Effect of nitrogen supply and shading on growth, kernel filling, size distribution, and protein and carbohydrate content in malting barley (*Hordeum vulgare* L.)

M.J. Marinissen & C. Grashoff

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Addresses

Location Wageningen:
P.O. Box 14, 6700 AA Wageningen
The Netherlands
phone (+) 31 8370 75700
fax (+) 31 8370 23110
e-mail postmaster@ab.agro.nl

Location Haren:
P.O. Box 129, 9750 AC Haren
The Netherlands
phone (+) 31 50 337777
fax (+) 31 50 337291
e-mail postmaster@ab.agro.nl

In memory of Kees Spitters

Abstract

Interest in the effects of environmental factors on malting and brewing quality of malting barley is increasing. We studied the effect of three nitrogen dressings (N1: only soil Nmin; N2: 90 kg/ha minus soil Nmin; N3: 90 kg/ha minus soil Nmin plus 60 kg/ha at flag leaf stage) and four shading periods (S1: no shading control; S2 shading during tillering; S3 shading during stem elongation; S4 shading during kernel filling) on growth, yield, and the following quality factors: mean kernel weight, kernel size distribution, and carbohydrate and protein contents. Nitrogen dressing increased LAI and total dry matter production. It had little effect on total kernel yield but reduced the mean kernel weight by 20 % and increased the protein content with 25 % to 160 g kg^{-1}. Shading during tillering, during stem elongation or during kernel filling reduced the total kernel yield with 10%, 35%, 50% respectively. Shading during stem elongation showed a kernel size distribution with 40% of the kernels larger than 2.8 mm. In contrast, shading during kernel filling resulted in a size distribution with 65% of the kernels smaller than 2.2 mm. This treatment increased the kernel protein content to 220 g kg^{-1}.

Preface

This research was carried out within the framework of a project which was partially funded by the Netherlands Grain Centre (NGC) from 1989-1992. We wish to express our thanks to the NGC and to the NGC-working committee under chairmanship of ir. L.A.J. Slootmaker for enthusiastic discussions and inspiring criticism about the progress of the project.
The project was initiated by the late dr. ir. C.J.T. Spitters, who passed away suddenly on April 26, 1990. The loss of the broad experience and creativeness of Kees Spitters was a heavy bereavement. We thank prof. dr. ir. H. van Keulen, who took over a part of the supervision of the project.

Last but not least we thank the collaborators of the CABO-DLO technical assistance service, especially Ms M. Albers and Mr A. van der Scheur for their technical support.

Wageningen, February 1994,

Marjan Marinissen
Kees Grashoff

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1. Introduction

Increasing interest in effects of environment on malting quality

Malting barley is an interesting alternative crop for growers of wheat and fodder barley, as the beer industry, to which barley is the main raw material, pays about 10-15% extra if the produce is of an appropriate quality for malting and brewing. Quality, however, is very sensitive to complex interactions of weather and cultural management conditions. Barley-growers and -breeders, policy makers, and the malting and brewing industry show an increasing interest in quantitative knowledge of the effects of such conditions, related to regional differences in quality and yield of malting barley. Such knowledge provides a risk assessment for crop management and breeding strategies, price control and evaluation of quality and yield in different regions.

The most important quality aspects of malting barley are *grain size, size distribution, protein content in grains and malt, and extracting efficiency.* These quality aspects are determined by the complex interaction of physiological crop growth processes, such as assimilation, dynamics of organ formation (numbers of tillers, culms, ears and grains) based on carbohydrate availability, dry matter partitioning, grain filling, N-content in crop parts and N-(re)allocation.

Short description of environmental effects on malting quality

It is known that grains of different size behave differently during the malting and brewing processes. Consequently, heterogeneous seed lots must be graded before processing (Burger & Laberge, 1985). Moreover, in general, large grains have a higher malt yield and therefore a different extracting efficiency. The final number and size, and the size distribution of barley grains are affected by the dynamics of formation of tillers, culms, spikes and spikelets (Biscoe & Gallagher, 1977; Scott et al., 1983). The formation of these organs is affected by the crop production of carbohydrates and the competition for carbohydrates between the organs, and thus depends on a complex interaction of environmental factors such as radiation, temperature, air humidity, and water and nitrogen availability (Van Keulen & Seligman, 1987). For reasons of brewing technique and adequate malt quality, the final protein content of the barley grains has to be within the range of 0.08-0.11 g/g. This content is determined by the balance of carbohydrates and nitrogen in the crop and also depends on the interaction of the same environmental factors. Although experimental data indicate that the protein content of barley kernels usually is higher in Mediterranean climates than in northern locations, a sound management of N-fertilization may yield an excellent quality malting barley even in southern locations. To date, little is known about the environmental effects on starch and protein quality and β–glucane content, but it has been suggested that nitrogen fertilization and radiation can have large effects on these aspects.

Aims of the project

For a systematic analysis of the combined effects of environmental factors on quality aspects, the integration of the physiological processes involved in a simulation model is required. In the project, which was funded partially by the Netherlands Grain Centre (NGC), such a model is being developed for malting barley. It is derived from the detailed model for spring wheat of

Van Keulen & Seligman (1987). The barley model simulates the phenology of the crop, photosynthesis-light response curve, dry matter partitioning, relations between carbohydrate supply and dynamics of organ formation, partitioning of nitrogen between the organs and respiration processes. The main aim of the project was to gain more insight in and to quantify the effects of the environmental factors temperature, radiation, rainfall and nitrogen fertilization on the quality aspects kernel filling, protein content and kernel size distribution of malting barley. These quantifications were used to parameterize and calibrate the model. The second aim was to validate the model in a comparison with data from independent field trials.
This report provides the results of these field trials, which were conducted with various N-fertilization rates and shading periods. In the experiments, not only crop growth was recorded, but also the number of organs formed, and the course of their contents of nitrogen and sugars.

2. Materials and methods

2.1 General description of the three experiments

Three field trials were conducted with spring barley in the years 1989-1991. Those trials were located on the experimental farm "De Bouwing" in Randwijk on a river clay soil with a silt percentage 60% and an organic matter content of 3.0%. The first two (henceforward referred to as KS8902 and KS9003) were identical in experimental conditions. Two barley varieties were tested under three nitrogen dressings. The third experiment (henceforward referred to as KG 9104) had the same nitrogen dressings, but also contained four shading periods and was conducted with only one variety. Table 1 gives an overview of important data of the three experimental designs. In the following sections the experiments are explained in more detail.

2.2 Detailed description of the experiments KS8902 and KS9003

Varieties
These two experiments were performed with the spring barley varieties Prisma and Golf. These two varieties are most widely cultivated in the Netherlands for brewing and animal feeding purpose, respectively.

Design and treatments
The experiments were laid out in a splitplot with four replicates (Figures 89-21 and 90-21) with nitrogen level in the plots and varieties in the sub-plots.The treatments were: no nitrogen application (N1), a nitrogen application as used in common practice (N2) and a surplus nitrogen application (N3)(Tables 89-2 and 90-2).

Whole-crop harvests.
Periodic harvests of all crop parts were carried out every two weeks. The crop was cut at soil level, with the exception of the first three (in 1989) or four (in 1990) harvests, where the whole plants were harvested. Fresh weight of total harvested plant material was determined. 25 main stems were selected and divided into green leaves (in some harvests separated per leaf layer), dead leaves, stems and sheaths, kernels and chaff. Fresh and dry weights (after drying at 70 °C) of the different plant parts were recorded (Tables 89-8, 89-9, 90-7, 90-8) and the leaf area (Tables 89-10 and 90-9) was measured with a Li-cor equipment. The selection of main stems may have resulted in an overestimation of the production only on hectare-basis, especially for the kernel yield.

Ear samples
During the period of ear filling, ears were sampled separately in plots of 16 rows (2.24 m) of a length of 0.70 m, in the weeks in between the periodoc harvests of all crop parts. For these samples 25 (in 1989) or 20 (in 1990) main stems were selected, without sampling the rest of the plants. The weight was measured and the number of kernels was counted (Tables 89-7; 89-15, 90-15). The largest part of the kernels was frozen immediately in liquid nitrogen and stored at

- 20°C and dry frozen later. 5 gram of each sample was not frozen, but was used for determination of the dry matter content. These samples were analysed by TNO-Agro-NIBEM (address: P.O. Box 360, 3700 AJ Zeist), on quality aspects for malting and brewing.

Final harvest
The final samples were harvested by a combine harvester, and 1000 kernel weight and kernel size distribution were determined (Tables 89-16 and 90-16). Sub-samples of the final harvest were analysed by TNO-Agro-NIBEM.

Chemical analysis
In the various plant parts dry matter content, total nitrogen content and carbohydrate content were analysed (Tables 89-12 to 89-14; 90-11 to 90-14). The amount of mineral nitrogen in soil samples during the season was also determined Tables 89-19, 90-19).

Countings and phenology
The numbers of plants and the number of secondary stems were counted and plant phenological development was determined, using the Zadoks decimal code (DC) (Zadoks et al., 1974) and an apex development scale (Meurs & de Vos, 1992). This scale is explained in Table 91-21 and the results are in the Tables 89-4, 89-5, 90-4, 90-5.

Weather data
For weather data during the period of this experiment we refer to the CABO-DLO 'WEATHER' data bank (ing. W. Stol).

Additional information for experiment KS8902

Soil description
The experiment in 1989 was conducted on a field (internal farm registration: lot nr 8) with a lime content of 0.1%, Pw-number 27, K-number 12, pH-KCl 6.4 and K-HCl 12 . The amount of nitrogen in the soil from 0 to 60 cm was 40 kg per ha at February 27. On March 14, 1989, 90 kg P_2O_5 and 240 kg K_2O per hectare were applied. The preceding crop in 1988 was sugar beet; after harvesting, their leaves were chopped and ploughed under.

Crop management, phenolgy and harvest dates
The field was prepared for sowing on April 1 with a rotor-harrow. Due to a lack of frost during winter, the soil structure for sowing was not excellent. On April 1, sown took place with an Øyord sowing machine, in rows spaced at 14 cm and at a seed rate 150 kg/ha. The seed was desinfected (Table 89-3). On April 15, 50 % of the plants had emerged. On June 6 the flag leaves were unfolded. The date of onset of flowering was June 20 (Table 89-4). The periodic harvests were carried out on April 25, May 9, May 23, June 6, June 20, July 4 and July 18. The separate ear samples were on June 12, July 11 and July 25 (Table 89-6). The final harvest took place on August 4, under good weather conditions.

Nitrogen dressings
The nitrogen dressings were applied with the Enti. The nitrogen start dressing (in N2), applied on May 2, was 50 kg N per ha (= 90 minus soil mineral nitrogen). The top dressing of 60 kg per ha was applied on June 1, at flag leaf stage.

Crop protection
On June 6, the crop was sprayed against aphids, mildew and rust. The summer of 1989 hardly showed any diseases. But because of the very mild winter, aphids survived on winter wheats and they spread barley yellow dwarf virus. Much damage was caused by this virus before the aphids were killed. For details about the disease control, see Table 89-3.

Additional information for experiment KS9003

Soil description
In 1990 the experiment was conducted on a field with a lime content of 0.1%, Pw-number 48, K-number 17, pH-KCl 6.5 and K-HCl 18 (internal farm registration: lot nr 2A). The preceding crop in 1989 was potato. After the 1989 harvest the soil was grubbed till 50 cm depth followed by a cultivation treatment. On November 30, 1989, after a night of frost, the soil was cultivated again. On December 4 1989, 100 kg P_2O_5 per hectare were applied. The amount of nitrogen in the soil from 0 to 60 cm was 40 kg per ha in the beginning of March.

Crop management, phenology and harvest dates
The field was prepared for sowing on March 15 with a rotor-harrow. The seed was desinfected (Table 90-3). On March 30, 50 % of the plants had emerged and emergence was completed on April 1. On May 25 the flag leaves were unfolded. The date of onset of flowering was June 12 (Tables 90-4, 90-5). On June 26 and 27, there were heavy thunderstorms, which caused serious lodging. Later during the season this lodging caused secondary growth (Table 90-18). In 1990, periodic harvests were carried out on April 17, May 2, May 15, May 19, June 12, June 26, July 11 and July 24. Separate samples for recording of ear filling were carried out on June 18, July 4, July 18 and August 1 (Table 90-6). The final harvest took place on August 2, under good weather conditions.

Nitrogen dressings
The nitrogen dressings were applied with the Enti. The first nitrogen dressing (in N2), applied on April 10, was 50 kg N per ha (= 90 minus soil mineral nitrogen). The top dressing of 60 kg per ha was applied on June 1, at flag leaf stage.

Crop protection
On April 24, a spraying took place against aphids, to prevent the crop from the barley yellow dwarf virus. Against weeds was sprayed on May 4, which proved to be very effective. Against mildew and other fungi diseases and aphids was sprayed on May 15. On June 26, a second spraying was carried out against aphids. The last spraying took place on July 11, against mildew and rust. For details about the disease control, see Table 90-3.

2.3 Detailed description of the experiment KG9104

Varieties
This experiment was performed with the spring barley variety Prisma.

Design and treatments
The experiment was layed out in a splitplot with four replicates (Fig. 91-20) with shading treatments in the plots and levels of nitrogen in the sub-plots. The shading treatments were:

no shading (S1); shading from starting of tillering to beginning of culm elongation (S2); shading from beginning of culm elongation to heading (S3); and shading from heading to the end of the grain filling period (S4)(Table 91-2). The shading was realised by placing shading nets in the field at 1.5 m above soil level. These shading nets reduced the level of radiation with about 60%. The three nitrogen levels were the same as in the previous experiments.

Whole-crop harvests
The area of the periodic harvests was 8 rows (0.96 m) of a length of 1.0 m. The crop was cut at soil level, with the exception of the first three harvests, where whole plants were harvested. Of the total harvested plant material, a sub-sample of about 100 g was taken for a total dry matter determination. A second aselect sub-sample was taken from the total harvested plant material and this was divided into green leaves, dead leaves, stems and sheaths, kernels and chaff. The leaf area, and fresh and dry weights of the different plant parts were recorded. For each plot the total fresh weight was measured. In this way the various weights of plant parts per unit soil area could be calculated.

Ear samples
During the kernel filling period, 20 main ears and 20 secondary ears were harvested and dried. These ears were analysed for number of kernels per ear and the weight and nitrogen content per kernel per position in the ear. The results of these measurements, which are carried out in co-operation with TNO-Agro-NIBEM, are published by Duijnhouwer et al. (1993).

Final harvest
The final samples were harvested by a combine harvester and kernel size distribution was determined (Tables 91-13 to 91-15). Sub-samples of the final harvest were analysed by TNO-Agro-NIBEM for 1000-kernel-weight and quality aspects for malting and brewing (Duijnhouwer et al., 1993).

Chemical analysis
The various plant parts were analysed for dry matter content, total nitrogen content and carbohydrate content (Tables 91-10, 91-11 and 91-16). The amount of mineral nitrogen in soil samples during the season was measured (Table 91-18).

Countings and phenology
The plant phenological development was recorded , using the Zadoks decimal code (DC) (Zadoks et al.,1974) and an apex development scale (Meurs & de Vos, 1992). This scale is explained in Table 91-21 and the results are in Table 91-4. The numbers of plants per m^2, tillers per plant, ears per m^2 and kernels per ear were counted on a couple of dates(Table 91-5). The number of primary and secondary tillers and culms were counted weekly, but these results are not included in this report. They will be analysed by Dr. L.F. D'Antuono (University of Bologna, Department of Agronomy, Via Filippo Re 6-8, 40126 Bologna, Italy).

Weather data
For weather data during the period of this experiment we refer to the CABO-DLO 'WEATHER' data bank (Ing. W. Stol).

Additional information for experiment KG9104

Soil description
The experiment of 1991 was conducted on a field with a lime content of 0.1%, Pw-number 60, K-number 18, pH-kaliumchloride 6.3 and K-HCl 20 (internal farm registration: lot nr. 8). The preceding crop in 1990 was potato. After harvesting the soil was grubbed till ca. 60 cm depth and shortly after that one cultivation took place after a night of frost. On January 17, 1991, 200 kg P_2O_5 per hectare were applied. On January 30, after a night of frost, the soil was cultivated again. The amount of nitrogen in the soil from 0 to 60 cm was 70 kg per ha at February 27.

Crop management, phenolgy and harvest dates
The field was prepared for sowing on March 16 with a rotorharrow. On March 16 sowing took place with a Hasia sowing machine, which is also used in common practice. The row spacing was 12 cm with a seed rate of 140 kg/ha. On March 30, 50 % of the plants had emerged and emergence was completed on April 2. On June 10, the flag leaves were unfolded. The date of onset of flowering was June 26 (Table 91-4). The periodic whole-crop harvests during the season were carried out on April 2, April 16, May 21, June 26 and July 29. The data at which these harvests took place, were chosen in such a way that they coincided as much as possible with the beginning and the end of the different shading treatments. The final harvest was on August 12, under good weather conditions, except treatment N3S3. This treatment was harvested on August 22, because of the delayed ripening of the crop.

Nitrogen dressings
The nitrogen dressing was applied with the Enti. The first (yearly) nitrogen dressing (in N2), applied on April 3, was 20 kg N per ha (= 90 minus soil mineral nitrogen). The top dressing of 60 kg per ha was applied on June 4, at the stage of stem elongation.

Crop protection
Because of the very wet month of June (114 mm) and probably also because of the high content of mineral nitrogen, the crop lodged early in season. Due to the shading treatments, the sensitivity of the crop for lodging and mildew increased. On May 13, a spraying took place to prevent the crop from lodging. Against weeds was sprayed on May 14. Against mildew and other fungi diseases and aphids was sprayed on June 24. The final spraying took place on July 10, against mildew and rust. For details about the disease control, see Table 91-3.

Table 1. General overview of the materials and methods of the field trials in 1989, 1990 and 1991

	1989	1990	1991
Registration	KS8902	KS9003	KG9104
Farm	De Bouwing	De Bouwing	De Bouwing
Varieties	Prisma, Golf	Prisma, Golf	Prisma
Treatments	N1, N2, N3	N1, N2, N3	S1, S2, S3, S4 over N1, N2, N3
Whole harvest	25/4, 9/5, 23/5, 6/6 20/6, 4/7, 18/7	17/4, 2/5, 15/5, 19/5, 12/6, 26/6, 11/7, 24/7	2/4, 16/4, 21/5, 26/6, 29/7
Ear harvest	12/6, 11/7, 25/7	18/6, 4/7, 18/7, 1/8	
Final harvest	4/8	2/8	12/8 and 22/8
Remarks	Main ears only	Main ears only	Aselect samples and main ears. Tiller dynamics by L.F. d'Antuono
NIBEM analysis	Global	Global	Detailed

3. Results

3.1 Effects of N-supply

The fertilized treatments N2 and N3 resulted in faster leaf growth (Fig. 1), a slightly higher LAI (Fig. 2) and about 3 t/ha higher *maximum* dry matter production (Fig. 3) than the untreated control N1. However, the effects of N-rate on *final* total dry matter production were small (Fig. 3). The effects on kernel yield were also small: in 1990 N3 showed a *maximum* kernel yield of 9 t/ha and N2 and N1 both 8 t/ha (Fig. 4). The differences in *final* kernel yields between the N-treatments were almost negligible (Fig. 4).

A higher N-rate resulted in a strong increase in the number of culms per m^2 already early in the season but had no effect on the number of kernels per ear (Table 2 on page 15). This resulted thus in a remarkably increase in the number of kernels per m^2 (Table 2). As the seed yield per ha hardly differed, the highest N-rate showed the lowest average kernel weight, which was 40 mg per kernel in 1990 (Fig. 5), with a maximum of 37% in the size-class of 2.5-2.8 mm (Fig. 6). At the lowest N-rate, the thickest kernels were found: 50 mg per kernel in 1990 (Fig. 5), with a maximum of 35 % in the class > 3 mm (Fig. 6).

A higher N-rate delayed the decrease in N-concentration in the stems and leaf sheaths (Fig. 7) and in the leaf blades (Fig. 8) and accelerated the increase in N-concentration in the kernels (Fig. 9). Therefore, the final crude protein content in the kernels of the highest N-rate (in 1990: 16%) was far too high for the qualification of malting barley (maximum 11.5%). N2 and N1 qualified with values of 11% and 10 %, respectively (Fig. 9).

Finally, a higher N-rate resulted in lower contents of soluble carbohydrates, especially in stems and sheaths (Fig. 10). In 1990 this content increased up to 325 g kg^{-1} in the non-fertilized control N1; in N2 the content was generally 50 g kg^{-1} lower. The N-top dressing in N3 resulted again in a decrease in 50 g kg^{-1}. The N-rate had no effect on the course of the soluble carbohydrates content in the kernels (Fig. 11).

These effects of N-rate were almost identical in the experiments of 1989 and 1991. In the experiment of 1990, a higher N-rate also resulted in more serious lodging and more immature green stems at the end of the season (see also Table 90-18).

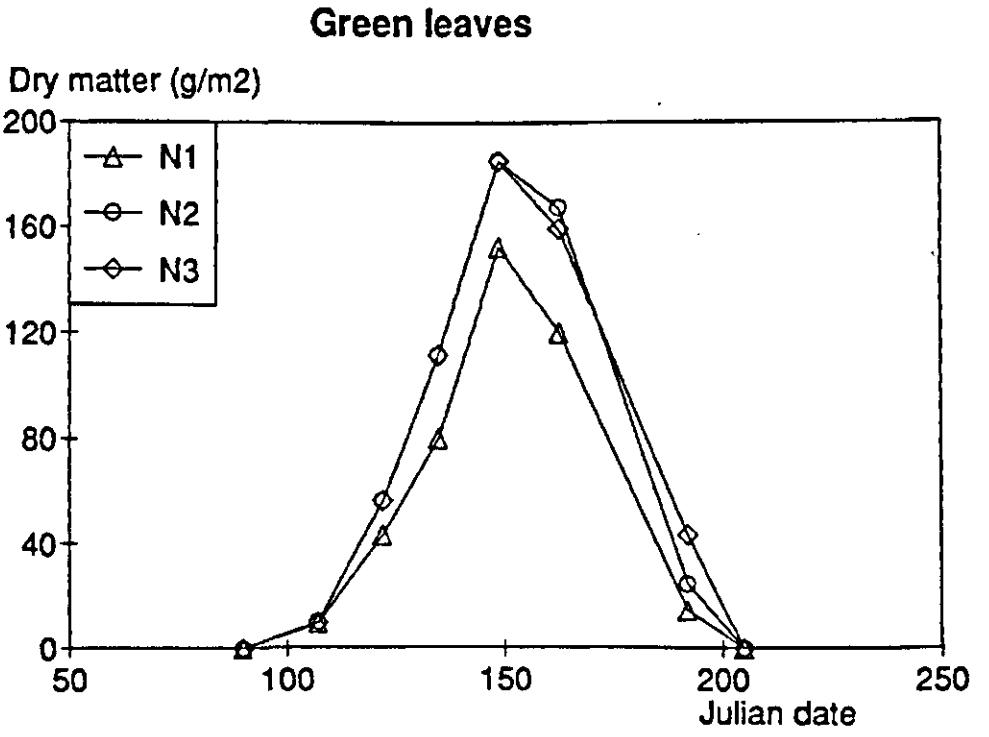

Figure 1 The effect of nitrogen supply on the dry matter production of green leaves of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

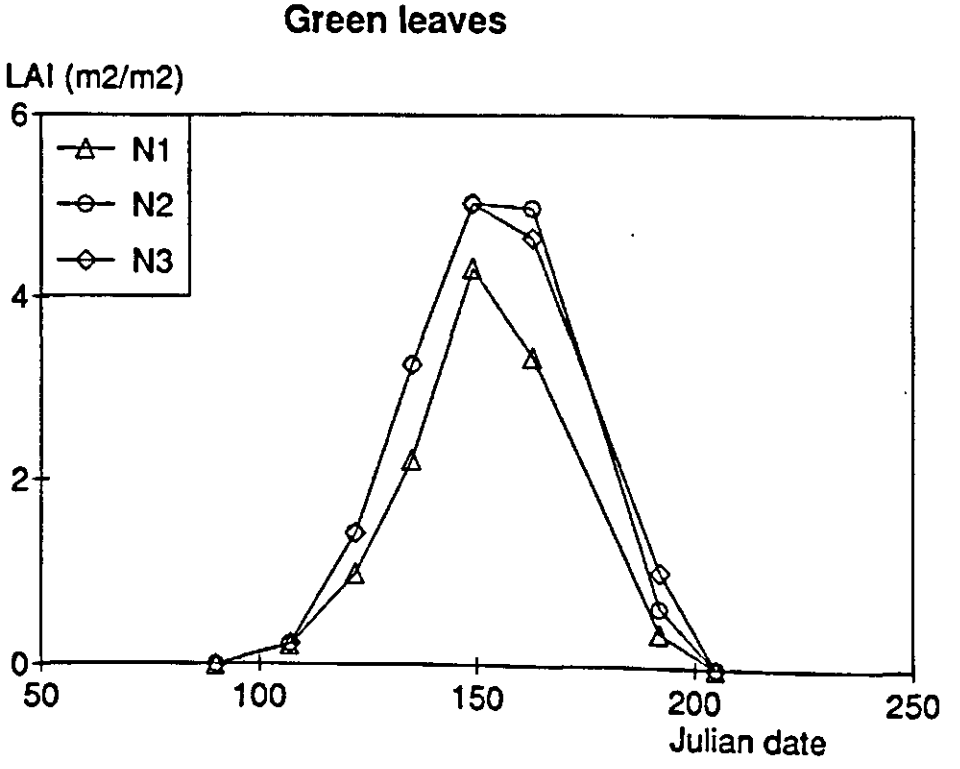

Figure 2 The effect of nitrogen supply on the leaf area index (LAI) of green leaves of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

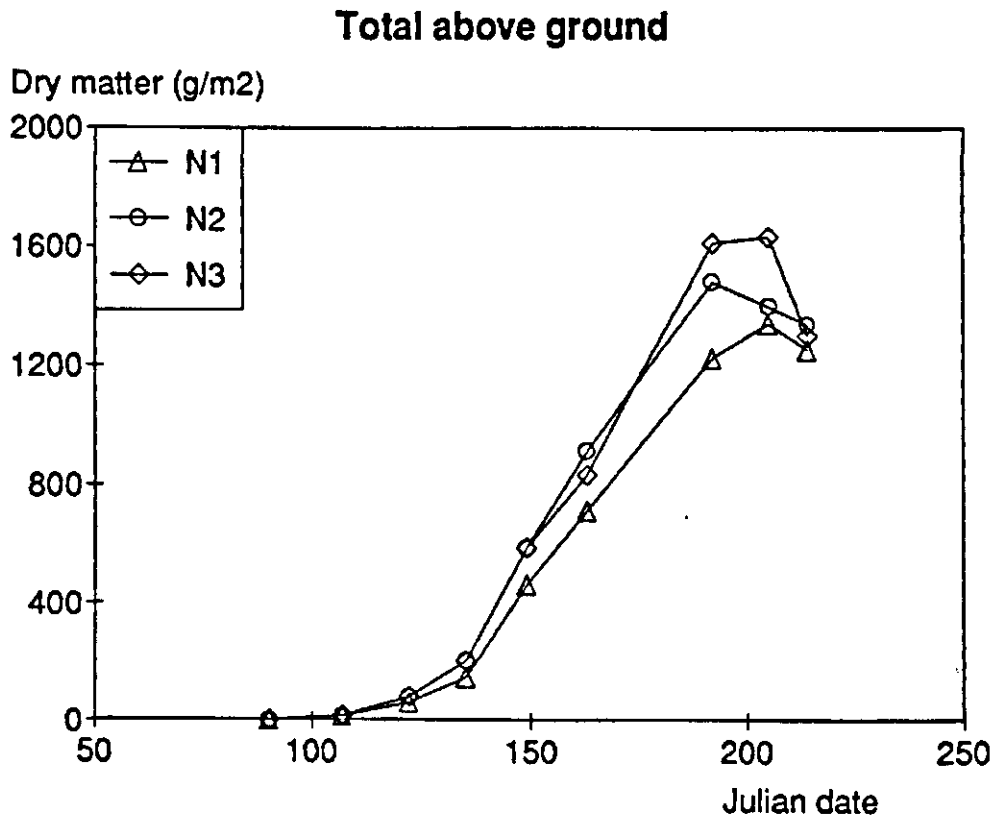

Figure 3 The effect of nitrogen supply on total above ground biomass of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; N-rates see Table 90-2).

