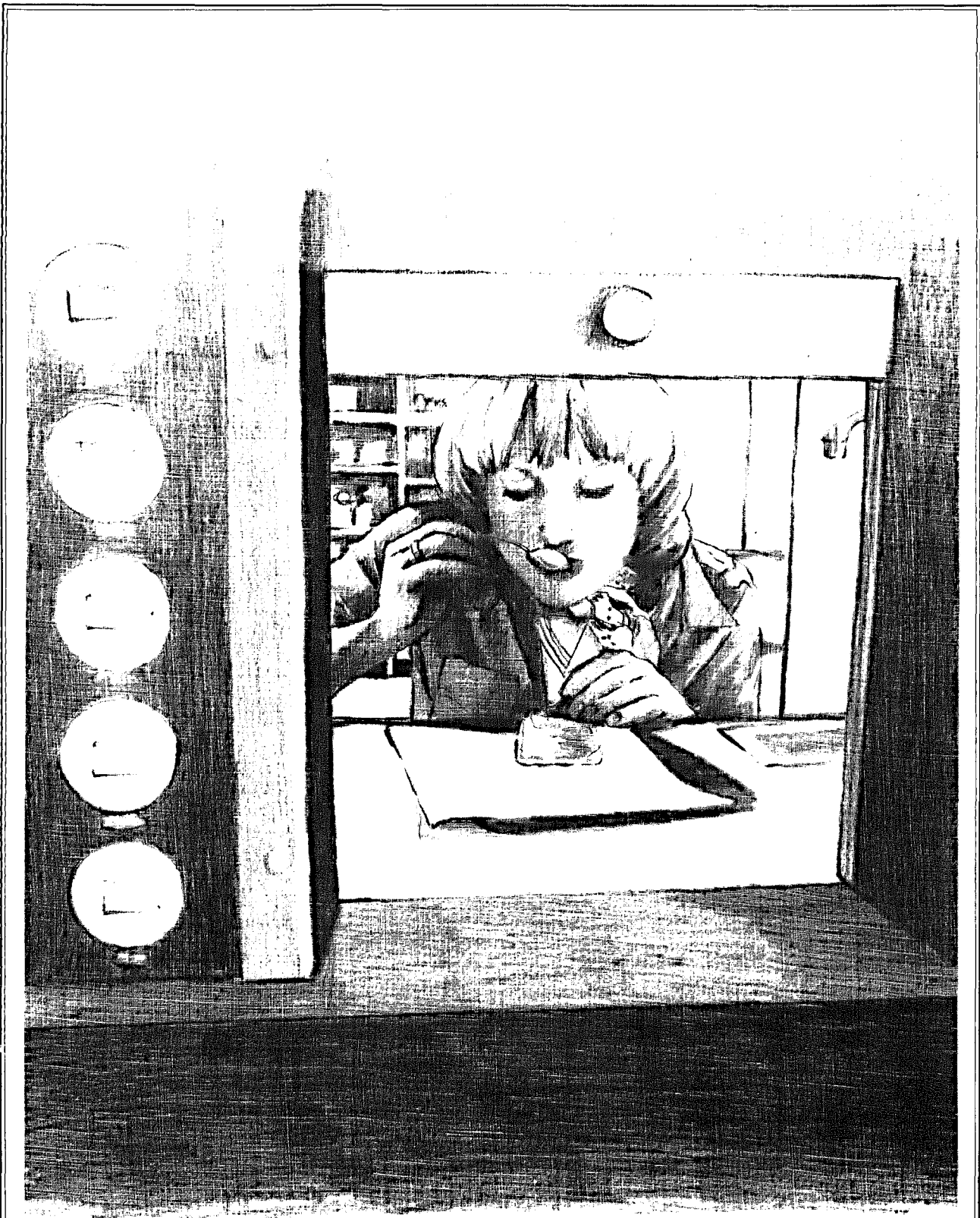
They should

- be able to intensify, make applicable and transmit scientific know-how about a problem submitted to them;
- in addition to know-how and insight in one area of study, possess a coherent insight into those aspects of 'agricultural' problems relevant to their own field;
- possess social skills;
- be aware of the social consequences of the application or realization of the results of scientific research;
- be acquainted with management problems.

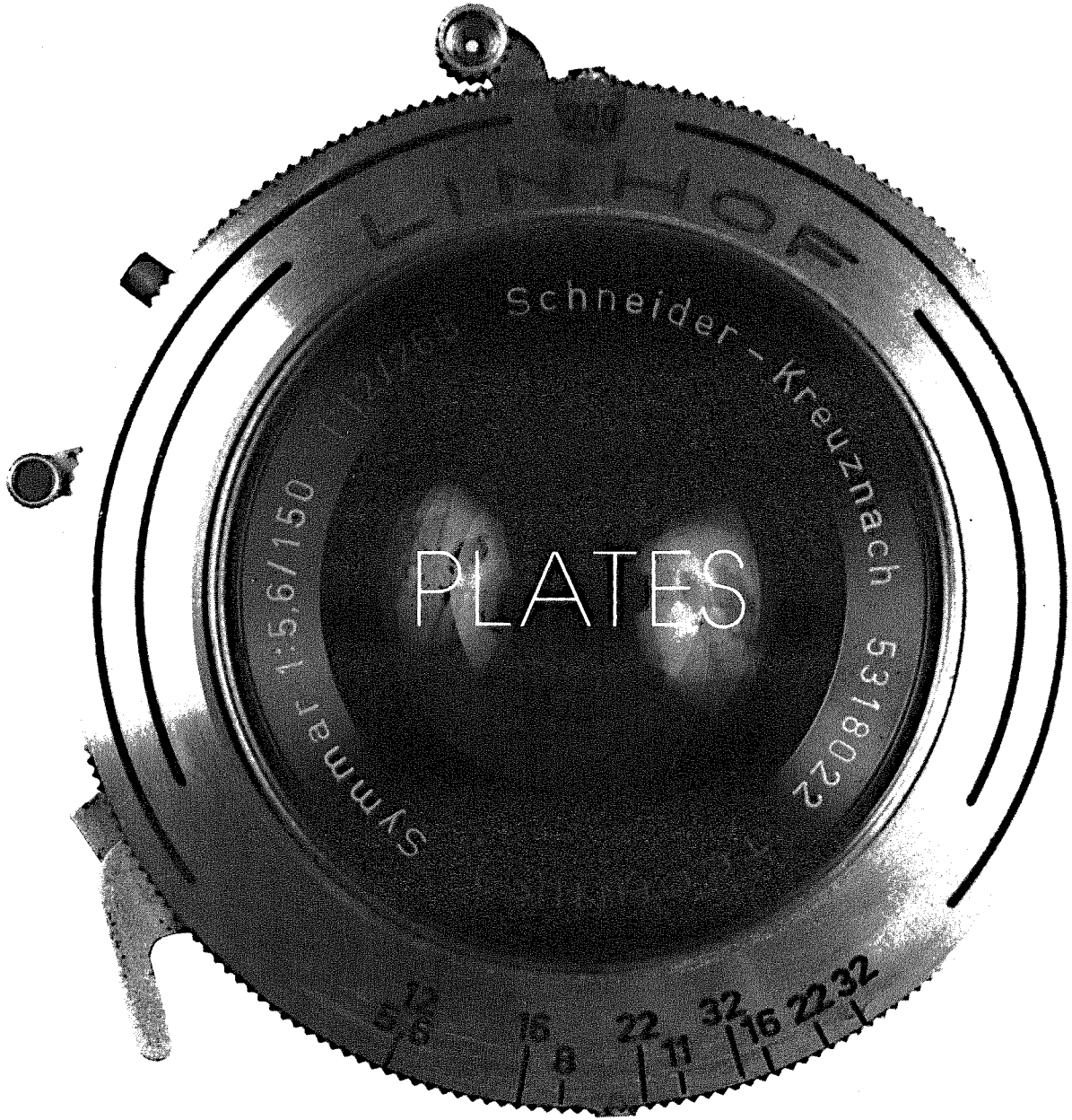
This formulation may be a somewhat more refined rendering of the objective, but it boils down to the same thing: turning out scientifically trained 'functional' people who can make a practical contribution to the solution of social problems in a responsible way. An old saying still holds good, although it should not be taken too literally:

*'Wageningen graduates are farmers, not professors.'*

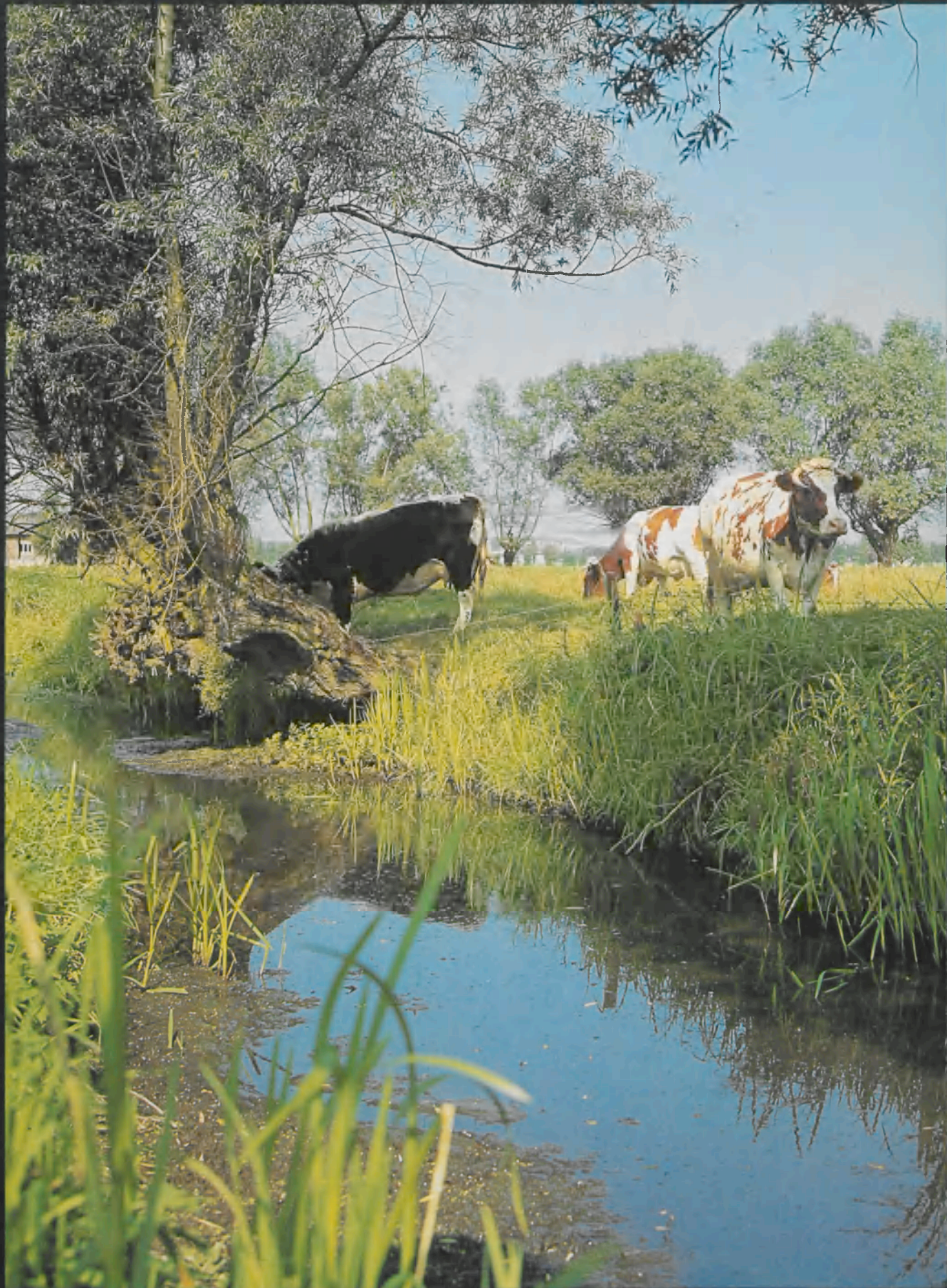




Taste-testing cabin of the department of Human Nutrition, where a lot of research is done into the causes of haert disease.











