NN

NETHERLANDS NITROGEN TECHNICAL BULLETIN

NUMBER 11, JULY 1979

THE SEASONAL RESPONSE OF GRASSLAND TO NITROGEN AT DIFFERENT LEVELS OF NITROGEN PRETREATMENT. I. EXPERIMENTS 1972 AND 1973.

W.H. PRINS AND P.F.J. VAN BURG

AGRICULTURAL BUREAU
NETHERLANDS NITROGEN FERTILIZER INDUSTRY

THE HAGUE 1979

NN Technical Bulletin series:

No. 1. The influence of fineness on the effectiveness of phosphorus fertilizers with particular reference to liquid phosphoric acid. P. F. J. VAN BURG (September 1966).

No. 2. The agricultural value of anhydrous ammonia on grassland: experiments 1963 - 1965. P. F. J. VAN BURG, G. D. VAN BRAKEL and J. H. SCHEPERS (March 1967).

No. 3. The agricultural value of anhydrous ammonia on arable land: experiments 1963 - 1966. P. F. J. VAN BURG, G. D. VAN BRAKEL and J. H. SCHEPPERS (May 1967).

No. 4. Relation of rate of nitrogen fertilization, seed spacing and seed size to yield of potatoes. P. F. J. VAN BURG (October 1967).

No. 5. Late topdressing of winter wheat by means of aerial spraying with urea. G. H. ARNOLD and K. DILZ (December 1967).

No. 6. Nitrogen fertilizing of grassland in spring. P. F. J. VAN BURG (December 1968).

No. 7. Effect of the growth regulant CCC on the growth of cereals. 1. Experiments 1963-1964. P. F. J. VAN BURG and G. H. ARNOLD (May 1969).

No. 8. The seasonal response of grassland herbage to nitrogen. P. F. J. VAN BURG (June 1970).

No. 9. Carotene in barn-dried hay. P. J. J. PHILIPSEN and P. S. HAK (February 1971).

No. 10. Effect of chlormequat on the growth of cereals. 2. 1965-1966. Effects of time of chlormequat application, level of nitrogen, and split application of nitrogen on resistance to lodging, and on yield of winter wheat. K. DILZ (May 1971).

(continued on inside back cover)

The NN Technical Bulletin is published at irregular intervals and is sent free of charge to those interested. If you would like to receive subsequent issues (possible more than one copy of each) please send your request to:

AGRICULTURAL BUREAU
NETHERLANDS NITROGEN FERTILIZER INDUSTRY

THORBECKELAAN 360, 2564 BZ THE HAGUE, THE NETHERLANDS

Netherlands Nitrogen Technical Bulletin, No. 11, July 1979

THE SEASONAL RESPONSE OF GRASSLAND TO NITROGEN AT DIFFERENT LEVELS OF NITROGEN PRETREATMENT.
I. EXPERIMENTS 1972 and 1973

Ir W.H. PRINS* and Dr Ir P.F.J. VAN BURG**
Institute for Soil Fertility, Haren (Gr.), The Netherlands

* Research Officer with the Agricultural Bureau of the Netherlands Nitrogen Fertilizer Industry, seconded to the Institute for Soil Fertility

** Head of the Agricultural Bureau of the Netherlands Nitrogen Fertilizer Industry, previously seconded to the Institute for Soil Fertility

INTRODUCTION

Nitrogen, a key to pasture productivity

The average nitrogen consumption on grassland in The Netherlands has reached approximately 250 kg N per ha in 1977. It is notable that the national average is following the trend set by the nitrogen consumption of a group of about 15 Nitrogen Pilot Farms (Figure 1). The question arises how the higher levels of annual nitrogen application influence the response to nitrogen during the season.

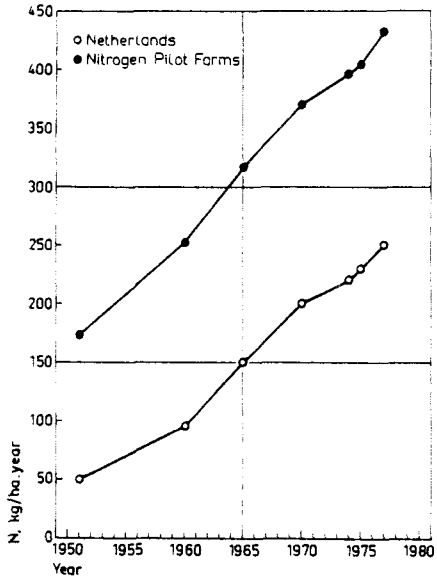


FIGURE 1

Average consumption of nitrogen fertilizer on grassland in The Netherlands and by the Nitrogen Pilot Farms

In NN Technical Bulletin No. 8 (1) we dealt with the results of experiments carried out during 1957-1959 to study the effect of nitrogen fertilization on grassland in spring, summer and late summer or autumn. The effect was studied at a fairly low level of nitrogen pretreatment, approximately corresponding with the national average. This level excluded any residual nitrogen effects. The 1957-1959 results relate to an 'extensive' farming system using 100 to 150 kg N per ha per year.

With the increase in usage of nitrogen in grassland farming it was of interest to know the effect of nitrogen fertilization at higher levels of nitrogen pretreatment. Therefore, in each of the years 1972, 1973 and 1974, one complex experiment was set up to study the effect of nitrogen fertilization at different levels of nitrogen pretreatment. This Bulletin only deals with the results of the experiments in 1972 and 1973. Some of the results have already been published (2, 3, 4, 5, 6, 7), but we thought it useful to compile these in one publication together with the detailed experimental data given in the Annexes. The Annexes comprise data on dry-matter yield of herbage and stubble, herbage composition (N,

NO_3, CF, Ash, VEM*, DOM), soil (mineral N, moisture) as well as meteorological data.

METHODS

In both years, 1972 and 1973, one experiment was laid out on permanent grassland on clay soil near Ten Boer, in the province of Groningen. Details are given in Annex 1.

MAIN SERIES 1972 and 1973

When studying the seasonal response of grassland to nitrogen in relation to levels of nitrogen pretreatment, the following factors have to be included in the experiments:

A. times** of nitrogen application during the growing season;
B. increasing rates of nitrogen at each time of application to determine the response to nitrogen;
C. periodical harvests after each nitrogen application to establish the growth curve;
D. different levels of nitrogen pretreatment to determine the pretreatment effect (= nitrogen intensity effect).

A. Times of application

In most experiments on the seasonal effect of nitrogen the same plots are used throughout the whole growing period. This makes it impossible to separate the direct effect of the fertilizer from its residual effect or, when cutting is postponed too long, to eliminate the adverse effect of a heavy grass crop on subsequent regrowth. In order to avoid such effects in our experiments, we have always used separate plots for each time of nitrogen application in our 'seasonal-response' experiments (1). In these experiments, dairy cows or sheep grazed the trial area preceding each date of application. Sometimes, with late times of application (summer or late summer), a silage or hay cut was taken early in the season (1).

In the 1972 and 1973 experiments no pretreatment grazing was allowed and it was decided to standardize pretreatment cutting. The following standard cutting schemes were adopted:

1972 - a silage-stage cut followed by grazing-stage cuts, another silage-stage cut in July/August followed by grazing-stage cuts.

1973 - only grazing-stage cuts.

The standard grazing-stage cuts and silage-stage cuts were taken when production had

---

* VEM, VoederEenheden Melk = net energy value for dairy cows in feed units/kg. 1 VEM = 6.9036 kJ. See Manual for the calculation of the nutritive value of forages (1977), published by Centraal Veevoederbureau, Lelystad.

** Time (of nitrogen application) is used in the sense of point of time.

reached about 2 and 3.5 t dry matter per ha, respectively. The dates of nitrogen application are given in Annex 1.

B. and C. Nitrogen response and growth rate

At each time of application the response to nitrogen was determined at rates of 0, 40, 80, 120 and 200 kg N per ha (1972) or 0, 40, 80 and 120 kg N per ha (1973). After each time of application periodical cuts were taken at about weekly intervals to establish the growth curve. The number of periodical harvests, designated M 1, M 2, etc., varied from 6 or 7 earlier in the season to 2 or 3 at the end of the season. To study the response to nitrogen as well as the growth rate, the blocks were subdivided into plots with the different rates of nitrogen and the different periodical harvests. The plot size is given in Annex 1.

D. Pretreatment

The nitrogen pretreatments consisted of two levels: E, low, corresponding to an extensive system and I, high, corresponding to an intensive system. The E- and I-series were arranged in pretreatment blocks. For each new time-of-application investigation, designated S 1, S 2, etc. for each new starting date of the E- and I-series, a new pretreatment block was used. Within these blocks rates of nitrogen and dates of periodical harvest were fully randomized. As an example the 1973 lay-out of the pretreatment blocks in replication I is given in Figure 2.

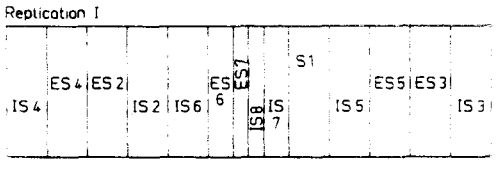


FIGURE 2

Lay-out of replication I of Exp. IB 2032, 1973, showing S 1 (= ES 1 = IS 1) block as 1st time of nitrogen application as well as ES 2 - ES 7 and IS 2 - IS 8 pretreatment blocks, to be used for subsequent times of nitrogen application. Not shown in Figure: For the determination of the response to nitrogen and the rate of growth each block is subdivided into plots with different rates of nitrogen application and different dates of periodical harvest

An increase in nitrogen application generally leads to an increase in growth rate of the grass and consequently a specific stage, e.g. grazing or silage stage, will be reached sooner.

Figure 3 shows as an example schematically the growth curves at application rates of 40

and 80 kg N per ha. With 40 kg N, grazing stage is reached after 27 days (between periodical harvests M 3 and M 4) and silage stage after 37 days (between harvests M 5 and M 6).