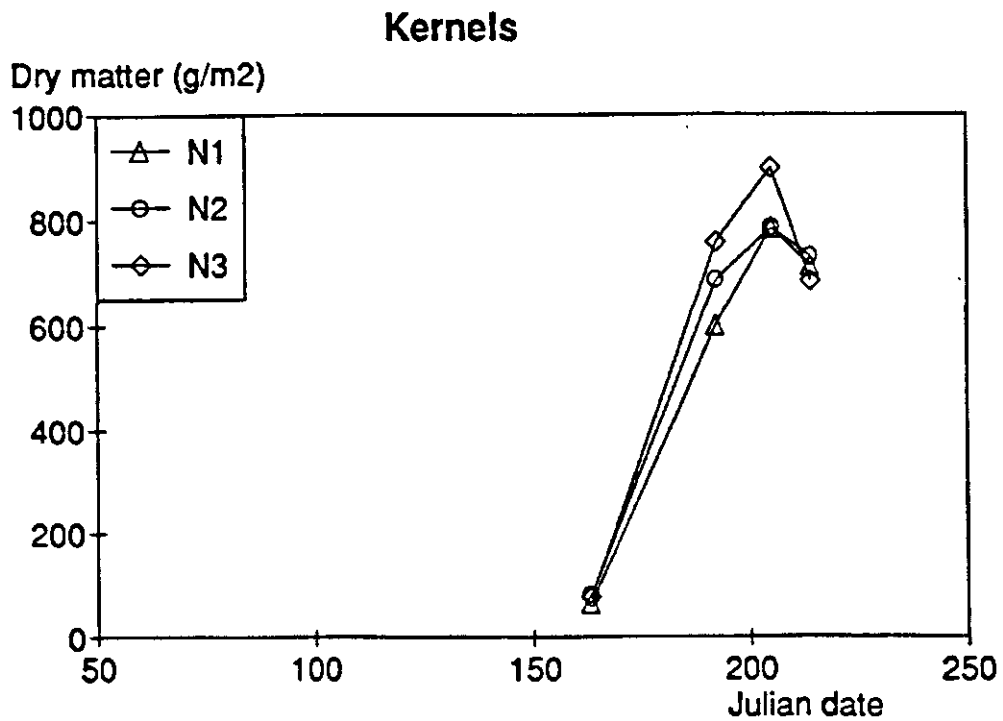

Figure 4 The effect of nitrogen supply on kernel yield of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

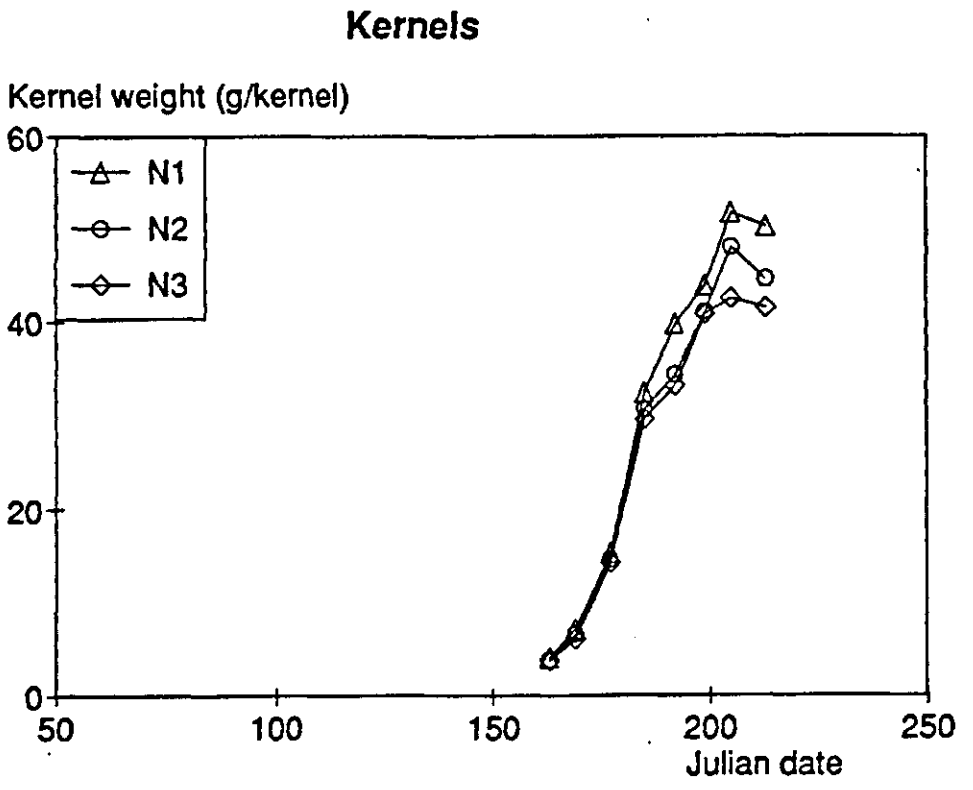

Figure 5 The effect of nitrogen supply on the weight of individual kernels of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

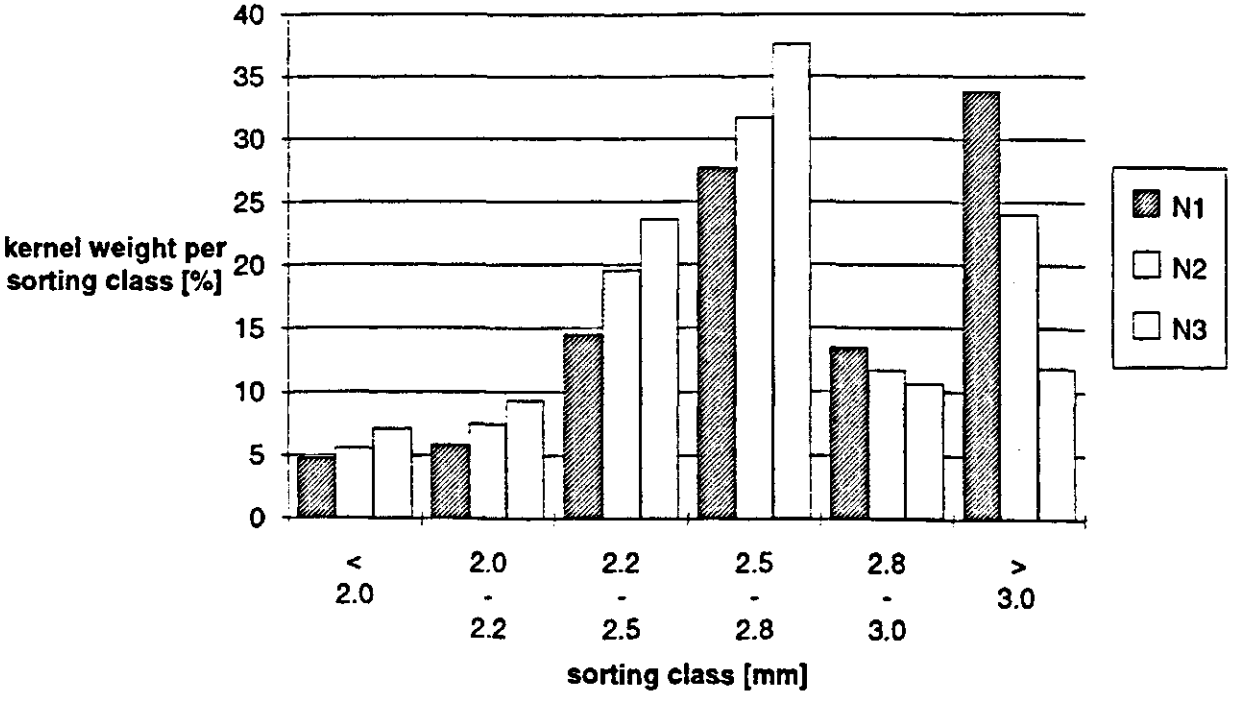

Figure 6 The effect of nitrogen supply on the kernel size distribution of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

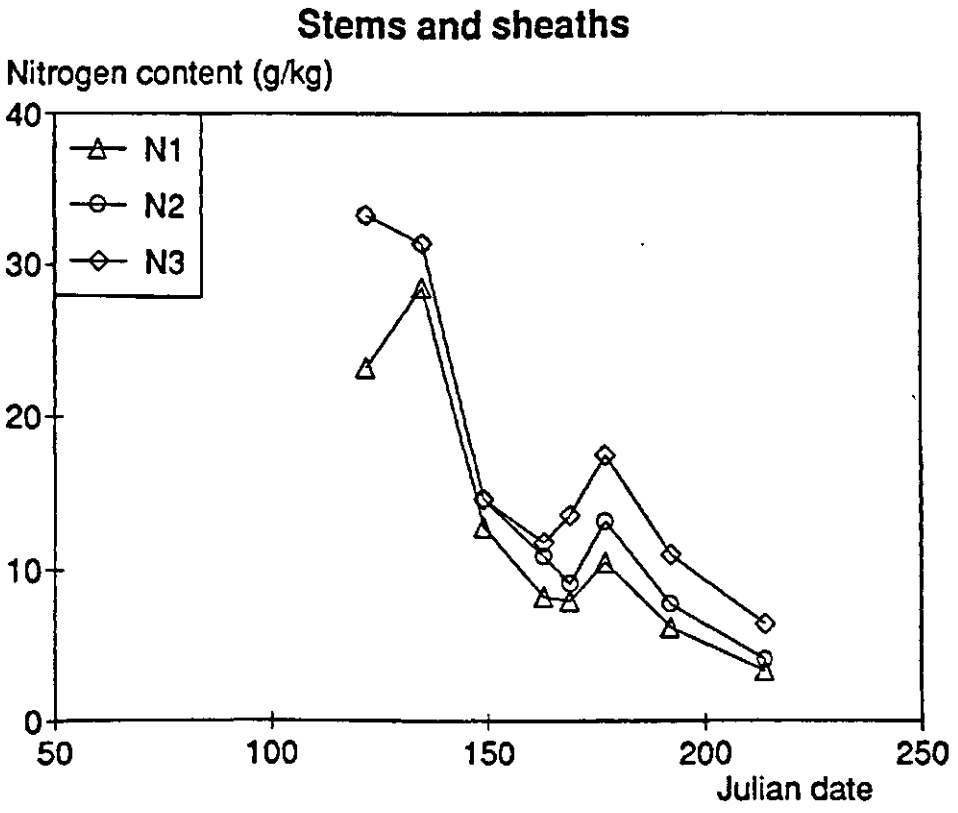

Figure 7 The effect of nitrogen supply on the nitrogen content of stems and sheaths of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

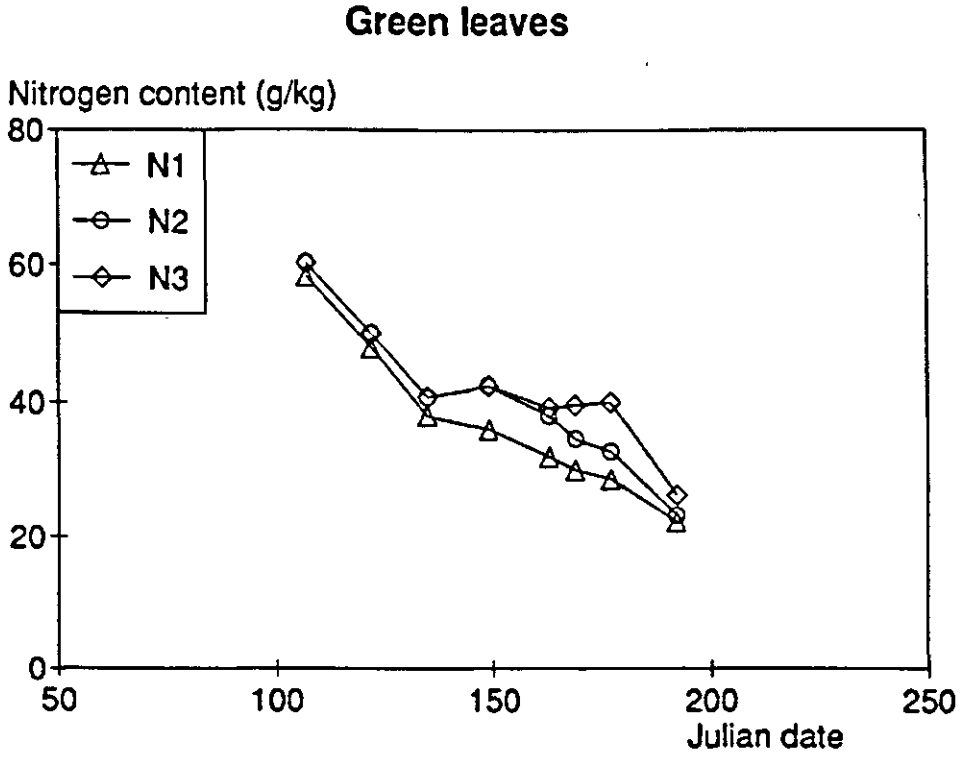

Figure 8 The effect of nitrogen supply on the nitrogen content of green leaves of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

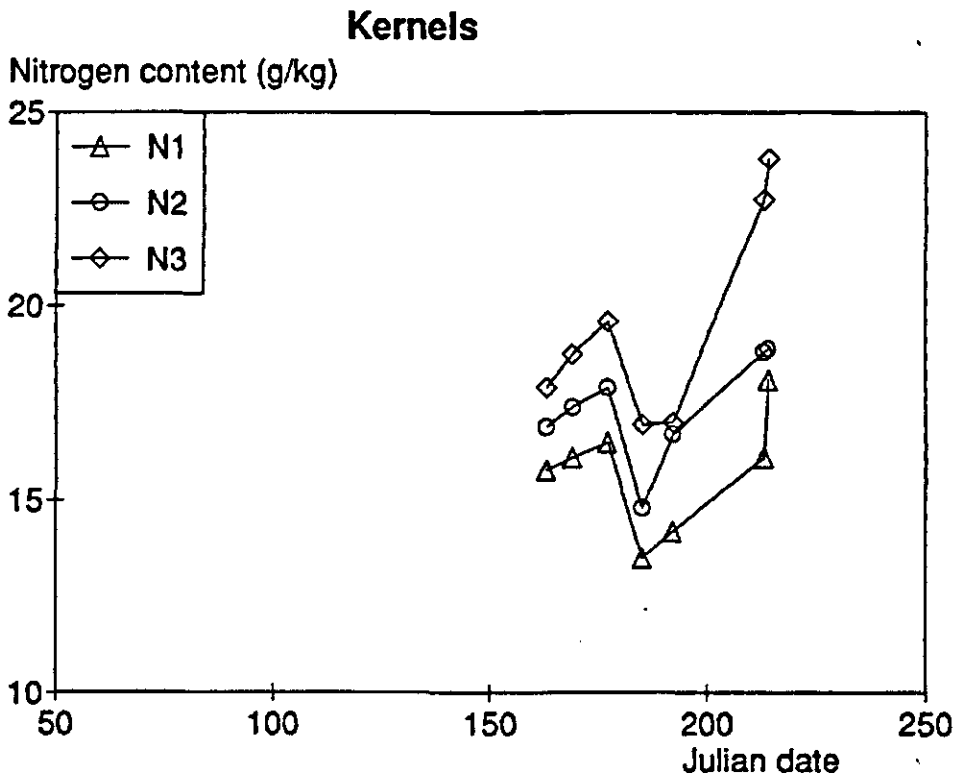

Figure 9 The effect of nitrogen supply on the nitrogen content of the kernels of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

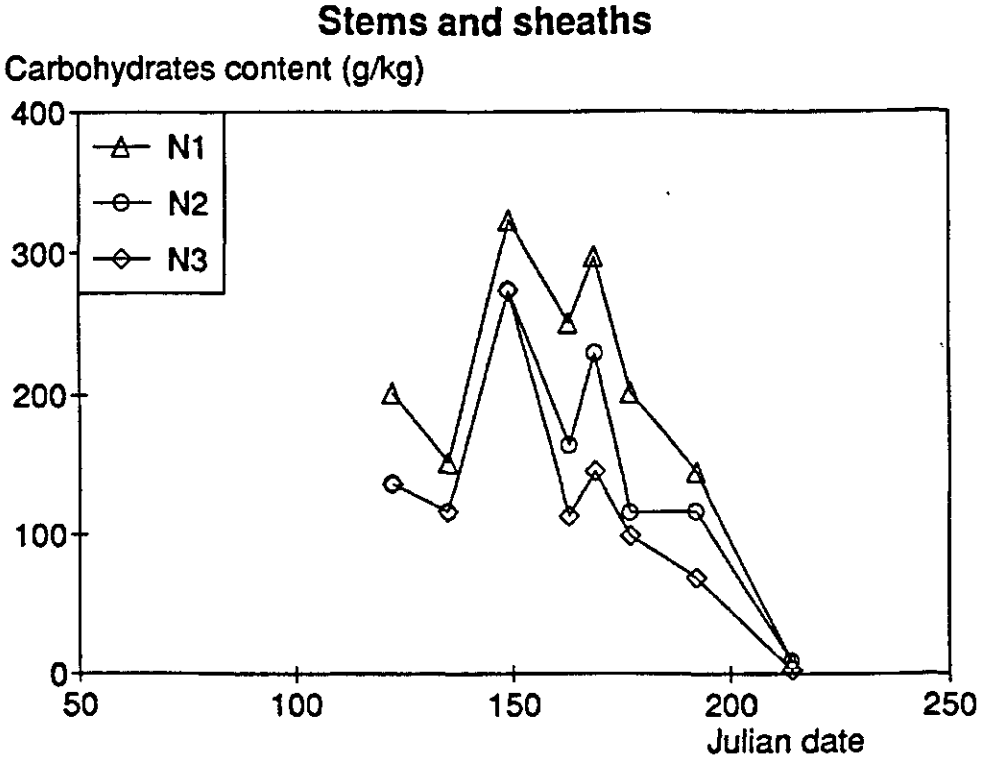

Figure 10 The effect of nitrogen supply on the content of carbohydrates of the stems and sheaths of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2).

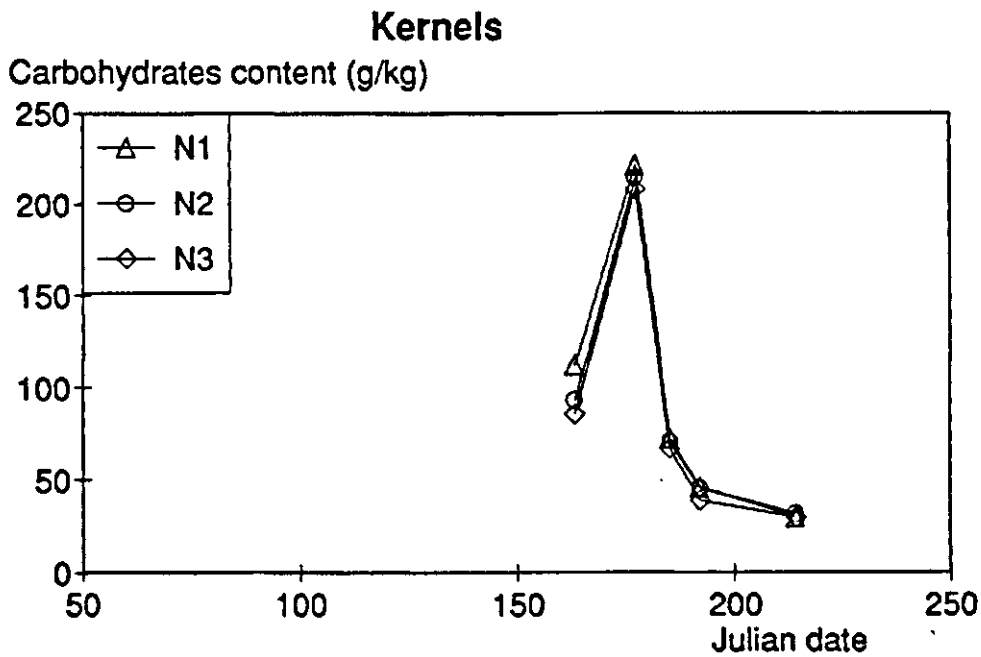

Figure 11 The effect of nitrogen supply on the content of carbohydrates of the kernels of malting barley (cv Prisma) during the growing season of 1990.
(Experiment KS9003; for N-rates see Table 90-2),

Table 2 Dynamics of organ formation. Number of plants per m^2, tillers per plant, tillers per m^2, kernels per ear and kernels per m^2 at different harvest dates (T1-T9) for three different nitrogen supply treatments (N1-N3) in malting barley (cv Prisma) in 1990.
Numbers between [ ]: countings of aselect samples of ears; other numbers from countings of main ears.
(Experiment KS9003; for N-rates see Table 90-2).

N-supply		Date and harvest number					
		17/4	15/5	29/5	12/6	2/8	
		T1	**T3**	**T4**	**T5**	**T9**	
plants/m^2		290					
tillers/plant	N1		5	3			
	N2		4	3			
tillers/m^2	N1				750	725	[650]
	N2				860	850	[780]
	N3				950	975	[850]
kernels/ear	N1				27	25	[22]
	N2				27	25	[21]
	N3				26	25	[22]
kernels/m^2	N1					14300	
	N2					16380	
	N3					18700	

3.2 Effect of shading period

The early shading treatment S2 resulted in a small positive effect on the growth of the leaves (Fig. 12) and leaf area index (LAI) (Fig. 13) and in a higher specific leaf area (SLA) (Fig. 14). After finishing this treatment, the SLA of S2 became equal to that of the unshaded control S1. Shading during stem elongation (S3), also resulted in a higher SLA. In general, shading resulted in very large effects on dry matter production (Fig. 15) and ear yields (Fig. 16); the final yields were lower when shading took place later in the season. In the sequence S1-S4 the final ear yields were 8.5, 7.5, 6 and 4.5 t/ha, respectively (Fig. 16).

Shading during tillering (S2) had little effect on the dynamics of organ formation and final kernel yield. In contrast, shading during stem elongation (S3) resulted in a halving of the number of kernels per ear (Table 91-5) and led to a kernel distribution with 40% of the kernels larger than 2.8 mm (Fig. 17). Shading during kernel filling (S4) resulted in a lower rate of kernel filling; the kernel size distribution was thus very fine with 65% of the kernels thinner than 2.2 mm (Fig. 18).

Shading during tillering or during stem elongation showed an increased N-content in stems and leaf sheaths (Fig. 19) and leaf blades (Fig. 20), and had little effect on N-contents in the kernels (Fig. 21). Shading during kernel filling had no effect on the N-content in the vegetative parts (Figs 19 and 20) but showed a strong positive effect on N-content in the kernels which increased to 35 g kg^{-1}, resulting in a protein content of 22% (Fig. 21).

The soluble carbohydrate content in the vegetative parts was lowered with 50 g kg^{-1} by shading during tillering or during stem elongation, compared with the unshaded control (Figs 22 and 23). In contrast, shading during kernel filling had no effect on these contents (Figs 22 and 23). In general, shading had little effect on the course of soluble sugars in the kernels. Only shading during stem elongation slightly delayed the decrease in this content.

4. Conclusions

The effects of nitrogen dressing on growth and yield were not large, probably as the Nmin contents of the soil (40 kg N/ha in 1989 and 1990 and even 70 kg N/ha in 1991) were rather high. Nevertheless, high fertilizer applications resulted in a decrease in mean kernel weight and a concomitant increase in protein content, which both affect brewing quality negatively. The lower carbohydrate content in stems and sheaths with higher nitrogen dressings is explained by an increased use of reserves for vegetative growth. An important part may be invested in secondary growth, which will result in a heterogeneous crop. High nitrogen rates on these type of clay soils have to be avoided in brewing barley, even if the total nitrogen dressing is split in two applications.

Shading had large effects on kernel yield and kernel quality, and the effects depended on the period of shading. Shading during stem elongation was disadvantageous for kernel yield, but resulted in large grains, which is a positive quality aspect. Shading during kernel filling resulted in very low yields, with a very low quality: small grains and an extremely high protein content. In further modeling research, the consequences of these experimental results for growth and kernel filling under periods with natural light reduction (dark weather conditions) have to be evaluated. In general, the detailed measurements proved to be suited data sets for the validation of the simulation model. The results of this validation will be published in scientific journals. Besides this, seed material of the shading experiment has been used for a study on the effect of kernel filling on a set of malting/brewing quality aspects of the wort. The results of these micro-malting experiments have been published by Duijnhouwer et al. (1993).

For future use, the results of the field trials of this report are documented in detail in the Tables of the appendices.