Holland is also a horticultural land. In the spring the tourist sees brightly coloured fields with row upon row of flowers. As well as flowers, vegetables and fruit, Dutch bulbs are also an important export asset. Wageningen is the most important centre of horticultural and agricultural education and research in the Netherlands, which is illustrated by this series of photographs.

A picturesque view of the Dutch landscape: languidly grazing cows in lush meadows criss-crossed by ditches. A stereotype picture of Dutch agriculture. But Holland is more than just this, there are other landscapes and other forms of agriculture (left).





Wageningen is situated on the Rhine, which is one of the most important rivers in Europe. The wide river is one of the busiest waterways and offers the people of Wageningen plenty of recreation (left).

Although Wageningen is situated on a large river and has a busy transshipment harbour, it has not become an industrial town (below).





Winter work—manure storage—on a Dutch cattle farm. The total grazing land in Holland is 1 300 000 ha. There are 175 cows per hundred hectares.



Grain harvest on one of the polders. Grain, potatoes and sugar beet are the most important arable crops in Holland. About 650 000 ha are used for this purpose. The yield per ha has increased over the last 25 years by 30 to 50 per cent.





Weekly cattle markets are held in many places. The largest are in Zwolle (photo) and 's Hertogenbosch.



Local and regional organizations have regular stock-judging competitions. After the individual inspections, a group of progeny from one bull are demonstrated.



Holland is the flower garden of Europe. The flowers are transported and sold by auction, mainly in the west and south of the country.





More than 110000 ha are used for horticulture, 8000 ha of which being employed for cultivation in greenhouses. The largest area of greenhouses is in the west of the country.

In the forecourt of the University in Wageningen is a statue by August Falise which symbolises Dutch agriculture: a sowing farmer.

A symbol of the industry that processes agricultural products: the old Dutch corn mill. This beautiful example in Wageningen grinds corn every Saturday for the 'do-it-yourself' bakers.







The botanical garden, 'Belmonte', belonging to the Agricultural University, is situated on a hill on the outskirts of the town. The park encompasses an area of 17 ha and contains a large collection of rhododendrons.



The 'Hoogstraat' (High Street), the most important shopping centre, is a pedestrian precinct.



The 'Grote Kerk' (Big Church) in the middle of the town was built in 1288. During the Second World War, Wageningen – including the church – was badly damaged twice.







The market is enlivened by the typically Dutch sounds of a barrel organ.

The Market Place. A market has been held here since 1263.







During the seventies the University expanded rapidly, until there were about 6 000 students, which resulted in crowded lecture rooms.



Students do their own research in the last phase of their study.





The area around the town is suitable for excursions and field studies. Here, the students are learning to recognize plant diseases in the fields.





Wild varieties are often used in plant breeding. For example, in this case, wild lettuce.





To get an improved variety, thousands of plants have to be grown in order to select those with the best properties.



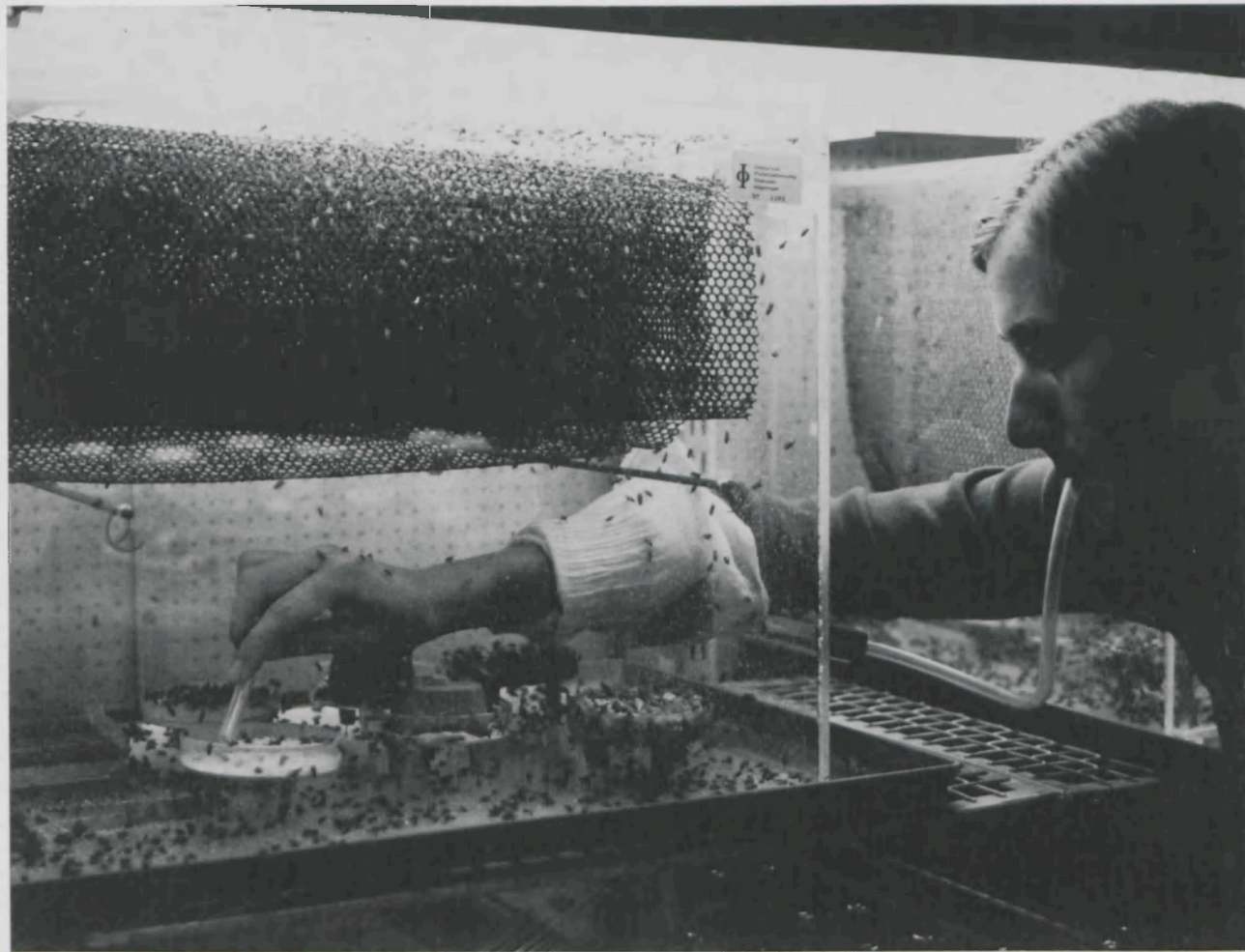


To study transport of materials in the soil they are radio-labelled, so that they can be followed on their way through a soil column.



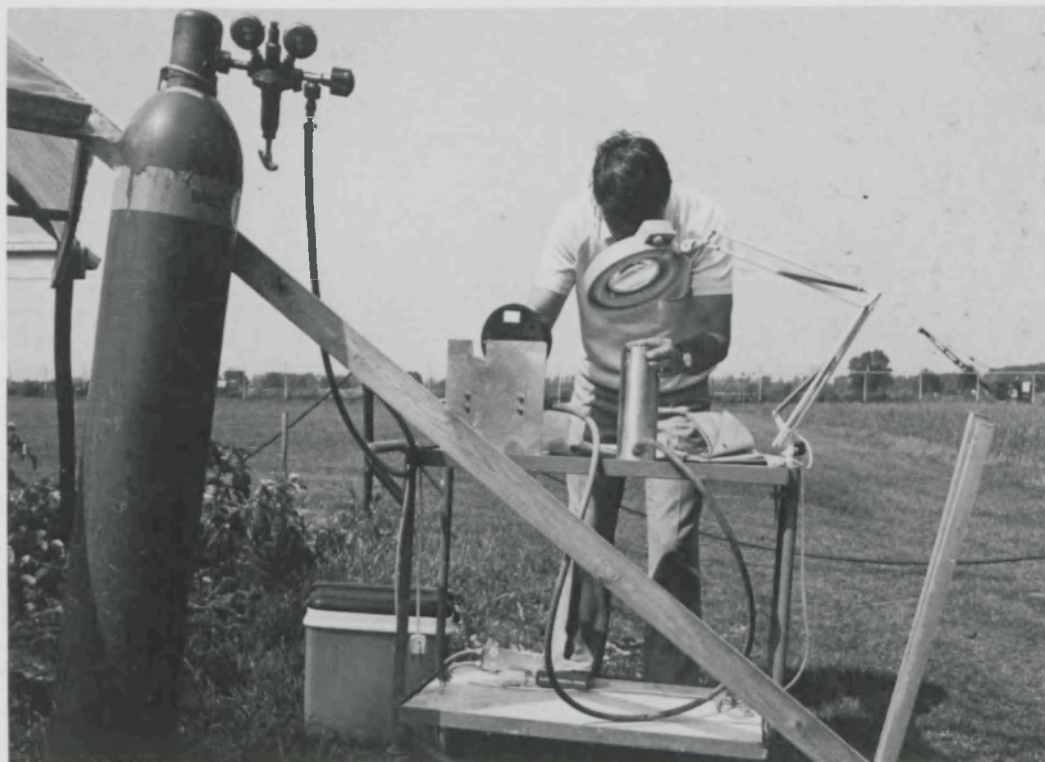
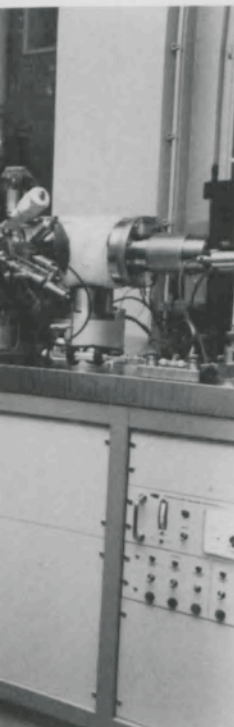


By rendering male specimens sterile, the onion fly can be sufficiently controlled. A great deal of field research is therefore essential. Mass rearing of onion flies.









Modern apparatus here being employed in molecular physics: the laser. This is used in photosynthesis research (above left).

Analytical apparatus being used for virus purification (above right).