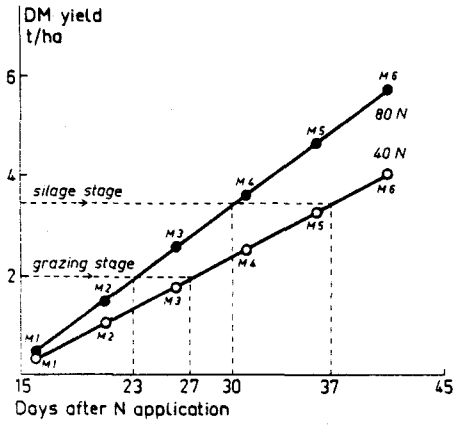


FIGURE 3

Schematic presentation of growth curves (determined by periodical harvests M 1 to M 6) of grass fertilized with 40 and 80 kg N per ha, respectively. Dotted lines indicate when standard grazing-stage (2 t DM/ha) and standard silage-stage (3.5 t DM/ha) have been reached

However, with 80 kg N, grazing stage is reached after 23 days (between M 2 and M 3) and silage stage after 30 days (between M 3 and M 4). In other words, with 80 kg N, grazing stage and silage stage are reached 4 and 7 days earlier than with 40 kg N. This means that in the case of low and high nitrogen pretreatment levels the standardized pretreatment cuts have to be harvested at different dates. Consequently the high nitrogen pretreatment leads to more times of cutting and therefore to more times of nitrogen application than the low pretreatment (e.g. 7 times with E-series and 8 times with I-series in Figure 2).

The start of each time of nitrogen application could be planned by taking into consideration: 1. Each time of application the nitrogen rates included the pretreatment rates. 2. The grass was cut periodically at about weekly intervals, providing a growth curve after the pretreatment rates. Therefore, the start of the next time of application could fairly easily be forecast from these growth curves (see Figure 3).

For clarity of meaning of a pretreatment scheme let us describe the sequence of events in the intensive (I) series of 1973 (see Figure 4): On 22 March the first nitrogen was applied: 0, 40, 80 and 120 kg N per ha. This is the so-called S 1 series (= IS 1 = ES 1, both series having the same first starting date). On the same day all I-pretreatment blocks (IS 2 - IS 8) received a basal application of 80 kg N per ha. On 9 May, when the 80 N grass in the S 1 series had reached the standard grazing-stage (2 t DM/ha, estimated from the growth curve between periodical harvests M 2 and M 3, see Annex 28): a) all I-pretreatment blocks were cut; b) the IS 2 pretreatment block was used to determine the nitrogen response by applying 0, 40, 80 and 120 kg N per ha; and c) the IS 3 - IS 8 pretreatment blocks received a further basal application of 80 kg N per ha. On 29 May, when the 80 N grass in the IS 2 series had reached the standard grazing-stage: a) the IS 3 -

IB 2032, 1973

Date of nitrogen applicaton	Pretreatment blocks							
	S1	IS2	IS3	IS4	IS5	IS6	IS7	IS8
22/3	0, 40, 80*, 120 M1 - M5	80	80	80	80	80	80	80
9/5		0, 40, 80*, 120 M1 - M6	80	80	80	80	80	80
29/5			0, 40, 80*, 120 M1 - M6	80	80	80	80	80
20/6				0, 40, 80*, 120 M1 - M6	80	80	80	80
17/7					0, 40, 80*, 120 M1 - M6	80	80	80
7/8						0, 40, 80*, 120 M1 - M6	80	80
29/8							0, 40, 80*, 120 M1 - M4	80
19/9								0, 40, 80, 120 M1 - M2

* Periodical harvests of 80 kg N plots indicate date of reaching the standard grazing-stage (generally between harvests M1 and M2 or M2 and M3)

Figure 4

Example of pretreatment blocks with their respective experimental treatments. The example represents the intensive (I) series of 1973

IS 8 pretreatment blocks were cut; b) the IS 3 pretreatment block was now used to determine the nitrogen response; and c) the remaining IS 4 - IS 8 pretreatment blocks again received a basal application of 80 kg N per ha. So every time a pretreatment block was started until finally on 19 September the IS 8 block was used. This scheme may also be read in Annex 1.

Figure 5 shows schematically the course of the IS 1 to IS 8 series in 1973. By 19 Septem-

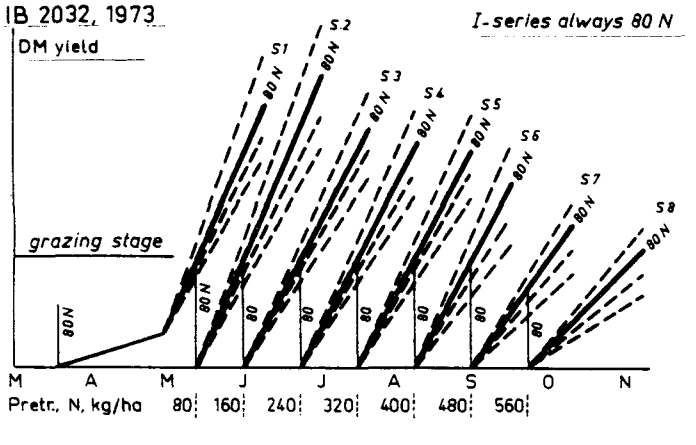


FIGURE 5

Schematic presentation of I-series in 1973. The dates of cutting at standard grazing-stage and application of 80 kg N per ha on the pretreatment blocks are shown by the vertical lines. These dates have subsequently been estimated from the growth curves for the 80 kg N application (S 1 - S 8). The X-axis shows dates and cumulative pretreatment application of nitrogen

ber a total of 7 x 80 = 560 kg N per ha had been applied as pretreatment. The pretreatment blocks of the E-series received in 1973 each time a basal application of 40 kg N per ha. As grass growth with 40 kg N was slower than with 80 kg N, there were only 6 times of application up to 19 September with the E-series. At that date a total of 6 x 40 = 240 kg N per ha had been applied as pretreatment.

Details of the E- and I-series in 1972 and 1973 are presented in Annex 1. It should be noted that the 1973 lay-out differs from the 1972 lay-out in two main points:

1. In 1972 the E- and I-pretreatment blocks started in March with 80 and 120 kg N per ha, respectively. From ES 2 and IS 2 onwards the pretreatment blocks received basal dressings of 40 and 80 kg N per ha, respectively, at each time of application. In 1973, however, the E- and I-pretreatment blocks received already from the beginning basal dressings of 40 and 80 kg N per ha, respectively, at each time of application.
2. In 1972 the application times ES 2 and IS 2 and also ES 6 and IS 5 started after standard silage-stage cuts, whereas the remaining application times started after standard grazing-stage cuts. In 1973, however, all application times (ES 2 - ES 7 and IS 2 - IS 8) started after standard grazing-stage cuts.

REGROWTH SERIES 1972

It is an established fact that generally the rate of regrowth after a heavy preceding cut is smaller than after a light one. In 1972, in a number of instances the plots which had been used for the nitrogen response studies in the main series were not abandoned, but the opportunity was taken to use these selected plots (see Table 1) to study the relation between the rate of regrowth and the quantity of herbage harvested at the preceding cut. For this

Table 1 Regrowth series 1972. R = regrowth determined; - = regrowth not determined. In some series M 1 was divided into M 1a and M 1b

Series	Mowing sequence							
	M 1	M 1a	M 1b	M 2	M 3	M 4	M 5	M 6
S 1	-			-	-	-	R	R
ES 2		-	-	R	R	R	R	R
ES 3		-	-	R	R	R	R	R
ES 4		-	-	R	R	R	R	R
ES 5	-			-	-	-	-	-
ES 6	-			-	-	-	-	-
ES 7	-			-	-			
IS 2	R			R	R	R	R	R
IS 3		-	-	R	R	R	R	R
IS 4	R			R	R	R	R	R
IS 5		-	-	R	R	R	-	-
IS 6	-			-	-	-	-	-
IS 7	-			-	-	-	-	-
IS 8	-			-	-			

purpose the selected regrowth plots in the main series received 80 kg N per ha after mowing. The regrowth was cut after three and five weeks on separate halves of the original plots. Thereafter the plots were abandoned.

CUTTING FREQUENCY SERIES 1973

In 1973, all plots of the main series were abandoned except for those of M 3 and M 5 of the S 1 series. These plots were used during the whole season to study the effect of cutting at a specific date and not at a specific stage (as was done in the main series). The M 3 plots were cut every three and the M 5 plots were cut every six weeks, in total eight and four times, respectively. Figure 6 clarifies the cutting scheme and shows the different rates of nitrogen application for each cut. Over the whole season both M 3 and M 5 plots were at each rate given the same amount of nitrogen, namely in total 0, 160, 320 and 480 kg N per ha.

IB 2032, 1973

Date of 1st N application	Date of cutting and rate of nitrogen application per cut (kg/ha)								
22/3	14/5	5/6	26/6	18/7	7/8	28/8	19/9	9/10	Total N
3 weeks									
	0	— 0 —	0	— 0 —	0	— 0 —	0	— 0	0
	40	— 0 —	20	— 20 —	20	— 20 —	20	— 20	160
	80	— 0 —	40	— 40 —	40	— 40 —	40	— 40	320
	120	— 0 —	60	— 60 —	60	— 60 —	60	— 60	480
6 weeks									
	0	——	0	——	0	——	0		0
	40	——	40	——	40	——	40		160
	80	——	80	——	80	——	80		320
	120	——	120	——	120	——	120		480

FIGURE 6

Cutting frequency series 1973. Scheme of dates of cutting and rates of nitrogen application for each cut with 3- and 6-weeks' cutting frequencies

STUBBLE YIELD

In both years some attention was paid to the effect of different nitrogen and cutting regimes on stubble weight. The stubble, i.e. residual herbage with a height of about 3 cm, was clipped at ground level in subplots of 0.50 x 0.50 m.

GENERAL INFORMATION

The 1972 and 1973 experiments were carried out on permanent grassland on clay soil with *Lolium perenne* as the dominant species. White clover and weeds were controlled by spraying with a herbicide. Nitrogen was applied as ammonium nitrate limestone (26 per cent N). Phosphorus and potassium were applied at every cut in adequate amounts. Details are given in Annex 1. The experiments totaled 900 plots in 1972 (3 replications) and 1136 plots in

1973 (4 replications). Plots were harvested with a motor mower, cutting the herbage at about 3 cm above ground level. The green herbage was weighed for yield determination and sampled for dry-matter determination. For chemical analyses replicate dry-matter samples were bulked.