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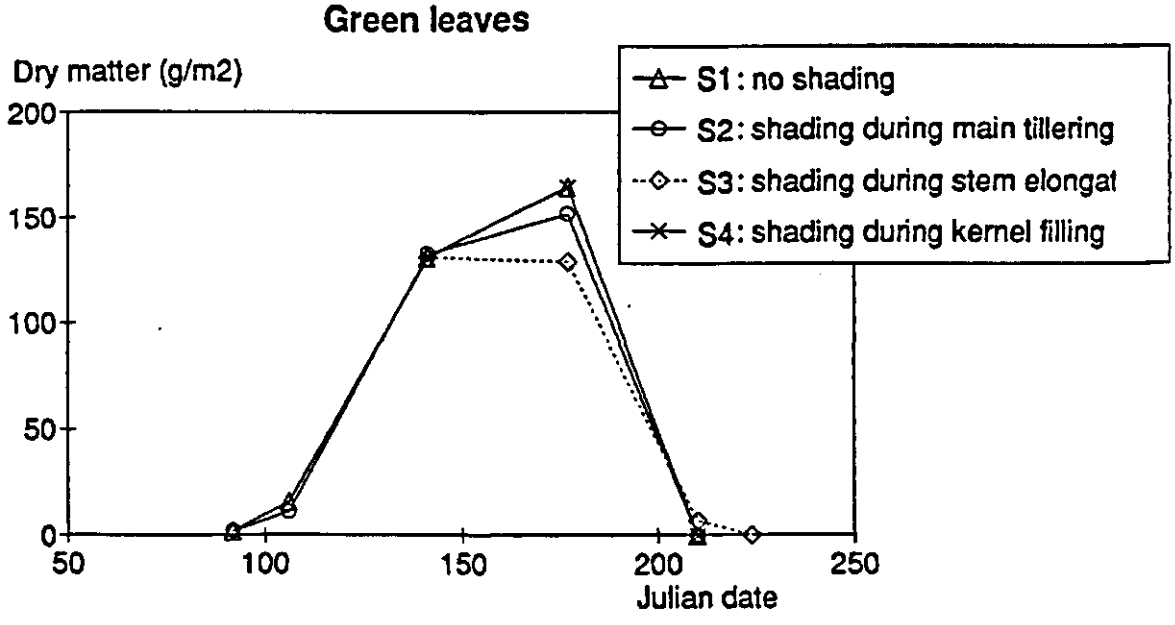

Figure 12 The effect of shading period on the dry matter production of green leaves of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

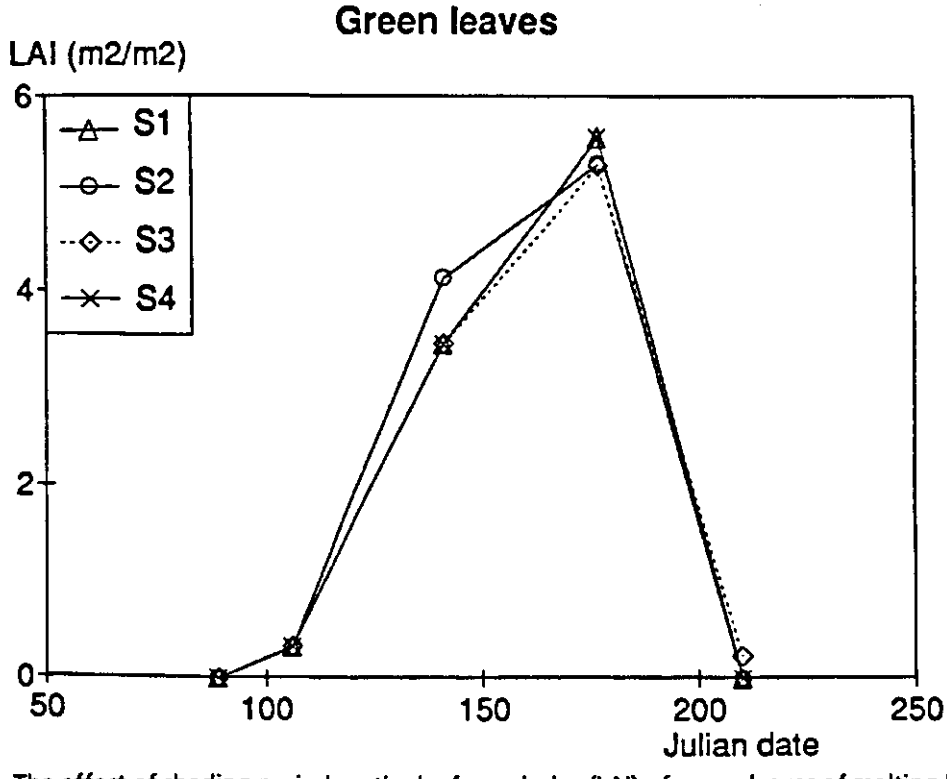

Figure 13 The effect of shading period on the leaf area index (LAI) of green leaves of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

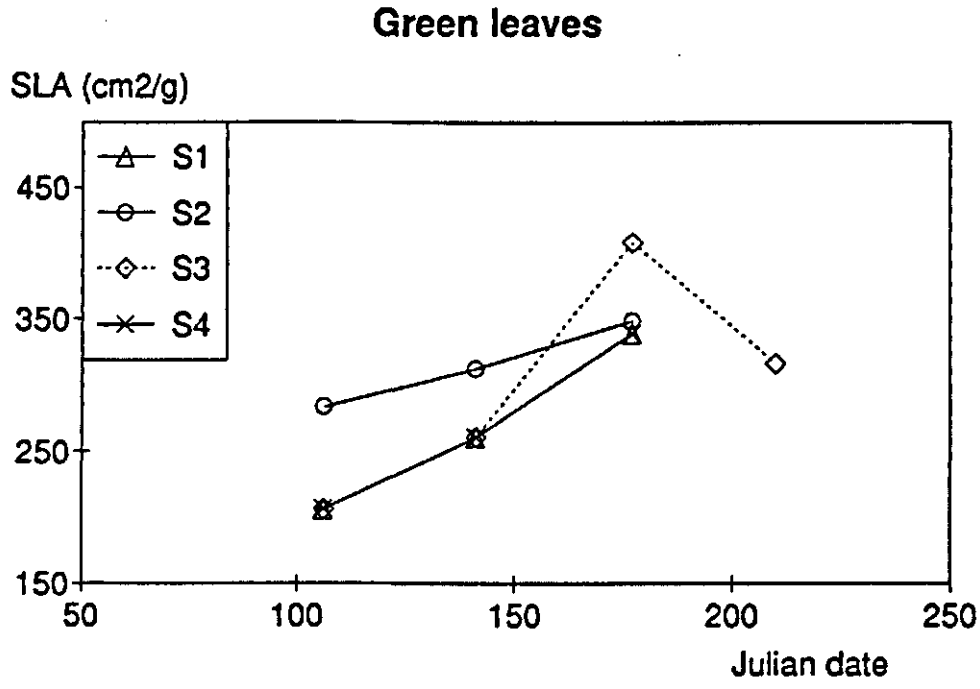

Figure 14 The effect of shading period on the specific leaf area (SLA) of green leaves of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

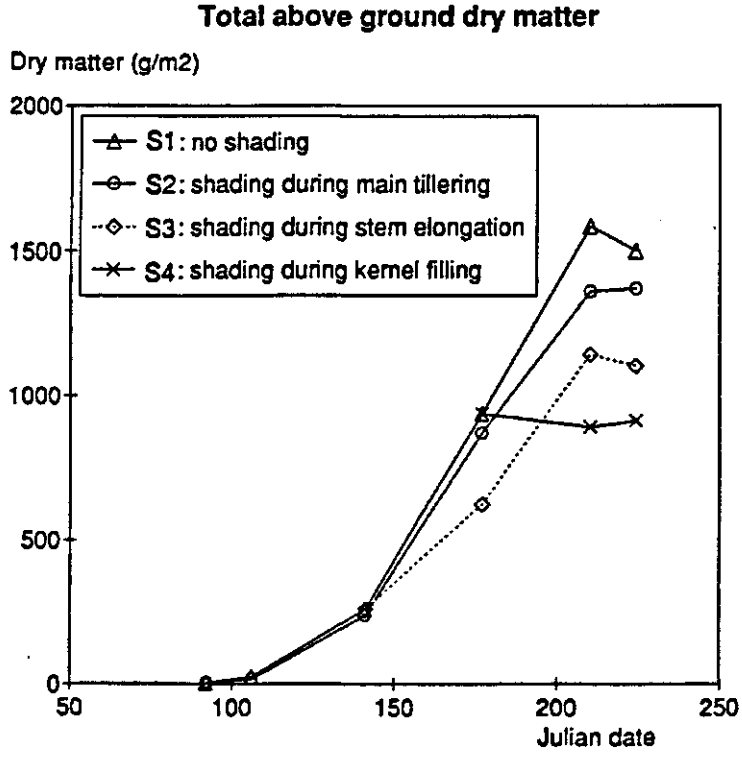

Figure 15 The effect of shading period on the total above ground dry biomass of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

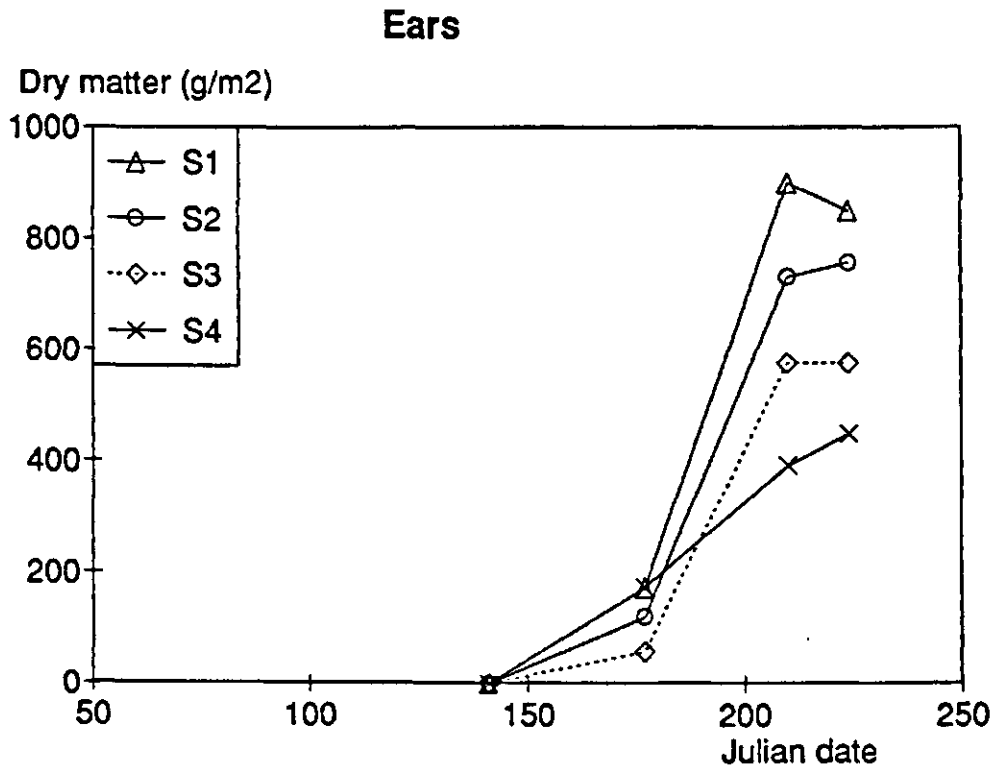

Figure 16 The effect of shading period on the dry matter yields of the ears of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

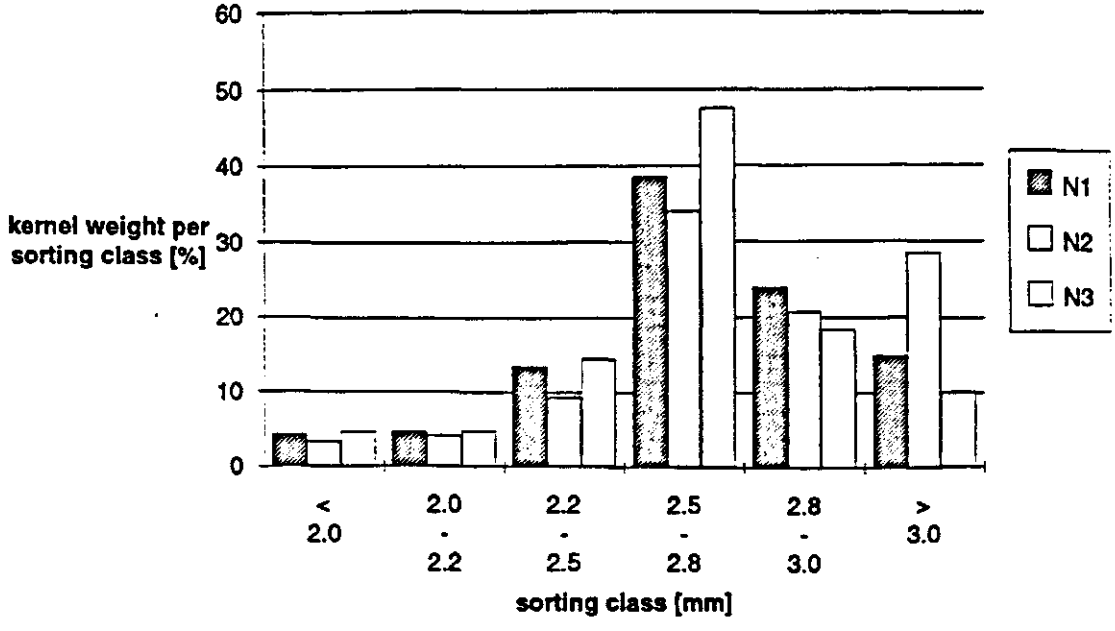

Figure 17 The effect of shading during stem elongation (S3) on the kernel size distribution of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods and N-rates: see Table 91-2).

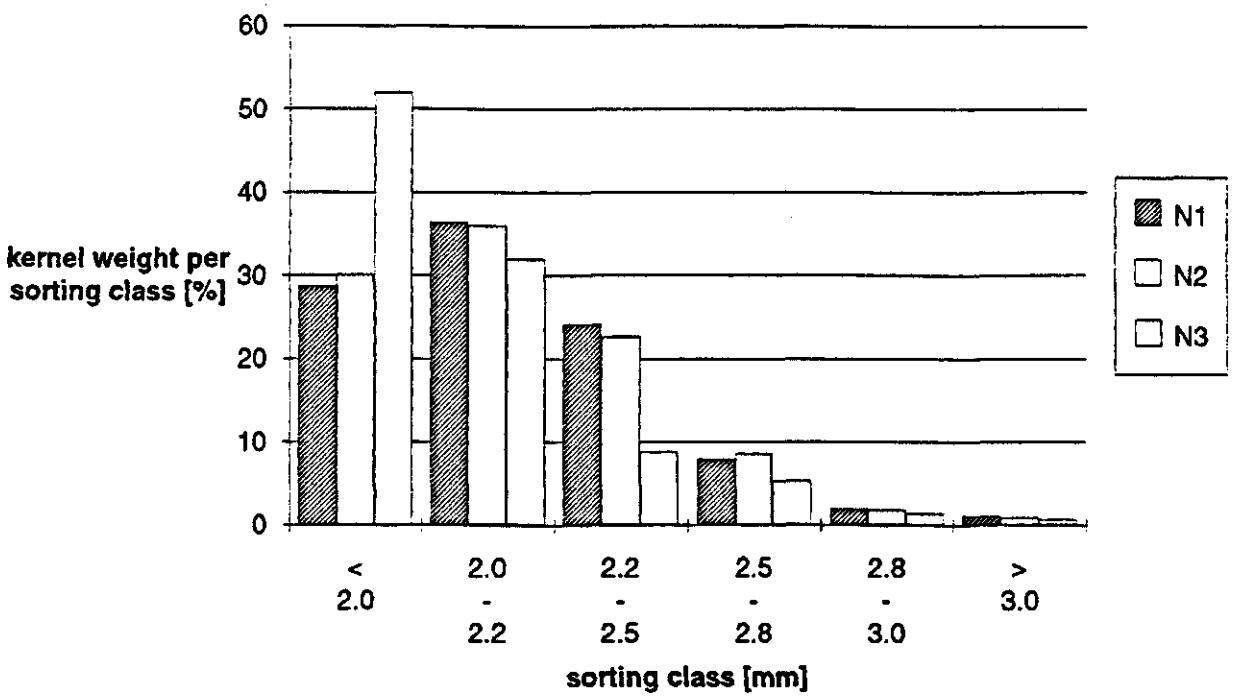

Figure 18 The effect of shading during kernel filling (S4) on the kernel size distribution of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of N-rates and shading periods: see Table 91-2).

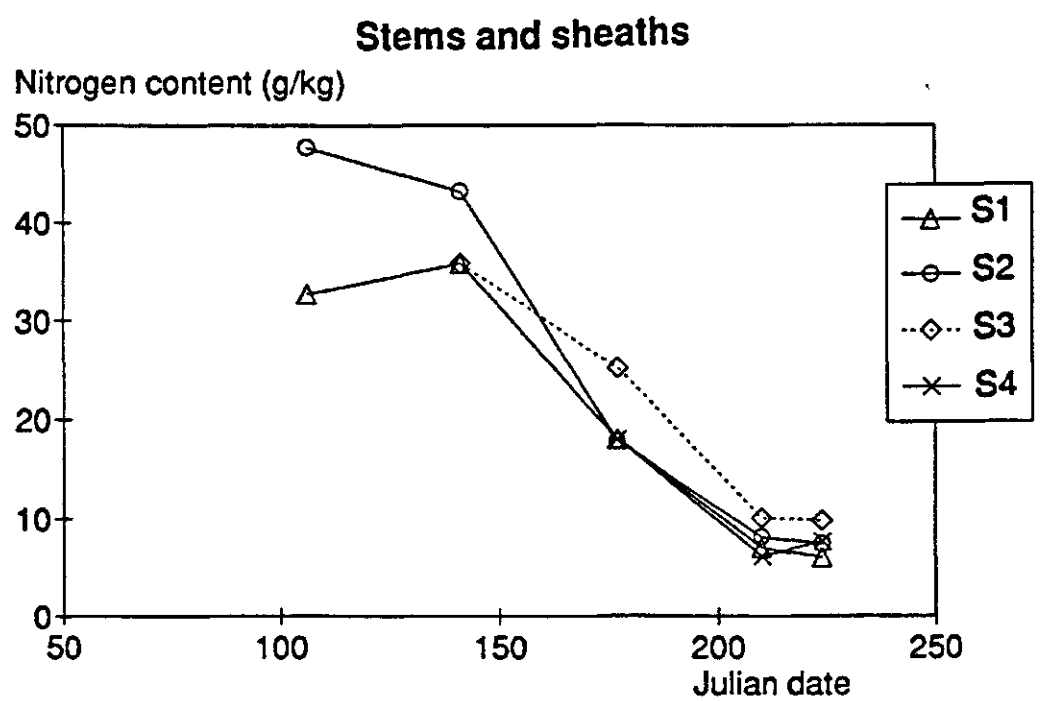

Figure 19 The effect of shading period on the nitrogen content of stems and sheaths of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

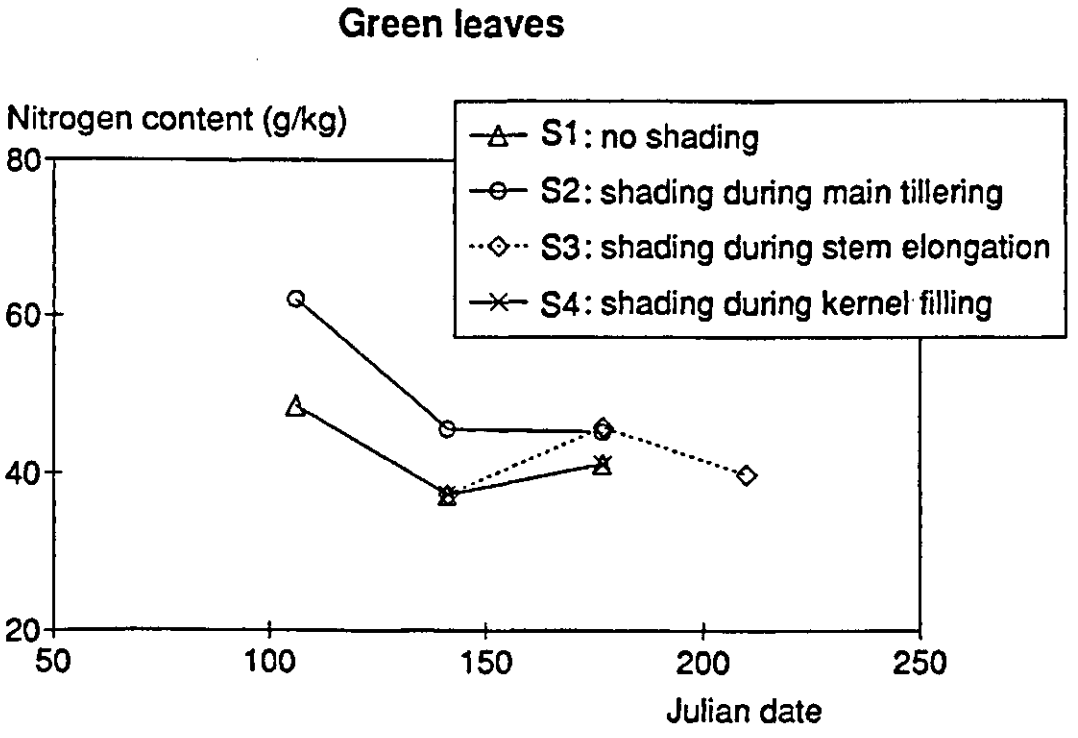

Figure 20 The effect of shading period on the nitrogen content of green leaves of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

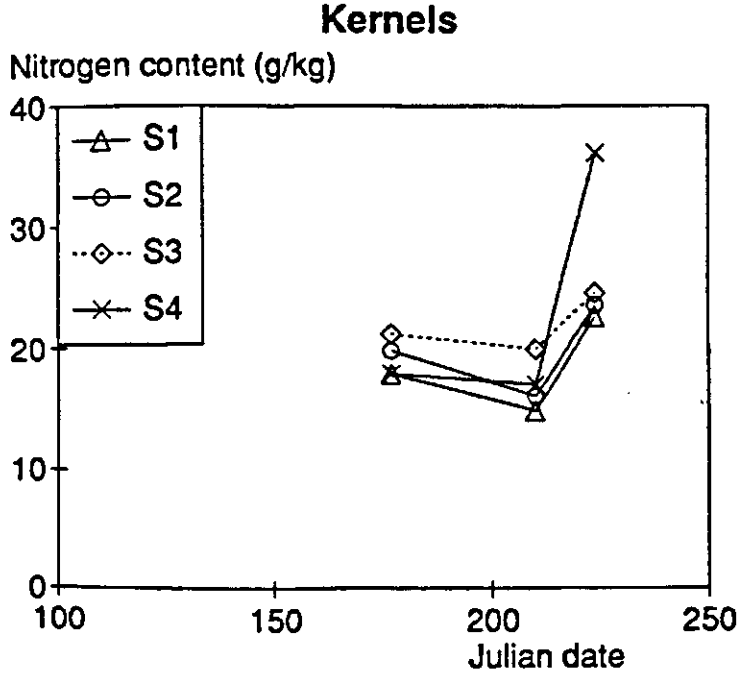

Figure 21 The effect of shading period on the nitrogen content of the kernels of malting barley (cv Prisma) in the growing season of 1991.
((Experiment KG9104; for description of shading periods see Table 91-2b).

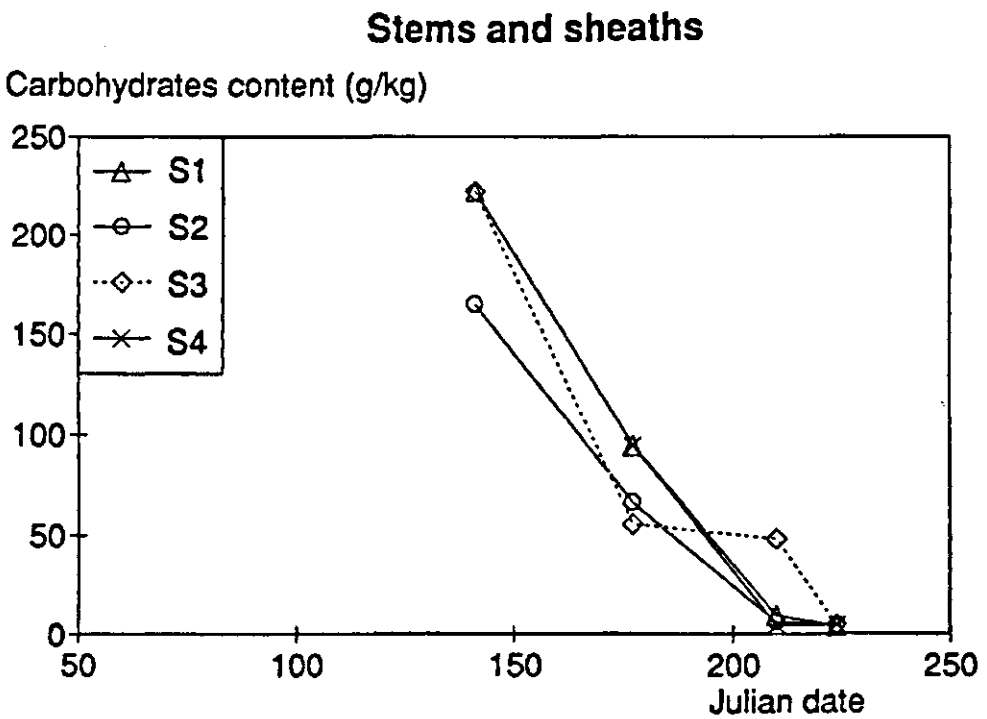

Figure 22 The effect of shading period on the content of carbohydrates of the stems and sheaths of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

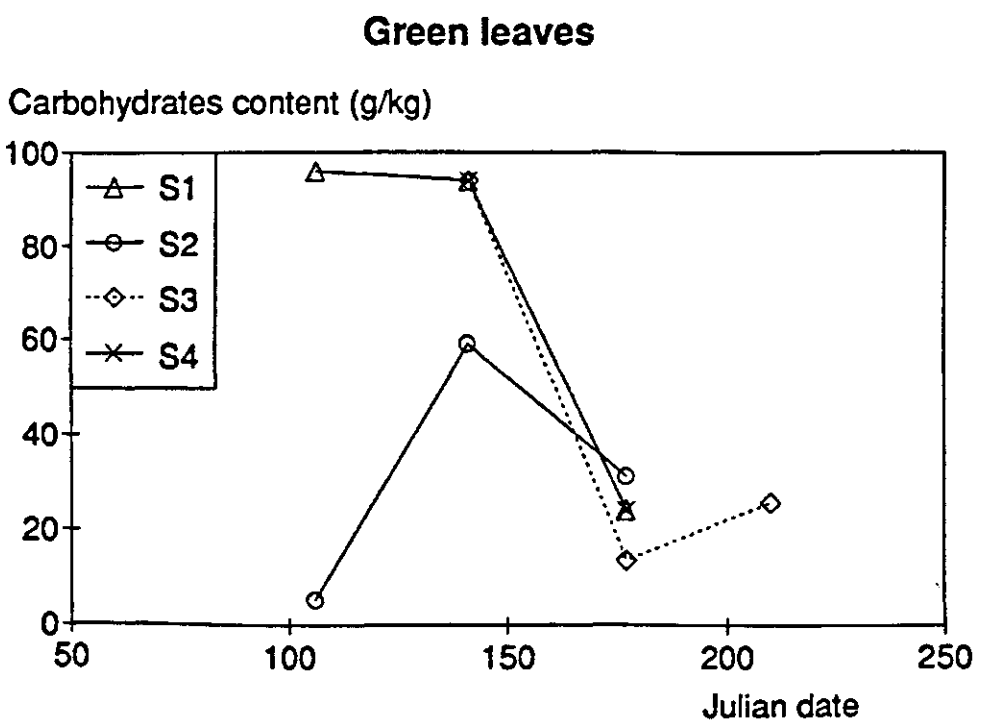

Figure 23 The effect of shading period on the content of carbohydrates of the green leaves of malting barley (cv Prisma) in the growing season of 1991.
(Experiment KG9104; for description of shading periods see Table 91-2b).