How do crops function? One of the things to be investigated is the moisture tension in leaves. The photograph shows measuring apparatus set up in the field. (above)

The combination of gas chromatography and mass spectrometry from the Department of Organic Chemistry serves many branches of research. For example, in the case of water or soil pollution, this method can be used to analyse the mixture of polluting substances (left).

Radiation is one of the methods used in plant-breeding to cause mutations (far left).





Research into production and feeding value of green fodder such as maize.

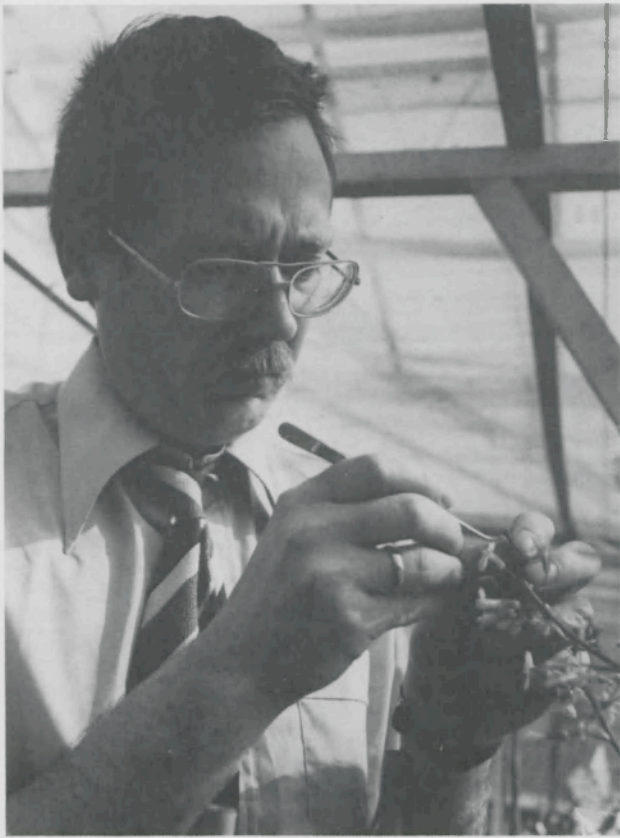
In a herb garden, students can become acquainted with the most frequently occurring herbs and weeds of fields and meadows.



Students following a course in tropical crop husbandry learn to recognize the exotic plant crops in the experimental greenhouses.





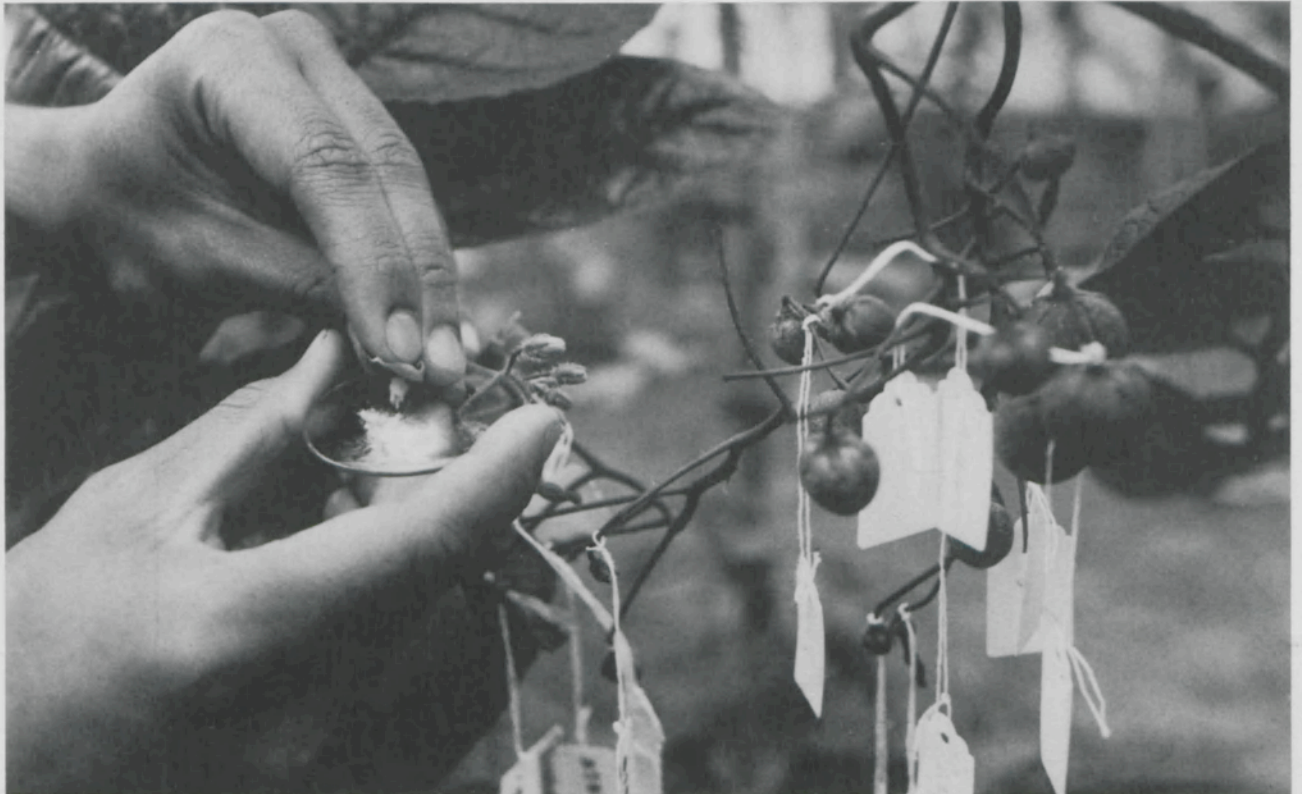


Plant-breeding gives nature a helping hand.



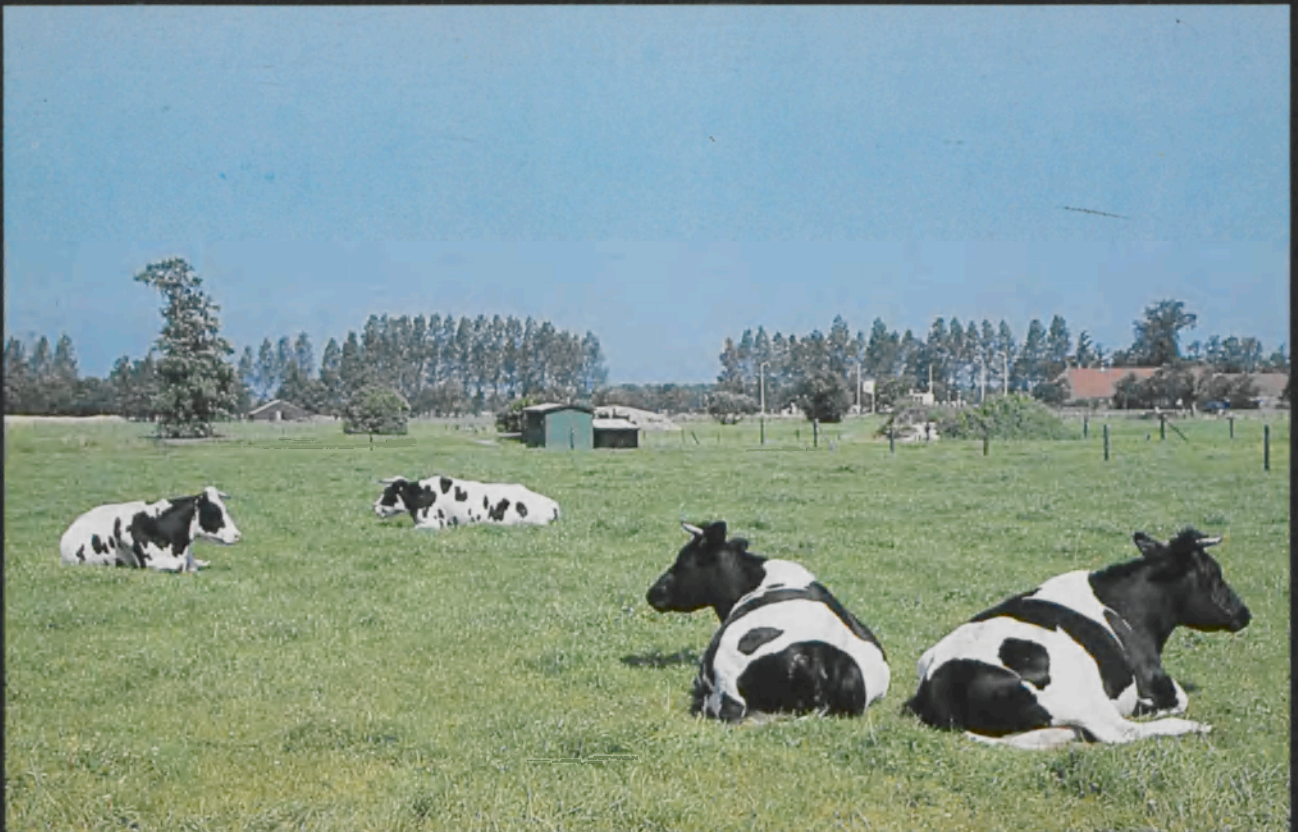
New fruit varieties are being developed, albeit on a modest scale.

This is how potatoes are cross-bred. The pistils in the flowers are each pollinated separately.





By using monozygotic twin cows in grazing experiments, more or less identical groups can be produced, which for comparative experiments is very important.







For agricultural research in animal husbandry and arable farming, a large area is required for experiments. The fields around the research buildings resemble a patchwork quilt. For some experiments a large number of small fields are necessary.



Because experimental fields are usually smaller than normal ones, and because all sorts of things need to be done to the harvested products (counting, weighing, measuring, etc.), specially designed machines are often necessary to get in the harvest.





The quality of vegetables and fruit is very important. Agricultural research, therefore, also includes the study of preservation and processing techniques.





Studying the processing technique of potato crisps.



Research is also done on the industrial processing of agricultural products.



Alstroemeria Orchid flower.



White Wings.



Yellow Tiger.