RESULTS

MAIN SERIES 1972 and 1973

The growth curves of the basal application of the E- and I-series of 1972 and 1973 are presented in Figures 7 and 8, respectively. These figures also include some meteorological

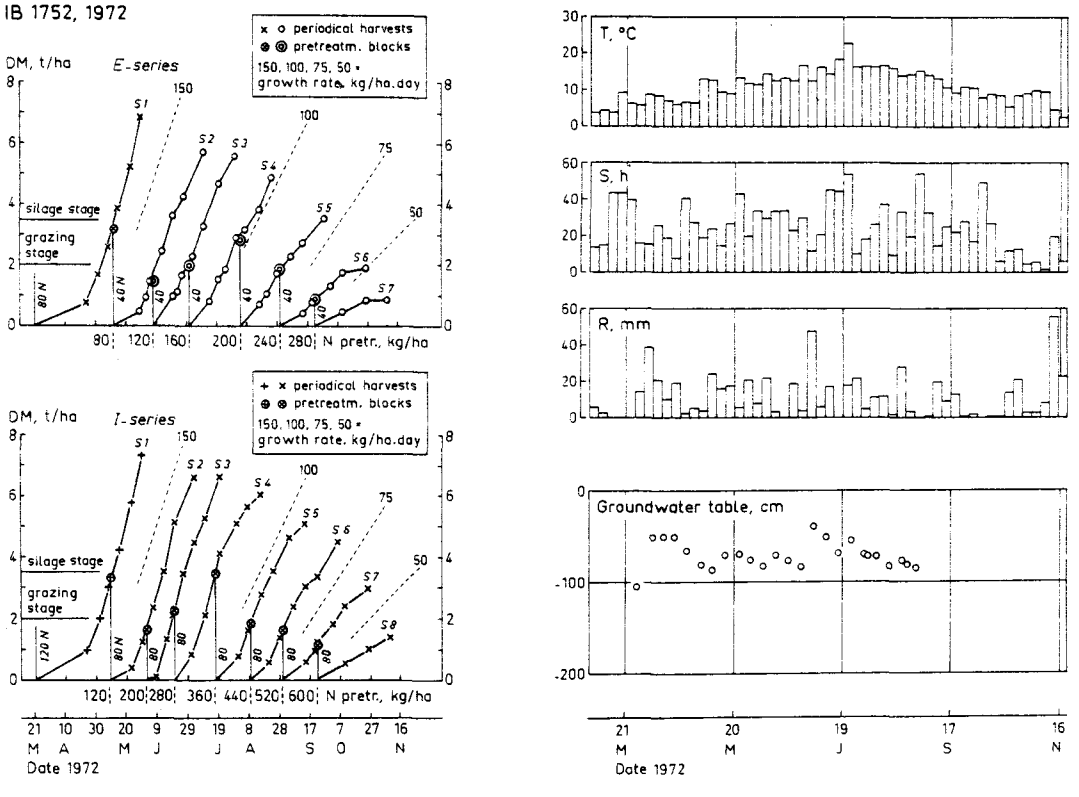


FIGURE 7

Effect of rates of nitrogen application on growth rate of the herbage in the E- and I-series during 1972. Each time of nitrogen application has been estimated from the corresponding growth curve. Dotted lines indicate rates of growth expressed as kg DM per ha per day. The graphs on the right show the temperature (T, °C, mean of 5 days, based on hourly observations), rainfall (R, mm per 5 days), sunshine (S, hours per 5 days) at Eelde Airport (at 15 km distance) as well as the depth of groundwater at the trial site

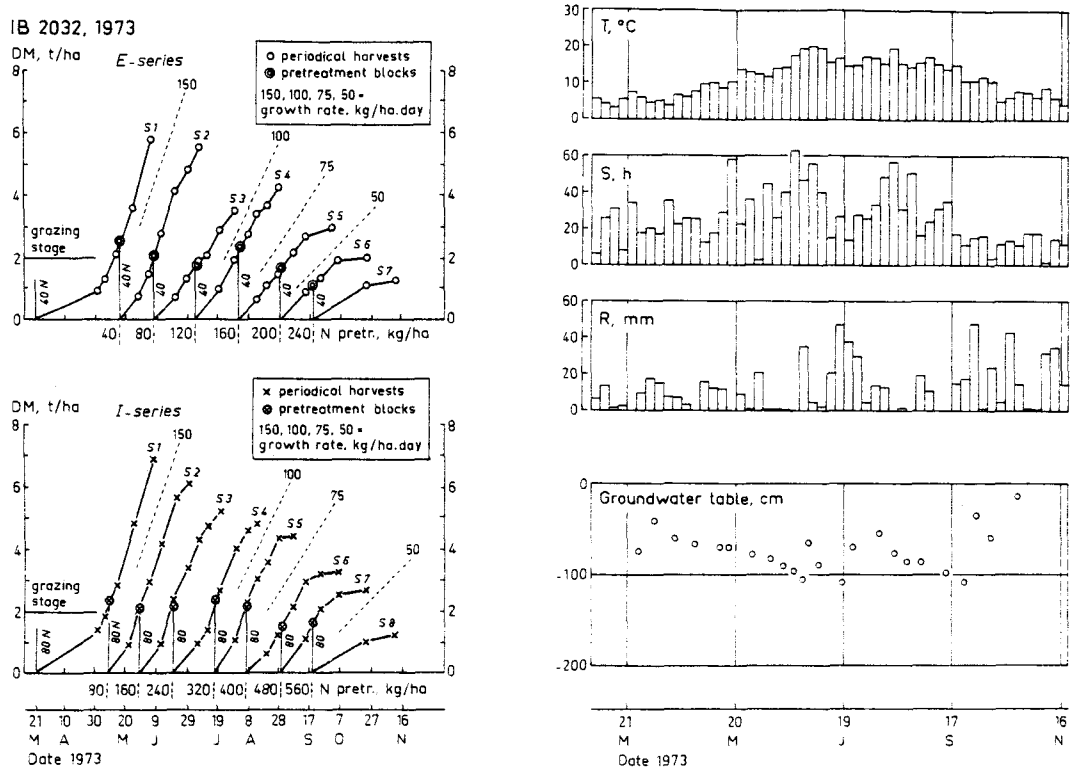


FIGURE 8
As caption to Figure 7, but now for 1973

data and a plot of the variation of the groundwater table during the season. It can be seen that in the E-series the dates of application were determined by the estimated production of the 40 kg N per ha rate of application (except in 1972 when 80 kg N per ha was the standard application in spring). In the I-series the dates of application were determined by the estimated production at the 80 kg N per ha rate of application (except in 1972 when 120 kg N per ha was the standard application in spring). The yields of the pretreatment blocks fit very well in the corresponding growth curves and yields also agree reasonably well with the planned yields.

The annual dry-matter yield of the E- and I-pretreatment cuts plus the final cut of the last series was in 1972 13.1 and 16.7 t per ha with 320 and 680 kg N per ha, respectively, and in 1973 12.7 and 16.2 t per ha with 280 and 640 kg N per ha, respectively. This means that the increase in nitrogen application by 360 kg N resulted in both years in a production increase of nearly 10 kg DM per kg N applied. Details per cut are presented in Annexes 2 and 27.

The dotted lines in Figures 7 and 8 indicate the rate of growth. In accordance with our previous results (1), it is clear that the rate of growth in spring and early summer was much higher than in late summer and autumn.

Figures 7 and 8 show furthermore that the growth curves level off after a certain period of growth. This is particularly evident in 1973 in the second half of the growing season for ES 5, ES 6, ES 7 and IS 5, IS 6 and IS 7 between the last two or three periodical harvests. It is, however, remarkable that the growth rate varies over the same growing period. For instance in IS 5 growth has nearly come to a standstill at the end of August/ beginning of September, while in the same period in IS 6 daily production is still about 75 kg DM per ha.

Nitrogen response

The nitrogen response in 1972 at each time of application and at each harvest date is shown in Figure 9. In each curve the number of growing days after nitrogen application is given.

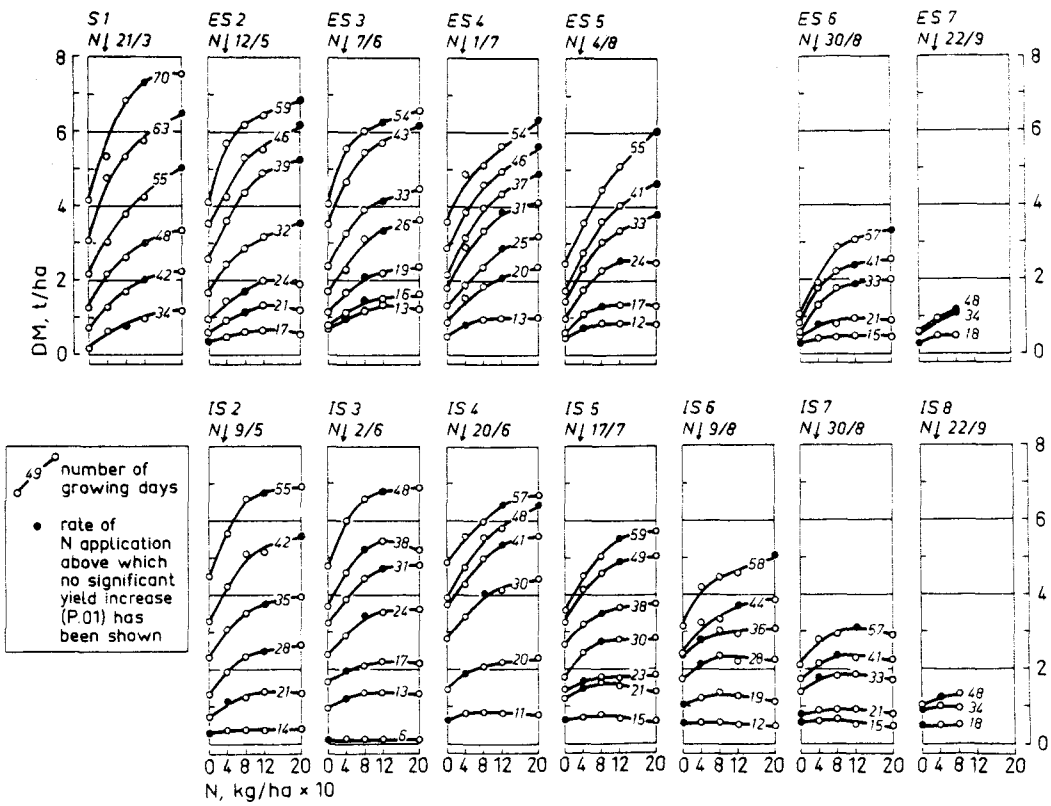


FIGURE 9 Effect of time of application (N ↓) and length of growing period on response to nitrogen in E- and I-series during the 1972 season

The curves are based on data given in Annexes 3 to 16. The black plot (●) in each curve indicates that at lower rates of nitrogen, dry-matter yields are significantly lower and that higher rates of nitrogen are not significantly different from the 'black plot' rate. It should be noted that as 200 kg N per ha was the highest rate used, a black plot at 200 kg N means a significantly higher dry-matter yield than with 120 kg N, but it does not mean that an application in excess of 200 kg N would not have given a further significant increase in yield.