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89-10c. Treatment N3, cv. Prisma
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Table 89-11. **Specific leaf area (SLA)**
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89-12f. Treatment N3, cv. Golf

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89-13e. Treatment N2, cv. Golf
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Table 89-14. **Nitrogen distribution and nitrogen content in green leaves and dead leaves**
At different harvest dates nitrogen content and amount in total green leaf, total dead leaf, flagleaf, leaf 2, leaf 3, leaf 4 and leaf 5
The leaves are numbered from the top down
89-14a. Treatment N1, cv. Prisma
89-14b. Treatment N2, cv. Prisma
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Table 89-1. General information

	KS8902
Location	: Randwijk Experimental farm 'De Bouwing' lot no. 8
Barley varieties	: Prisma, Golf
Sowing date	: 1th of April 1989
Soil type	: Clay
Percentage silt	: 60%
Row spacing	: 14 cm
Previous crop	: Sugarbeets, leaves plought under.
Sowing density	: 310 seeds/m²

Table 89-2. Treatments: Nitrogen dressings (kg/ha)

Mineral nitrogen (890227)(0-60 cm) : 40 kg/ha

treatment	date (yymmdd)		total (incl. N min)
	890502	890601	
N1	0	0	40
N2	50	0	90
N3	50	60	150

Table 89-3. Crop protection treatments

date yymmdd	protection agent	active ingredient	amount
-	Panoctin Plus	guazatine; imazalil	2 ml/kg zaad
890606	Pirimor	pirimicarb	0.5 kg/ha
	Corbel	fenpropimorf	1.0 kg/ha

Table 89-4. Crop development description for main stem.

Table 89-4a. Treatment N1, cv. Prisma.

date yymmdd	number of defolded leaves	DC (Zadoks)	apex development	number of total primordia	number of leaf primordia
890425	1.2	11.2	3	10.5	
890502	1.4	20.3	4	17.9	13.0
890509	2.9	22.5	5	30.5	10.3
890516	4.0	23.2			
890523	5.7	23.0 - 32.0	12		8.5
890530	8.1	33.0	12		8.5
890607	8.4	33.0 - 42.0	13		

Table 89-4b. Treatment N2, cv. Prisma.

date yymmdd	number of defolded leaves	DC (Zadoks)	apex development	number of total primordia	number of leaf primordia
890509	2.9	22.3	5	29.5	10.3
890523	5.5	23.8 - 32.0	11		8.3
890530	7.5	33.5	12		8.5
890607	8.1	32.9 - 42.3	13		

Table 89-4c. Treatment N1, cv. Golf.

date yymmdd	number of defolded leaves	DC (Zadoks)	apex development	number of total primordia	number of leaf primordia
890425	1.7	11.7	3	10.0	
890502	1.2	20.4			
890530	7.6	32.9	13		7.8
890607	7.7	33.0 - 40.8	14		

Table 89-4d. Treatment N2, cv. Golf.

date yymmdd	number of defolded leaves	DC (Zadoks)	apex development	number of total primordia	number of leaf primordia
890530	7.9	32.8	13		7.8
890607	7.8	33.0 - 41.5	14		

Table 89-5. Crop development and crop description.

Table 89-5a. Treatment N1, cv. Prisma.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	plant lenght [cm]	tiller density [tillers.m-2]
890415		10					
890425	1.2	11.2	256				
890502	1.4	20.3		0.3			
890509	2.9	22.5	238	2.5			
890516	4.0	23.2		3.2			
890523	5.7	23.0 - 32.0	278	3.0		34.6	
890530	8.1	33.0		2.6		48.9	
890607	8.4	33.0 - 42.0		2.1		47.0	
890612		49					
890620		65					
890627					23.7		
890704		77			24.0		
890711		85			23.9		
890718					22.8		
890725					23.1		
890804		92			21.1		749

Table 89-5b. Treatment N2, cv. Prisma.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	plant lenght [cm]	tiller density [tillers.m-2]
890509	2.9	22	283	2.3			
890523	5.5	23.8 - 32.0	285	3.8		33.7	
890530	7.5	33.5		3.1			
890607	8.1	32.9 - 42.3		3.4		49.2	
890613	8.4	34.2 - 47.5		3.7		66.8	
890620		65		2.8		79.8	
890627					23.6		
890704					24.2		
890711					24.8		
890718					22.0		
890725					23.2		
890804		92			20.9		823

Table 89-5. (continued) Crop development and crop description.

Table 89-5c. Treatment N3, cv. Prisma.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	plant lenght [cm]	tiller density [tillers.m-2]
890627					23.6		
890704					23.7		
890711					24.0		
890718					21.5		
890725					23.3		
890804		92			20.8		921

Table 89-5. (continued) Crop development and crop description.

Table 89-5d. Treatment N1, cv. Golf.

date yymmdd	number of defolded leaves per main stem	DC	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	plant lenght [cm]	tiller density [tillers.m-2]
890415		10					
890425	1.7	11.7	284				
890509			327				
890530	7.6	32.9		1.9		44.8	
890607	7.7	33.0 - 40.8		2.5		42.6	
890620		65					
890627					22.1		
890704					21.4		
890711					22.4		
890718					20.7		
890725					21.6		
890804		92			20.0		886

Table 89-5e. Treatment N2, cv. Golf.

date yymmdd	number of defolded leaves per main stem	DC	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	plant lenght [cm]	tiller density [tillers.m-2]
890509			310				
890530	7.9	32.8		3.0		46.0	
890607	7.8	33.0 - 41.5		3.5		44.8	
890613	7.8	34.1 - 50.3		4.6		67.0	
890620		65					
890627					21.6		
890704					21.6		
890711					22.5		
890718					21.7		
890725					21.8		
890804		92			18.9		871

Table 89-5. (continued) Crop development and crop description.

Table 89-5f. Treatment N3, cv. Golf.

date yymmdd	number of defolded leaves per main stem	DC	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	plant lenght [cm]	tiller density [tillers.m-2]
890627					21.8		
890704					21.6		
890711					22.2		
890718					21.3		
890725					21.7		
890804		92			18.9		1094

Table 89-6. Harvest data.

date yymmdd	harvest number	ear harvest number
890425	T1	
890509	T2	
890523	T3	
890606	T4	
890620	T5	
890627		T5a
890704	T6	
890711		T6a
890718	T7	
890725		T7a
890804	T8	

Table 89-7. Starting position of the sowing seed.

cultivar	1000 - kernel-weight [gr]	dry matter [%]
Prisma	47.51	89.39
Golf	45.08	89.22

Table 89-8. Dry matter distribution.

Table 89-8a. Treatment N1, cv. Prisma.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
890425	2.98	2.98	0.00	1.77			
890509	28.90	23.67	0.00	7.19	5.23		
890523	187.54	114.10	5.10	33.99	68.35		
890606	442.34	132.55	17.37	40.22	292.42		
890620	877.51	115.23	9.18		486.82	122.08	144.20
890704	1074.06	46.98	34.33		432.13	104.06	456.56
890718	1420.06	0.00	67.66		407.16	149.23	796.00
890804	1025.87	0.00	43.29		280.89	110.56	591.13

Table 89-8b. Treatment N2, cv. Prisma.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
890509	31.40	25.05	0.00	8.55	6.35		
890523	187.26	115.80	4.41	31.69	67.04		
890606	429.26	129.41	17.39	43.95	282.47		
890620	923.76	127.15	9.81		506.82	128.95	151.04
890704	1331.71	74.94	30.96		503.00	158.66	564.16
890718	1539.29	0.00	83.19		434.91	154.85	866.35
890804	1043.66	0.00	36.22		275.51	111.59	620.34

Table 89-8c. Treatment N3, cv. Prisma.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
890620	935.79	139.90	12.46		503.65	136.16	143.63
890704	1277.80	83.73	29.48		493.54	132.71	538.35
890718	1643.72	0.00	89.86		477.44	171.41	905.01
890804	1065.15	0.00	55.32		277.27	111.13	621.43

Table 89-8. (continued) Dry matter distribution.

Table 89-8d. Treatment N1, cv. Golf.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
890425	3.47	3.47	0.00	2.21			
890509	36.57	30.04	0.00	9.90	6.53		
890606	479.75	133.37	18.58	39.71	327.80		
890620	1029.41	135.42	7.68		560.89	145.24	180.18
890704	1227.82	65.08	28.98		461.17	114.59	586.65
890718	1439.23	0.13	72.86		404.64	142.13	819.48
890804	1143.51	0.00	61.13		301.30	111.20	669.88

Table 89-8e. Treatment N2, cv. Golf.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
890509	38.94	31.12	0.00	9.92	7.83		
890606	461.79	131.27	18.44	48.66	312.08		
890620	1013.20	135.25	10.97		544.54	150.25	172.20
890704	1265.13	81.68	19.93		472.56	115.95	575.01
890718	1415.17	0.94	74.93		387.17	136.65	815.48
890804	1230.82	0.00	64.92		307.36	117.56	740.98

Table 89-8f. Treatment N3, cv. Golf.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
890620	989.58	146.29	8.53		507.06	148.74	178.96
890704	1301.62	95.82	19.37		476.59	113.70	596.14
890718	1689.66	5.32	94.55		473.35	158.00	958.44
890804	1281.93	0.00	66.85		342.62	123.85	748.61

Table 89-9. Dry green leaf weight and dry green leaf weight distribution.

Leaves are numbered from the top down.

Table 89-9a. Treatment N1, cv. Prisma.

date yymmdd	total leaf (g.m-2)	flagleaf (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)
890425	2.98					
890509	23.67					
890523	114.10					
890606	132.55					
890620	115.23	10.42	31.88	36.30	31.44	5.20
890704	46.98	5.73	17.54	14.90	8.80	0.00
890718	0.00					
890804	0.00					

Table 89-9b. Treatment N2, cv. Prisma.

date yymmdd	total leaf (g.m-2)	flagleaf (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)
890509	25.05					
890523	115.80					
890606	129.41					
890620	127.15	11.53	33.87	37.15	35.19	9.40
890704	74.94	9.88	27.89	25.07	11.26	0.85
890718	0.00					
890804	0.00					

Table 89-9c. Treatment N3, cv. Prisma.

date yymmdd	total leaf (g.m-2)	flagleaf (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)
890620	139.90	13.45	40.11	42.94	34.36	9.04
890704	83.73	10.26	29.47	29.34	14.39	0.28
890718	0.00					
890804	0.00					

Table 89-9. (continued) Dry green leaf weight and dry green leaf weight distribution.

Leaves are numbered from the top down.

Table 89-9d. Treatment N1, cv. Golf.

date yymmdd	total leaf (g.m-2)	flagleaf (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)
890425	3.47					
890509	30.04					
890606	133.37					
890620	135.42	10.94	34.61	43.55	38.42	79.20
890704	65.08	7.85	24.61	25.82	6.80	0.00
890718	0.13	0.00	0.13	0.00	0.00	0.00
890804	0.00					

Table 89-9e. Treatment N2, cv. Golf.

date yymmdd	total leaf (g.m-2)	flagleaf (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)
890509	31.12					
890606	131.27					
890620	135.25	11.19	36.95	48.30	35.06	3.74
890704	81.68	8.57	29.39	32.37	11.26	0.09
890718	0.94	0.00	0.75	0.19	0.00	0.00
890804	0.00					

Table 89-9f. Treatment N3, cv. Golf.

date yymmdd	total leaf (g.m-2)	flagleaf (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)
890620	146.29	13.46	43.47	54.25	33.45	1.66
890704	95.82	9.91	32.44	38.16	15.31	0.00
890718	5.32	0.72	3.75	0.85	0.00	0.00
890804	0.00					

Table 89-10. Leaf area index.

Leaves are numbered from the top down.

Table 89-10a. Treatment N1, cv. Prisma.

date yymmdd	total leaf (m2.m-2)	flagleaf (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)
890425	0.09					
890509	0.56					
890523	3.15					
890606	3.39					
890620	2.72	0.16	0.70	0.89	0.83	0.13
890704	1.23	0.10	0.45	0.43	0.25	0.00
890718	0.00					
890804	0.00					

Table 89-10b. Treatment N2, cv. Prisma.

date yymmdd	total leaf (m2.m-2)	flagleaf (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)
890509	0.66					
890523	3.37					
890606	3.32					
890620	3.07	0.18	0.75	0.94	0.94	0.26
890704	1.23	0.10	0.45	0.43	0.25	0.00
890718	0.00					
890804	0.00					

Table 89-10c. Treatment N3, cv. Prisma.

date yymmdd	total leaf (m2.m-2)	flagleaf (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)
890620	3.40	0.23	0.89	1.11	0.93	0.24
890704	2.28	0.19	0.78	0.88	0.41	0.01
890718	0.00					
890804	0.00					

Table 89-10. (continued) Leaf area index.

Leaves are numbered from the top down.

Table 89-10d. Treatment N1, cv. Golf.

date yymmdd	total leaf (m2.m-2)	flagleaf (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)
890425	0.11					
890509	0.72					
890606	3.37					
890620	1.66	0.13	0.64	0.70	0.19	0.00
890704	0.00	0.00	0.00	0.00	0.00	0.00
890718						
890804						

Table 89-10e. Treatment N2, cv. Golf.

date yymmdd	total leaf (m2.m-2)	flagleaf (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)
890509	0.76					
890606	3.00					
890620	3.25	0.19	0.84	1.18	0.93	0.13
890704	2.03	0.15	0.73	0.85	0.30	0.01
890718	0.02	0.00	0.01	0.00	0.00	0.00
890804	0.00					

Table 89-10f. Treatment N3, cv. Golf.

date yymmdd	total leaf (m2.m-2)	flagleaf (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)
890620	3.42	0.29	0.95	1.27	0.86	0.06
890704	2.47	0.20	0.84	1.08	0.42	0.00
890718	0.10	0.01	0.07	0.02	0.00	0.00
890804	0.00					

Table 89-11. Specific leaf area.

Leaves are numbered from the top down.

Table 89-11a. Treatment N1, cv. Prisma.

date yymmdd	total leaf (cm2.g-1)	flagleaf (cm2.g-1)	leaf 2 (cm2.g-1)	leaf 3 (cm2.g-1)	leaf 4 (cm2.g-1)	leaf 5 (cm2.g-1)
890425	307.5					
890509	235.2					
890523	276.1					
890606	253.8					
890620	235.2	156.0	219.9	245.7	262.9	236.6
890704	253.9	167.2	252.6	278.5	277.8	
890718	0.0					
890804	0.0					

Table 89-11b. Treatment N2, cv. Prisma.

date yymmdd	total leaf (cm2.g-1)	flagleaf (cm2.g-1)	leaf 2 (cm2.g-1)	leaf 3 (cm2.g-1)	leaf 4 (cm2.g-1)	leaf 5 (cm2.g-1)
890509	236.4					
890523	291.7					
890606	254.6					
890620	240.9	153.3	221.4	252.0	267.1	276.4
890704	255.6	205.1	252.2	275.2	277.9	296.4
890718	0.0					
890804	0.0					

Table 89-11c. Treatment N3, cv. Prisma.

date yymmdd	total leaf (cm2.g-1)	flagleaf (cm2.g-1)	leaf 2 (cm2.g-1)	leaf 3 (cm2.g-1)	leaf 4 (cm2.g-1)	leaf 5 (cm2.g-1)
890620	242.0	173.1	221.2	256.6	268.7	266.1
890704	268.2	186.4	261.6	296.6	281.3	391.9
890718	0.0					
890804	0.0					

Table 89-11. (continued) Specific leaf area.

Leaves are numbered from the top down.

Table 89-11d. Treatment N1, cv. Golf.

date yymmdd	total leaf (cm2.g-1)	flagleaf (cm2.g-1)	leaf 2 (cm2.g-1)	leaf 3 (cm2.g-1)	leaf 4 (cm2.g-1)	leaf 5 (cm2.g-1)
890425	330.1					
890509	240.9					
890606	244.7					
890620	248.4	169.9	235.5	255.3	275.1	251.0
890704	247.1	185.4	255.9	260.3	263.7	0.0
890718	218.7					
890804	0.0					

Table 89-11e. Treatment N2, cv. Golf.

date yymmdd	total leaf (cm2.g-1)	flagleaf (cm2.g-1)	leaf 2 (cm2.g-1)	leaf 3 (cm2.g-1)	leaf 4 (cm2.g-1)	leaf 5 (cm2.g-1)
890509	242.8					
890606	228.1					
890620	239.4	173.4	228.4	244.1	265.0	257.7
890704	246.1	172.3	248.2	260.6	254.9	239.2
890718	179.8	0.0	181.5	145.4	0.0	0.0
890804	0.0					

Table 89-11f. Treatment N3, cv. Golf.

date yymmdd	total leaf (cm2.g-1)	flagleaf (cm2.g-1)	leaf 2 (cm2.g-1)	leaf 3 (cm2.g-1)	leaf 4 (cm2.g-1)	leaf 5 (cm2.g-1)
890620	232.6	178.9	218.5	231.6	258.3	270.7
890704	254.8	192.1	257.6	281.3	135.2	0.0
890718	202.8	0.0	220.4	187.9	0.0	0.0
890804	0.0					

Table 89-12. Nitrogen distribution and nitrogen content in crop.

Table 89-12a. Treatment N1, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890425		2.51	57.31	1.71			45.57	0.80						
890509		16.06	48.51	11.47			39.56	2.83	33.51	1.77				
890523		61.45	35.52	40.51	13.27	0.68	16.53	5.62	21.42	14.64				
890606		84.04	31.32	41.52	9.09	1.57	9.84	3.96	12.65	37.00				
890620		108.04		29.81					6.81	33.18	15.07	18.39	18.39	26.66
890627											14.65			
890704				11.89	14.85	5.14			6.63	28.57	12.78	13.25		
890711											7.98			
890718						5.96			3.96	16.10	5.77	8.60		
890725											3.77			
890804		122.00			11.08	4.76			2.87	8.06	4.98	5.52	17.49	103.67

Table 89-12. (continued) Nitrogen distribution and nitrogen content in crop.

Table 89-12b. Treatment N2, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890509		17.47	48.17	12.03			38.06	3.28	33.79	2.17				
890523		69.70	41.00	47.48	15.39	0.68	17.57	5.58	23.82	15.97				
890606		82.84	31.50	40.73	9.25	1.60	10.31	4.53	12.82	35.97				
890620		126.07		37.02					7.83	39.67	15.57	20.09	19.37	29.29
890627											13.98			
890704				19.38	13.89	4.28			7.28	36.58	13.52	21.46		
890711											9.70			
890718						9.42			4.74	20.58	6.69	10.41		
890725											4.96			
890804		139.50			12.40	4.58			3.42	9.41	5.00	5.58	19.28	119.97

Table 89-12. (continued) Nitrogen distribution and nitrogen content in crop.

Table 89-12c. Treatment N3, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890620		155.85		47.24					10.68	53.63	18.01	24.54	21.10	30.44
890627											16.73			
890704				23.52	15.46	4.54			10.23	50.49	14.96	19.73		
890711											10.75			
890718						11.56			4.92	23.44	7.58	12.91		
890725											6.06			
890804		155.50			18.21	10.11			4.42	12.29	6.93	7.71	20.18	125.4

Table 89-12. (continued) Nitrogen distribution and nitrogen content in crop.

Table 89-12d. Treatment N1, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890425		3.13	60.92	2.11			45.87	1.01						
890509		18.81	44.77	13.43			35.12	3.47	29.34	1.92				
890523	-													
890606		65.58	30.59	38.85	8.48	1.58	8.15	3.63	12.50	40.95				
890620		128.02		33.44					6.92	38.78	15.31	22.20	18.72	33.59
890627											14.57			
890704				14.60	10.07	2.88			5.92	27.35	11.11	12.74		
890711											6.58			
890718				0.02		5.79			3.86	15.62	5.18	7.34		
890725											3.90			
890804		136.40			9.61	5.92			3.08	9.30	4.38	4.88	17.34	116.28

Table 89-12. (continued) Nitrogen distribution and nitrogen content in crop.

Table 89-12e. Treatment N2, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890509		20.32	46.04	14.34			35.66	3.58	30.86	2.40				
890523	-													
890606		84.30	28.35	37.99	9.82	1.79	9.32	4.55	12.76	39.97				
890620		140.14		37.48					8.03	43.68	16.32	24.52	20.01	34.46
890627											14.88			
890704				20.32	12.49	2.48			7.79	35.40	12.16	14.09		
890711											7.47			
890718				0.14		6.61			4.18	16.20	5.51	7.51		
890725											4.16			
890804		159.50			11.24	7.30			3.26	10.02	4.73	5.56	18.44	136.62

Table 89-12. (continued) Nitrogen distribution and nitrogen content in crop.

Table 89-12f. Treatment N3, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890620		170.78		45.63					11.03	55.95	18.92	28.13	22.95	41.06
890627											17.12			
890704				25.57	14.62	2.83			9.04	43.10	13.49	15.29		
890711											8.80			
890718				1.09		10.49			5.37	25.44	5.63	8.90		
890725											5.85			
890804		195.90			14.32	9.51			6.05	21.26	6.00	7.47	21.11	157.62

Table 89-13. Carbohydrates distribution and carbohydrates content in crop.

Table 89-13a. Treatment N1, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890425		5.13	59.77	1.77			190.50	3.36						
890509		26.69	112.57	26.69										
890523		269.87	66.32	75.77	31.00	1.59	164.90	56.10	199.70	136.41				
890606							185.80	74.59	281.90	824.47				
890620			88.70	102.21					283.40	1381.00				
890627											33.92			
890704			42.00	19.70					227.80	986.50	30.89	32.21		
890711														
890718					3.67	2.48			81.40	331.40	8.35	12.48		
890725											4.59			
890804					2.66	1.15					3.42	3.79		

Table 89-13. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 89-13b. Treatment N2, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890509		28.11	110.96	28.11										
890523		194.72	34.89	40.45	33.50	1.48	129.40	40.90	166.92	111.89				
890606							166.40	73.12	293.40	833.20				
890620			72.30	91.90					250.10	1266.70				
890627											38.76			
890704			41.30	30.69					200.00	1015.80	27.91	44.30		
890711														
890718					3.10	2.59			62.00	269.40	9.10	14.15		
890725											4.96			
890804					4.04	1.31					3.44	3.78		

Table 89-13. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 89-13c. Treatment N3, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890620			48.20	66.72					186.00	941.50				
890627											35.91			
890704			25.90	21.56					175.40	866.30	20.81	27.17		
890711														
890718					2.90	2.59			59.60	284.60	10.47	17.78		
890725											5.73			
890804					3.53	1.95					4.23	4.72		

Table 89-13. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 89-13d. Treatment N1, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890425		5.68	44.10	1.53			188.00	4.15						
890509		29.78	98.71	29.78										
890523	-													
890606							149.10	57.66	258.80	847.82				
890620			74.70	101.22					265.20	1493.50				
890627											34.90			
890704			49.60	32.28					311.90	1423.70	20.78	23.74		
890711														
890718					2.76	2.02			85.70	346.20	8.45	12.10		
890725											5.71			
890804					3.40	2.08					4.05	4.49		

Table 89-13. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 89-13e. Treatment N2, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890509		34.22	110.24	34.22										
890523	-													
890606							156.70	76.65	260.80	813.12				
890620			62.00	83.88					233.30	1272.00				
890627											31.76			
890704			46.80	38.23					204.80	967.80	22.90	26.89		
890711														
890718			21.70	0.17	3.60	2.73			77.80	300.80	8.21	11.22		
890725											7.74			
890804					4.84	3.03					3.80	4.46		

Table 89-13. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 89-13f. Treatment N3, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890620			45.80	66.98					174.10	880.90				
890627											37.01			
890704			31.00	29.67					149.40	711.50	13.59	15.73		
890711														
890718			23.60	1.28	3.90	3.69			82.70	391.60	6.34	10.00		
890725											11.78			
890804					3.29	2.16					4.41	5.45		

Table 89-14. Nitrogen distribution and nitrogen content in green leaves and dead leaves.

Table 89-14a. Treatment N1, cv. Prisma. Leaves are numbered from the top down.

date	total green leaf **total dead leaf**		flagleaf		leaf 2		leaf 3		leaf 4		leaf 5	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890425	57.31	1.71										
890509	48.51	11.47										
890523	35.52	40.51										
890523	**13.27**	**0.68**										
890606	31.32	41.52										
890606	**9.09**	**1.57**										
890620		29.81	35.56	3.71	32.58	10.39	24.55	8.89	19.00	5.97	16.37	0.85
890620		-										
890704		11.89	34.99	2.00	30.03	5.27	21.31	3.17	16.86	1.45		
890704	**14.85**	**5.14**										
890718		-										
890718		**5.96**	**10.57**	**0.74**	**10.04**	**2.18**	**8.53**	**1.99**	**6.91**	**1.06**		
890804	**11.08**	**4.76**										

Table 89-14. (continued) Nitrogen distribution and nitrogen content in green leaves and dead leaves.

Table 89-14b. Treatment N2, cv. Prisma. Leaves are numbered from the top down.

date	total green leaf **total dead leaf**		flagleaf		leaf 2		leaf 3		leaf 4		leaf 5	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890509	48.17	12.03										
890523	41.00	47.48										
890523	**15.39**	**0.68**										
890606	31.50	40.73										
890606	**9.25**	**1.60**										
890620		37.02	37.55	4.32	35.57	12.05	28.80	10.70	23.09	8.13	19.59	1.82
890620		-										
890704		19.38	31.76	3.13	30.19	8.45	22.67	5.69	17.79	2.00	13.06	0.11
890704	**13.89**	**4.28**										
890718		-										
890718		**9.42**	**13.30**	**1.16**	**12.82**	**3.54**	**11.50**	**3.41**	**8.06**	**1.31**		
890804	**12.40**	**4.58**										

Table 89-14. (continued) Nitrogen distribution and nitrogen content in green leaves and dead leaves.

Table 89-14c. Treatment N3, cv. Prisma. Leaves are numbered from the top down.

date	total green leaf total dead leaf		flagleaf		leaf 2		leaf 3		leaf 4		leaf 5	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890620		47.24	42.00	5.66	41.63	16.69	32.44	13.92	25.99	8.93	23.06	2.05
890620		-										
890704		23.52	32.47	3.32	32.89	9.70	25.37	7.45	20.70	2.97	28.97	0.08
890704	**15.46**	**4.54**										
890718		-										
890718		**11.56**	**15.19**	**1.48**	**15.02**	**4.52**	**12.80**	**3.85**	**8.92**	**1.71**		
890804	**18.21**	**10.11**										

Table 89-14. (continued) Nitrogen distribution and nitrogen content in green leaves and dead leaves.