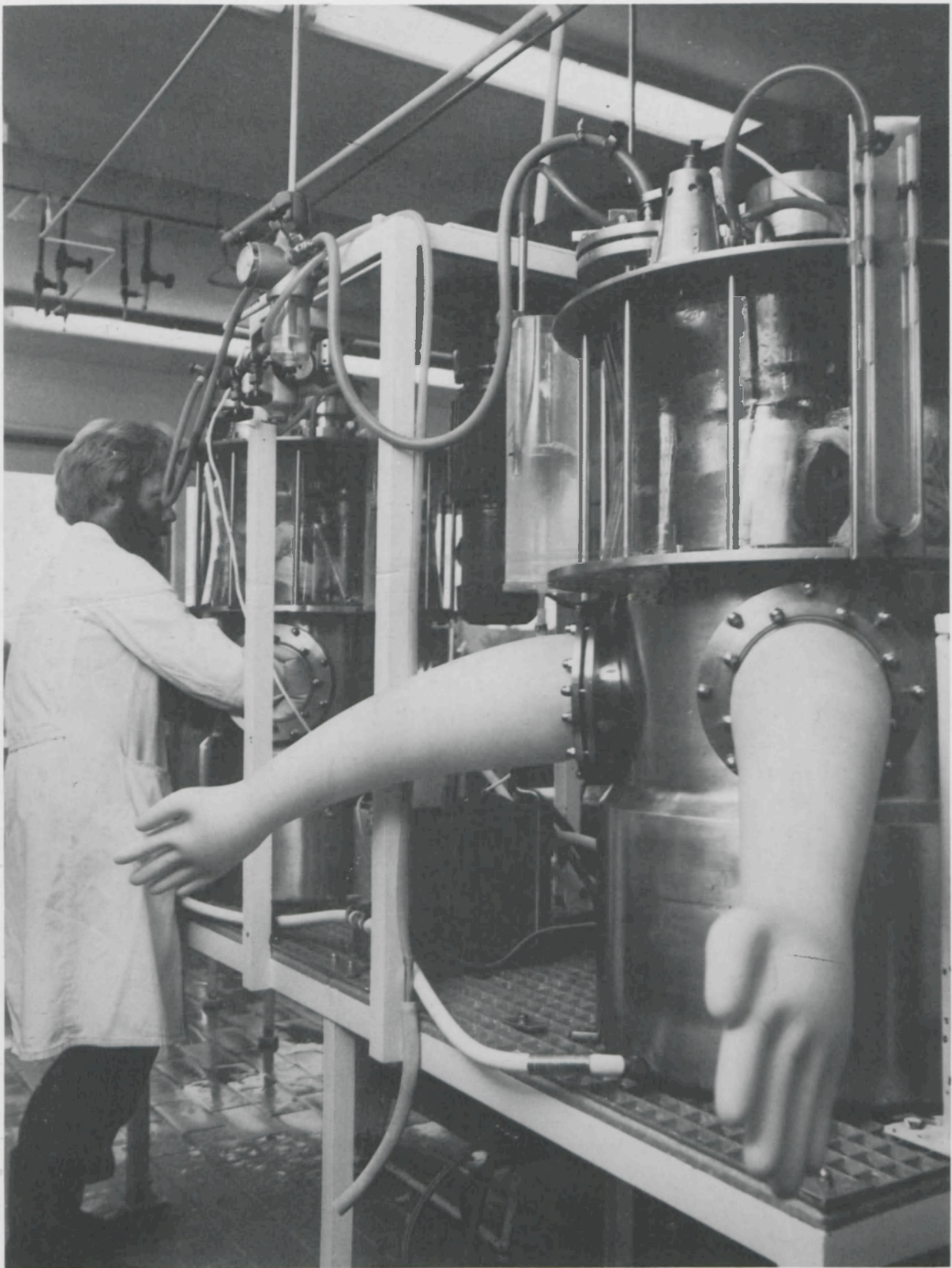


Zebra.



Canaria.

Mutations can be obtained by irradiation, especially in flowers. The original cultivar: Alstroemeria Orchid flower (left) and four mutations.

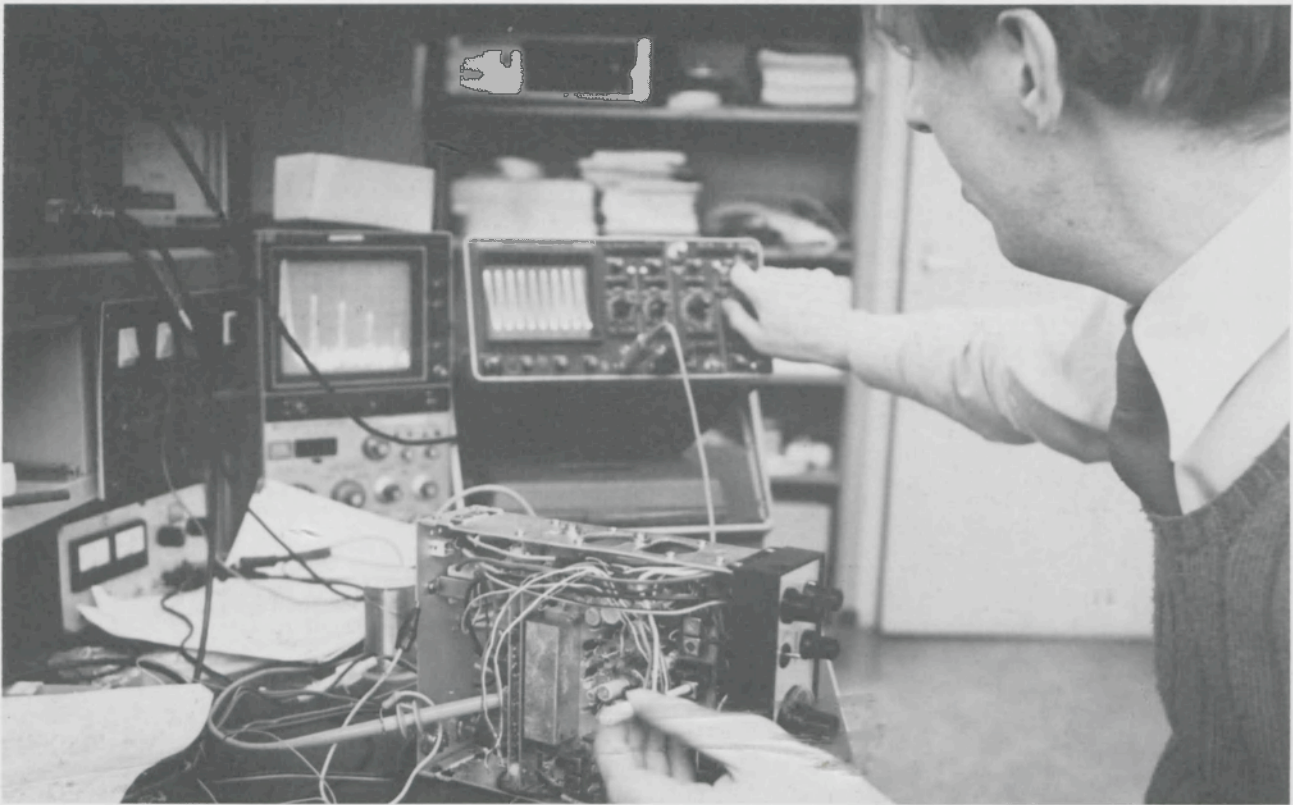


Cheese-making under controlled conditions as part of the food technological research.





In routine research, tables full of samples have to be prepared in order to carry out an endless series of identical tests.

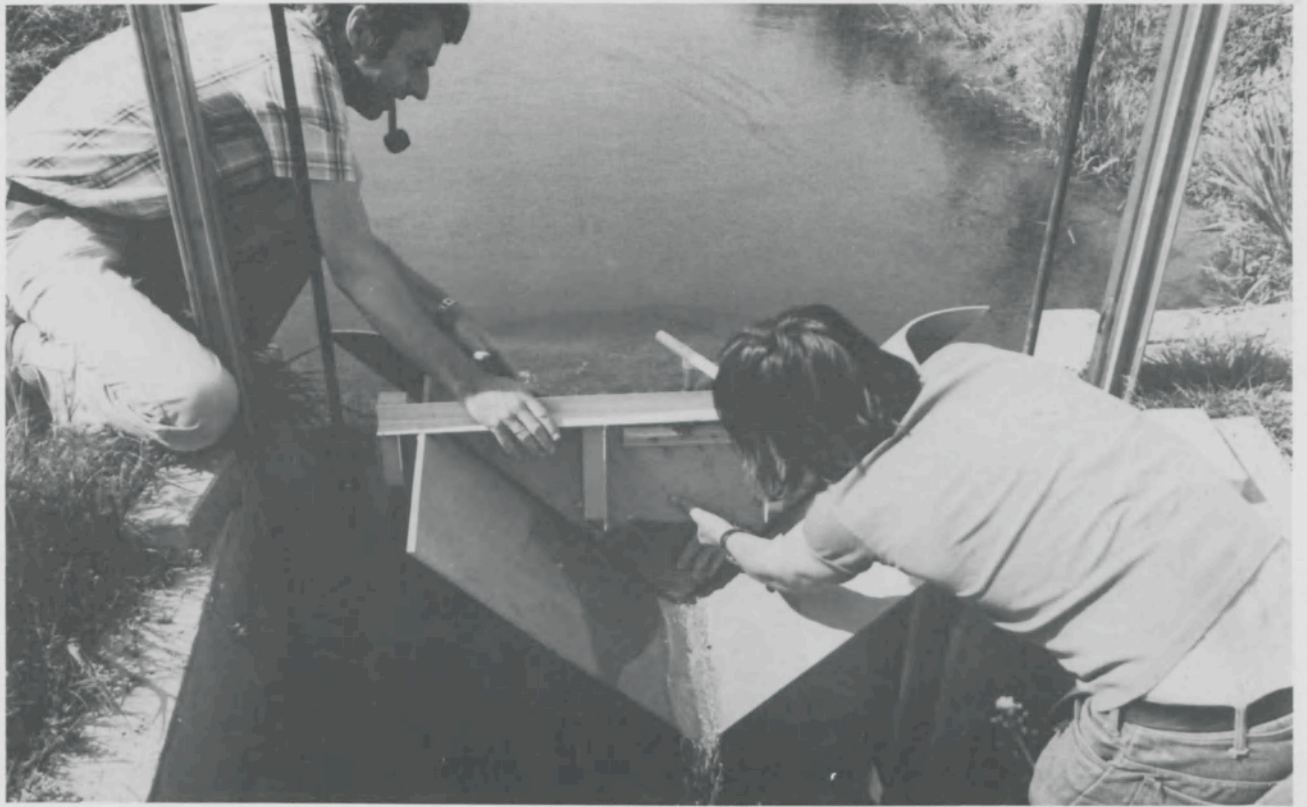


Modern measuring apparatus is essential for agricultural research. Many specialists are available for making specific apparatus.

The Department of Meteorology of the Agricultural University is especially concerned with the study of the micro-climate of crops. Scientists are now also studying the possibility of very localized weather forecasting for farmers.