Figure 9 shows the following:

a) With a short growing period, there is no significant increase in DM yield to be obtained above a low rate of nitrogen application. With longer growing periods, non-significance is reached at higher rates of nitrogen: the black plot moves to the right.

b) There is an interaction between rates of nitrogen and growing periods: with an early harvest, a negative yield response sometimes occurs at rates of 80 to 200 kg N per ha. At later harvests, this changes into a positive response, except for the grass growth of IS 7.

c) At a similar number of growing days and a roughly similar time of nitrogen application non-significance is reached at a lower rate of nitrogen application in the I-series than in the E-series.

d) Despite the high nitrogen pretreatment, in the I-series there is no strong decrease in nitrogen response until IS 7 on 30 August.

The results of 1973, which were nearly identical, have been analysed in another way, namely by assessing the response to nitrogen after a certain period of growth. Table 2 presents the response to nitrogen after 30 days' growth. It is evident that

1. the response to nitrogen is lower with a high (= I-series) than with a low (= E-series) nitrogen pretreatment.

Table 2 Effect of time of application and nitrogen pretreatment on response* to nitrogen (kg DM per ha) after 30 days' growth in 1973

Series	Date of N ↓	0→40 N	40→80 N	0→80 N	80→120 N	0→120 N
ES 2	16/5	850	500	1350	400	1750
ES 3	7/6	750	450	1200	350	1550
ES 4	5/7	850	550	1400	300	1700
ES 5	2/8	750	600	1350	350	1700
ES 6	29/8	650	500	1150	300	1450
IS 2	9/5	750	450	1200	200	1400
IS 3	29/5	600	550	1150	200	1350
IS 4	20/6	800	250	1050	250	1300
IS 5	17/7	750	500	1250	200	1450
IS 6	7/8	450	250	700	200	900
IS 7	29/8	350	150	500	100	600

* Expressed as yield differences between two rates of nitrogen application

2. with the E-series the response to nitrogen remains roughly unchanged till the application in early August, see last columns of Table 2. This is in agreement with our previous experiments (1).
3. with the I-series the response to nitrogen remains roughly unchanged till the mid-July application. Thereafter the response decreases. This decrease coincides with an increase of about 30 kg mineral nitrogen per ha in the upper 25 cm of the soil at the application on 29 August and 19 September 1973 (see Annex 46).

Residual effect

The differences in response to nitrogen discussed in the previous paragraph are due to a residual effect of the higher nitrogen pretreatment of the I-series (4, 5, 6). One example is given in Figure 10, referring to the difference in nitrogen response of ES 6 and IS 7

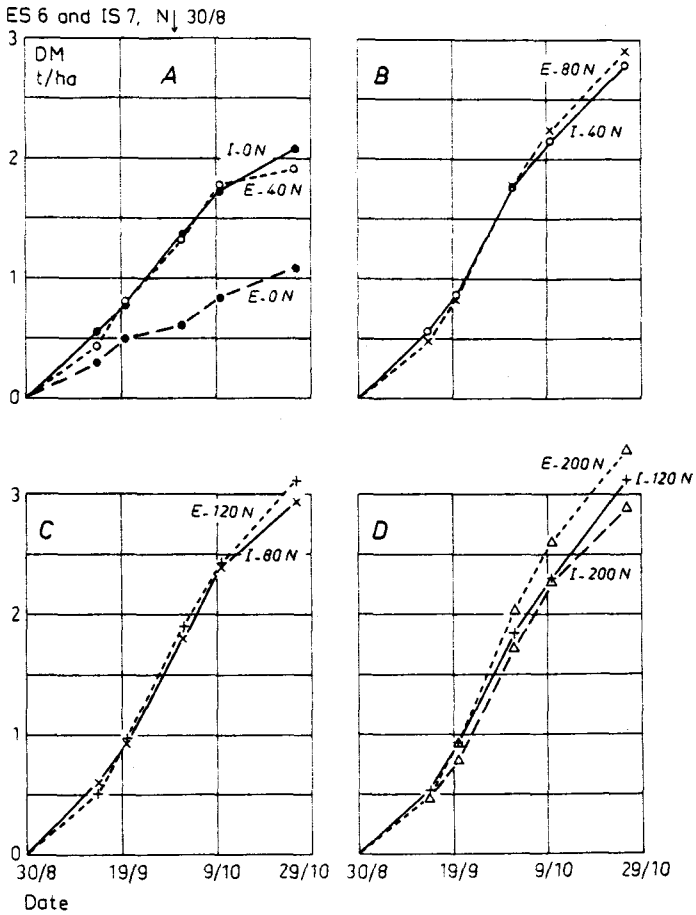


FIGURE 10

Residual effects of E- and I-series at different rates of nitrogen application on the growth rate of the herbage at the end of the 1972 season

series after nitrogen application on 30 August 1972. The graphs in Figure 10 show that during the growing period 30 August - 26 October 1972 the grass of the E-series needed about 40 kg N more than the I-series grass to get comparable DM yields: the growth curves of E - 40 N, E - 80 N and E - 120 N equal those of I - 0 N, I - 40 N and I - 80 N, respectively (Figure 10, graphs A, B and C). Without nitrogen being applied on 30 August the growth rate of the I - 0 N grass was about twice that of E - 0 N grass (Figure 10, graph A).

The residual nitrogen can also be deduced from the quantity of mineral N in the soil, as mentioned above, and from the nitrogen uptake data. On the plots without fertilizer the nitrogen uptake for E- and I-series was 18 and 31 kg per ha, respectively, after 22 days, and 29 and 60 kg per ha after 58 days (Annexes 8 and 15).

It seems that at this time of the season the initial grass growth of the E-series was a bit slower than that of the I-series (Figure 10). However, from 3 weeks after the date of application of nitrogen the growth rate of the E-series grass was higher. The curves in Figure 10, graph D, indicate an adverse effect of high rates of nitrogen on I-series grass: the I - 200 N curve lags behind the I - 120 N curve, while the E - 120 N curve exceeds both I - 120 N and I - 200 N curves.

Time gain

Grass is a continuously growing crop which, in practice, is not harvested on a fixed date but when a certain production stage has been reached. This stage depends on how the grass is to be utilized. It is of great interest to know at what date a certain stage is attained at each time of nitrogen application and at different rates of nitrogen. By plotting yield against growing period (for instance, see Annex 26 for 1972) the dates at which grazing, silage or hay stage would have been reached can be determined graphically. Table 3 summarizes for 1972 and 1973 the number of days necessary to reach the standard grazing-stage (2 t DM per ha).

The time gain which throughout the season can be achieved with higher applications of nitrogen is greater at a generally low nitrogen level, as represented by the E-series. The time gain is greater going from 0 → 40 or 40 → 80 than from 80 → 120 and 120 → 200 kg N per ha.

Table 3 Effect of nitrogen application and nitrogen pretreatment (E- and I-series) on *A.* number of days to reach the standard grazing-stage (2 t DM/ha), *B.* time gain between two rates of application. In 1973 there was no 200 kg N treatment

Series	Time of N application	*A*					*B*			
		N, kg/ha					N-range, kg/ha			
		0	40	80	120	200	0→40	40→80	80→120	120→200
1972										
S 1	21/3	55	48	45	43	41	7	3	2	2
ES 2	12/5	35	29	26	24	25	6	3	2	-1
ES 3	7/6	29	21	19	18	18	8	2	1	0
ES 4	1/7	35	24	21	19	18	11	3	2	1
ES 5	4/8	46	29	22	21	21	17	7	1	0
ES 6	30/8	-*	-	38	35	33	-	-	3	2
IS 2	9/5	33	29	26	25	25	4	3	1	0
IS 3	2/6	21	18	17	16	17	3	1	1	-1
IS 4	20/6	24	21	20	19	19	3	1	1	0
IS 5	17/7	33	27	25	25	24	6	2	0	1
IS 6	9/8	32	27	25	25	25	5	2	0	0
IS 7	30/8	53	38	37	37	37	15	1	0	0
1973										
S 1	22/3	59	52	47	44		7	5	3	
ES 2	16/5	37	23	20	19		14	3	1	
ES 3	7/6	43	33	27	25		10	6	2	
ES 4	5/7	35	26	22	20		9	4	2	
ES 5	2/8	60	32	26	22		28	6	4	
ES 6	29/8	-	52	28	25		-	24	3	
IS 2	9/5	26	22	18	18		4	4	0	
IS 3	29/5	28	22	20	20		6	2	0	
IS 4	20/6	33	26	25	24		7	1	1	
IS 5	17/7	27	22	19	18		5	3	1	
IS 6	7/8	36	31	28	26		5	3	2	
IS 7	29/8	36	26	25	24		10	1	1	

* - = Standard grazing-stage not reached

Quality aspects

Crude fibre content

The crude fibre content determines to a large extent the feeding value of the grass: the lower the crude fibre content the higher the feeding value. What is the effect of nitrogen on the crude fibre content? Since herbage is utilized when a certain production stage has been reached it seems appropriate to study the effect of nitrogen at that stage. As an example we have chosen the crude fibre content at a yield level of 3 t DM per ha. Averaged over the E- and I-series in both years it was possible to compare 0 kg N and 40 kg N per ha 17 times. The average crude fibre content at a yield of 3 t DM per ha was 25.7 per cent with 0 kg N and 25.2 with 40 kg N per ha. Between 40, 80 and 120 kg N per ha there were 20 possible comparisons (Table 4).

Table 4 The crude fibre content of grass harvested at a yield level of 3 t DM per ha after applications of 40, 80 and 120 kg N per ha. ( ) = number of comparisons

N, kg/ha	1972			1973			Overall average
	S 1	ES 2 - ES 5	IS 2 - IS 6	S 1	ES 2 - ES 5	IS 2 - IS 6	
	(1)	(4)	(5)	(1)	(4)	(5)	(20)
40	21.4	25.2	24.4	22.3	27.2	25.9	25.2
80	20.9	24.6	24.2	20.4	26.4	25.1	24.6
120	20.9	24.1	23.9	20.3	25.3	24.9	24.1

With higher application of nitrogen the crude fibre content of the grass at a *same yield level* decreases. Furthermore, it is evident from Table 4 that the grass of the intensive (I) series has a lower crude fibre content than the grass of the extensive (E) series. These results are in agreement with our previous findings (1).