Table 89-14d. Treatment N1, cv. Golf. Leaves are numbered from the top down.

date	total green leaf total dead leaf		flagleaf		leaf 2		leaf 3		leaf 4		leaf 5	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890425	60.92	2.11										
890509	44.77	13.43										
890523		-										
890523		-										
890606	30.59	38.85										
890606	**8.48**	**1.58**										
890620		33.44	37.11	4.05	31.55	10.90	23.25	10.13	18.76	7.21	15.19	1.17
890620		-										
890704		14.60	31.55	2.46	25.76	6.34	17.80	4.60	17.69	1.19		
890704	**10.07**	**2.88**										
890718		0.02			14.57	0.076						
890718		**5.79**	**10.55**	**0.81**	**9.04**	**1.99**	**7.20**	**1.96**	**6.91**	**1.02**		
890804	**9.61**	**5.92**										

Table 89-14. (continued) Nitrogen distribution and nitrogen content in green leaves and dead leaves.

Table 89-14e. Treatment N2, cv. Golf. Leaves are numbered from the top down.

date	total green leaf **total dead leaf**		flagleaf		leaf 2		leaf 3		leaf 4		leaf 5	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890509	46.04	14.34										
890523		-										
890523		-										
890606	28.35	37.99										
890606	**9.82**	**1.79**										
890620		37.48	39.36	4.41	34.39	12.71	25.79	12.46	20.41	7.15	20.11	1.01
890620		-										
890704		20.32	32.21	2.76	30.37	8.93	20.45	6.62	17.95	2.02		
890704	**12.49**	**2.48**										
890718		0.14			14.58	0.11	16.38	0.03				
890718		**6.61**	**11.53**	**0.74**	**9.58**	**2.33**	**8.15**	**2.48**	**7.65**	**1.05**		
890804	**11.24**	**7.30**										

Table 89-14. (continued) Nitrogen distribution and nitrogen content in green leaves and dead leaves.

Table 89-14f. Treatment N3, cv. Golf. Leaves are numbered from the top down.

date	total green leaf		flagleaf		leaf 2		leaf 3		leaf 4		leaf 5	
	total dead leaf											
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
890620		45.63	41.82	5.64	36.77	15.99	28.82	15.63	23.92	8.00	22.45	0.50
890620		-										
890704		25.57	35.32	3.50	31.87	10.33	22.99	8.77	19.38	2.97		
890704	**14.62**	**2.83**										
890718		1.09	18.00	0.18	22.08	0.83	15.10	0.17				
890718		**10.49**	**14.61**	**1.22**	**13.42**	**3.90**	**10.16**	**3.59**	**9.15**	**1.78**		
890804	**14.32**	**9.51**										

Table 89-15. Kernel growth.

Table 89-15a. Cv. Prisma.

date yymmdd	dry weight per kernel (mg)		
	treatment N1	treatment N2	treatment N3
890627	21.72	23.49	20.50
890704	31.99	32.85	27.93
890711	46.68	43.46	43.26
890718	49.41	47.03	45.94
890725	50.48	49.18	48.14
890804	42.89 *)1	43.43 *)1	41.34 *)1

Table 89-15b. Cv. Golf.

date yymmdd	dry weight per kernel (mg)		
	treatment N1	treatment N2	treatment N3
890627	21.67	23.54	21.77
890704	36.41	34.36	32.01
890711	46.95	47.27	46.61
890718	50.18	50.16	52.45
890725	51.06	48.33	48.13
890804	45.13 *)1	46.68 *)1	43.40 *)1

*)1 The first five harvests are samples of kernels from main stems, at the final harvest the kernels are from a general sample. For more information see paragraph 2.2.

Table 89-16. Kernel size distribution at final harvest.

Table 89-16a. Fresh weight distribution (%).

sort (mm)	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
< 2.0	1.81	3.56	4.75	2.64	3.18	4.15
2.0 - 2.2	2.94	4.66	5.88	3.46	3.81	4.74
2.2 - 2.5	12.86	15.97	18.53	14.02	15.14	19.85
2.5 - 2.8	26.30	28.65	31.33	49.47	45.32	48.48
2.8 - 3.0	10.36	13.74	10.86	18.47	18.44	12.78
3.0 - 3.2	42.81	31.82	27.97	11.81	13.99	9.90
> 3.2	2.91	1.60	0.68	0.13	0.12	0.10

Table 89-16b. Fresh weight per kernel per sortingclass (mg).

sort (mm)	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
total	46.93	43.92	43.93	48.59	49.40	45.31
< 2.0	21.49	22.03	22.23	23.45	23.82	23.70
2.0 - 2.2	27.23	27.57	27.47	29.85	30.12	30.05
2.2 - 2.5	34.34	35.34	34.95	39.01	40.27	40.00
2.5 - 2.8	44.45	46.00	45.88	52.46	52.28	52.40
2.8 - 3.0	50.85	51.77	51.25	58.96	59.67	59.96
3.0 - 3.2	57.80	58.69	59.41	61.55	63.14	64.35
> 3.2	63.92	65.07	62.96	56.85	57.73	55.01

Table 89-16. (continued) Kernel size distribution at final harvest.

Table 89-16c. Dry matter content per sortingclass (%).

sort (mm)	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
total	89.02	89.04	89.03	89.00	89.47	89.20
< 2.0	89.25	89.19	89.30	89.38	89.51	89.35
2.0 - 2.2	89.13	89.23	89.35	89.22	89.65	89.47
2.2 - 2.5	89.17	89.26	89.45	89.23	89.55	89.24
2.5 - 2.8	89.23	89.31	89.29	88.89	89.59	89.77
2.8 - 3.0	91.45	91.57	91.75	91.79	91.95	92.09
3.0 - 3.2	91.51	91.52	91.71	91.83	91.96	92.10
> 3.2	91.44	91.63	91.58	90.46	90.72	91.37

Table 89-17. Nitrogen distribution and nitrogen content in kernels per sortingclass.

Table 89-17a. Nitrogen content per sortingclass (g.kg-1).

sort (mm)	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
total	16.7	19.6	20.8	16.6	18.8	21.0
< 2.0	19.8	23.5	24.2	20.6	24.8	25.4
2.0 - 2.2	18.5	21.5	23.2	19.1	22.6	24.3
2.2 - 2.5	20.0	19.5	21.3	19.9	18.6	21.4
2.5 - 2.8	16.5	19.2	20.3	15.8	17.6	19.7
2.8 - 3.0	15.8	18.0	20.2	16.1	17.4	19.2
3.0 - 3.2	16.2	18.3	19.6	16.2	17.8	18.6
> 3.2	17.0	18.2	19.2	17.4	17.2	19.4

Table 89-17b. Nitrogen amount per sortingclass (kg.ha-1).

sort (mm)	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
total	96.45	115.24	121.41	100.97	116.18	140.55
< 2.0	2.07	4.93	6.97	3.33	4.92	7.07
2.0 - 2.2	3.14	5.90	8.17	4.02	5.32	7.72
2.2 - 2.5	14.87	18.20	22.92	17.00	17.39	28.33
2.5 - 2.8	25.07	32.29	36.63	47.51	49.15	63.89
2.8 - 3.0	9.40	14.52	12.67	18.05	19.89	16.49
3.0 - 3.2	40.02	34.40	32.28	11.66	15.28	12.35
> 3.2	2.85	1.70	0.77	0.14	0.13	0.13

Table 89-18. Combine harvest kernel yield (kg.ha-1) at 16 % moisture.

date yymmdd	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
890805	6867	7120	7403	7254	7594	7982

Table 89-19. Soil mineral nitrogen content and amount (ammonium + nitrate), cv. Prisma.

treatment	date yymmdd	nitrogen content and amount per soil layers					
		0 - 30 cm		30 - 60 cm		60 - 90 cm	
		(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)
N1	890510	8.62	33.62	8.38	32.68	6.52	25.43
	890601	10.04	39.16	5.29	20.63	6.66	25.97
	890627	6.51	25.39	4.29	16.73	3.46	13.49
	890801	2.86	11.15	1.64	6.40	3.73	14.55
N2	890510	23.71	92.47	12.09	47.15	7.30	28.47
	890601	31.05	121.10	27.91	108.85	11.21	43.72
	890627	12.40	48.36	9.05	35.30	5.22	20.36
	890801	3.46	13.49	1.66	6.47	3.68	14.35
N3	890627	27.10	105.69	13.65	53.24	11.67	45.51
	890801	6.82	26.60	4.59	17.90	8.60	33.54

Table 89-20. Statistical analyses.

Table 89-20a. Statistical analyses of plant parts and crop caracteristics.

Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Total plant mass above and below ground, fresh weight. [kg.ha-1]	T1	(*)		
	T2	**	-	-
	T3		(*)	
	T4	-	-	-
Total plant mass above and below ground, dry weight. [kg.ha-1]	T1	*		
	T2	***	(*)	-
	T3		-	
	T4	-	-	-
Total plant mass above ground, fresh weight. [kg.ha-1]	T1	**		
	T2	**	-	-
	T3		*	
	T4	-	-	-
	T5	**	(*)	-
	T6	-	***	(*)
	T7	-	**	**
	T8	**	***	*
Total plant mass above ground, dry weight. [kg.ha-1]	T1	**		
	T2	***	(*)	-
	T3		-	
	T4	-	-	-
	T5	**	-	-
	T6	-	*	(*)
	T7	-	*	(*)
	T8	***	*	-
Green leaves + stems, fresh [kg.ha-1]	T1	**		
Green leaves + stems, dry [kg.ha-1]	T1	**		
Total of green leaves, fresh weight. [kg.ha-1]	T2	**	-	(*)
	T3		*	
	T4	-	-	-
	T5	**	***	-
	T6	**	***	-
	T7	**	**	**
Total of green leaves, dry weight. [kg.ha-1]	T2	**	(*)	-
	T3		-	
	T4	-	-	-
	T5	**	**	-
	T6	***	***	-
	T7	**	**	**
Stem parts below ground, fresh weight. [kg.ha-1]	T1	-		
	T2	(*)	-	-
	T3		-	
	T4	-	-	-
Stem parts below ground, dry weight. [kg.ha-1]	T1	(*)		
	T2	**	-	-
	T3		-	
	T4	-	-	-

Table 89-20a. (continued) Statistical analyses of plant parts and crop caracteristics.

Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Dead leaves, fresh weight. [kg.ha-1]	T3		-	
	T4	-	-	-
	T5	-	-	-
	T6	**	-	-
	T7	***	***	**
	T8			
Dead leaves, dry weight. [kg.ha-1]	T3		-	
	T4	-	-	-
	T5	-	-	-
	T6	**	**	-
	T7	-	**	-
	T8	***	-	-
Stems and sheaths, fresh weight. [kg.ha-1]	T2	**	-	-
	T3		*	
	T4	-	-	-
	T5	(*)	*	-
	T6	(*)	**	-
	T7	-	**	*
	T8			
Stems and sheaths, dry weight. [kg.ha-1]	T2	***	*	-
	T3		-	
	T4	-	-	-
	T5	(*)	-	-
	T6	-	-	-
	T7	(*)	*	-
	T8	**	-	-
Kernels, fresh weight. [kg.ha-1]	T6			
	T7			-
	T8	***	**	-
Kernels, dry weight. [kg.ha-1]	T5	***	-	-
	T6	***	(*)	*
	T7	-	(*)	(*)
	T8	***	**	-
Chaff, fresh weight. [kg.ha-1]	T6			
	T7			
	T8	(*)	-	-
Chaff, dry weight. [kg.ha-1]	T5	**	-	-
	T6	(*)	-	(*)
	T7	**	(*)	-
	T8	(*)	-	-
Ears, fresh weight. [kg.ha-1]	T5	***	-	-
	T6	***	***	*
	T7	**	**	**
	T8			
Ears, dry weight. [kg.ha-1]	T5	***	-	-
	T6	(*)	*	(*)
	T7	-	*	(*)
	T8			

Table 89-20a. (continued) Statistical analyses of plant parts and crop caracteristics.

Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Leaf area index, LAI. [m2.m-2]	T1	**		
	T2	***	-	-
	T3		-	
	T4	-	-	-
	T5	*	*	(*)
	T6	**	***	-
	T7	*	(*)	(*)
Number of plants. [1.m-2]	T1	*		
	T2	**	(*)	(*)
	T3		-	
Number of main stems. [1.m-2]	T8	-	-	-
Number of hare's ears [1.m-2]	T8	-	-	-
Dry weight per kernel [mg]	T6	**	***	-
	T7	**	-	-
	T8	**	-	-
Number of kernels per ear	T6	***	-	-
	T7	*	-	(*)
	T8	***	(*)	-

Table 89-20. (continued) Statistical analyses.

Table 89-20b. Statistical analyses of nitrogen and carbohydrate amounts in plant parts.

Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Total N amount in above ground parts (leaves and stems). [kg.ha-1]	T1	***		
Total N amount in green leaves. [kg.ha-1]	T2	**	-	-
	T3		**	
	T4	-	-	-
	T5	-	***	-
	T6	**	***	-
	T7	**	**	**
Total N amount in stems and sheaths. [kg.ha-1]	T2	-	-	-
	T3		*	
	T4	-	-	-
	T5	**	***	-
	T6	**	***	(*)
	T7	-	***	(*)
	T8	*	***	(*)
Total N amount in stem below ground. [kg.ha-1]	T1	*		
	T2	(*)	-	-
	T3		-	
	T4	-	-	-
Total N amount in dead leaves. [kg.ha-1]	T3		-	
	T4	-	-	-
	T5			
	T6	***	-	-
	T7	***	***	**
	T8	-	**	-
Total N amount in kernels. [kg.ha-1]	T5	***	(*)	-
	T6			
	T7			
	T8	***	***	-
Total N amount in chaff. [kg.ha-1]	T5	***	***	-
	T6	**	(*)	(*)
	T7	***	**	*
	T8	-	**	-
Total N amount in ears. [kg.ha-1]	T5	***	**	-
	T6			
	T7			
	T8			
Total N amount in whole plants. [kg.ha-1]	T1	**		
	T2	**	-	-
	T3		*	
	T4	-	-	-
	T5	**	***	-
	T6			
	T7			
	T8	***	***	-

Table 89-20b. (continued) Statistical analyses of nitrogen and carbohydrate amounts in plant parts.

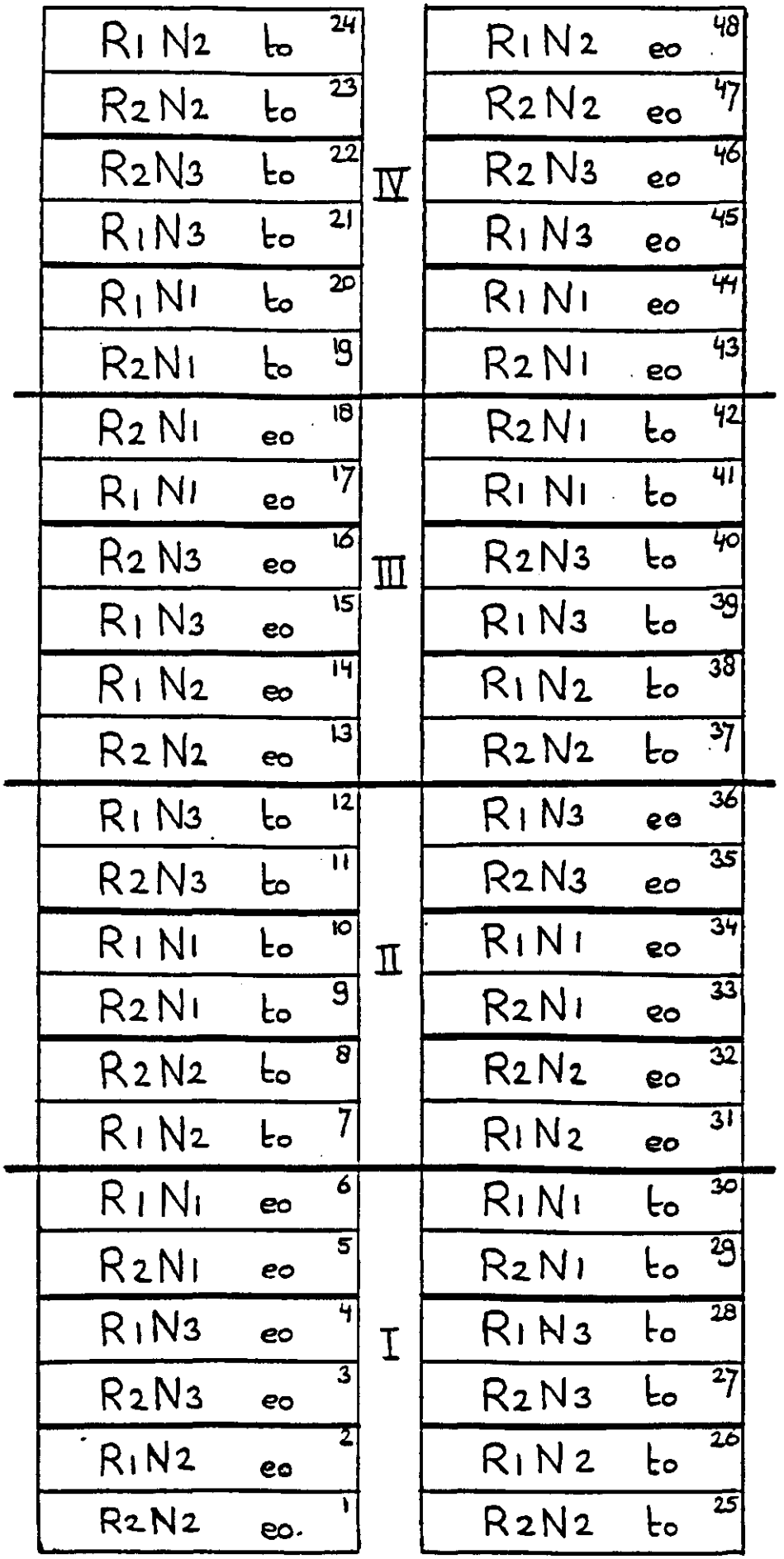
Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Carbohydrate amount in above ground parts (leaves and stems). [kg.ha-1]	T1	(*)		
Carbohydrate amount in green leaves. [kg.ha-1]	T2	(*)	-	-
	T3		***	
	T4			
	T5	-	***	-
	T6	***	***	-
	T7	**	**	**
Carbohydrate amount in stems and sheaths. [kg.ha-1]	T2			
	T3		**	
	T4	-	-	-
	T5	-	***	-
	T6	-	(*)	**
	T7	**	**	(*)
	T8			
Carbohydrate amount in stem below ground. [kg.ha-1]	T1	(*)		
	T2			
	T3	*	-	-
	T4	-	(*)	(*)
Carbohydrate amount in dead leaves. [kg.ha-1]	T3		(*)	
	T4			
	T5			
	T6			
	T7	-	(*)	-
	T8	***	-	**
Carbohydrate amount in kernels. [kg.ha-1]	T5			
	T6			
	T7			
	T8			
Carbohydrate amount in chaff. [kg.ha-1]	T5			
	T6	***	*	-
	T7	**	-	(*)
	T8	**	*	-
Carbohydrate amount in ears. [kg.ha-1]	T5			
	T6			
	T7			
	T8			
Carbohydrate amount in whole plants. [kg.ha-1]	T1	*		
	T2			
	T3		**	
	T4			
	T5			
	T6			
	T7			
	T8	(*)	-	-

Table 89-20. (continued) Statistical analyses.

Table 89-20c. Meaning of used symbols.

symbol	significance
-	: P > 0.200
(*)	: 0.100 < P < 0.200
*	: 0.050 < P < 0.100
**	: 0.010 < P < 0.050
***	: P < 0.010

Figure 89-21. Experimental design.



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At different harvest dates the specific leaf area of total dry green leaf and separated for leaf 1 to flagleaf. The leaves are numbered in order of emergence
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At different harvest dates nitrogen content and amount in total plant, green leaf, dead leaf, stem below ground, stems plus sheaths, chaff and grains
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At different harvest dates carbohydrate content and amount in total plant, green leaf, dead leaf, stem below ground, stems plus sheaths, chaff and grains
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90-12b. Treatment N2, cv. Prisma
90-12c. Treatment N3, cv. Prisma
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90-12f. Treatment N3, cv. Golf

Table 90-13. **Nitrogen distribution and nitrogen content in green leaves**
At different harvest dates nitrogen content and amount in total green leaf and separated for leaf 1 to flagleaf
The leaves are numbered in order of emergence
90-13a. Treatment N1, cv. Prisma
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90-13c. Treatment N3, cv. Prisma
90-13d. Treatment N1, cv. Golf
90-13e. Treatment N2, cv. Golf
90-13f. Treatment N3, cv. Golf

Table 90-1. General information

	KS9003
Location	: Randwijk Experimental farm 'De Bouwing' lot no. 2A
Barley varieties	: Prisma, Golf
Sowing date	: 16 maart 1990
Soil type	: Clay
Percentage silt	: 60%
Row spacing	: 14 cm
Previous crop	: Potatoes
Sowing density	: 310 seeds/m²

Table 90-2. Treatments: Nitrogen dressings (kg/ha)

Mineral nitrogen (9003)(0-60 cm) : 40 kg/ha

treatment	date (yymmdd)		total (incl. N min)
	900410	900601	
N1	0	0	40
N2	50	0	90
N3	50	60	150

Table 90-3. Crop protection treatments

date yymmdd	protection agent	active ingredient	amount
-	Panoctin Plus	guazatine; imazalil	2 ml/kg zaad
900424	Perfection	dimethoaat	0.75 l/ha
900504	Itarane	fluroxupyr	0.5 l/ha
	Basagran Duplo P	bentazon; mecoprop-p	2.0 l/ha
900515	Tilt	propiconazool	0.5 l/ha
	Comehem Maneb	maneb 80	2.0 kg/ha
	Pirimor	pirimicarb	0.25 kg/ha
900626	Pirimor	pirimicarb	0.25 kg/ha
900711	Corbel	fenpropimorf	1.0 l/ha
	Benlate	benomyl	0.5 kg/ha

Table 90-4. Crop development description for main stem.

Table 90-4a. Treatment N1, cv. Prisma.

date yymmdd	number of defolded leaves	DC (Zadoks)	apex development	number of total primordia	number of leaf primordia
900330	1.0	10.0			
900417	1.0	20.0	3	15.5	
900503	4.0	22.0	6a	33.0	

Table 90-4b. Treatment N2 (=N3), cv. Prisma.

date yymmdd	number of defolded leaves	DC (Zadoks)	apex development	number of total primordia	number of leaf primordia
900330	1.0	10.0			
900417	1.5	20.5	3	15.5	
900418	1.5	20.8	3	17.0	
900423	2.0	21.8	4	23.1	
900503	4.0	25.8	6b	34.5	
900515	6.4	25.6-31.2	11	35.6	9.6

Table 90-4. (continued) Crop development description for main stem.

Table 90-4c. Treatment N1, cv. Golf.

date yymmdd	number of defolded leaves	DC (Zadoks)	apex development	number of total primordia	number of leaf primordia
900330	1.0	10.0			
900417	1.3	21.0	3	15.0	
900503	4.0	23.3	6b	34.2	8.8

Table 90-4d. Treatment N2 (=N3), cv. Golf.

date yymmdd	number of defolded leaves	DC (Zadoks)	apex development	number of total primordia	number of leaf primordia
900330	1.0	10.0			
900417	1.5	21.0	3	17.0	
900418	1.7	21.2	3	16.5	
900423	2.0	21.9	4	23.4	
900503	4.0	25.2	6b	35.2	9.0
900515	6.2	24.8-32.0	12	34.8	9.0

Table 90-5. Crop development and crop description.

Table 90-5a. Treatment N1, cv. Prisma.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	tiller density [tillers.m-2]	number of kernels per ear	plant lenght [cm]
900330	1.0	10.0	255				
900417	1.0	20.0	282				
900502	4.0	22.0	300				
900515	6.3			4.1			32.0
900525		39					
900529	8.8			3.0			53.7
900602		49					
900612		60-69			752	26.7	
900618						26.1	74.3
900626					705	25.0	73.0
900704						25.4	
900711						25.6	74.5
900718		86.1				25.5	
900724		88.6				25.2	74.3
900801		92			722	24.8	

Table 90-5b. Treatment N2, cv. Prisma.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	tiller density [tillers.m-2]	number of kernels per ear	plant lenght [cm]
900417	1.5	20.5	292				
900418	1.5	20.8	287				
900423	2.0	21.8					
900502	4.0	25.8					
900515	6.3	25.6-31.2		4.1			34.0
900525		39					
900529	7.2			3.3			57.9
900602		49					
900612		60-69			860	27.0	
900618						25.4	80.0
900626					809	25.4	83.5
900704						25.8	
900711						26.0	80.1
900718		87.0				24.9	
900724		89.1				25.5	82.5
900801		92			850	25.2	

Table 90-5. (continued) Crop development and crop description.

Table 90-5c. Treatment N3, cv. Prisma.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	tiller density [tillers.m-2]	number of kernels per ear	plant lenght [cm]
900612		60-69			945	26.1	
900618						26.1	82.5
900626					979	25.4	80.5
900704						25.5	
900711						25.2	79.8
900718		87.1				24.8	
900724		87.5				25.2	81.0
900801		92			979	24.8	

Table 90-5. (continued) Crop development and crop description.

Table 90-5d. Treatment N1, cv. Golf.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	tiller density [tillers.m-2]	number of kernels per ear	plant lenght [cm]
900330	1.0	10.0	237				
900417	1.3	21.0	262				
900502	4.0	23.3	275				
900515	6.1			3.5			37.6
900525		39					
900529	8.9			3.1			64.2
900602		49					
900612		60-69			823	26.3	
900618						26.0	86.0
900626					826	26.4	87.3
900704						24.9	
900711						24.7	88.7
900718		86.0				25.4	
900724		88.5				25.1	88.5
900801		92			698	24.8	

Table 90-5e. Treatment N2, cv. Golf.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	tiller density [tillers.m-2]	number of kernels per ear	plant lenght [cm]
900417	1.5	21.0	278				
900418	1.7	21.2	305				
900423	2.0	21.9					
900502	4.0	25.2					
900515	6.2	24.8-32.0		4.8			42.1
900525		39					
900529	9.2			3.3			72.9
900602		49					
900612		60-69			909	26.2	
900618						24.9	87.5
900626					856	25.1	90.8
900704						24.9	
900711						25.2	91.0
900718		86.4				25.9	
900724		89.1				25.5	93.3
900801		92			695	23.7	

Table 90-5. (continued) Crop development and crop description.

Table 90-5f. Treatment N3, cv. Golf.

date yymmdd	number of defolded leaves per main stem	DC (Zadoks)	plant density [plant.m-2]	number of sprouts per plant	tiller density [tillers.m-2]	number of kernels per ear	plant lenght [cm]
900612		60-69			889	26.0	
900618						24.7	91.0
900626					929	25.5	92.5
900704						26.3	
900711						26.0	91.0
900718		86.8				25.3	
900724		89.4				25.5	94.0
900801		92			1019	24.7	

Table 90-6. Harvest data.

date yymmdd	harvest number	ear harvest number
900417	T1	
900502	T2	
900515	T3	
900529	T4	
900612	T5	
900618		T5a
900626	T6)*1	
900704		T6a
900711	T7	
900718		T7a
900724	T8	
900801		T8a
900802	T9	

)*1 No total field weight, therefor no kg.ha-1 results.