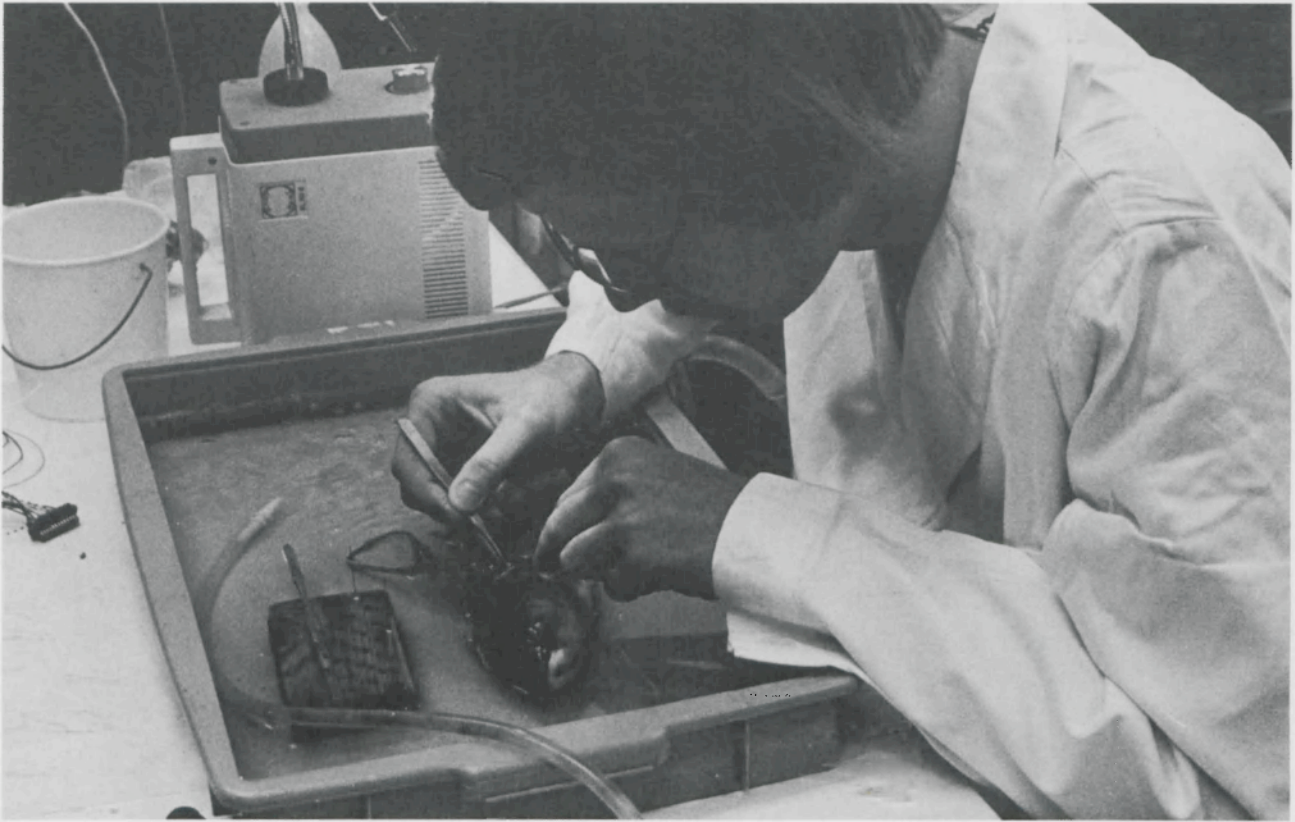
Regulating the water level in ditches where tests are done with water plants. Water plants with large floating leaves suppress the smaller ones by light competition enabling the drainage to be kept at a correct level.

Students of the Agricultural University during a land surveying practical.



For taxonomic studies plants are collected, for example, from Africa. The dried plants are put in a herbarium, the fruits are preserved in pots. Live material is stored in gene-banks.





Electrodes being inserted into a fish. Research into fish mastication.

In fish breeding research, feeding, growth and reproduction of the African catfish are studied.







Students from the Department of Nature Conservation doing practical work in the field.



It is still essential in agricultural research to use animals in experiments: taking blood via the skull of a rat to study blood reactions, without the danger of being interrupted by shock, as is often the case with venapuncture.

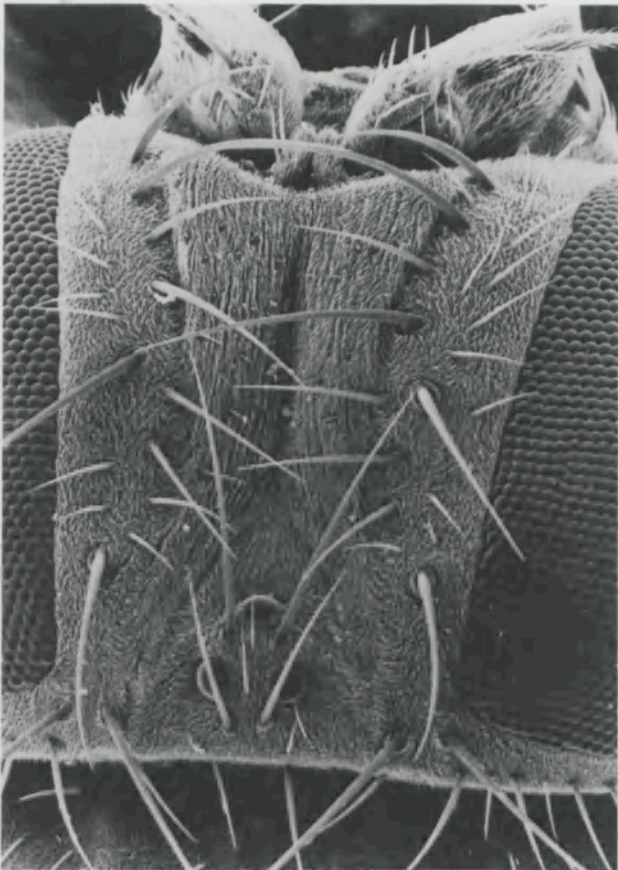




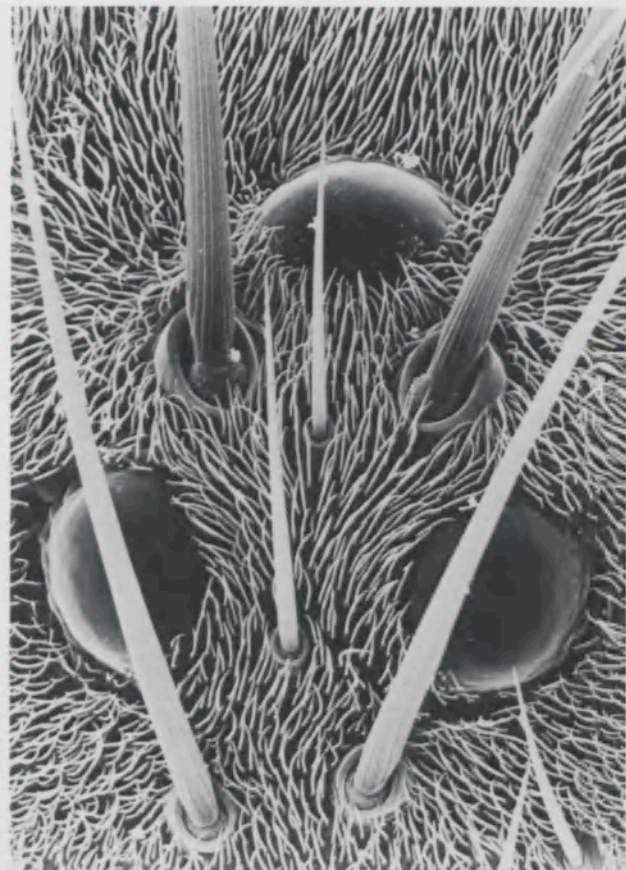
Making the invisible visible with the help of an electron microscope.



A common housefly. Parts of the fly, as seen through an electron microscope, are illustrated on these pages.

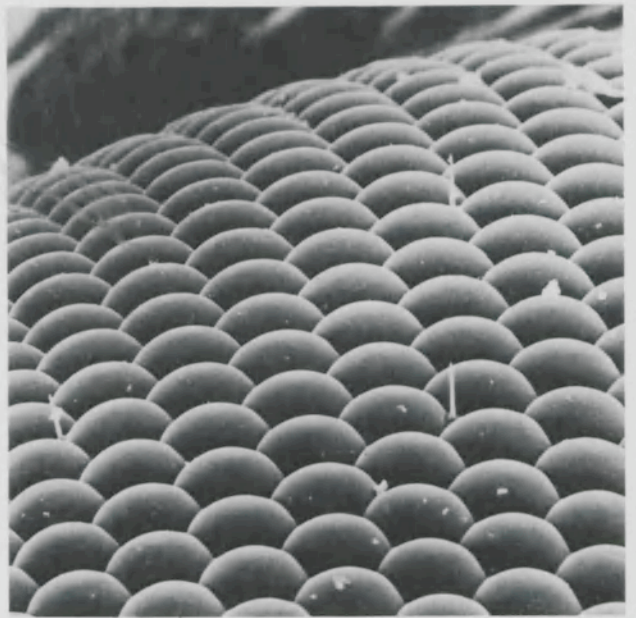
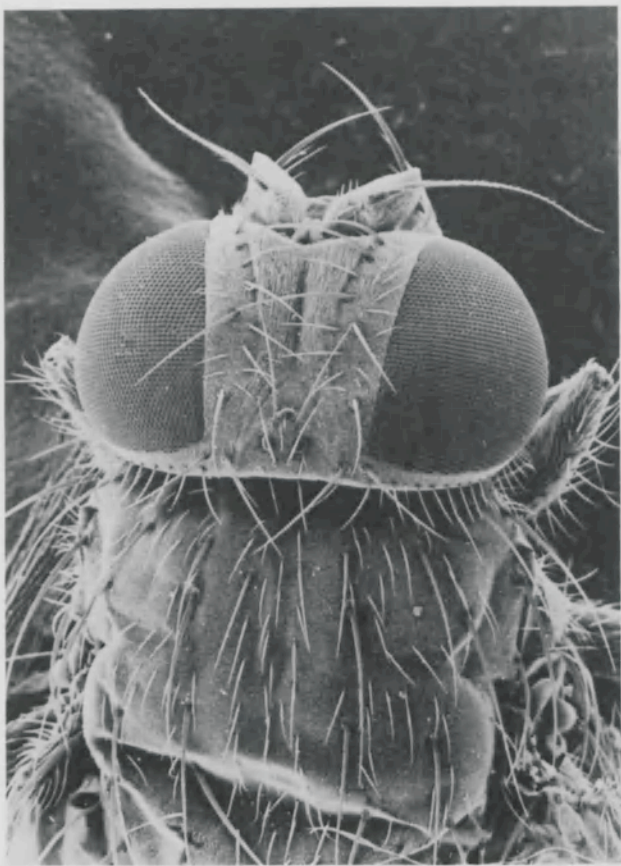


This part of a fly's head has been magnified 100 times.