However, when the nitrogen effect at a *same date* is compared, as is done in most experiments described in the literature, the results are different. Figure 11 shows the nitrogen effect at every periodical harvest of the IS 2 grass in 1972:

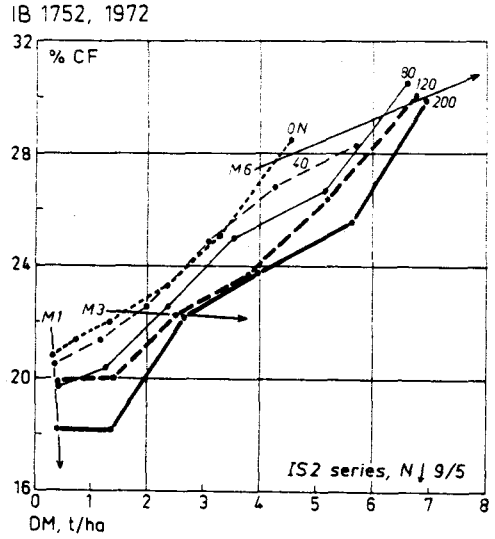


FIGURE 11

Effect of stage of growth on crude fibre content of IS 2 herbage at different rates of nitrogen application. Arrows indicate for periodical harvests M 1, M 3 and M 6 the trends in crude fibre content when increasing the nitrogen application from 0 to 200 kg N per ha

1. At an early cut (M 1) the crude fibre content decreases with increasing rates of nitrogen application.
2. At a later date (M 3) the crude fibre content is roughly the same at all nitrogen levels.
3. At a late cut (M 6) the crude fibre content increases with increasing rates of nitrogen application.

Figure 11 also confirms that at the same yield levels, from grazing stage to hay stage, the crude fibre content is always lower with higher rates of nitrogen application.

PLATE 1

For adequate moisture determination and chemical analysis a sample is taken with an auger, at the trial site immediately after cutting and weighing the herbage mass.

(Photo: A. Hekman)

Nitrate content

The nitrate content has been determined in grass of A. the pretreatment cuts in both 1972 and 1973, and of B. the periodical harvests at each time of application in 1972 (not at all nitrogen levels).

A. From Annexes 2 and 27 it can be learned that with the low nitrogen pretreatment (E-series) the nitrate content stays below 0.2 per cent at a yield level of about 2 t DM per ha. However, with the high nitrogen pretreatment (I-series) the nitrate content increases to over 1.0 per cent during the second half of the growing season. This increase in nitrate content coincides with a decrease in response to nitrogen (see for instance Table 3).

B. At each time of nitrogen application the grass generally shows a decrease in nitrate content with every periodical harvest: the older the grass, the lower the nitrate content. In spring, nitrate contents are at the lowest level, with a maximum of 0.08 and 0.82 per cent after applications of 80 and 200 kg N per ha, respectively (Annex 3). Later in the season the level of nitrate in the grass is higher.
Examples of the change in nitrate contents in both E- and I-series are presented in Figure 12. When ES 6 and IS 7 are compared, the residual effect of the higher nitrogen pretreatment level of the I-series is evident.

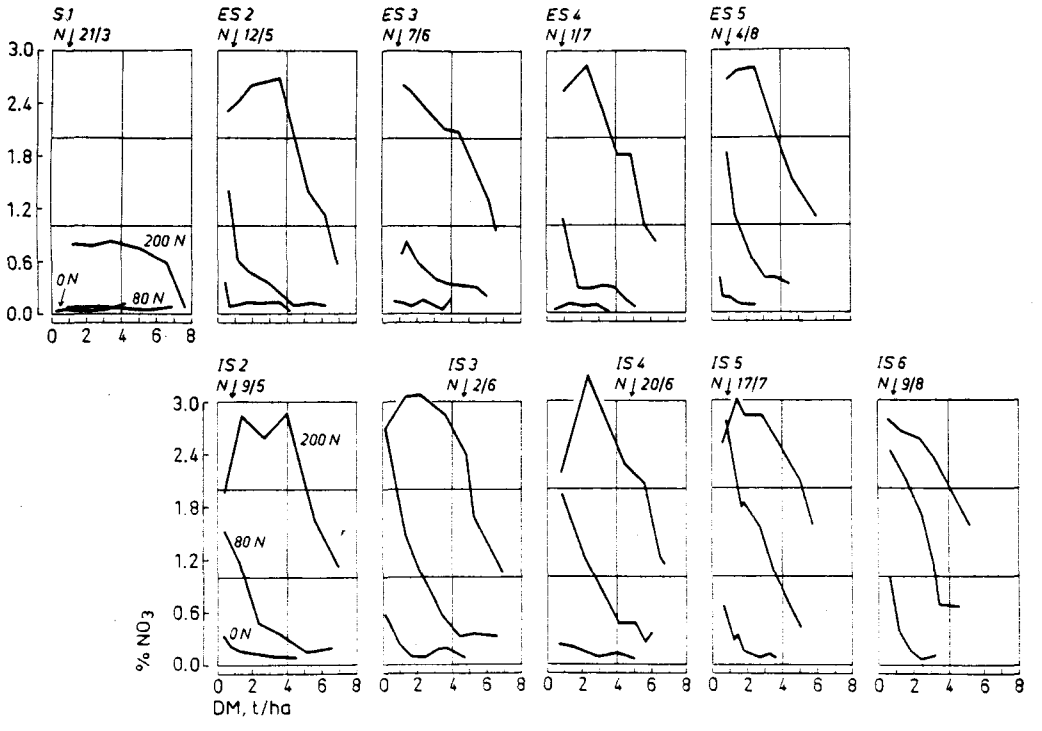


FIGURE 12

REGROWTH SERIES 1972

In the 1972 experiment regrowth studies were carried out on a number of main series plots after they had been used to establish seasonal nitrogen responses (see Table 1 and Annexes 17 to 24). The regrowth, fertilized with 80 kg N per ha, was harvested after 3 and 5 weeks.

As an example, in Figure 13 regrowth yields have been plotted against yields of the preceding cuts which had not received fertilizer nitrogen. The data refer to the S 1 series and the E- and I-series during the period 23 March to 11 September. Figure 13 clearly shows that an increase in preceding yield is accompanied by a decrease in regrowth yield. The relationship between preceding yield x and regrowth yield y has been approximated with quadratic equations. These are shown in Table 5 for the nitrogen treatments 0, 40, 80, 120 and 200 kg per ha.

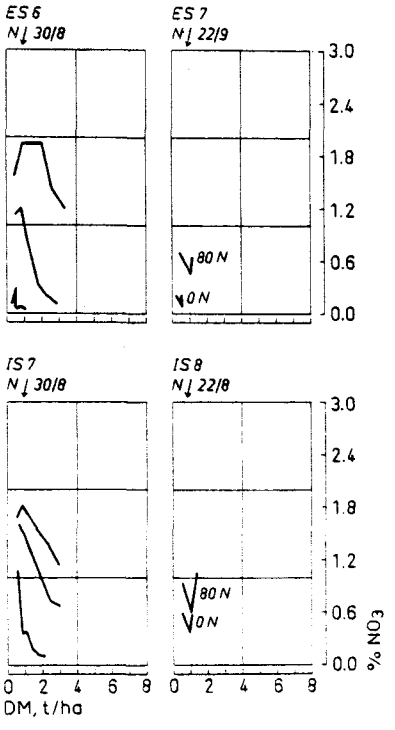


FIGURE 12

Effect of stage of growth and time of application in E- and I-series on the nitrate content of the herbage. Results of 1972

FIGURE 13

Effect of preceding herbage yield (grown without application of nitrogen fertilizer) on yield of 3- and 5-weeks' regrowth (applied with 80 kg N per ha) of S 1 (x), ES 2 - ES 4 (o) and IS 2 - IS 4 (●). Results of 1972

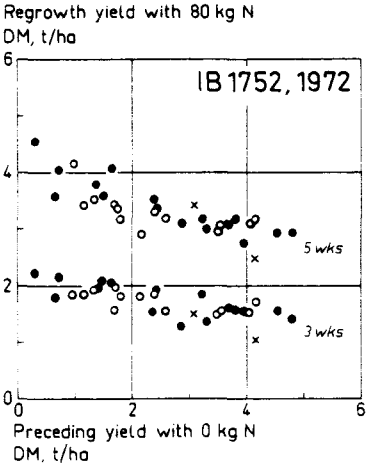


Table 5 Effect of previous DM yield (fertilized with 0, 40, 80, 120 and 200 kg N per ha, respectively) on regrowth (fertilized with 80 kg N per ha). Regression approximated with quadratic equation $y = a + bx + cx^2$; y = regrowth yield and x = preceding yield, both expressed in 100 kg DM. The range of x is 3 to 49 at 0 kg N, 4 to 57 at 40 kg N, 4 to 68 at 80 kg N, 4 to 73 at 120 kg N and 4 to 76 at 200 kg N

Regrowth period	N, kg/ha to preceding cut	Regression equation
3 weeks	0	$y = 22.26 - 0.2750\ x + 0.002273\ x^2$
	40	$y = 28.81 - 0.5629\ x + 0.004928\ x^2$
	80	$y = 30.94 - 0.5811\ x + 0.004089\ x^2$
	120	$y = 32.97 - 0.6424\ x + 0.004307\ x^2$
	200	$y = 34.03 - 0.6611\ x + 0.004220\ x^2$
5 weeks	0	$y = 43.83 - 0.6254\ x + 0.007306\ x^2$
	40	$y = 48.24 - 0.6653\ x + 0.005813\ x^2$
	80	$y = 54.50 - 0.8569\ x + 0.007083\ x^2$
	120	$y = 55.63 - 0.8005\ x + 0.005765\ x^2$
	200	$y = 57.64 - 0.8096\ x + 0.005394\ x^2$

From Table 5 the following can be deduced:

a. In all cases an increase in preceding yields leads to a decrease in regrowth.

b. After light preceding cuts regrowth yields have the following ranking: 200 N > 120 N > 80 N > 40 N > 0 N. This is mainly a result of the residual effect of the nitrogen applied to the preceding cut. A clear example of such a residual effect is shown in Annexes 4 and 18 for ES 2 - M 2 at 200 kg N. In the preceding cut only 31 per cent of the applied nitrogen was recovered, while total recovery (in preceding cut + regrowth) amounted to 58 per cent.

c. With an increase in preceding yields the differences in regrowth between the various nitrogen treatments decrease. At a preceding yield level of about 3 to 4 t DM per ha the regression lines even cross and after heavy preceding yields of over 5 t DM per ha the regrowth has the following ranking: 0 N > 40 N > 80 N > 120 N > 200 N. Apparently regrowth is retarded more when a heavy preceding cut is obtained with a high rate of nitrogen than when a similar heavy cut is produced with a lower rate of nitrogen.