Table 90-7. Dry matter distribution.

Table 90-7a. Treatment N1, cv. Prisma.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
900417	9.72	9.72	0.00	4.87			
900502	51.49	43.28	0.00	11.35	8.21		
900515	125.79	80.36	2.21	20.33	43.22		
900529	461.82	153.02	20.44		288.36		
900612	710.88	120.30	6.99		423.70	92.50	67.38
900711	1221.81	14.51	59.24		426.14	120.70	601.22
900724	1336.79	0.00	64.66		361.31	125.96	784.87
900802	1248.46	0.00	59.99		360.26	115.69	712.52

Table 90-7b. Treatment N2, cv. Prisma.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
900417	9.99	9.99	0.00	4.75			
900502	67.41	56.27	0.00	13.87	11.14		
900515	177.10	111.75	0.79	27.93	61.01		
900529	585.50	185.28	36.63		363.59		
900612	911.56	167.41	13.57		528.61	118.61	83.36
900711	1479.67	24.67	76.77		542.52	149.17	686.53
900724	1396.09	0.00	79.05		403.45	128.49	785.10
900802	1333.48	0.00	75.05		416.74	110.30	731.39

Table 90-7c. Treatment N3, cv. Prisma.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
900612	831.83	159.56	12.21		472.01	109.88	78.16
900711	1609.50	43.18	78.32		569.74	160.03	758.22
900724	1631.80	0.00	100.66		484.79	147.03	899.31
900802	1296.27	0.00	74.96		414.46	122.39	684.47

Table 90-7. (continued) Dry matter distribution.

Table 90-7d. Treatment N1, cv. Golf.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
900417	9.27	9.27	0.00	4.75			
900502	54.22	45.58	0.00	10.16	8.63		
900515	156.62	92.70	2.79	21.40	61.13		
900529	561.91	174.79	17.77		369.35		
900612	777.73	130.53	5.97		503.83	81.62	55.77
900711	1441.32	36.60	66.95		610.22	106.29	621.26
900724	1325.17	0.00	74.15		460.92	101.49	688.61
900802	1191.97	0.00	66.19		444.28	83.38	598.12

Table 90-7e. Treatment N2, cv. Golf.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
900417	9.55	9.55	0.00	4.61			
900502	78.40	64.10	0.00	13.35	14.29		
900515	221.91	129.63	0.84	26.39	88.58		
900529	707.55	210.32	44.31		452.91		
900612	1008.59	167.85	22.44		645.87	101.80	70.63
900711	1618.66	25.32	90.55		674.32	118.44	710.02
900724	1629.48	0.00	100.88		582.79	114.25	831.56
900802	1295.95	0.00	88.78		566.66	95.19	545.31

Table 90-7f. Treatment N3, cv. Golf.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
900612	988.75	171.87	20.09		631.77	98.13	66.89
900711	1636.78	32.16	99.28		701.10	127.03	677.21
900724	1666.29	0.00	112.29		588.75	118.25	847.00
900802	1367.96	0.00	85.65		542.71	91.72	647.89

Table 90-8. Dry green leaf weight and dry green leaf weight distribution.

Table 90-8a. Treatment N1, cv. Prisma. Leaves are numbered in order of emergence.

date yymmdd	total leaf (g.m-2)	leaf 1 (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)	leaf 6 (g.m-2)	leaf 7 (g.m-2)	leaf 8 (g.m-2)	leaf 9 (g.m-2)	flagleaf (g.m-2)	rest leaf (g.m-2)
900417	9.72											
900502	43.28	4.65	5.42	7.40								25.81
900515	80.36				5.84	8.41	8.45					57.67
900529	153.02						11.69	17.17	12.84	1.80	4.54	105.43
900612	120.30											
900711	14.51											
900724	0.00											

Table 90-8b. Treatment N2, cv. Prisma.

date yymmdd	total leaf (g.m-2)	leaf 1 (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)	leaf 6 (g.m-2)	leaf 7 (g.m-2)	leaf 8 (g.m-2)	leaf 9 (g.m-2)	flagleaf (g.m-2)	rest leaf (g.m-2)
900417	9.99											
900502	56.27	4.23	4.91	7.83								39.30
900515	111.75				7.63	11.09	9.62					83.41
900529	185.28						11.57	15.41	17.92	3.79	4.80	131.80
900612	167.41											
900711	24.67											
900724	0.00											

Table 90-8. (continued) Dry green leaf weight and dry green leaf weight distribution.

Table 90-8c. Treatment N1, cv. Golf. Leaves are numbered in order of emergence.

date yymmdd	total leaf (g.m-2)	leaf 1 (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)	leaf 6 (g.m-2)	leaf 7 (g.m-2)	leaf 8 (g.m-2)	leaf 9 (g.m-2)	flagleaf (g.m-2)	rest leaf (g.m-2)
900417	9.27											
900502	45.58	3.63	4.52	6.95								30.49
900515	92.70				6.60	9.46	7.83					68.80
900529	174.79						12.76	17.27	9.14	1.64	5.23	128.75
900612	130.53											
900711	36.60											
900724	0.00											

Table 90-8d. Treatment N2, cv. Golf.

date yymmdd	total leaf (g.m-2)	leaf 1 (g.m-2)	leaf 2 (g.m-2)	leaf 3 (g.m-2)	leaf 4 (g.m-2)	leaf 5 (g.m-2)	leaf 6 (g.m-2)	leaf 7 (g.m-2)	leaf 8 (g.m-2)	leaf 9 (g.m-2)	flagleaf (g.m-2)	rest leaf (g.m-2)
900417	9.55											
900502	64.10	4.53	4.93	8.01								46.65
900515	129.63				9.41	13.92	11.67					94.63
900529	210.32						15.02	20.73	18.15	3.70	6.16	146.56
900612	167.85											
900711	25.32											
900724	0.00											

Table 90-9. Leaf area index.

Table 90-9a. Treatment N1, cv. Prisma. Leaves are numbered in order of emergence.

date yymmdd	total leaf (m2.m-2)	leaf 1 (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)	leaf 6 (m2.m-2)	leaf 7 (m2.m-2)	leaf 8 (m2.m-2)	leaf 9 (m2.m-2)	flagleaf (m2.m-2)	rest leaf (m2.m-2)
900417	0.22											
900502	1.00	0.11	0.12	0.16								0.61
900515	2.23				0.18	0.25	0.27					1.52
900529	4.32						0.34	0.44	0.33	0.05	0.10	3.07
900612	3.35											
900711	0.37											
900724	0.00											

Table 90-9b. Treatment N2, cv. Prisma.

date yymmdd	total leaf (m2.m-2)	leaf 1 (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)	leaf 6 (m2.m-2)	leaf 7 (m2.m-2)	leaf 8 (m2.m-2)	leaf 9 (m2.m-2)	flagleaf (m2.m-2)	rest leaf (m2.m-2)
900417	0.23											
900502	1.43	0.10	0.12	0.18								1.03
900515	3.27				0.24	0.33	0.30					2.40
900529	5.03						0.34	0.42	0.45	0.09	0.03	4.01
900612	4.97											
900711	0.64											
900724	0.00											

Table 90-9. (continued) Leaf area index.

Table 90-9c Treatment N3, cv. Prisma. Leaves are numbered in order of emergence.

date yymmdd	total leaf (m2.m-2)	leaf 1 (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)	leaf 6 (m2.m-2)	leaf 7 (m2.m-2)	leaf 8 (m2.m-2)	leaf 9 (m2.m-2)	flagleaf (m2.m-2)	rest leaf (m2.m-2)
900612	4.65											
900711	1.03											
900724	0.00											

Table 90-9. (continued) Leaf area index.

Table 90-9d. Treatment N1, cv. Golf. Leaves are numbered in order of emergence.

date yymmdd	total leaf (m2.m-2)	leaf 1 (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)	leaf 6 (m2.m-2)	leaf 7 (m2.m-2)	leaf 8 (m2.m-2)	leaf 9 (m2.m-2)	flagleaf (m2.m-2)	rest leaf (m2.m-2)
900417	0.23											
900502	1.20	0.09	0.11	0.18								0.82
900515	2.57				0.21	0.28	0.25					1.83
900529	4.97						0.38	0.47	0.21	0.04	0.10	3.78
900612	3.67											
900711	0.69											
900724	0.00											

Table 90-9e. Treatment N2, cv. Golf.

date yymmdd	total leaf (m2.m-2)	leaf 1 (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)	leaf 6 (m2.m-2)	leaf 7 (m2.m-2)	leaf 8 (m2.m-2)	leaf 9 (m2.m-2)	flagleaf (m2.m-2)	rest leaf (m2.m-2)
900417	0.24											
900502	1.67	0.11	0.12	0.20								1.23
900515	3.95				0.33	0.42	0.37					2.83
900529	6.37						0.45	0.59	0.47	0.09	0.15	4.63
900612	4.90											
900711	0.62											
900724	0.00											

Table 90-9. (continued) Leaf area index.

Table 90-9f. Treatment N3, cv. Golf. Leaves are numbered in order of emergence.

date yymmdd	total leaf (m2.m-2)	leaf 1 (m2.m-2)	leaf 2 (m2.m-2)	leaf 3 (m2.m-2)	leaf 4 (m2.m-2)	leaf 5 (m2.m-2)	leaf 6 (m2.m-2)	leaf 7 (m2.m-2)	leaf 8 (m2.m-2)	leaf 9 (m2.m-2)	flagleaf (m2.m-2)	rest leaf (m2.m-2)
900612	5.00											
900711	0.82											
900724	0.00											

Table 90-10. Specific Leaf Area.

Table 90-10a. Treatment N1, cv. Prisma. Leaves are numbered in order of emergence.

date yymmdd	total leaf (cm2.gr-1)	leaf 1 (cm2.gr-1)	leaf 2 (cm2.gr-1)	leaf 3 (cm2.gr-1)	leaf 4 (cm2.gr-1)	leaf 5 (cm2.gr-1)	leaf 6 (cm2.gr-1)	leaf 7 (cm2.gr-1)	leaf 8 (cm2.gr-1)	leaf 9 (cm2.gr-1)	flagleaf (cm2.gr-1)	rest leaf (cm2.gr-1)
900417	229.8											
900502	231.6	230.1	220.6	214.8								239.4
900515	278.2				313.7	299.9	323.7					264.3
900529	281.8						288.6	259.5	255.6	281.7	230.1	290.2
900612	277.7											
900626	286.4											
900711	240.0											
900724	0.0											

Table 90-10. (continued) Specific Leaf Area.

Table 90-10b. Treatment N2, cv. Prisma.

date yymmdd	total leaf (cm2.gr-1)	leaf 1 (cm2.gr-1)	leaf 2 (cm2.gr-1)	leaf 3 (cm2.gr-1)	leaf 4 (cm2.gr-1)	leaf 5 (cm2.gr-1)	leaf 6 (cm2.gr-1)	leaf 7 (cm2.gr-1)	leaf 8 (cm2.gr-1)	leaf 9 (cm2.gr-1)	flagleaf (cm2.gr-1)	rest leaf (cm2.gr-1)
900417	225.7											
900502	254.1	244.5	240.0	225.6								262.6
900515	293.7				318.2	303.4	311.4					288.4
900529	292.0						288.5	281.8	256.3	250.1	246.7	304.1
900612	296.1											
900626	313.2											
900711	258.2											
900724	0.0											

Table 90-10c. Treatment N3, cv. Prisma. Leaves are numbered in order of emergence.

date yymmdd	total leaf (cm2.gr-1)	leaf 1 (cm2.gr-1)	leaf 2 (cm2.gr-1)	leaf 3 (cm2.gr-1)	leaf 4 (cm2.gr-1)	leaf 5 (cm2.gr-1)	leaf 6 (cm2.gr-1)	leaf 7 (cm2.gr-1)	leaf 8 (cm2.gr-1)	leaf 9 (cm2.gr-1)	flagleaf (cm2.gr-1)	rest leaf (cm2.gr-1)
900612	290.4											
900626	309.8											
900711	263.6											
900724	0.0											

Table 90-10. (continued) Specific Leaf Area.

Table 90-10d. Treatment N1, cv. Golf. Leaves are numbered in order of emergence.

date yymmdd	total leaf (cm2.gr-1)	leaf 1 (cm2.gr-1)	leaf 2 (cm2.gr-1)	leaf 3 (cm2.gr-1)	leaf 4 (cm2.gr-1)	leaf 5 (cm2.gr-1)	leaf 6 (cm2.gr-1)	leaf 7 (cm2.gr-1)	leaf 8 (cm2.gr-1)	leaf 9 (cm2.gr-1)	flagleaf (cm2.gr-1)	rest leaf (cm2.gr-1)
900417	243.9											
900502	262.5	246.5	246.0	252.4								266.9
900515	278.1				317.9	295.7	332.1					267.0
900529	284.7						297.8	271.4	225.6	245.9	187.2	293.9
900612	279.1											
900626	269.0											
900711	234.8											
900724	0.0											

Table 90-10. (continued) Specific Leaf Area.

Table 90-10e. Treatment N2, cv. Golf.

date yymmdd	total leaf (cm2.gr-1)	leaf 1 (cm2.gr-1)	leaf 2 (cm2.gr-1)	leaf 3 (cm2.gr-1)	leaf 4 (cm2.gr-1)	leaf 5 (cm2.gr-1)	leaf 6 (cm2.gr-1)	leaf 7 (cm2.gr-1)	leaf 8 (cm2.gr-1)	leaf 9 (cm2.gr-1)	flagleaf (cm2.gr-1)	rest leaf (cm2.gr-1)
900417	248.7											
900502	258.4	251.3	245.8	247.5								262.6
900515	304.3				350.6	305.9	318.2					298.3
900529	303.1						303.1	285.2	256.3	229.6	238.5	316.2
900612	291.8											
900626	279.1											
900711	247.9											
900724	0.0											

Table 90-10f. Treatment N3, cv. Golf. Leaves are numbered in order of emergence.

date yymmdd	total leaf (cm2.gr-1)	leaf 1 (cm2.gr-1)	leaf 2 (cm2.gr-1)	leaf 3 (cm2.gr-1)	leaf 4 (cm2.gr-1)	leaf 5 (cm2.gr-1)	leaf 6 (cm2.gr-1)	leaf 7 (cm2.gr-1)	leaf 8 (cm2.gr-1)	leaf 9 (cm2.gr-1)	flagleaf (cm2.gr-1)	rest leaf (cm2.gr-1)
900612	290.7											
900626	279.7											
900711	248.6											
900724	0.0											

Table 90-11. Nitrogen distribution and nitrogen content in crop.

Table 90-11a. Treatment N1, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417		7.97	58.50	5.69			46.85	2.29						
900502		25.23	45.40	4.54			30.80	3.56	23.26	1.93				
900515		46.79		30.50	12.50	0.28	18.20	3.69	28.50	12.29				
900529		94.81		55.00	14.00	2.85			12.80	36.91				
900612		99.70	31.90	38.38	15.20	1.07			8.26	34.97	15.90	14.65	15.80	10.65
900618									7.99		14.85			
900626					17.10				10.50		17.80		16.50	
900704											14.00		13.50	
900711		133.30	22.30	3.12	11.40	6.70			6.23	25.38	11.70	14.30	14.20	83.81
900718											8.66		18.70	
900724		168.30			11.10	7.12			5.28	19.16	5.63	7.07	17.20	135.00
900801											5.75		16.10	
900802		152.02			10.08	6.13			3.35	11.98	5.93	6.86	18.10	127.05

Table 90-11. (continued) Nitrogen distribution and nitrogen content in crop.

Table 90-11b. Treatment N2, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417		8.41	60.40	6.03			50.00	2.37						
900502		43.55	60.10	33.80			43.68	6.06	33.29	3.70				
900515		69.93		45.40	11.50	0.09	19.50	5.41	31.40	19.06				
900529		135.40		78.31	12.50	4.52			14.60	52.62				
900612		157.50	37.90	63.38	11.40	1.56			10.90	57.77	17.40	20.65	16.90	14.11
900618									9.11		15.60			
900626					18.80				13.20		17.60		17.90	
900704											15.20		14.80	
900711		192.60	23.20	5.68	14.40	11.13			7.79	42.29	13.10	19.51	16.70	113.96
900718											10.91		21.30	
900724		210.90			13.70	10.79			5.78	23.24	10.08	12.60	20.90	164.20
900801											7.62		18.80	
900802		171.17			12.35	9.27			4.11	17.16	6.30	6.97	18.90	137.77

Table 90-11. (continued) Nitrogen distribution and nitrogen content in crop.

Table 90-11c. Treatment N3, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900612		154.30	39.10	62.47	16.50	2.02			11.80	55.43	18.60	20.44	17.90	13.99
900618									13.60		17.55			
900626					19.10				17.50		20.90		19.60	
900704											16.60		16.95	
900711		236.70	26.20	11.25	14.60	11.47			11.00	62.67	14.30	22.79	17.00	128.55
900718											12.00		22.40	
900724		289.20			15.70	15.78			8.01	38.89	9.27	13.62	24.50	220.9
900801											8.76		22.75	
900802		212.33			15.50	11.63			6.45	26.67	9.01	11.13	23.80	162.9

Table 90-11. (continued) Nitrogen distribution and nitrogen content in crop.

Table 90-11d. Treatment N1, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417		8.39	63.16	5.85			53.48	2.54						
900502		25.37	44.90	20.41			29.30	2.95	23.29	2.02				
900515		52.46		32.10	11.50	0.32	14.00	2.99	28.00	17.09				
900529		105.98		53.10	13.90	2.46			13.70	50.41				
900612		106.70	31.40	41.06	12.80	0.75			8.44	42.52	16.30	13.26	16.40	9.14
900618									8.32		17.35			
900626					17.50				10.90		17.40		18.30	
900704											14.50		14.15	
900711		162.00	21.70	8.01	11.90	7.94			5.76	34.95	11.40	12.00	16.10	99.06
900718											8.62		19.60	
900724		173.20			11.90	8.83			4.86	22.41	6.96	7.06	19.60	134.90
900801											6.67		17.85	
900802		150.21			12.75	8.41			4.03	17.77	7.21	6.03	19.80	118.00

Table 90-11. (continued) Nitrogen distribution and nitrogen content in crop.

Table 90-11e. Treatment N2, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417		8.93	66.58	6.36			55.77	2.57						
900502		47.02	57.30	36.68			42.99	5.74	32.18	4.60				
900515		81.83		50.20	11.00	0.09	17.20	4.59	30.40	26.99				
900529		156.20		87.62	15.50	6.86			13.70	61.73				
900612		152.00	34.00	59.97	10.70	2.46			9.27	59.93	19.50	19.82	18.10	12.79
900618									9.68		17.80			
900626					13.30				13.70		18.70		19.70	
900704											15.20		16.95	
900711		211.60	23.20	5.87	15.10	13.62			7.35	49.51	11.60	13.66	18.20	128.95
900718											7.59		20.60	
900724		233.90			14.20	14.23			5.59	32.48	6.61	7.54	21.70	179.60
900801											7.19		19.80	
900802		138.24			15.45	10.59			5.38	24.17	9.77	7.70	23.00	95.78

Table 90-11. (continued) Nitrogen distribution and nitrogen content in crop.

Table 90-11f. Treatment N3, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900612		185.90	38.80	66.69	13.40	2.66			13.20	83.26	21.30	20.90	18.60	12.42
900618									14.25		19.20			
900626					18.80				16.60		21.70		22.60	
900704											16.40		19.30	
900711		256.70	23.00	7.49	16.80	16.72			9.82	69.67	12.80	16.35	21.00	146.5
900718											8.99		24.40	
900724		300.70			16.30	18.24			9.83	57.87	7.84	9.26	25.50	215.3
900801											6.93		20.65	
900802		208.11			18.20	15.29			7.45	35.30	11.75	11.00	25.50	158.3

Table 90-12. Carbohydrates distribution and carbohydrates content in crop.

Table 90-12a. Treatment N1, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417		19.94	133.00	12.93			144.50	7.01						
900502		107.00	171.00	73.60			143.00	16.94	201.00	16.43				
900515		137.84		38.50			165.00	33.57	152.00	65.73				
900529		1130.23		182.10	87.70	17.87			323.00	930.20				
900612		1255.70	60.10	72.22					250.00	1057.30	55.10	50.98	112.00	75.15
900618									297.00		103.95			
900626					98.95				201.00		51.80		221.00	
900704											46.45		72.25	
900711		928.80			16.60	9.37			144.00	606.72	29.40	32.96	45.70	279.79
900718											25.00		43.60	
900724		444.10			6.35	4.11			32.30	117.60	16.30	20.62	38.50	301.80
900801											3.76		33.85	
900802		251.46			6.19	3.18			8.48	30.95	2.81	3.62	29.90	213.72

Table 90-12. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 90-12b. Treatment N2, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417		20.19	130.50	13.07			150.00	7.12						
900502		94.85	102.00	57.01			163.00	22.57	137.00	15.27				
900515		160.62		50.90			133.00	37.54	117.00	72.22				
900529		1193.90		181.59	60.40	22.04			14.60	52.62				
900612		1054.20	36.60	61.24	54.60	7.61			164.00	861.30	39.10	46.45	92.90	77.51
900618									229.00		99.30			
900626					78.80				116.00		55.00		214.00	
900704											45.25		70.45	
900711		994.10	33.40	8.19	15.60	11.98			116.00	626.98	24.60	36.63	45.30	310.28
900718											23.40		42.20	
900724		408.90			6.74	5.35			23.90	96.14	14.20	18.03	37.00	289.40
900801											5.41		34.90	
900802		270.17			1.53	1.01			9.18	35.46	2.40	2.51	31.70	231.19

Table 90-12. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 90-12c. Treatment N3, cv. Prisma.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900612		717.80	41.70	65.21	134.00	16.90			114.00	541.60	32.90	35.78	85.60	66.79
900618									146.00		89.50			
900626					57.60				99.70		41.00		208.00	
900704											44.55		66.55	
900711		742.80	35.40	18.29	13.00	10.23			68.10	395.87	22.70	36.16	38.70	291.36
900718											22.80		42.30	
900724		509.10			7.06	7.12			26.20	126.90	18.40	27.05	38.80	348.00
900801											3.22		33.95	
900802		220.03			2.18	1.78			2.82	12.00	1.67	2.04	29.60	204.21

Table 90-12. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 90-12d. Treatment N1, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417		14.77	98.50	9.15			118.50	5.62						
900502		104.50	144.00	65.62			222.00	22.66	188.00	16.17				
900515		140.95		45.40			126.00	26.93	112.00	68.64				
900529		1098.23		181.70	127.00	22.51			242.00	894.06				
900612		1210.20	54.60	70.35					206.00	1035.80	51.50	41.92	110.60	62.11
900618									234.00		79.00			
900626					108.00				145.00		52.30		194.00	
900704											43.70		61.10	
900711		1344.20	36.10	10.65	18.70	12.52			158.00	973.32	33.20	35.18	50.20	317.81
900718											22.90		44.70	
900724		484.10			4.76	3.60			46.70	214.30	11.90	12.06	36.90	254.20
900801											6.17		37.70	
900802		280.90			3.25	2.20			14.49	62.01	5.05	4.22	35.50	212.47

Table 90-12. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 90-12e. Treatment N2, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417		13.42	87.60	8.40			109.00	5.02						
900502		102.17	93.50	60.10			159.00	21.22	144.00	20.85				
900515		158.94		51.80			108.00	27.92	90.00	79.24				
900529		995.90		182.85	88.60	39.84			171.00	773.19				
900612		1495.50	47.00	78.66	58.00	14.00			200.00	1287.70	41.20	41.81	104.00	73.30
900618									205.00		88.35			
900626					45.10				115.00		39.40		137.00	
900704											38.50		57.80	
900711		1104.50	57.50	14.75	17.00	15.24			109.00	731.39	22.00	25.95	46.00	324.50
900718											14.00		42.60	
900724		674.10			6.32	6.31			52.70	305.90	13.10	14.55	41.70	347.30
900801											5.57		37.25	
900802		184.01			1.18	0.44			12.35	51.84	1.50	1.53	31.60	130.20

Table 90-12. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 90-12f. Treatment N3, cv. Golf.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900612		1000.20	34.00	58.42	58.40	11.89			133.00	835.60	33.10	32.44	92.30	61.84
900618									139.00		75.80			
900626					56.10				77.50		30.50		172.00	
900704											40.00		60.55	
900711		749.50	40.60	12.33	12.70	11.98			61.40	417.64	19.00	22.58	42.00	285.01
900718											16.80		42.50	
900724		566.60			7.62	8.54			33.00	194.30	13.20	15.62	41.20	348.20
900801											3.30		33.45	
900802		346.63			5.77	5.28			27.10	136.12	5.55	6.34	36.80	244.26

Table 90-13. Nitrogen distribution and nitrogen content in green leaves.

Table 90-13a. Treatment N1, cv. Prisma. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417	58.50	5.69																
900502	45.40	4.54																
900515		30.50	30.20	1.76	34.00	2.90	39.80	3.38									39.00	22.50
900529		55.00					33.70	3.94	41.60	7.16	36.70	4.74	-	-	37.60	1.71	35.20	37.51
900612	31.90	38.38																
900626									19.30		26.70		33.20		39.30			
900711	22.30	3.12																

Table 90-13. (continued) Nitrogen distribution and nitrogen content in green leaves.

Table 90-13b. Treatment N2, cv. Prisma. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417	60.40	6.03																
900502	60.10	33.80																
900515		45.40	31.60	2.40	34.80	3.85	40.50	3.89									42.40	35.23
900529		78.31					34.80	3.99	44.40	6.83	46.80	8.35	40.80	1.88	41.00	1.96	42.60	56.23
900612	37.90	63.38																
900626							18.80		20.60		28.00		38.10		42.60			
900711	23.20	5.68																

Table 90-13c. Treatment N3, cv. Prisma.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900612	39.10	62.47																
900626							18.80		23.10		31.80		41.40		43.90			
900711	26.20	11.25																

Table 90-13. (continued) Nitrogen distribution and nitrogen content in green leaves.

Table 90-13d. Treatment N1, cv. Golf. Leaves : Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417	63.16	5.85																
900502	44.90	20.41																
900515		32.10	28.10	1.85	30.80	2.92	37.10	2.90									35.50	24.40
900529		53.10					33.00	4.25	39.80	6.89	36.50	3.32	30.80	0.79	38.00	1.99	28.10	36.27
900612	31.40	41.06																
900626							16.30		20.30		26.40		33.40		38.70			
900711	21.7	8.01																

Table 90-13. (continued) Nitrogen distribution and nitrogen content in green leaves.

Table 90-13e. Treatment N2, cv. Golf. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417	66.58	6.36																
900502	57.30	36.68																
900515		50.20	30.90	2.91	37.20	5.17	41.60	4.85									39.00	37.24
900529		87.62					32.60	4.88	45.70	9.44	49.20	8.94	41.60	1.61	43.90	2.71	41.60	60.84
900612	34.00	59.97																
900626							15.30		20.50		29.30		36.10		42.50			
900711	23.20	5.87																

Table 90-13f. Treatment N3, cv. Golf.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900612	38.80	66.69																
900626							20.80		24.60		34.80		42.40		45.20			
900711	23.00	7.49																

Table 90-14. Carbohydrates distribution and carbohydrates content in green leaves.