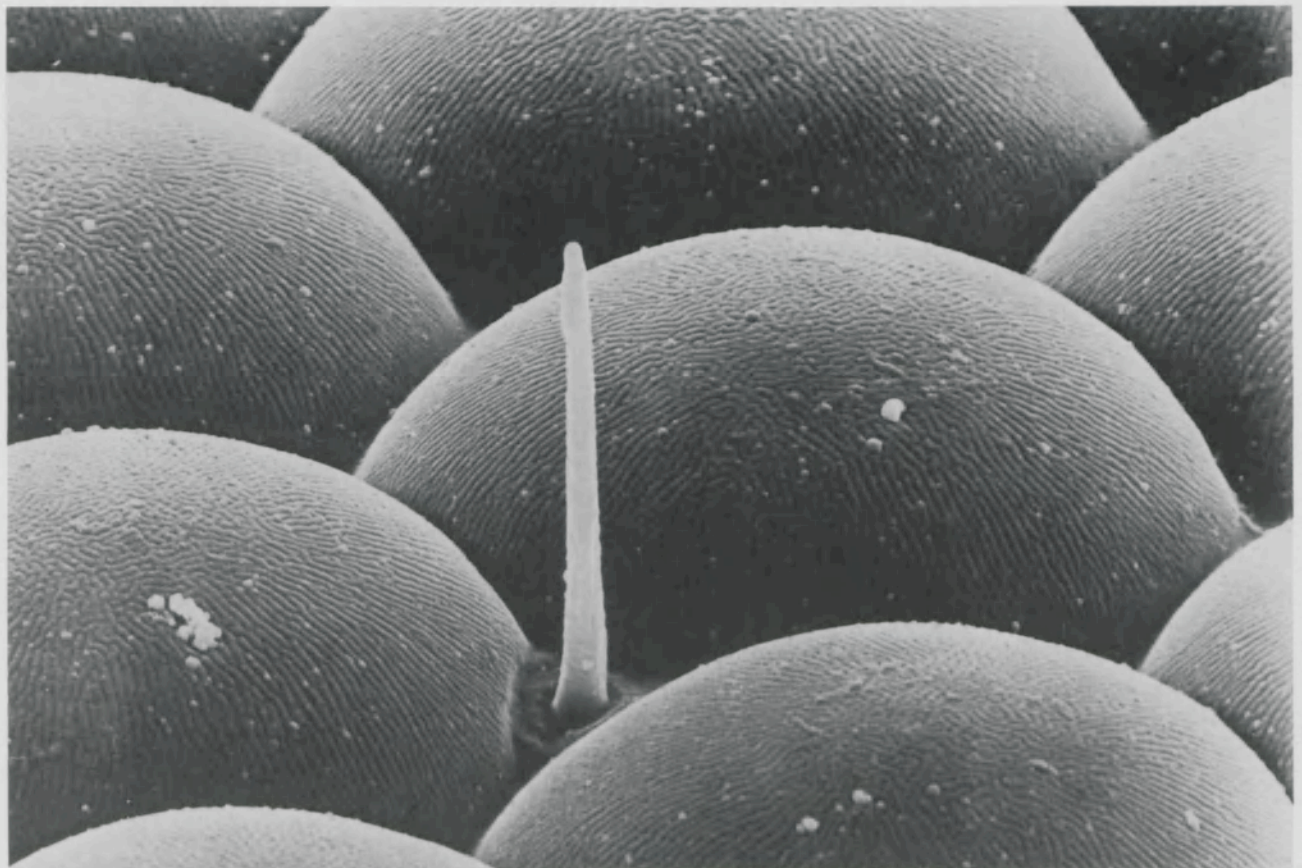
Even closer (magnified 500 times).





Part of the eye of a fly, magnified 650 times (above).

The eyes of a fly, magnified 40 times (left).



This part of a fly's eye has been magnified 3 600 times.





Wageningen, being a University town and full of students, sometimes has more than its fair share of activity and bustle! Open-air concert during the week in August when new students are introduced to the University.



In a comparatively small town—Wageningen has 30 000 inhabitants—it is not always easy for 6 000 students to find living accommodation. Five blocks of high-rise flats have, therefore, been built on the outskirts of the town.

This is still the cheapest way for students to travel home for the week-end.



The Department of Extension Education frequently uses video apparatus for training in oral communication.



Modern research without the aid of computers is inconceivable. Students must, therefore, learn how to work with them.



In practicals, the lecturers make use of student-assistants: advanced students who help the beginners.





In the summer there is a lot of field work to be done. Researchers and students counting plant-lice in grain.



Crops are often affected by the weather. Students busy investigating the relation between the weather and the spreading of micro-organisms.



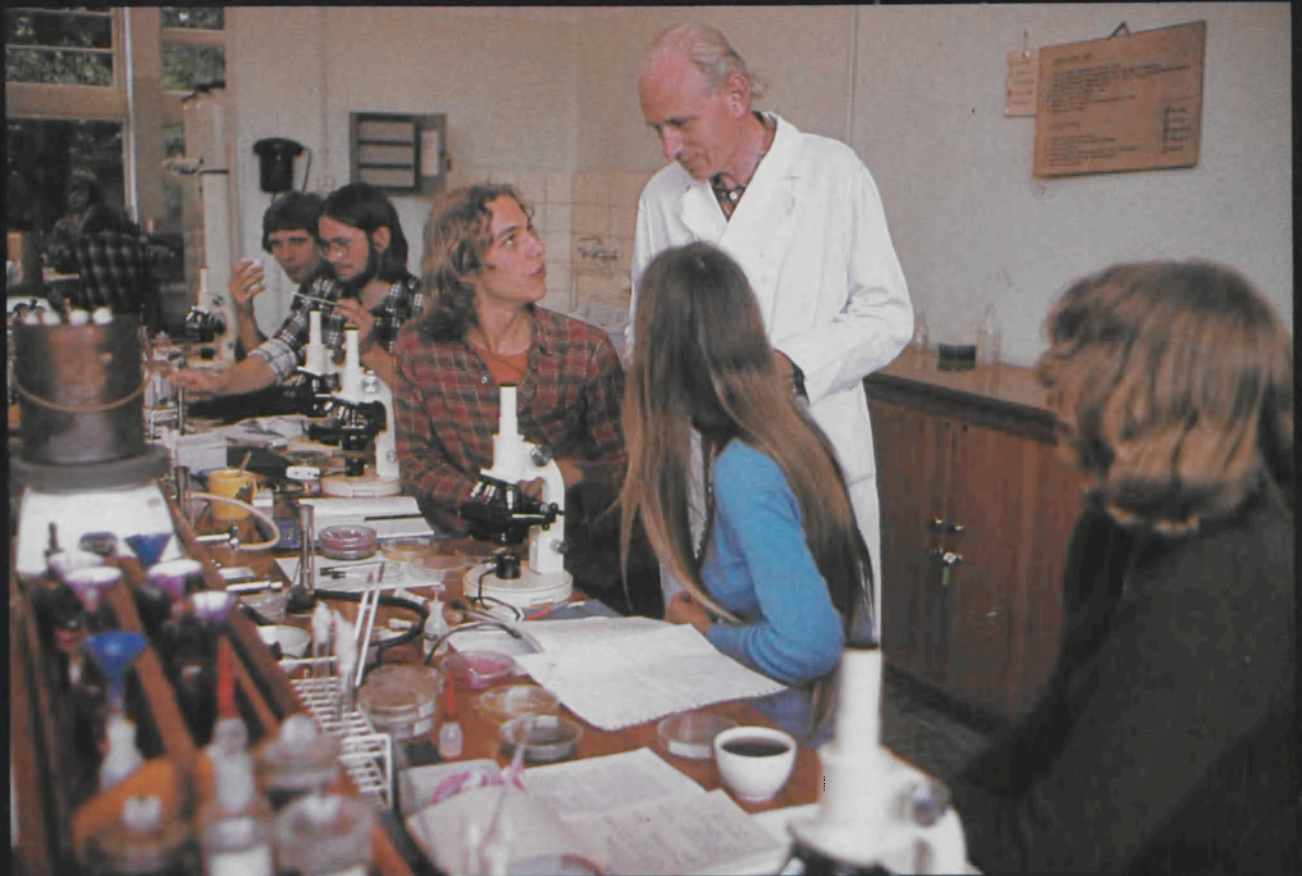
Studies in which weather conditions are important are continued day and night. A caravan serves as a mobile laboratory (left).



Forestry students also learn to work with the tools of the lumberjack.



The lecturer in charge of a practical, discussing a problem with microbiology students.

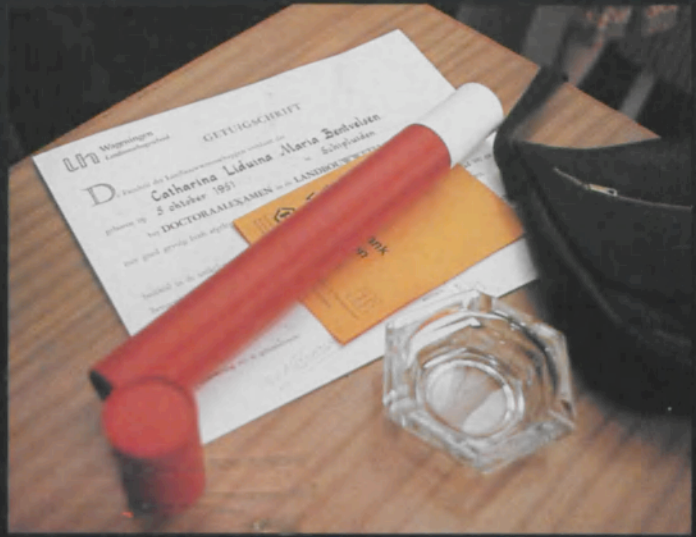






Several times a year the examination halls are thickly packed with students. It is usually the preliminary exams that are held on such a large scale. Later on students often sit for individual exams.

A graduate receiving his 'ingenieur's' diploma which is comparable to the 'doctorandus' degree from other Dutch Universities (about equivalent to an English M.Sc.).



The presentation ceremony is a festive affair with family and friends all gathered in the 'Aula'.



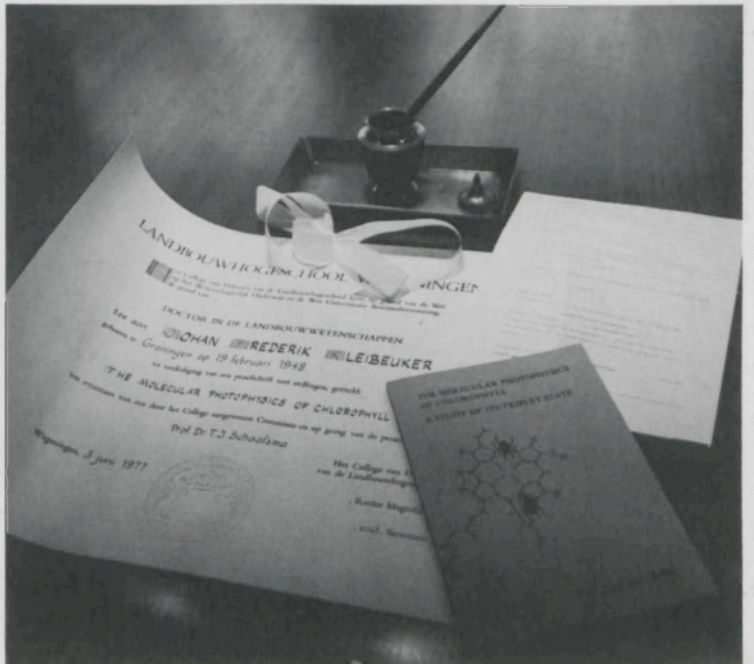




The graduate is entitled to work on a thesis which can earn him the title of Doctor in Agricultural Sciences. He is required to defend his thesis in public. The ceremony, in the 'Aula', is opened and closed by the academic registrar of the University (above).

During the public defence the graduate is accompanied by two paranympths (above right).

After the graduating ceremony, the new Doctor is presented with a document bearing the title of his thesis (right).





All universities have their quota of demonstrations. The Agricultural University is no exception and is regularly confronted with student demonstrations.

The opening of the Academic Year or a graduating ceremony are sometimes taken as an opportunity to hold a demonstration.







Students occasionally protest in the streets of Wageningen against social changes that they find unacceptable.

The new students arriving in September can buy cheap second hand household articles from a jumble sale specially set up for them.



The students also enjoy organizing street parties, and are happy to allow the inhabitants of Wageningen to join them.