It should be noted that the regression equations are based on the results of all regrowth periods. This might have affected the regression lines. However, the negative effect of the combination high yield/high nitrogen on regrowth is even more pronounced when one considers only one regrowth period. Figure 14 shows the regrowth periods 10 July - 31 July and 10 July - 14 August of the ES 2, ES 3, IS 3 and IS 4 series. It can be seen that after a preceding cut of 4.5 t DM per ha the 3-weeks' regrowth of ES 3 - 200 kg N was approximately 250 and 500 kg DM per ha lower than of IS 3 - 40 kg N and ES 2 - 5 kg N*, respectively. In addition, Figure 14 shows the marked positive effect on regrowth of the combination low yield/high nitrogen (IS 4 at 5-weeks' regrowth).

* Estimated by interpolation

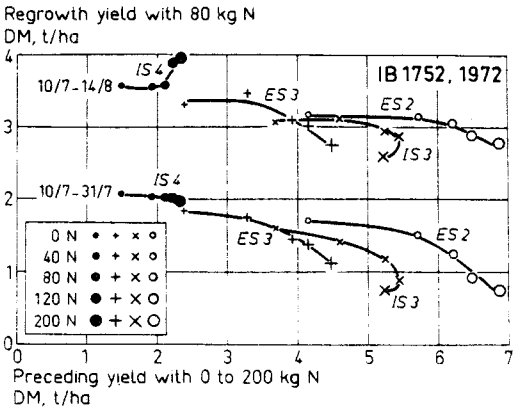


FIGURE 14

Effect of preceding yield and nitrogen pretreatment on regrowth (fertilized with 80 kg N per ha) of ES 2, ES 3, IS 3 and IS 4 during 10 July - 31 July (3 weeks) and 10 July - 14 August (5 weeks). Results of 1972

CUTTING FREQUENCY SERIES 1973

As mentioned under 'Methods', the plots of the S 1 series periodical harvest M 3 were harvested every 3 weeks (in total 8 times) and those of M 5 every 6 weeks (in total 4 times). Both cutting frequency series were given the same total amount of nitrogen, namely 0, 160, 320 and 480 kg N per ha per year (see Figure 5 and Annex 42). A 6-weeks' cutting interval resulted in a considerably higher dry-matter yield production but only in a slightly higher (approximately 10 per cent) uptake of nitrogen than a 3-weeks' interval (Table 6). From a graph plotting dry-matter yield against nitrogen uptake (not presented here) it was assessed that the nitrogen efficiency (kg DM/kg N taken up) increased 30 per cent by lengthening the growing period from 3 to 6 weeks. However, the feeding value of the grass, expressed as VEM*, was decreased with the decrease in cutting frequency (Table 6).

Table 6 Effect of nitrogen on total DM yield, N-uptake and net energy value (VEM) of main series (E and I) and of 3- and 6-weeks' cutting frequency series (regrowth of S 1 M 3 and S 1 M 5 plots) in 1973

N, kg/ha	DM, t/ha			N-uptake, kg/ha			VEM		
	Main series*	Frequency series		Main series	Frequency series		Main series	Frequency series	
		3 wks**	6 wks**		3 wks	6 wks		3 wks	6 wks
0		5.4	8.4		143	173		914	845
160		8.7	13.1		251	276		917	841
280	12.7 (E)			359			896		
320		11.6	16.3		358	390		923	833
480		14.0	18.0		463	464		934	849
640	16.2 (I)			584			918		

* 22 March - 12 November 1973
** 22 March - 9 October 1973

* See note on page 3

The results of the cutting frequency series may be compared with those of the main series (Table 6). The effect of a longer season with the main series (till 12 November as against 9 October with the frequency series) is thought to be of minor importance as growth between those two dates had almost come to a standstill (see Annexes 33/34 and 40/41). A 6-weeks' cutting frequency produced about the same amount of dry matter with 320 kg N per ha as the I-main series with 640 kg N. In the case of the I-main series the grass was cut 8 times. This means an average growing period of only 3 to 3½ weeks between cuts, and therefore a lower nitrogen efficiency regarding DM production as compared with a 6-weeks' cutting frequency. However, the feeding value was much lower with the 6-weeks' cutting frequency. Without nitrogen fertilization, nitrogen uptake was 143 and 173 kg per ha for the two cutting frequency series. When taking the latter figure (173 kg N) as a measure for the main series, we find a recovery of the fertilizer nitrogen in the herbage of 66 and 64 per cent for the E- and I-series, respectively.

STUBBLE YIELD

In 1972, some preliminary determinations of stubble yield were made towards the end of the season (Table 7 and Annex 44), while in 1973 stubble yields were determined at various times during the whole season (Annex 45). As shown in Table 7, stubble dry-matter yield is inversely related to herbage yield. In the E- as well as in the I-series, the lowest

Table 7 Effect of rate of nitrogen on DM yield (t/ha) of herbage and stubble of ES 5 - M 6 and IS 6 - M 6 grass in 1972

Plant parts	ES 5 - M 6, 28 September*			IS 6 - M 6, 6 October**		
	0 N	80 N	200 N	0 N	80 N	200 N
Herbage	2.5	4.5	6.0	3.1	4.5	5.1
Stubble	1.8	1.6	1.5	1.2	1.0	1.0
Total	4.3	6.1	7.5	4.3	5.5	6.1

* Annexes 7 and 44
** Annexes 14 and 44

herbage yield (0 N) resulted in the highest stubble yield. Sward density is normally higher at low than at high rates of nitrogen application and a high stubble weight may therefore be considered as an indication of a high sward density. It is striking that stubble yield was much lower in the I- than in the E-series, although herbage yields did not differ much (Table 7). The effect may be due partly to the fact that the I-series sward still suffered from damage caused by a hot dry spell immediately after the silage-stage cut on 17 July 1972 and partly to the difference in fertilizer regime and the consequent difference in number of cuts (Annex 44). The results obtained in 1972 were confirmed in 1973. The stubble dry-matter yield of the E-series increased from 1.4 t per ha in May/June to 1.7 t at the end of September, whereas the I-series stubble yields stayed at a level of

about 1.2 t per ha throughout the 1973 season (Annex 45).
It can further be deduced from the combined data on herbage yield in Annex 42 and stubble yield in Annex 45*B* that in the 3- and 6-weeks' cutting frequency series there is a strong negative relationship between total herbage yield and stubble yield. The higher the herbage yield, either by applying more nitrogen fertilizer or by less frequent cutting, the lower the stubble yield.

SUMMARY AND CONCLUSIONS

Experiments were carried out on clover-free permanent grassland on clay soil in 1972 and 1973 to study the response to nitrogen during the growing season in relation to two levels of nitrogen pretreatment. These two levels resulted in two intensities of nitrogen fertilization, namely about 300 and 600 kg N per ha per annum.
Apart from these two intensities of nitrogen fertilization, the experimental treatments included

- different times of nitrogen application during the season,
- increasing rates of nitrogen at each time of application, and
- series of periodical harvests after each time of nitrogen application in order to establish growth curves.

The experimental design was such that each time of nitrogen application could be started on a new set of plots either after standard silage-stage and grazing-stage cuts (in 1972) or after standard grazing-stage cuts only (in 1973). This system made it possible to avoid the adverse effects which cutting a heavy grass crop generally has on subsequent regrowth. Since an increase in the level of nitrogen accelerates grass growth, the 'standard' cuts were attained quicker at the high- than at the low-intensity pretreatment. Consequently the high-intensity treatments resulted in more times of application during the season than the low-intensity treatments.
In the 1972 experiment the opportunity was taken to study, on selected plots, the interaction between quantity of herbage harvested and subsequent rate of regrowth.
In the 1973 experiment selected plots were used to establish the nitrogen effect at cutting frequencies of 3 and 6 weeks throughout the season.
The following conclusions can be made:

1. The response to nitrogen is considerably lower with a high than with a low intensity of nitrogen fertilization, particularly at the end of the season.
2. This difference in response is due to a residual effect of the higher nitrogen pretreatment.
3. In a low-intensity system the response to nitrogen stays about the same from May till early/late August application, while in a high-intensity system this holds true for nitrogen applied from May till mid- or late July.
4. Compared at a same yield level, the crude fibre content of the grass always decreases

with an increase in nitrogen supply. Over the range 0, 40, 80, 120 kg N per ha, crude fibre content of silage-stage grass decreased by 0.5 per cent per 40 kg N.

5. From August onwards, the nitrate content in the grass is considerably higher in the high-intensity treatment than in the low-intensity treatment. In the time-of-application treatments the ageing of the grass is accompanied by a decrease in nitrate.
6. There is a close negative relationship between quantity of herbage harvested at a cut and subsequent regrowth. The higher the rate of nitrogen applied to the preceding cut, the stronger this negative relationship. However, after a relatively low preceding yield and a high level of nitrogen pretreatment, the negative effect may be counteracted by the positive effect of residual nitrogen.
7. Nitrogen is used more effectively as the cutting frequency is reduced. A decrease in the number of cuts from 8 to 4 resulted in a 30 per cent increase in effectiveness of the nitrogen taken up by the grass. However, the feeding value of the product decreased considerably.
8. An increase in yield, either by cutting less frequently or by applying more nitrogen, has a negative effect on sward density as indicated by a decrease in stubble yield.

ACKNOWLEDGEMENT

We thank Mr. D.H.W. Thompson for his kindness to read the manuscript and give his comments.

PREVIOUS PUBLICATIONS RELATING TO THE EXPERIMENTS

1. Burg, P.F.J. van — 1970 — The seasonal response of grassland herbage to nitrogen. Neth. Nitrogen Techn. Bull. no. 8, pp 59

2. Burg, P.F.J. van — 1974 — Stikstofreaktie gedurende het groeiseizoen. NVWV Geb. Versl. 13, 14-25

3. Burg, P.F.J. van — 1977 — Nitrogen fertilization of grassland. Proc. Int. Meeting on An. Prod. from Temp. Grassl., Dublin June 1977, 104-108

4. Minderhoud, J.W., Burg, P.F.J. van, Deinum, B., Dirven, J.G.P. and 't Hart, M.L. — 1976 — Effects of high levels of nitrogen fertilization and adequate utilization on grassland productivity and cattle performance, with special reference to permanent pastures in the temperate regions. Proc. XIIth Int. Grassl. Congr. Moscow 1974, I, 1, 99-121

5. Prins, W.H. en Burg, P.F.J. van — 1975 — Stikstofbemesting van grasland. 8. De nawerking van eerder gegeven stikstof. Stikstof, band 7, no. 80, 232-240

6. Prins, W.H. and Burg, P.F.J. van — The residual effect of fertilizer nitrogen on grassland within one growing season. Proc. XIIIth Int. Grassl. Congr. Leipzig 1977

7. Wieling, H. — 1974 — Stikstofopname en stikstofverwerking gedurende het groeiseizoen. NVWV Geb. Versl. 13, 26-52

ERRATA PREVIOUS BULLETINS

NN Bulletin no. 2.