Table 90-14a. Treatment N1, cv. Prisma. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417	133.00	12.93																
900502	171.00	73.60																
900515		38.50	39.50	2.35	73.20	6.21	65.00	5.49									42.40	24.50
900529		182.10					111.40	13.03	161.00	27.47	171.00	21.85	-	-	67.20	3.06	112.00	116.73
900612	60.10	72.22																
900626									49.30		53.90		59.50		30.30			
900711																		

Table 90-14. (continued) Carbohydrates distribution and carbohydrates content in green leaves.

Table 90-14b. Treatment N2, cv. Prisma. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417	130.50	13.07																
900502	102.00	57.01																
900515		50.90	37.70	2.99	55.20	6.24	60.20	5.77									42.10	35.85
900529		181.59					95.40	11.08	113.00	11.25	140.00	25.17	110.00	5.07	52.90	2.55	93.70	122.91
900612	36.60	61.24																
900626							-		49.90		41.10		38.30		27.70			
900711	33.40	8.19																

Table 90-14c. Treatment N3, cv. Prisma. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900612	41.70	65.21																
900626							-		28.50		25.40		24.70		22.70			
900711	35.40	18.29																

Table 90-14. (continued) Carbohydrates distribution and carbohydrates content in green leaves.

Table 90-14d. Treatment N1, cv. Golf. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417	98.5	9.15																
900502	144.00	65.62																
900515		45.40	46.00	3.04	63.50	6.00	68.90	5.35									45.00	31.00
900529		181.70					86.60	11.10	117.00	20.49	147.00	13.65	-	-	67.80	3.49	104.00	132.94
900612	54.60	70.35																
900626									43.20		48.60		57.50		32.90			
900711	36.10	10.65																

Table 90-14. (continued) Carbohydrates distribution and carbohydrates content in green leaves.

Table 90-14e. Treatment N1, cv. Golf. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900417	87.60	8.40																
900502	93.50	60.10																
900515		51.80	36.00	3.39	48.30	6.73	41.20	4.79									39.50	36.87
900529		182.85					75.50	11.52	94.00	19.62	113.60	20.51	-	-	56.40	3.48	86.80	127.72
900612	47.00	78.66																
900626							-		41.60		44.40		39.40		28.10			
900711	57.50	14.75																

Table 90-14f. Treatment N1, cv. Golf. Leaves are numbered in order of emergence.

date	total leaf		leaf 4		leaf 5		leaf 6		leaf 7		leaf 8		leaf 9		flagleaf		rest leaf	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
900612	34.00	58.42																
900626							-		29.30		30.70		22.60		23.70			
900711	40.60	12.33																

Table 90-15. Kernel growth.

Table 90-15a. Cv. Prisma.

date yymmdd	dry weight per kernel (mg)		
	treatment N1	treatment N2	treatment N3
900612	4.22	3.89	3.90
900618	7.25	6.65	6.15
900626	15.31	14.64	14.29
900704	32.55	30.68	29.74
900711	39.80	34.43	33.28
900718	43.92	41.11	40.86
900724	51.73	48.03	42.53
900801	50.27 *)1	44.61 *)1	41.60 *)1

Table 90-15b. Cv. Golf.

date yymmdd	dry weight per kernel (mg)		
	treatment N1	treatment N2	treatment N3
900612	3.62	3.53	3.31
900618	6.72	6.41	5.48
900626	15.38	16.36	14.74
900704	30.17	29.32	29.73
900711	35.69	35.74	31.10
900718	42.74	45.62	43.27
900724	48.25	47.10	45.16
900801	46.65 *)1	44.91 *)1	42.68 *)1

*)1 The first five harvests are samples of kernels from main stems, at the final harvest the kernels are from a general sample. For more information see paragraph 2.2.

Table 90-16. Kernel size distribution at final harvest.

Table 90-16a. Fresh weight distribution (%).

sort (mm)	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
< 2.0	4.77	5.57	7.07	3.91	6.50	6.40
2.0 - 2.2	5.82	7.48	9.29	4.93	6.70	7.33
2.2 - 2.5	14.49	19.58	23.62	15.49	18.07	19.14
2.5 - 2.8	27.66	31.69	37.58	31.61	31.46	37.06
2.8 - 3.0	13.45	11.66	10.60	16.68	14.45	13.74
> 3.0	33.80	24.01	11.83	27.38	22.82	16.32

Table 90-16b. Fresh weight per kernel per sortingclass (mg).

sort (mm)	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
total	42.64	40.62	37.66	42.16	38.86	39.48
< 2.0	19.28	18.85	18.82	18.24	18.68	18.64
2.0 - 2.2	26.55	25.90	25.96	25.78	25.84	26.18
2.2 - 2.5	33.37	33.07	33.28	32.59	32.50	32.62
2.5 - 2.8	42.97	42.95	43.22	44.53	42.12	42.46
2.8 - 3.0	49.54	49.73	51.13	49.99	49.38	49.75
> 3.0	57.09	56.75	57.56	55.50	54.59	55.49

Table 90-16. (continued) Kernel size distribution at final harvest.

Table 90-16c. Dry matter content per sortingclass (%).

sort (mm)	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
< 2.0	88.68	88.68	89.01	88.91	88.68	88.76
2.0 - 2.2	88.57	88.75	88.78	88.79	89.03	88.90
2.2 - 2.5	89.56	89.51	89.69	89.74	89.66	89.82
2.5 - 2.8	91.50	91.63	91.79	91.77	91.52	91.90
2.8 - 3.0	90.58	90.66	90.65	89.88	90.39	90.62
> 3.0	91.33	91.49	91.23	91.28	91.54	91.44

Table 90-17. Combine harvest kernel yield (kg.ha-1) at 16 % moisture.

date yymmdd	cv. Prisma			cv. Golf		
	N1	N2	N3	N1	N2	N3
900803	7132	6913	6581	6455	6245	6180

Table 90-18. Score for lodging and hear's ear (secondary growth)

1= little lodging/hear's ear; 10 = much lodging/hear's ear.

date yymmdd	cv. Prisma			cv. Golf		
900719	N1	N2	N3	N1	N2	N3
Lodging	2.8	6.6	8.4	6.0	7.1	8.5
Hear's ear	3.1	4.3	6.9	4.8	6.1	8.6

Table 90-19. Soil mineral nitrogen content and amount (ammonium + nitrate).

Table 90-19a. Cv. Prisma.

treatment	date yymmdd	nitrogen content and amount per soil layers					
		0 - 30 cm		30 - 60 cm		60 - 90 cm	
		(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)
N1	900530	4.01	15.64	3.89	15.17	3.57	13.92
	900803	6.37	24.84	5.19	20.24	4.18	16.30
N2	900530	9.20	35.88	7.21	28.12	7.71	30.07
	900803	5.59	21.80	4.44	17.32	4.21	16.42
N3	900803	7.68	29.95	4.78	18.64	5.08	19.81

Table 90-19b. Cv. Golf

treatment	date yymmdd	nitrogen content and amount per soil layers					
		0 - 30 cm		30 - 60 cm		60 - 90 cm	
		(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)
N1	900530	4.18	16.30	3.56	13.88	4.47	17.43
	900803	5.11	19.93	4.84	18.88	3.50	13.65
N2	900530	6.09	23.75	7.44	29.02	8.19	31.94
	900803	5.67	22.11	4.76	18.56	2.52	9.83
N3	900803	8.03	31.32	5.74	22.39	6.64	25.90

Table 90-20. Statistical analyses.

Table 90-20a. Statistical analyses of plant parts and crop caracteristics.

Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Total plant mass above and below ground, fresh weight. [kg.ha-1]	T1	-	-	-
	T2	-	*	-
	T3	***	***	-
Total plant mass above and below ground, dry weight. [kg.ha-1]	T1	-	-	-
	T2	-	*	-
	T3	***	**	-
Total plant mass above ground, fresh weight. [kg.ha-1]	T1	-	-	-
	T2	(*)	*	-
	T3	***	***	(*)
	T4	***	***	-
	T5	***	***	-
	T7	**	***	-
	T8	**	**	-
	T9	-	-	-
Total plant mass above ground, dry weight. [kg.ha-1]	T1	-	-	-
	T2	-	*	-
	T3	***	***	-
	T4	***	**	-
	T5	***	***	-
	T7	-	**	-
	T8	(*)	**	-
	T9	-	-	-
Green leaves + stems, fresh [kg.ha-1]	T1	-	-	-
Green leaves + stems, dry [kg.ha-1]	T1	-	-	-
Total of green leaves, fresh weight. [kg.ha-1]	T2	(*)	*	-
	T3	***	***	(*)
	T4	***	**	-
	T5	-	***	-
	T7	-	**	-
Total of green leaves, dry weight. [kg.ha-1]	T2	-	*	-
	T3	***	***	-
	T4	***	*	-
	T5	(*)	***	-
	T7	-	**	-
Stems and sheaths, fresh weight. [kg.ha-1]	T2	*	**	-
	T3	***	***	-
	T4	***	***	-
	T5	***	***	-
	T7	***	***	-
	T8	***	**	-
	T9	***	(*)	-
Stems and sheaths, dry weight. [kg.ha-1]	T2	(*)	*	-
	T3	***	**	(*)
	T4	***	**	-
	T5	***	***	(*)
	T7	***	**	-
	T8	***	**	(*)
	T9	***	(*)	-

Table 90-20a. (continued) Statistical analyses of plant parts and crop caracteristics.

Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Stem parts below ground, fresh weight. [kg.ha-1]	T1	-	-	-
	T2	-	(*)	-
	T3	-	**	*
Stem parts below ground, dry weight. [kg.ha-1]	T1	-	-	-
	T2	-	(*)	-
	T3	-	**	-
Dead leaves, fresh weight. [kg.ha-1]	T3	-	***	-
	T4	*	***	**
	T5	(*)	**	-
	T7	*	**	*
	T8	***	**	-
	T9	**	-	(*)
Dead leaves, dry weight. [kg.ha-1]	T3	-	**	-
	T4	*	***	***
	T5	**	**	(*)
	T7	**	**	-
	T8	***	***	-
	T9	**	-	(*)
Kernels, fresh weight. [kg.ha-1]	T5	***	***	-
	T7	*	**	-
	T8	(*)	-	-
	T9	*	-	-
Kernels, dry weight. [kg.ha-1]	T5	***	***	-
	T7	-	(*)	-
	T8	-	(*)	-
	T9	*	-	-
Chaff, fresh weight. [kg.ha-1]	T5	***	***	-
	T7	***	**	-
	T8	***	*	-
	T9	**	-	-
Chaff, dry weight. [kg.ha-1]	T5	***	***	-
	T7	***	**	-
	T8	***	(*)	-
	T9	**	-	-
Ears, fresh weight. [kg.ha-1]	T5	***	***	-
	T7	***	**	-
	T8	(*)	-	-
	T9	**	-	-
Ears, dry weight. [kg.ha-1]	T5	***	***	-
	T7	(*)	(*)	-
	T8	(*)	(*)	-
	T9	**	-	-

Table 90-20a. (continued) Statistical analyses of plant parts and crop caracteristics.

Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Leaf area index, LAI. [m2.m-2]	T1	-	-	-
	T2	(*)	*	-
	T3	***	***	(*)
	T4	**	**	-
	T5	-	***	-
	T7	-	*	-
Number of plants. [1.m-2]	T1	-	-	-
	T2	-	-	(*)
Plant hight. [cm]	T3	***	*	-
	T4	***	***	-
	T7	***	(*)	-
	T8	***	**	-
Number of sprouts. [1.plant-1]	T3	-	-	-
	T4	-	-	-
Number of blades. [1.m-2]	T5	-	**	-
	T9	-	**	-
Peduncle length. [cm]	T7	***	-	-
	T8	***	-	***
Number of main stems. [1.m-2]	T9	-	(*)	-
Number of hare's ears [1.m-2]	T9	*	***	-

Table 90-20. (continued) Statistical analyses.

Table 90-20b. *Statistical analyses of nitrogen and carbohydrate amounts in plant parts.*

Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Total N amount in above ground parts (leaves and stems). [kg.ha-1]	T1	-	-	-
Total N amount in green leaves. [kg.ha-1]	T2	-	**	-
	T3	(*)	***	-
	T4	(*)	***	*
	T5	-	***	(*)
	T7	-	***	-
Total N amount in stems and sheaths. [kg.ha-1]	T2	*	***	(*)
	T3	***	***	-
	T4	***	**	-
	T5	***	***	***
	T7	**	***	-
	T8	***	***	***
	T9	***	***	-
Total N amount in stem below ground. [kg.ha-1]	T1	-	-	-
	T2	-	**	-
	T3	*	**	-
Total N amount in dead leaves. [kg.ha-1]	T3	-	**	-
	T4	***	***	***
	T5	(*)	*	-
	T7	***	**	-
	T8	***	***	-
	T9	***	**	*
Total N amount in kernels. [kg.ha-1]	T5	***	***	-
	T7	*	***	-
	T8	-	***	-
	T9	-	**	-
Total N amount in chaff. [kg.ha-1]	T5	-	***	-
	T7	***	***	**
	T8	***	**	**
	T9	-	**	(*)
Total N amount in ears. [kg.ha-1]	T5	**	***	-
	T7	-	***	-
	T8	-	***	-
	T9	-	**	-
Total N amount in whole plants. [kg.ha-1]	T1	-	-	-
	T2	-	**	-
	T3	**	***	-
	T4	***	***	-
	T5	**	***	***
	T7	*	***	-
	T8	(*)	***	-
	T9	-	**	-

Table 90-20b. (continued) Statistical analyses of nitrogen and carbohydrate amounts in plant parts.

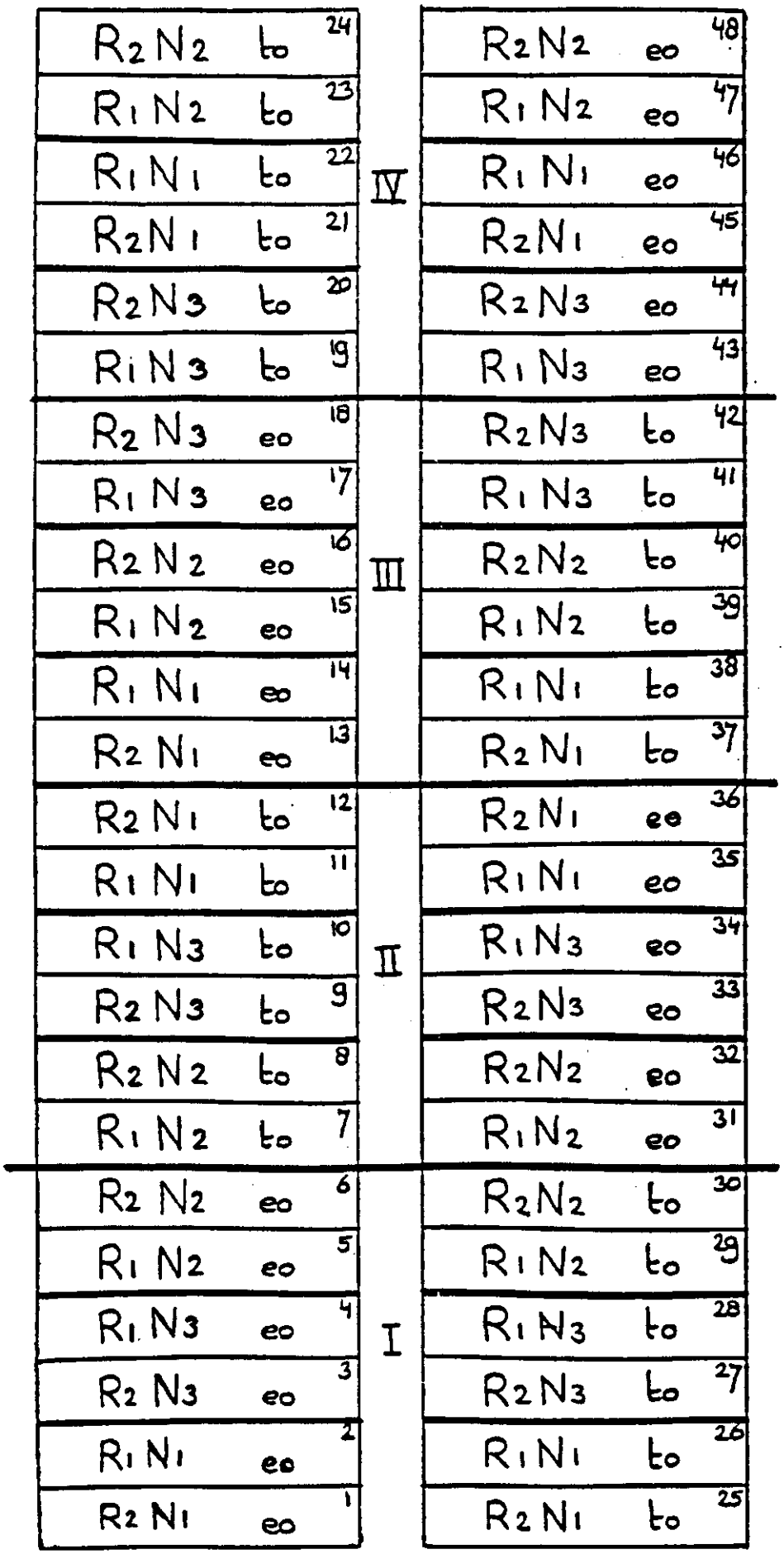
Properties	Harvest number	Significance :		
		Variety	N-level	Variety * N-level
Carbohydrate amount in above ground parts (leaves and stems). [kg.ha-1]	T1	**	-	-
Carbohydrate amount in green leaves. [kg.ha-1]	T2	-	-	-
	T3	-	(*)	-
	T4	-	-	-
	T5	-	-	*
	T7	-	-	-
Carbohydrate amount in stems and sheaths. [kg.ha-1]	T2	-	-	-
	T3	-	-	-
	T4	**	-	(*)
	T5	***	***	***
	T7	-	**	-
	T8	***	-	*
	T9	***	(*)	*
Carbohydrate amount in stem below ground. [kg.ha-1]	T1	**	-	-
	T2	-	-	-
	T3	*	-	-
Carbohydrate amount in dead leaves. [kg.ha-1]	T3			
	T4	**	*	(*)
	T5	-	*	*
	T7	**	-	-
	T8	**	***	**
	T9	-	***	*
Carbohydrate amount in kernels. [kg.ha-1]	T5	**	**	-
	T7	-	-	(*)
	T8	-	(*)	**
	T9	-	-	(*)
Carbohydrate amount in chaff. [kg.ha-1]	T5	***	***	-
	T7	***	**	**
	T8	***	***	-
	T9	-	-	(*)
Carbohydrate amount in ears. [kg.ha-1]	T5	**	**	-
	T7	(*)	-	-
	T8	-	*	**
	T9	-	-	(*)
Carbohydrate amount in whole plants. [kg.ha-1]	T1	**	-	-
	T2	-	-	-
	T3	-	-	-
	T4	*	-	(*)
	T5	***	***	***
	T7	-	**	-
	T8	***	-	**
	T9	*	-	*

Table 90-20. (continued) Statistical analyses.

Table 90-20c. Meaning of used symbols.

symbol	significance
-	: P > 0.200
(*)	: 0.100 < P < 0.200
*	: 0.050 < P < 0.100
**	: 0.010 < P < 0.050
***	: P < 0.010

Figure 90-21. Experimental design.



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At different harvest dates carbohydrate content and amount in total plant, green leaf, dead leaf, stem below ground, stems plus sheaths, chaff and grains
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Per sortingclass the nitrogen content of the kernels in that class
91-16a. Treatment N1
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Table 91-1. General information

	KG9104
Location	: Randwijk Experimental farm 'De Bouwing' field no. 8
Barley variety	: Prisma
Sowing date	: 16 maart 1991
Soil type	: Clay
Percentage silt	: 62%
Row spacing	: 12 cm
Previous crop	: consumption potatoes
Sowing density	: 300 seeds/m²

Table 91-2. Treatments

Table 91-2a. Nitrogen dressings (kg/ha)

Mineral nitrogen (910227)(0-60 cm) : 70 kg/ha

treatment	date (yymmdd)		total (incl. N min)
	910403	910603	
N1	0	0	70
N2	20	0	90
N3	20	60	150

Table 91-2b. Shadowing period (light reduced 60 %)

treatment	date (yymmdd)		discription of period
	start	end	
S1	-	-	no shadow (control)
S2	910411	910519	from starting of tillering to beginning of culm elongation
S3	910521	910624	from beginning culm elongation to heading
S4	910627	910805	from heading to the end of the grain filling period

Table 91-3. Crop protection treatments.

date yymmdd	protection agent	active ingredient	amount
910513	Calixin	tridemorf	0.75 l.ha-1
	Terpal	chloormequat/ethifon	2.5 l.ha-1
910514	Basagran Duplo P	bentazon; mecoprop-p	2.0 l.ha-1
	Itarane	fluroxupyr	0.75 l.ha-1
910624	Tilt	propiconazool	0.5 l.ha-1
	Pirimor	pirimicarb	0.5 l.ha-1
910710	Bayfidan	triademenol	0.5 kg.ha-1

Table 91-4. Crop development description for main stem.

Table 91-4a. Treatment S1.

date yymmdd	number of defolded leaves	DC (Zadoks)	Remarks
910330		10	estimated 50 % emergence.
910402			estimated 100 % emergence.
910415	3	22	
910506	4	26	
910527		33	
910603		37	
910610		37 - 39	
910613		45	Treatment S4 has the same DC.
910617		49	
910626		60	

Table 91-4b. Treatment N2 S2.

date yymmdd	number of defolded leaves	DC (Zadoks)	Remarks
910516	5.0	21.8 - 30.5	
910527		33	
910603		37	
910610		41 - 43	
910613		41 - 43	Treatment S3 has the same DC.
910617		49	
910626		60	

Table 91-5. Crop description.

Table 91-5a. Treatment N1 S1.

date yymmdd	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	main tillers density [tillers.m-2]	hare's ear tillers density [tillers.m-2]
910402	254				
910416	250	1.51			
910603		5.11			
910626			22		
910805		8.20			
910812				838	331

Table 91-5b. Treatment N1 S2.

date yymmdd	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	tiller density [tillers.m-2]	tiller density [tillers.m-2]
910416	273	1.62			
910603		4.60			
910626			21		
910805		8.39			
910812				936	216

Table 91-5c. Treatment N1 S3.

date yymmdd	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	tiller density [tillers.m-2]	tiller density [tillers.m-2]
910416		1.45			
910603		5.25			
910626			15		
910805		9.19			
910812				1072	530

Table 91-5. (continued) Crop description.

Table 91-5d. Treatment N1 S4.

date yymmdd	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	tiller density [tillers.m-2]	tiller density [tillers.m-2]
910416		1.54			
910805		8.91			
910812				769	168

Table 91-5. (continued) Crop description.

Table 91-5e. Treatment N3 S1.

date yymmdd	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	tiller density [tillers.m-2]	hare's ear tillers density [tillers.m-2]
910416	253	1.47			
910603		5.68			
910626			22		
910805		9.44			
910812				945	672

Table 91-5f. Treatment N3 S2.

date yymmdd	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	tiller density [tillers.m-2]	tiller density [tillers.m-2]
910416	222	1.49			
910603		4.38			
910626			21		
910805		11.40			
910812				1029	481

Table 91-5g. Treatment N3 S3.

date yymmdd	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	tiller density [tillers.m-2]	tiller density [tillers.m-2]
910416		1.49			
910603		5.95			
910626			14		
910805		7.96			
910812				997	554

Table 91-5. (continued) Crop description.

Table 91-5h. Treatment N3 S4.

date yymmdd	plant density [plant.m-2]	number of sprouts per plant	number of kernels per ear	tiller density [tillers.m-2]	tiller density [tillers.m-2]
910416		1.58			
910805		6.59			
910812				816	182

Table 91-6. Harvest data.

date yymmdd	harvest number
910402	T1
910416	T2
910521	T3
910626	T4
910729	T5
910812	T6
910822	T6, treatment N3 S3

Table 91-7. Dry matter distribution.

Table 91-7a. Treatment N1 S1.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
910402	2.07	2.07	0.00	4.36 *)1			
910416	18.95	16.27	0.00	5.83	2.67		
910521	219.01	127.83	13.97	42.06	77.21		
910626	901.54	115.58	36.87		574.22	90.32	84.56
910729	1292.89	0.00	92.87	*)2	375.75	103.30	720.97
910812	1247.41	0.00	82.06	*)2	381.65	95.43	688.28

*)1 Including seedskin and reserve.
*)2 These harvests, only the main stems are harvested (aselect).

Table 91-7b. Treatment N1 S2.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
910416	14.33	12.09	0.00	3.92	2.24		
910521	204.71	122.88	4.88	24.57	76.95		
910626	888.87	130.49	67.11		559.31	73.33	58.63
910729	1221.20	0.00	108.25	*)2	385.91	93.75	633.29
910812	1272.08	0.00	99.16	*)2	382.80	94.41	695.71

Table 91-7c. Treatment N1 S3.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
910626	601.23	109.44	39.58		373.19	42.93	36.09
910729	918.02	35.60	70.17	*)2	323.55	73.60	447.14
910812	923.41	0.00	66.74	*)2	323.25	58.05	475.38

Table 91-7. (continued) Dry matter distribution.

Table 91-7d. Treatment N1 S4.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
910729	921.21	0.00	86.73	*)2	356.61	88.75	389.12
910812	847.36	0.00	75.29	*)2	340.82	76.73	354.51

Table 91-7e. Treatment N3 S1.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
910416	18.89	16.10	0.00	5.82	2.79		
910521	224.00	131.48	12.94	40.99	79.57		
910626	937.33	164.55	35.33		565.72	95.09	76.65
910729	1301.77	0.00	105.09	*)2	420.62	104.91	671.16
910812	1263.73	0.00	100.02	*)2	434.24	95.33	634.14

Table 91-7f. Treatment N3 S2.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
910416	13.54	11.33	0.00	3.53	2.21		
910521	215.52	133.11	4.04	26.23	78.34		
910626	871.31	151.77	80.86		518.97	65.98	53.74
910729	1201.81	0.00	107.26	*)2	422.34	107.56	564.65
910812	1214.63	0.00	103.98	*)2	427.64	84.55	598.45

*)2 These harvests, only the main stems are harvested (aselect).

Table 91-7. (continued) Dry matter distribution.

Table 91-7g. Treatment N3 S3.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
910626	624.42	129.59	49.89		387.49	31.87	25.58
910729	895.84	5.42	69.81	*)2	329.30	75.36	415.96
910812	844.75	0.00	54.96	*)2	303.33	60.49	425.98

Table 91-7h. Treatment N3 S4.

date yymmdd	total above ground (g.m-2)	green leaf (g.m-2)	dead leaf (g.m-2)	stem below ground (g.m-2)	stem + sheaths (g.m-2)	chaff (g.m-2)	grains (g.m-2)
910729	792.89	0.00	86.15	*)2	335.31	79.83	291.61
910812	849.88	0.00	66.44	*)2	350.21	79.70	353.53

*)2 These harvests, only the main stems are harvested (aselect).