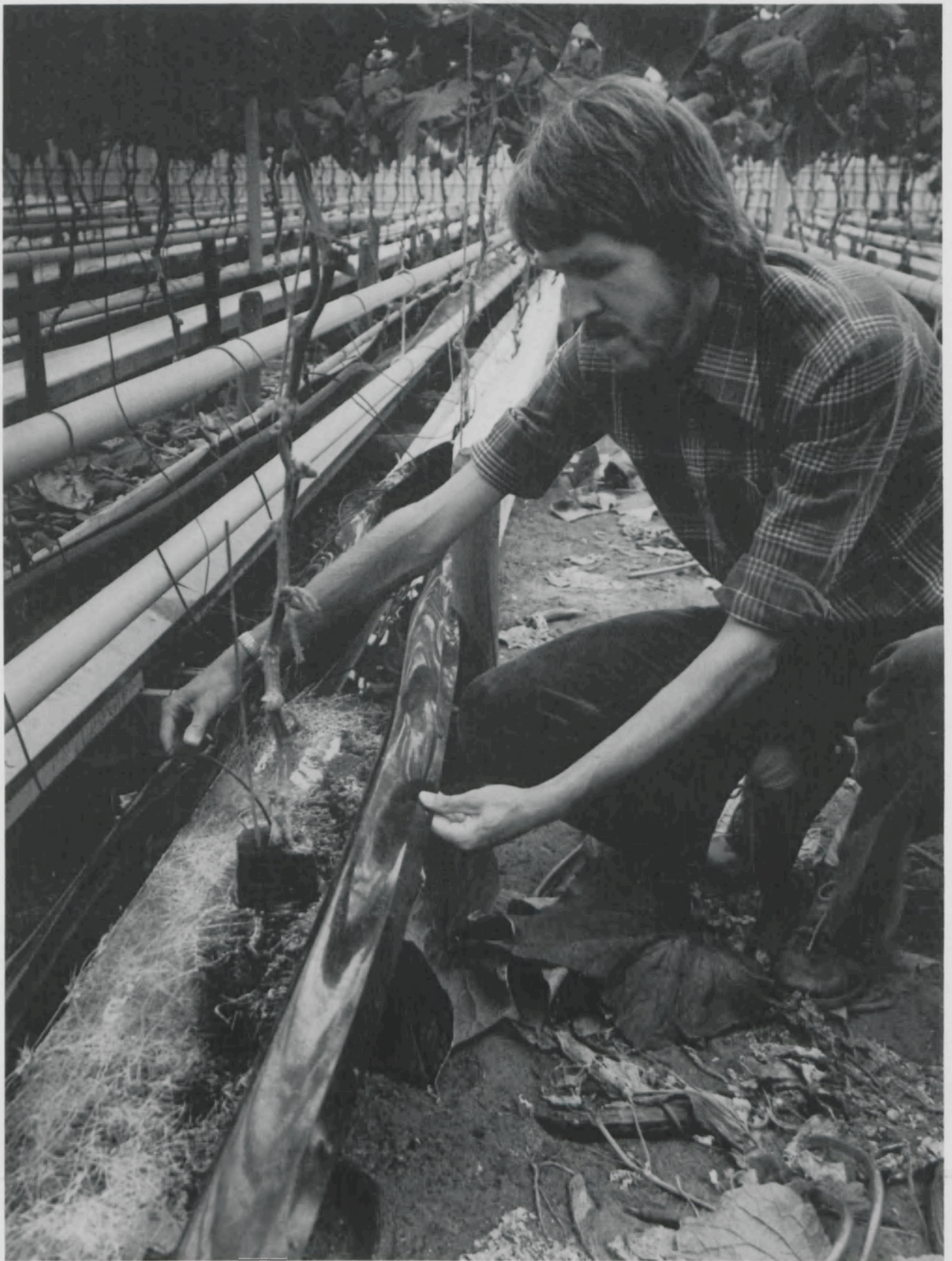


Research into the mechanical harvesting of mushrooms.



In horticultural research, investigations are carried out to see whether flowering crab apples planted in pots can be used as cross-pollinators in orchards. The whole orchard can then be used to produce the same type of apple.





Allowing plants to grow without soil in hydrocultures, prevents the transmission of disease via the soil.





Appropriate technology. The Department of Agricultural Engineering has designed a plough so simple to construct that a village smith in the Third World can assemble it.

Research for developing countries. The Department of Tropical Animal Husbandry is experimenting with the pigmy goat which has hardly been studied before: this is an animal valued by African small farmers.







Wageningen has always given a great deal of attention to the tropics. A collection of tropical butterflies and insects from the Department of Entomology is colourful proof of this.



Locust culture (left).

Preparing the insects.







Grass carps being planted.

Grass carps keep the ditches clean in a natural way. This can clearly be seen at the back of the ditch.

Studying the effects of polluted air on plants. The air is blown onto the plants using a fumigator.



Studying air quality on an industrial site in Arnhem.

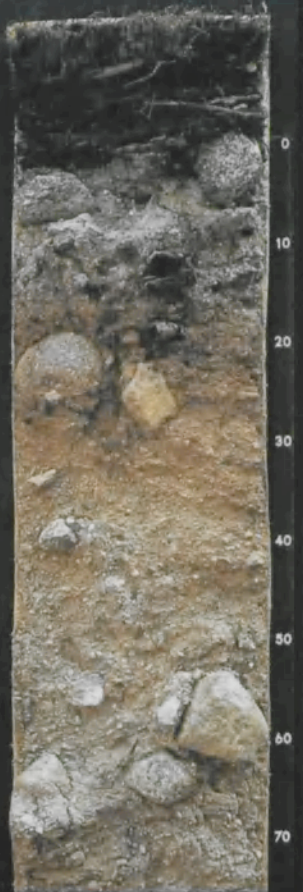






The natural stratification of the soil can be studied in the field (left).

The soil can also be studied in the laboratory using soil segments sprayed with lacquer. Soil profiles that look like a painting (right).



Tillage effects can also be studied indoors (simulation-model).







Several types of stalls are investigated for their practical application.



In studies involving a large number of cows, a revolving milking parlour offers the possibility of individually registering milk yield, diseases, etc (left).

Experimental fields where different varieties of grass can be compared.







The prototype of a straddle harvester moves over the trees during the harvesting of apples and pears.

In plant breeding research each pollination is carried out by hand and each flower has its own label. These are potatoes grafted onto a parent stock of tomatoes.

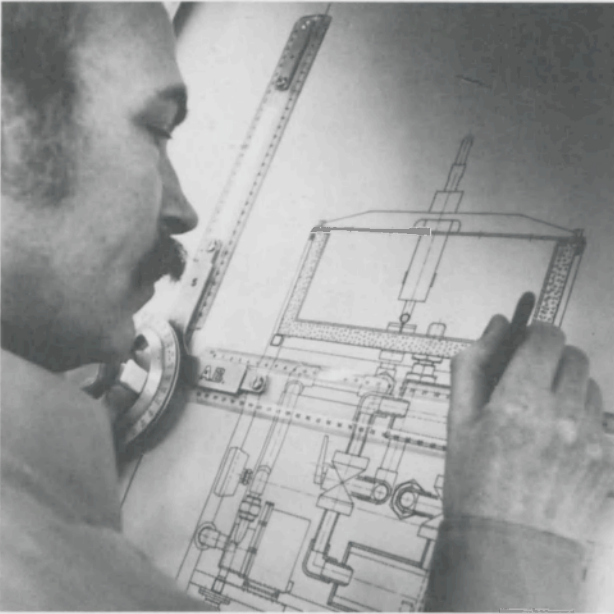


Breeders make use of certain properties of wild plants in order to improve cultivated varieties. The photo shows wild potatoes from South America next to cultivated varieties.

A new propagation method is cell culture. Pieces of plant tissue are placed on a culture medium and treated in such a way that new plants occur. The new plants are identical to the mother plant.







Without a good drawing, the workshop cannot make the desired apparatus.

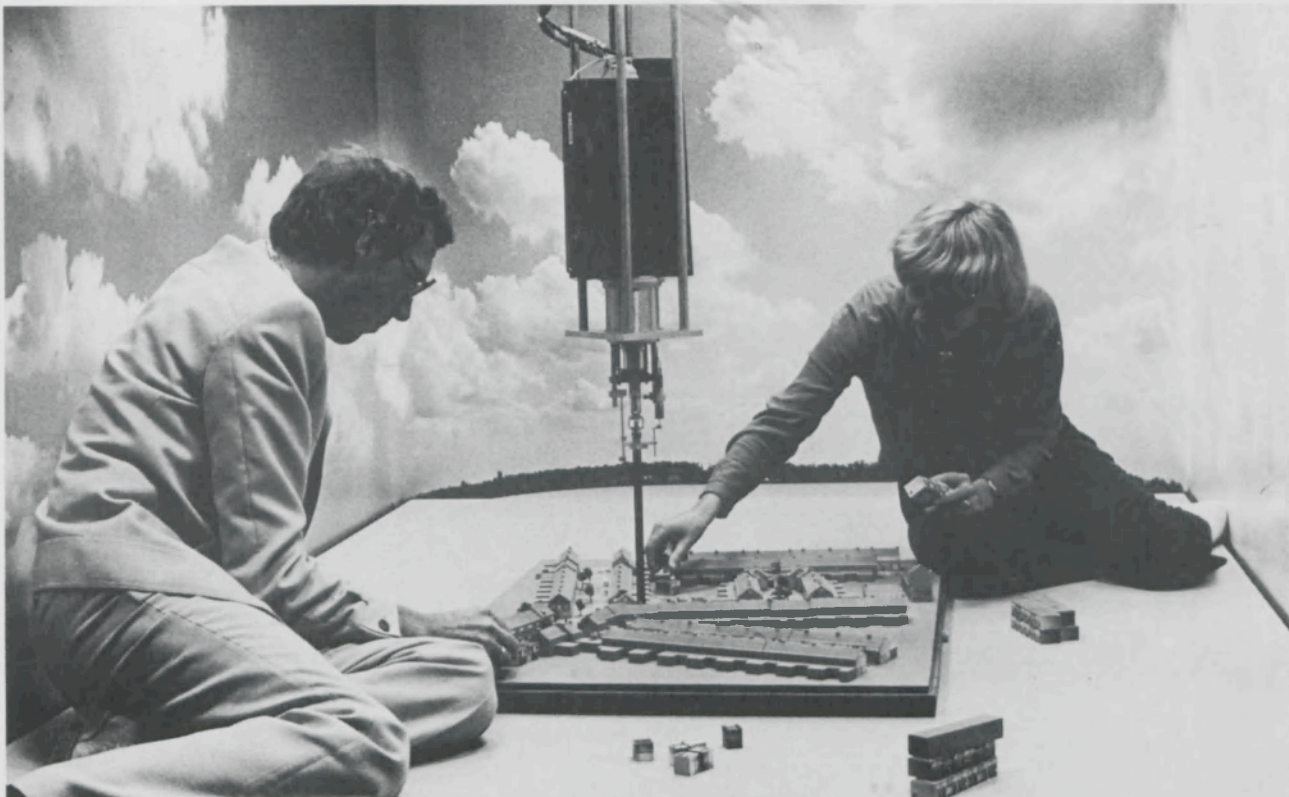


The University employs artists to make instruction murals (right).