Page 13, Table 11, last column:- 101.7 *should read* 88.1
Page 15, Table 13, column 4:- 76.2 *should read* 76.4

NN Bulletin no. 3.

Page 22, Table 9, column 4:- 6.31 *should read* 5.86

NN Bulletin no. 8.

Page 37, Summary, line 6:- taken a consecutive dates *should read* taken at consecutive dates.

Annex 1 General data of IB 1752 (1972) and IB 2032 (1973), both at Ten Boer, Groningen.

Exp. no.	*IB 1752 (1972)*	*IB 2032 (1973)*
Soil:		
% particles <.002 mm and .016 mm resp.	30 and 45	30 and 44
% org. matter	13.8	15.0
% $CaCO_3$	0.3	0.5
pH-KCl	6.3	6.2
P-Al	65	79
K-number	30	34
MgO ppm	608	622
Plot size:	main series S1, ES2, ES3, ES4, IS2, IS3, IS4, IS5 2 x 3.50 m; ES5, ES6, IS6, IS7 1 x 3.50 m; ES7, IS8 1 x 1.67 m; regrowth series 1 x 3.50 m	main series S1 1.25 x 4.50 m; ES2 - ES7, IS2 - IS8 1.10 x 4.50 m; 3- and 6-weeks' cutting frequency series 1.25 x 4.50 m
No. of replications:	3	4
Basal dressing of P and K at every cut:	50 kg P_2O_5 and 70 kg K_2O per ha as 0-20-28	40 kg P_2O_5 and 56 kg K_2O per ha as 0-20-28

Course of nitrogen fertilizer application and mowing of blocks of main series:

E-series

	IB 1752, 1972	*IB 2032, 1973*
N rates ↓[1] S1 blocks N ↓[2] S2-S7 pretreatment blocks	21/3 80 N	22/3 40 N
M ↑[3] S2-S7 pretr. blocks N rates ↓ S2 blocks 40 N ↓ S3-S7 pretr. blocks	12/5 silage stage	16/5 grazing stage
M ↑ S3-S7 pretr. blocks N rates ↓ S3 blocks 40 N ↓ S4-S7 pretr. blocks	7/6 grazing stage	7/6 grazing stage
M ↑ S4-S7 pretr. blocks N rates ↓ S4 blocks 40 N ↓ S5-S7 pretr. blocks	1/7 grazing stage	5/7 grazing stage
M ↑ S5-S7 pretr. blocks N rates ↓ S5 blocks 40 N ↓ S6-S7 pretr. blocks	4/8 silage stage	2/8 grazing stage
M ↑ S6-S7 pretr. blocks N rates ↓ S6 blocks 40 N ↓ S7 pretr. blocks	30/8 grazing stage	29/8 grazing stage
M ↑ S7 pretr. blocks N rates ↓ S7 blocks	22/9	19/9

I-series

	IB 1752, 1972	*IB 2032, 1973*
N rates ↓[1] S1 blocks N ↓[2] S2-S8 pretreatment blocks	21/3 120 N	22/3 80 N
M ↑[3] S2-S8 pretr. blocks N rates ↓ S2 blocks 80 N ↓ S3-S8 pretr. blocks	9/5 silage stage	9/5 grazing stage
M ↑ S3-S8 pretr. blocks N rates ↓ S3 blocks 80 N ↓ S4-S8 pretr. blocks	2/6 grazing stage	29/5 grazing stage
M ↑ S4-S8 pretr. blocks N rates ↓ S4 blocks 80 N ↓ S5-S8 pretr. blocks	20/6 grazing stage	20/6 grazing stage
M ↑ S5-S8 pretr. blocks N rates ↓ S5 blocks 80 N ↓ S6-S8 pretr. blocks	17/7 silage stage	17/7 grazing stage
M ↑ S6-S8 pretr. blocks N rates ↓ S6 blocks 80 N ↓ S7-S8 pretr. blocks	9/8 grazing stage	7/8 grazing stage
M ↑ S7-S8 pretr. blocks N rates ↓ S7 blocks 80 N ↓ S8 pretr. blocks	30/8 grazing stage	29/8 grazing stage
M ↑ S8 pretr. blocks N rates ↓ S8 blocks	22/9	19/9

1) N rates ↓ = rate of N application: 0, 40, 80, 120 and 200 kg N/ha in 1972, and 0, 40, 80 and 120 kg N/ha in 1973
2) N ↓ = nitrogen application to pretreatment blocks
3) M ↑ = mowing at grazing or silage stage as indicated

Annex 2 IB 1752, 1972. Herbage yield, herbage composition and nitrogen uptake of E- and I-pretreatment cuts plus final cut of last series.

Series	N kg/ha	Starting time	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
ES2	80	12/5	31.8	2.72	0.10	23.4	86
ES3	40	7/6	14.8	3.23	0.18	22.6	48
ES4	40	1/7	19.9	3.14	0.14	25.0	62
ES5	40	4/8	28.2	2.42	0.07	26.6	68
ES6	40	30/8	18.7	2.98	0.09	23.3	56
ES7	40	22/9	8.9	3.90	0.13	20.5	35
"ES7 M3" *	40	9/11	8.9	4.01	-	18.1	36
total	320		131.2				391
IS2	120	9/5	33.1	3.22	0.26	24.3	107
IS3	80	2/6	16.6	4.06	0.77	19.4	67
IS4	80	20/6	22.6	3.84	0.65	21.6	87
IS5	80	17/7	34.8	3.03	0.61	24.9	105
IS6	80	9/8	18.6	4.46	1.72	21.6	83
IS7	80	30/8	16.1	4.50	1.78	21.1	72
IS8	80	22/9	11.3	4.94	1.42	17.4	56
"IS8 M3" *	80	9/11	13.6	4.61	1.05	18.1	63
total	680		166.7				640

* Final cuts, see Annexes 9 and 16

Annex 3 IB 1752, 1972. Effect of rate of nitrogen and date of cutting (length of growing period) on herbage DM yield, herbage composition and N-uptake of S 1 series.

S 1, N + 21/3

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 24/4 (34 days)*					
0	1.8	3.06	0.04	14.9	6
40	6.3	3.55	0.05	15.2	22
80	7.8	4.05	0.08	14.6	32
120	9.8	4.59	0.35	15.0	45
200	11.6	4.93	0.79	15.0	57
M 2, 2/5 (42 d)					
0	7.3	2.87	0.06	16.5	21
40	12.7	3.10	0.04	16.6	39
80	17.0	3.45	0.07	17.2	59
120	20.0	3.68	0.14	18.0	74
200	22.3	4.54	0.77	17.7	101
M 3, 8/5 (48 d)					
0	12.7	2.54	0.04	18.4	32
40	21.7	2.68	0.04	20.2	58
80	26.1	2.92	0.08	19.7	76
120	30.0	3.29	0.12	20.9	99
200	33.5	3.97	0.82	21.2	133
M 4, 15/5 (55 d)					
0	21.6	2.12	0.03	20.4	46
40	30.2	2.12	-	21.4	64
80	38.7	2.31	0.06	23.7	89
120	42.3	2.66	-	23.3	113
200	50.3	3.28	0.74	24.1	165
M 5, 23/5 (63 d)					
0	30.8	1.88	0.05	23.0	58
40	47.6	1.90	-	24.6	90
80	53.2	1.93	0.04	24.5	103
120	57.5	2.03	-	25.7	117
200	64.9	2.57	0.58	25.1	167
M 6, 30/5 (70 d)					
0	41.5	1.69	0.12	26.0	70
40	53.3	1.46	-	26.9	78
80	68.3	1.62	0.08	27.6	111
120	73.1	2.01	-	27.7	147
200	75.5	2.36	0.07	28.5	178

* *M* = mowing sequence of periodical harvests

Annex 4-6 IB 1752, 1972. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of ES 2 - ES 4 series.

Annex 4 ES 2, pretreatment 80 kg N/ha N + 12/5

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1a, 29/5 (17 days)					
0	3.9	3.67	0.36	20.9	14
40	5.0	4.38	-	20.2	22
80	6.5	5.10	1.41	20.0	33
120	6.9	5.21	-	19.4	36
200	5.8	5.47	2.31	19.0	32
M 1b, 2/6 (21 d)					
0	6.3	3.05	0.08	20.2	19
40	9.5	3.54	-	19.1	34
80	11.6	4.17	0.60	18.4	48
120	13.6	4.73	-	19.3	64
200	12.2	5.26	2.42	18.0	64
M 2, 6/6 (24 d)					
0	9.7	3.06	0.11	19.6	30
40	14.4	3.22	-	19.6	46
80	17.3	3.73	0.48	20.1	65
120	20.2	4.23	-	20.2	85
200	19.1	4.90	2.60	19.6	94
M 3, 13/6 (32 d)					
0	16.7	2.33	0.13	23.2	39
40	24.4	2.61	-	23.2	64
80	28.8	2.98	0.35	23.4	86
120	31.9	3.45	-	23.1	110
200	35.8	4.01	2.68	23.3	144
M 4, 20/6 (39 d)					
0	25.7	2.04	0.12	25.1	52
40	36.2	2.06	-	26.4	75
80	43.7	2.11	0.09	25.2	92
120	49.1	2.45	-	25.6	120
200	52.8	3.19	1.38	24.5	168
M 5, 27/6 (46 d)					
0	35.4	1.80	0.13	26.9	64
40	42.8	1.92	-	26.3	82
80	53.4	2.03	0.12	27.3	108
120	55.5	2.18	-	29.2	121
200	62.0	2.86	1.12	28.8	177
M 6, 10/7 (59 d)					
0	41.3	1.67	0.03	28.2	69
40	57.1	1.59	-	28.8	91
80	62.1	1.78	0.09	31.6	111
120	64.8	2.06	-	30.1	133
200	68.7	2.44	0.57	31.5	168