Table 91-8. Leaf Area Index (LAI).

date yymmdd	Leaf Area Index (m2.m-2)							
treatment	N1 S1	N1 S2	N1 S3	N1 S4	N3 S1	N3 S2	N3 S3	N3 S4
910416	0.33	0.35			0.33	0.32		
910521	3.22	3.91			3.45	4.14		
910626	3.66	4.39	3.95		5.58	5.31	5.29	
910729	0.00	0.00	0.09	0.00	0.00	0.00	0.16	0.00
910812	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 91-9. Specific Leaf Area (SLA).

date yymmdd	Specific Leaf Area (cm2.gr-1)							
treatment	N1 S1	N1 S2	N1 S3	N1 S4	N3 S1	N3 S2	N3 S3	N3 S4
910416	202.8	287.2			206.5	283.1		
910521	251.7	318.4			260.8	312.4		
910626	315.6	331.4	360.8		339.0	348.3	408.1	
910729	0.0	0.0	278.6	0.0	0.0	0.0	316.3	0.0
910812	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 91-10. Nitrogen distribution and nitrogen content in crop.

Table 91-10a. Treatment N1 S1.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910416		11.22	49.13	7.99			39.26	2.29	35.18	0.94				
910521		81.80	38.50	49.41	14.10	1.96	19.20	8.06	29.00	22.38				
910626		127.70	32.60	37.48	11.20	4.09			9.62	55.27	17.60	15.83	17.80	15.01
910729		112.00			9.49	8.83			4.17	15.60	8.41	7.62	11.70	80.00
910812		154.60			9.61	7.94			3.75	14.30	6.09	5.89	18.40	126.50

Table 91-10b. Treatment N1 S2.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910416		10.02	61.34	7.42			52.67	2.07	49.02	1.08				
910521		95.71	43.90	53.90	21.10	1.02	27.50	6.78	44.70	34.00				
910626		137.00	34.30	44.94	14.80	9.90			10.50	58.88	17.40	12.80	17.90	10.47
910729		114.60			15.20	16.43			4.84	18.70	8.47	8.03	11.30	71.48
910812		155.90			13.20	13.03			3.96	15.14	6.04	5.71	17.60	122.00

Table 91-10. (continued) Nitrogen distribution and nitrogen content in crop.

Table 91-10c. Treatment N1 S3.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910626		120.90	39.60	43.25	14.00	5.66			15.20	56.55	19.60	8.43	19.40	7.01
910729		90.01	21.20	1.30	20.10	13.30			5.17	16.71	10.40	7.69	11.60	51.7
910812		127.40			15.60	10.42			5.12	16.46	6.70	3.88	20.40	96.66

Table 91-10d. Treatment N1 S4.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910729		78.61			10.90	9.54			4.72	16.84	9.73	8.63	11.20	43.6
910812		139.80			13.80	10.27			5.47	18.54	10.00	7.62	29.90	103.4

Table 91-10. (continued) Nitrogen distribution and nitrogen content in crop.

Table 91-10e. Treatment N3 S1.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910416		10.98	48.76	7.85			38.03	2.21	32.77	0.92				
910521		91.40	37.50	49.25	15.70	2.01	28.10	11.47	35.90	28.67				
910626		208.30	41.30	39.67	14.30	5.01			18.10	102.80	19.90	18.91	17.90	13.67
910729		155.40			14.60	15.38			7.11	30.54	9.03	9.50	14.80	100.00
910812		193.20			15.10	15.29			6.14	26.91	7.68	7.42	22.60	143.60

Table 91-10f. Treatment N3 S2.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910416		9.94	62.14	7.04			52.31	1.85	47.75	1.05				
910521		102.70	45.80	60.79	19.30	0.79	26.80	7.18	43.20	33.91				
910626		206.30	45.40	68.90	21.80	17.62			17.90	92.74	24.50	16.44	19.80	10.61
910729		158.50			17.90	19.14			8.16	34.62	12.80	14.03	16.00	90.66
910812		202.40			21.90	22.74			7.46	31.84	8.91	7.57	23.50	140.20

Table 91-10. (continued) Nitrogen distribution and nitrogen content in crop.

Table 91-10g. Treatment N3 S3.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910626		178.20	46.00	59.58	15.60	7.89			25.30	97.97	23.10	7.37	21.20	5.394
910729		143.70	40.00	3.90	21.40	14.94			10.10	32.64	15.20	11.47	19.90	82.7
910812		151.00			23.10	12.61			9.90	29.88	9.21	5.52	24.50	103

Table 91-10h. Treatment N3 S4.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910729		96.81			17.30	14.86			6.27	20.86	14.70	11.76	17.00	49.34
910812		174.80			17.10	11.42			7.71	26.85	11.60	9.25	36.10	127.3

Table 91-11. Carbohydrates distribution and carbohydrates content in crop.

Table 91-11a. Treatment N1 S1.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910416			91.00	14.81			67.90	3.99						
910521		437.90	120.00	152.20	68.40	9.54	229.00	96.27	234.00	180.00				
910626		1418.40	40.20	46.96	47.60	17.21			210.00	1209.30	41.60	37.82	129.00	107.10
910729		137.60			3.51	3.27			10.25	37.13	4.04	3.45	13.50	93.76
910812		247.30			3.28	2.79			4.28	16.18	2.63	2.51	32.80	225.80

Table 91-11b. Treatment N1 S2.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910416			8.25	1.00										
910521		284.70	67.10	82.34	48.80	2.67	216.00	53.01	191.00	148.10				
910626		1319.10	43.70	52.98	44.00	30.14			209.00	1156.60	39.40	28.57	86.90	50.83
910729		98.64			3.30	3.57			7.92	30.66	5.97	5.81	9.21	58.60
910812		260.60			6.51	6.49			5.08	19.43	2.24	2.11	33.40	232.60

Table 91-11. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 91-11c. Treatment N1 S3.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910626		493.20	29.00	31.79	19.70	7.78			108.00	400.70	45.40	19.32	92.60	33.63
910729		435.80	23.70	1.46	4.21	2.92			54.00	174.80	7.38	5.45	56.40	251.9
910812		183.70			4.42	2.96			4.42	14.29	2.12	1.23	34.70	165.3

Table 91-11d. Treatment N1 S4.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910729		95.15			2.78	2.42			4.11	14.52	2.76	2.44	19.40	75.77
910812		159.00			4.32	3.25			4.94	16.86	2.37	1.78	38.70	137.1

Table 91-11. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 91-11e. Treatment N3 S1.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910416			95.90	15.43			106.00	6.65						
910521		390.60	93.90	124.00	57.60	7.48	199.00	81.85	222.00	177.30				
910626		688.80	24.10	39.67	27.30	9.64			94.30	531.30	34.90	33.50	97.30	74.69
910729		226.70			3.49	3.66			9.48	43.49	3.52	3.86	23.10	175.70
910812		261.40			4.70	4.61			4.23	18.48	2.37	2.19	37.20	236.20

Table 91-11f. Treatment N3 S2.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910416			8.25	1.00										
910521		263.50	59.20	80.16	36.40	1.62	200.00	52.70	165.00	129.80				
910626		463.90	31.10	45.39	19.60	15.67			66.00	338.90	32.50	21.44	79.10	42.46
910729		61.93			3.55	3.81			6.52	27.21	6.62	7.42	4.19	23.50
910812		256.90			4.32	4.47			4.45	19.03	2.38	1.99	38.70	231.40

Table 91-11. (continued) Carbohydrates distribution and carbohydrates content in crop.

Table 91-11g. Treatment N3 S3.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910626		268.70	13.70	17.68	3.82	1.86			55.30	213.70	42.70	13.39	86.60	22.04
910729		379.10	25.60	2.49	6.92	4.84			48.30	160.20	13.30	10.09	48.30	202.7
910812		173.40			6.25	3.46			4.57	13.87	3.69	2.27	36.00	154.6

Table 91-11h. Treatment N3 S4.

date	total plant		green leaf		dead leaf		stem below ground		stems + sheaths		chaff		grains	
yymmdd	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)	(g.kg-1)	(kg.ha-1)
910729		40.53			3.28	2.82			4.76	16.33	3.66	2.94	6.40	18.44
910812		149.00			4.20	2.61			4.69	16.36	3.66	2.90	35.90	127.1

Table 91-12. Kernel growth.

date yymmdd	dry weight per kernel (mg)							
treatment	N1 S1	N1 S2	N1 S3	N1 S4	N3 S1	N3 S2	N3 S3	N3 S4
910626	4.26	3.56	2.88		3.78	3.24	2.52	
910729								
910812	34.95	36.83	39.10	20.20	29.09	28.39	33.75	18.49

Table 91-13. Fresh weight kernel distribution (%) at final harvest.

Table 91-13a. Treatment N1.

sort (mm)	S1	S2	S3	S4
< 2.0	4.70	5.51	4.27	28.69
2.0 - 2.2	4.55	6.84	4.65	36.65
2.2 - 2.5	21.92	22.65	13.54	24.15
2.5 - 2.8	53.23	47.16	38.63	7.84
2.8 - 3.0	11.94	11.42	23.96	1.92
> 3.0	3.67	6.42	14.95	1.06

Table 91-13b. Treatment N2.

sort (mm)	S1	S2	S3	S4
< 2.0	3.16	6.75	3.30	30.10
2.0 - 2.2	4.82	7.12	4.12	35.95
2.2 - 2.5	19.06	28.35	9.34	22.63
2.5 - 2.8	54.30	45.87	34.01	8.57
2.8 - 3.0	13.96	8.37	20.74	1.84
> 3.0	4.71	3.54	28.50	0.92

Table 91-13c. Treatment N3.

sort (mm)	S1	S2	S3	S4
< 2.0	11.46	12.38	4.66	51.97
2.0 - 2.2	12.86	12.93	4.80	31.96
2.2 - 2.5	41.12	35.59	14.53	8.79
2.5 - 2.8	31.58	33.84	47.54	5.25
2.8 - 3.0	2.31	3.58	18.37	1.37
> 3.0	0.67	1.69	10.10	0.66

Table 91-14. Fresh weight per kernel per sortingclass (mg) at final harvest.

Table 91-14a. Treatment N1.

sort (mm)	S1	S2	S3	S4
total	37.7	38.6	39.9	22.5
< 2.0	16.4	19.5	17.7	15.8
2.0 - 2.2	23.9	22.5	23.9	21.1
2.2 - 2.5	30.4	32.6	30.1	25.0
2.5 - 2.8	38.9	43.4	39.1	28.7
2.8 - 3.0	44.7	46.9	43.9	35.2
> 3.0	47.7	48.2	47.7	28.5

Table 91-14b. Treatment N2.

sort (mm)	S1	S2	S3	S4
total	40.0	36.7	40.6	22.5
< 2.0	7.9		15.2	16.0
2.0 - 2.2	20.4		19.9	21.4
2.2 - 2.5	32.2		23.3	24.8
2.5 - 2.8	41.7		38.4	26.9
2.8 - 3.0	45.4		42.6	23.9
> 3.0	43.9		48.2	26.5

Table 91-14c. Treatment N3.

sort (mm)	S1	S2	S3	S4
total	32.3	33.7	39.7	19.1
< 2.0	16.8	17.4	17.4	15.3
2.0 - 2.2	24.7	25.0	24.4	19.8
2.2 - 2.5	32.3	33.1	30.3	20.9
2.5 - 2.8	39.9	42.6	39.2	25.6
2.8 - 3.0	43.1	42.2	44.7	30.2
> 3.0	46.7	35.5	48.3	24.5

Table 91-15. Dry matter content per sortingclass (%) at final harvest.

Table 91-15a. Treatment N1.

sort (mm)	S1	S2	S3	S4
< 2.0	88.42	89.17	89.07	89.12
2.0 - 2.2	88.52	89.24	89.39	89.38
2.2 - 2.5	88.53	88.54	89.08	88.73
2.5 - 2.8	89.10	89.02	89.45	89.41
2.8 - 3.0	88.66	89.15	89.29	89.20
> 3.0	88.85	88.95	88.86	89.22

Table 91-15b. Treatment N2.

sort (mm)	S1	S2	S3	S4
< 2.0	88.50	88.73	89.50	89.11
2.0 - 2.2	88.44	88.58	89.33	88.88
2.2 - 2.5	88.09	88.44	89.03	88.94
2.5 - 2.8	88.44	88.69	89.21	89.02
2.8 - 3.0	88.39	88.35	89.39	89.24
> 3.0	88.40	88.41	89.40	89.60

Table 91-15c. Treatment N3.

sort (mm)	S1	S2	S3	S4
< 2.0	88.97	89.03	88.92	89.30
2.0 - 2.2	88.93	89.18	88.52	89.26
2.2 - 2.5	89.29	89.12	88.50	89.17
2.5 - 2.8	89.43	89.15	88.44	88.84
2.8 - 3.0	88.59	89.15	88.65	88.84
> 3.0		88.98	88.40	88.89

Table 91-16. Nitrogen distribution and nitrogen content in kernels per sortingclass (g.kg-1).

Table 91-16a. Treatment N1.

sort (mm)	S1	S2	S3	S4
< 2.0	23.04		23.20	31.60
2.0 - 2.2	18.68		20.84	28.72
2.2 - 2.5	17.20		20.32	24.56
2.5 - 2.8	15.72		20.00	22.28
2.8 - 3.0	14.92		19.84	21.20
> 3.0	14.88		19.88	21.12

Table 91-16b. Treatment N3.

sort (mm)	S1	S2	S3	S4
< 2.0	26.80		29.84	39.16
2.0 - 2.2	23.24		26.64	34.92
2.2 - 2.5	19.92		23.80	31.88
2.5 - 2.8	17.48		22.04	25.72
2.8 - 3.0	16.48		21.60	
> 3.0	16.80		21.28	

Table 91-17. Combine harvest kernel yield (kg.ha-1) at 16 % moisture.

Table 91-17a. Treatment N1.

date yymmdd	S1	S2	S3	S4
910813	8128	7734		4098
910822			5999	

Table 91-17b. Treatment N2.

date yymmdd	S1	S2	S3	S4
910813	8372	7729		4129
910822			6204	

Table 91-17c. Treatment N3.

date yymmdd	S1	S2	S3	S4
910813	7698	7081		3272
910822			5595	

Table 91-18. Soil mineral nitrogen content and amount (ammonium + nitrate).

treatment	date yymmdd	nitrogen content and amount per soil layers									
		0 - 10 cm		10 - 30 cm		30 - 60 cm		60 - 90 cm		90 - 120 cm	
		(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)	(mg.kg-1)	(kg.ha-1)
N1 S1	910318	16.25	21.13	10.20	26.52	5.77	22.50	8.98	35.02	11.95	46.61
	910603	3.61	4.69	29.05	75.53	3.65	14.24	3.50	13.65	5.62	21.92
	910822	7.82	10.17	6.58	17.11	2.81	10.96	**3.89**	**30.34**		
N1 S2	910603	4.33	5.63	27.05	70.33	3.99	15.56	5.00	19.50	6.40	24.96
	910822	7.15	9.30	7.78	20.23	3.28	12.79	**3.52**	**27.46**		
N1 S3	910603	4.35	5.66	18.20	47.32	4.05	15.80	3.99	15.56	6.29	24.53
	910822	3.98	5.17	3.78	9.83	2.43	9.48	**3.22**	**25.12**		
N1 S4	910822	12.38	16.09	9.66	25.12	3.22	12.56	**2.90**	**22.62**		
N3 S1	910603	7.49	9.74	21.65	56.29	3.75	14.63	3.96	15.44	6.92	26.99
	910822	9.58	12.45	8.56	22.26	4.27	16.65	**3.68**	**28.70**		
N3 S2	910603	7.83	10.18	25.10	65.26	4.42	17.24	5.22	20.36	8.31	32.39
	910822	12.80	16.64	13.13	34.14	6.18	24.10	**7.93**	**61.85**		
N3 S3	910603	6.63	8.62	25.60	66.56	4.04	15.76	4.80	18.72	7.15	27.87
	910822	7.11	9.24	6.65	17.29	4.57	17.82	**4.64**	**36.19**		
N3 S4	910822	20.13	26.17	17.03	44.28	7.66	29.87	**4.99**	**38.92**		

numbers printed bolt = soil layer 60 - 120 cm.

Table 91-19. Statistical analyses.

Table 91-19a. Statistical analyses of plant parts and crop caracteristics.

Properties	Harvest number	Significance :		
		Shading	N-level	Shading * N-level
Total plant mass above and below ground, fresh weight. [kg.ha-1]	T2	-	-	-
	T3	-	-	-
Total plant mass above and below ground, dry weight. [kg.ha-1]	T2	***	-	-
	T3	-	-	-
Total plant mass above ground, fresh weight. [kg.ha-1]	T2	-	-	-
	T3	*	-	-
	T4	(*)	***	-
	T5	***	(*)	-
	T6	***	-	-
	T6	***	-	-
Total plant mass above ground, dry weight. [kg.ha-1]	T2	***	-	-
	T3	**	**	***
	T4	***	-	-
	T5	***	-	-
	T6	***	-	-
Total of green leaves, fresh weight. [kg.ha-1]	T2	-	-	-
	T3	*	-	-
	T4	-	***	**
	T5	**	(*)	(*)
Total of green leaves, dry weight. [kg.ha-1]	T2	***	-	-
	T3	-	-	-
	T4	(*)	***	*
	T5	**	-	-
Stems and sheaths, fresh weight. [kg.ha-1]	T2	*	-	-
	T3	**	(*)	-
	T4	(*)	***	-
	T5	***	-	-
	T6	**	**	*
Stems and sheaths, dry weight. [kg.ha-1]	T2	*	-	-
	T3	-	-	-
	T4	***	-	-
	T5	***	-	-
	T6	**	**	**

Table 91-19a. (continued) Statistical analyses of plant parts and crop caracteristics.

Properties	Harvest number	Significance :		
		Shading	N-level	Shading * N-level
Stem parts below ground, fresh weight. [kg.ha-1]	T2	*	-	-
	T3	**	-	-
Stem parts below ground, dry weight. [kg.ha-1]	T2	***	-	-
	T3	**	-	-
Dead leaves, fresh weight. [kg.ha-1]	T3	***	-	-
	T4	**	***	*
	T5	**	***	*
	T6	***	-	**
Dead leaves, dry weight. [kg.ha-1]	T3	***	-	-
	T4	**	*	-
	T5	***	-	-
	T6	***	-	**
Kernels, fresh weight. [kg.ha-1]	T4	***	(*)	-
	T5	***	(*)	(*)
	T6	***	**	-
Kernels, dry weight. [kg.ha-1]	T4	***	*	-
	T5	***	**	-
	T6	***	**	-
Chaff, fresh weight. [kg.ha-1]	T4	***	-	-
	T5	**	**	-
	T6	***	-	-
Chaff, dry weight. [kg.ha-1]	T4	***	-	-
	T5	***	-	-
	T6	***	-	-
Ears, fresh weight. [kg.ha-1]	T5	***	-	(*)
	T6	***	**	-
Ears, dry weight. [kg.ha-1]	T5	***	*	-
	T6	***	*	-
Leaf area index, LAI. [m2.m-2]	T2	-	-	-
	T3	*	-	-
	T4	-	***	*
	T5	*	-	-
Number of plants. [1.m-2]	T2	-	(*)	*
Number of kernels per ear	T4	***	-	-
Weight per kernel [mg]	T4	***	***	-

Table 91-19. (continued) Statistical analyses.

Table 91-19b. Statistical analyses of nitrogen and carbohydrate amounts in plant parts.

Properties	Harvest number	Significance :		
		Shading	N-level	Shading * N-level
Total N amount in green leaves. [kg.ha-1]	T2	**	-	-
	T3	(*)	-	-
	T4	-	***	**
	T5		*	
Total N amount in stems and sheaths. [kg.ha-1]	T2	(*)	-	-
	T3	**	-	-
	T4	-	***	-
	T5	(*)	***	*
	T6	-	***	(*)
Total N amount in stem below ground. [kg.ha-1]	T2	*	-	-
	T3	*	-	-
Total N amount in dead leaves. [kg.ha-1]	T3	***	-	-
	T4	***	***	***
	T5	***	***	-
	T6	***	***	***
Total N amount in kernels. [kg.ha-1]	T4	***	-	-
	T5	***	***	(*)
	T6	***	***	-
Total N amount in chaff. [kg.ha-1]	T4	**	-	-
	T5	(*)	***	*
	T6	***	***	-
Total N amount in ears. [kg.ha-1]	T4	***	-	-
	T5	***	***	(*)
	T6	**	***	-
Total N amount in whole plants. [kg.ha-1]	T2	-	*	(*)
	T3	(*)	-	-
	T4	-	***	-
	T5	***	***	-
	T6	**	***	(*)

Table 91-19b. (continued) Statistical analyses of nitrogen and carbohydrate amounts in plant parts.

Properties	Harvest number	Significance :		
		Shading	N-level	Shading * N-level
Carbohydrate amount in green leaves. [kg.ha-1]	T2	***	-	-
	T3	*	*	*
	T4	(*)	**	-
	T5		(*)	
Carbohydrate amount in stems and sheaths. [kg.ha-1]	T2			
	T3	(*)	-	-
	T4	***	***	**
	T5	***	-	-
	T6	**	-	-
Carbohydrate amount in stem below ground. [kg.ha-1]	T2		-	
	T3	**	(*)	(*)
Carbohydrate amount in dead leaves. [kg.ha-1]	T3	***	(*)	-
	T4	**	***	-
	T5	*	***	*
	T6	**	-	**
Carbohydrate amount in kernels. [kg.ha-1]	T4	***	***	**
	T5	**	-	-
	T6	***	-	-
Carbohydrate amount in chaff. [kg.ha-1]	T4	***	**	-
	T5	***	***	***
	T6	*	***	***
Carbohydrate amount in ears. [kg.ha-1]	T4	***	***	-
	T5	***	-	-
	T6	***	-	-
Carbohydrate amount in whole plants. [kg.ha-1]	T2			
	T3	**	-	-
	T4	***	***	**
	T5	***	-	(*)
	T6	***	-	-

Table 91-19. (continued) Statistical analyses.

Table 91-19c. Meaning of used symbols.

symbol	significance
-	: P > 0.200
(*)	: 0.100 < P < 0.200
*	: 0.050 < P < 0.100
**	: 0.010 < P < 0.050
***	: P < 0.010

Figure 91-20. Experimental design.

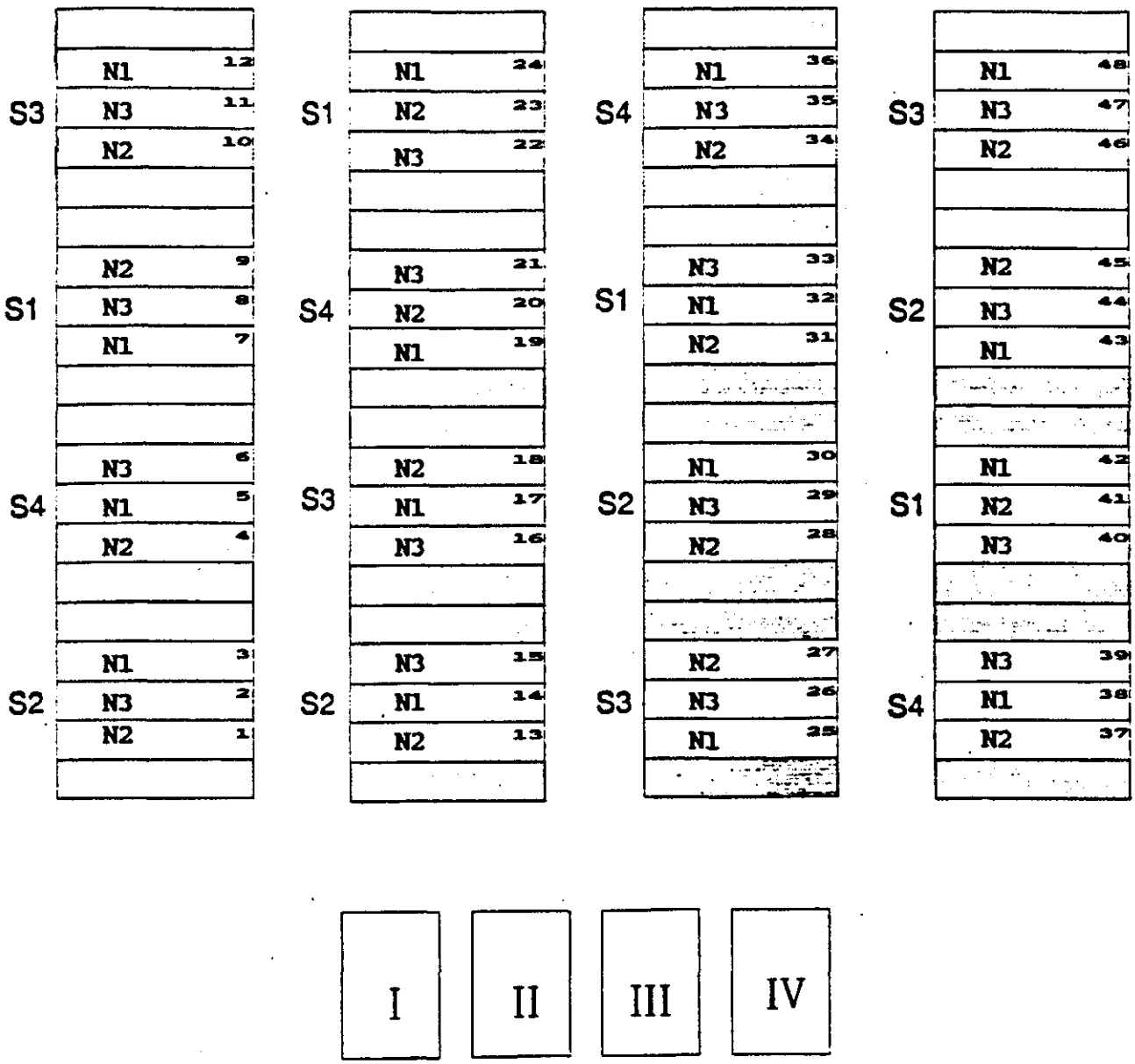

Table 91-21. Apex development scale (Meurs).

Stage	Developmental morphology
1	Growing point with a single leaf primordium.
2	Growing point with 2 to 3 leaf primordia.
3	Extended growing point with 4 to more leaf primordia.
4	Double-ridge stage.
5	Beginning of spikelet formation.
6a	Beginning of side spikelet formation.
6b	Side spikelets are clearly visible.
7	Empty glumes visible.
8	Formation of lemma visible.
9	Formation of anthers visible.
9a	Stamens clearly visible and lemma top bend.
9b	Stamen lobes emerge in spikelet, onset of stamen formation in side spikelets
10	The tip of the awn reaches the spikelet above on 1 to 6 spikelets in each side.
11	The tip of the awn reaches the spikelet above on 7 to more spikelets.
12	The awns longer than the spike.
13	Palea longer than stamens in spikelets in the middle of the spike.
14	Anthesis.