Even if you have no artistic talent, as a student you are expected to learn how to draw plants.



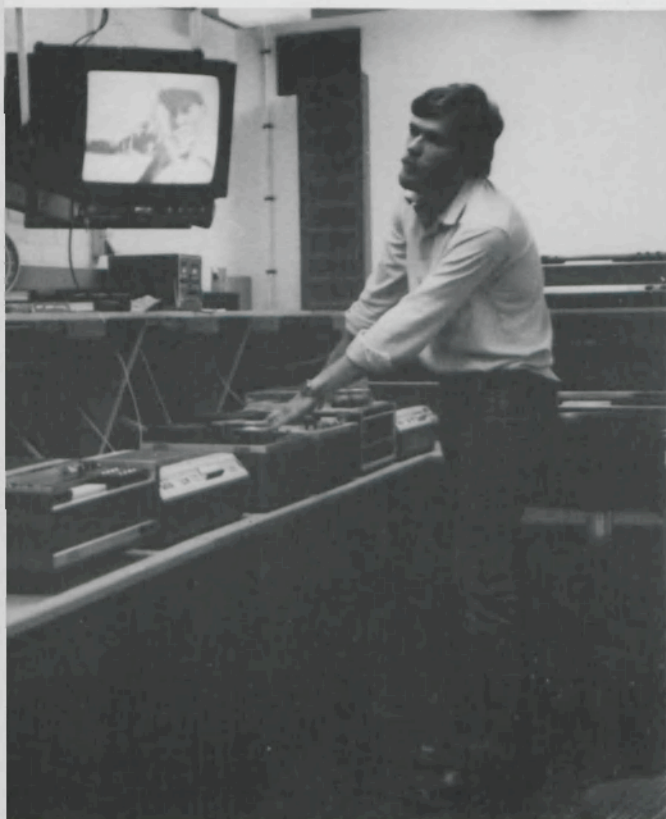




The Department of Ecology of Habitat makes use of an 'enthescope' for education and research. An extended video lens projecting onto a screen, gives the impression of walking through the streets of the model.

Video is used a great deal for teaching. A special department produces and is in charge of videofilms: the audio-visual centre.

A camera is often used to record research data.





The lending section of the central library. There are sub-branches and special libraries in other parts of Wageningen.

The library of the Agricultural University is one of the largest of its kind in Europe. A view of the card system.







Scientists use aeroplanes for a variety of purposes. A photographer is getting ready to take pictures of experimental fields.

Research into animal behaviour is increasing. Observing the behaviour of chickens can be done from behind a desk if the room is suitably equipped.





A great deal of technical apparatus is available to scientists and students studying food technology.

Culture of micro-organisms in the food technology laboratories.





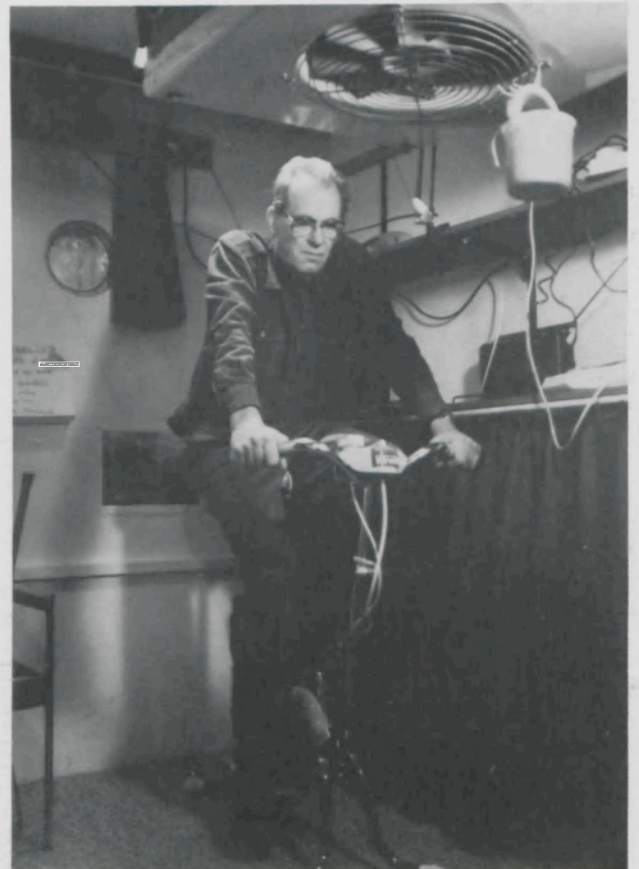


Food education and research was started in Wageningen in 1969. In particular, diseases caused by our Western way of living are studied. In the photo: cabins used for taste-testing.

Weighing under water is necessary to determine the fat content of the body.



Respiration chambers, where animals are usually studied, are used in human nutrition research to investigate which part of the food is converted into heat. The amount of oxygen taken in and the amount of carbon dioxide given off are measured in the chambers.



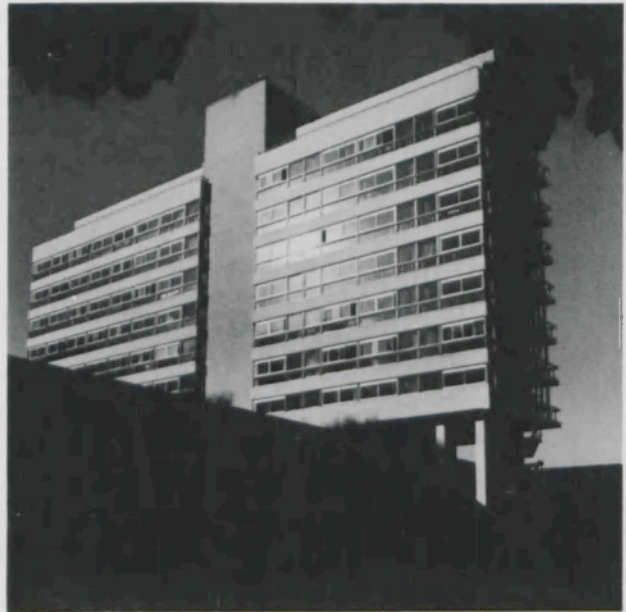


Every year Wageningen attracts thousands of visitors from both home and abroad.

Students with a city background have to learn to look at cows with the eyes of a farmer if they choose a course in animal husbandry.



The International Agricultural Centre, where many people from Third World countries follow courses. There is also a residential wing with 140 bedrooms.







A permanent exhibition gives an overall view of agricultural research in the Netherlands.

Many scientists from developing countries come to the Wageningen institutes to augment their knowledge (right).



Graduates of an M.Sc. course.







Delegates from Africa often turn to Wageningen for agricultural help. Five to ten per cent of the research effort in Wageningen is aimed at the Third World; almost twenty per cent of the graduates get a job in the tropics.

The first official delegation from the People's Republic of China visiting Wageningen after the end of the Cultural Revolution.







Roses in a climate chamber. Research into the keeping quality of cut flowers in water is carried out under controlled conditions.



Since the end of the seventies research has been directed towards limiting the use of energy in greenhouses. This gerbera variety is now being cultivated at a lower temperature than before.



Freesias in all their colourful glory.



Studies on flowers that .....





the consumer will  
soon be taking home

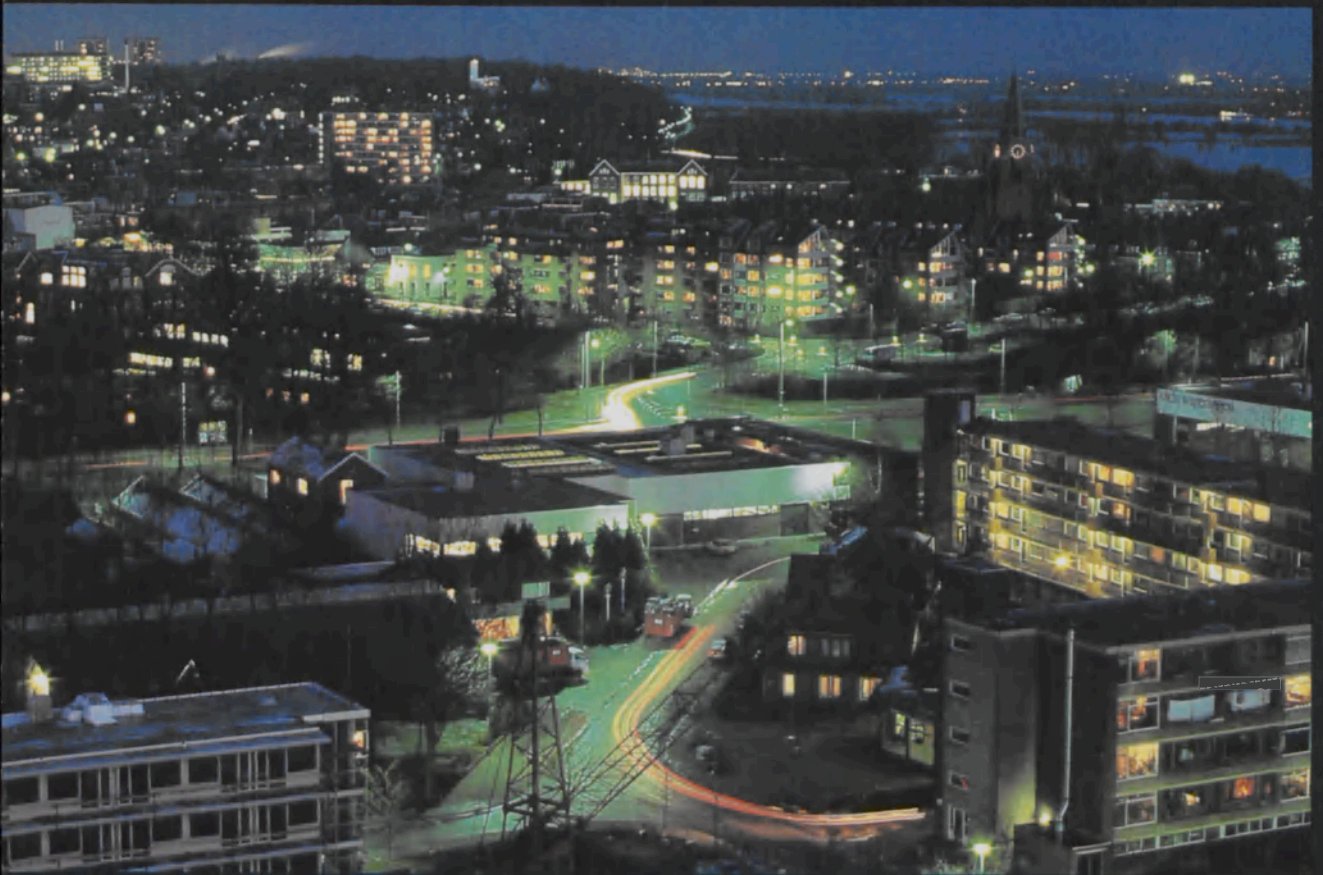








Wageningen, small town with a big name.



## Colophon

Text: Drir D. J. Maltha, former director of the Centre for Agricultural Publishing and Documentation and former lecturer of the Agricultural University.

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