Annex 5 ES 3, pretreatment 80-40 kg N/ha N + 7/6

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1a, 20/6 (13 days)					
0	7.0	3.26	0.13	20.1	23
40	9.8	3.69	-	20.2	36
80	11.9	4.29	0.68	19.7	51
120	13.4	5.03	-	18.5	67
200	12.6	5.65	2.60	18.0	71
M 1b, 23/6 (16 d)					
0	7.9	3.21	0.13	21.2	25
40	11.2	3.56	-	21.6	40
80	14.7	4.34	0.82	21.4	64
120	15.0	5.00	-	21.8	75
200	16.5	5.36	2.54	20.7	88
M 2, 28/6 (19 d)					
0	11.5	2.78	0.12	21.4	32
40	16.8	3.21	-	22.0	54
80	21.0	3.60	0.57	23.1	76
120	22.0	4.26	-	23.2	94
200	23.8	4.74	2.37	22.8	113
M 3, 3/7 (26 d)					
0	17.0	2.61	0.08	26.5	44
40	23.0	2.79	-	26.4	64
80	31.5	2.96	0.37	26.7	93
120	33.6	3.42	-	27.8	115
200	36.4	4.27	2.10	27.2	155
M 4, 10/7 (33 d)					
0	23.7	2.25	0.15	26.7	53
40	32.8	2.38	-	27.5	78
80	39.2	2.68	0.32	27.9	105
120	41.4	3.00	-	27.8	124
200	44.8	3.80	2.06	27.9	170
M 5, 20/7 (43 d)					
0	35.1	1.88	0.04	27.8	66
40	46.8	1.86	-	28.0	87
80	54.7	2.13	0.29	28.6	117
120	57.2	2.27	-	29.4	130
200	62.0	2.87	1.28	28.9	178
M 6, 31/7 (54 d)					
0	40.4	1.90	0.17	28.7	77
40	55.8	1.73	-	30.0	97
80	60.3	2.03	0.19	29.6	122
120	62.8	2.21	-	30.4	139
200	66.0	2.67	0.94	29.2	176

Annex 6 ES 4, pretreatment 80-40-40 kg N/ha N + 1/7

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1a, 14/7 (13 days)					
0	5.0	3.10	0.04	22.1	16
40	8.3	3.73	-	19.6	31
80	9.7	4.56	1.08	19.2	44
120	10.1	4.91	-	19.6	50
200	10.1	5.51	2.54	19.5	56
M 1b, 20/7 (19 d)					
0	8.5	2.81	0.07	22.7	24
40	15.4	2.94	-	22.8	45
80	18.5	3.55	0.29	23.0	66
120	21.0	4.11	-	23.6	86
200	23.8	4.68	2.83	22.7	111
M 2, 25/7 (24 d)					
0	13.3	2.68	0.11	24.5	36
40	18.8	2.74	-	23.9	52
80	23.8	3.18	0.28	25.3	76
120	28.9	3.71	-	24.7	107
200	32.1	4.18	2.36	24.2	134
M 3, 1/8 (31 d)					
0	17.7	2.40	0.10	24.5	42
40	29.1	2.43	-	25.5	71
80	33.5	2.86	0.32	26.3	96
120	38.4	3.00	-	25.9	115
200	41.0	3.56	1.82	26.0	146
M 4, 7/8 (37 d)					
0	21.6	2.19	0.08	24.5	47
40	31.8	2.30	-	26.0	73
80	39.5	2.45	0.30	26.6	97
120	43.6	2.71	-	26.9	118
200	49.1	3.36	1.82	27.1	165
M 5, 16/8 (46 d)					
0	28.9	2.20	0.10	27.6	64
40	38.4	2.21	-	26.6	85
80	46.0	2.26	0.16	27.5	104
120	49.6	2.54	-	27.8	126
200	56.5	2.88	1.03	27.7	163
M 6, 24/8 (54 d)					
0	35.8	2.00	0.02	27.4	72
40	48.8	2.00	-	27.3	98
80	51.2	2.10	0.08	28.0	108
120	56.3	2.28	-	28.2	128
200	63.5	2.63	0.82	27.8	167

Annex 7-9 IB 1752, 1972. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of ES 5 - ES 7 series.

Annex 7 ES 5, pretreatment 80-40-40-40 kg N/ha N ↓ 4/8

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 16/8 (12 days)					
0	4.5	3.31	0.40	23.7	15
40	7.2	4.21	-	21.8	30
80	8.5	4.96	1.83	21.1	42
120	8.6	5.42	-	19.9	47
200	8.2	5.56	2.66	20.0	46
M 2, 21/8 (17 d)					
0	5.7	3.18	0.18	21.9	18
40	10.9	3.71	-	22.0	40
80	13.2	4.38	1.11	21.8	58
120	14.5	4.80	-	20.9	70
200	14.2	5.48	2.76	20.0	78
M 3, 28/8 (24 d)					
0	9.8	3.01	0.17	22.9	29
40	17.5	3.15	-	22.6	55
80	22.8	3.49	0.62	23.3	80
120	25.3	4.21	-	22.2	107
200	24.8	4.69	2.80	21.3	116
M 4, 6/9 (33 d)					
0	14.2	2.62	0.11	22.0	37
40	23.1	2.65	-	21.8	61
80	30.4	2.90	0.39	23.1	88
120	33.5	3.36	-	22.6	113
200	38.1	3.90	1.98	23.0	149
M 5, 14/9 (41 d)					
0	17.2	2.37	0.09	21.2	41
40	27.4	2.35	-	23.4	64
80	35.9	2.61	0.40	22.3	94
120	40.3	2.91	-	23.1	117
200	46.6	3.51	1.52	24.4	164
M 6, 28/9 (55 d)					
0	24.8	2.16	0.09	20.0	54
40	35.5	2.14	-	22.7	76
80	44.6	2.41	0.32	23.7	107
120	51.0	2.53	-	22.6	129
200	60.2	3.08	1.09	22.4	185

Annex 8 ES 6, pretreatment 80-40-40-40-40 kg N/ha N ↓ 30/8

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 14/9 (16 days)					
0	3.0	3.52	0.11	19.8	11
40	4.4	4.44	-	19.5	20
80	4.8	5.01	1.13	19.0	24
120	5.1	5.35	-	18.9	27
200	4.7	5.53	1.57	18.8	26
M 2, 30/9 (22 d)					
0	5.0	3.60	0.28	18.2	18
40	8.1	4.26	-	18.8	35
80	8.2	5.02	1.19	18.4	41
120	9.7	5.00	-	18.4	48
200	9.2	5.30	1.94	17.7	49
M 3, 22/9 (24 d)					
0	4.8	3.31	0.07	20.3	16
40	8.8	3.89	-	20.4	34
80	11.4	4.72	0.85	20.5	54
40*	8.9	3.84	-	21.0	34
40*	9.1	3.97	0.13	20.0	36
M 4, 2/10 (34 d)					
0	6.1	3.21	0.06	20.0	20
40	13.2	3.31	-	19.9	44
80	17.8	3.86	0.32	19.3	69
120	19.0	4.67	-	20.2	89
200	20.3	4.85	1.94	19.6	98
M 5, 10/10 (42 d)					
0	8.4	2.90	0.08	19.6	24
40	17.8	3.03	-	19.7	54
80	22.4	3.32	0.21	19.7	74
120	24.3	3.87	-	19.8	94
200	26.0	4.36	1.42	20.0	113
M 6, 26/10 (58 d)					
0	10.8	2.68	0.05	18.7	29
40	19.1	2.63	-	19.3	50
80	29.0	2.72	0.12	19.9	79
120	31.1	3.24	-	19.6	101
200	33.6	3.95	1.19	19.5	133

* 120 N and 200 N replaced by 40 N to have extra plots available for ES 7

Annex 9 ES 7, pretreatment 80-40-40-40-40-40 kg N/ha N ↓ 22/9

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 10/10 (18 days)					
0	2.7	3.81	0.21	18.6	10
40	4.7	4.62	-	18.2	22
80	4.6	5.03	0.70	17.9	23
M 2, 26/10 (34 d)					
0	5.7	3.32	0.09	16.4	19
40	8.8	3.91	-	16.0	34
80	10.8	4.36	0.45	16.4	47
M 3, 9/11 (48 d)					
0	5.3	3.72	0.21	18.2	20
40	8.9	4.01	-	18.1	36
80	11.6	4.50	0.65	17.2	52

Annex 10-12 IB 1752, 1972. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of IS 2 - IS 4 series.

Annex 10 IS 2, pretreatment 120 kg N/ha
N + 9/5

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 23/5 (14 days)					
0	3.0	4.36	0.33	20.8	13
40	3.5	4.87	-	20.5	17
80	4.0	5.16	1.52	19.7	21
120	3.8	5.41	-	19.8	21
200	3.9	5.78	1.96	18.2	23
M 2, 30/5 (21 d)					
0	7.2	3.45	0.21	21.4	25
40	11.6	3.85	-	21.4	45
80	12.5	4.66	1.16	20.4	58
120	14.0	4.94	-	20.0	69
200	13.5	5.49	2.83	18.2	74
M 3, 6/6 (28 d)					
0	13.4	2.92	0.15	22.0	39
40	19.6	3.04	-	22.6	60
80	23.5	3.43	0.47	22.6	81
120	25.0	4.14	-	22.3	104
200	26.5	4.82	2.58	22.2	128
M 4, 13/6 (35 d)					
0	23.4	2.38	0.12	23.3	56
40	30.8	2.53	-	24.9	78
80	35.1	2.86	0.35	25.0	100
120	37.7	3.21	-	23.7	121
200	39.5	3.99	2.86	23.8	158
M 5, 20/6 (42 d)					
0	32.9	1.86	0.09	25.1	61
40	42.4	2.07	-	26.8	88
80	51.2	2.16	0.14	26.7	111
120	51.8	2.73	-	26.4	141
200	56.0	3.12	1.65	25.6	175
M 6, 3/7 (55 d)					
0	45.1	1.76	0.08	28.5	79
40	56.7	1.74	-	28.3	99
80	65.9	1.88	0.19	30.5	124
120	67.4	2.22	-	30.1	150
200	69.3	2.57	1.12	29.9	178

Annex 11 IS 3, pretreatment 120-80 kg N/ha
N + 2/6

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1a, 8/6 (6 days)					
0	1.1	4.32	0.57	22.7	5
40	1.3	5.36	-	20.2	7
80	1.2	5.40	2.70	20.6	6
120	1.2	5.58	-	20.7	7
200	1.1	5.53	2.68	19.4	6
M 1b, 15/6 (13 d)					
0	9.4	3.27	0.23	19.5	31
40	12.0	3.96	-	19.2	48
80	13.4	4.76	1.48	19.3	64
120	13.8	5.39	-	19.1	74
200	13.2	5.65	3.06	19.2	75
M 2, 19/6 (17 d)					
0	16.5	2.92	0.09	20.9	48
40	19.6	3.65	-	21.5	72
80	20.9	4.16	1.08	21.0	87
120	22.0	4.61	-	21.3	101
200	21.4	5.21	3.08	20.7	111
M 3, 26/6 (24 d)					
0	23.9	2.41	0.08	24.4	58
40	29.4	2.63	-	24.4	77
80	34.4	3.04	0.55	25.9	105
120	35.1	3.48	-	24.6	122
200	36.3	4.32	2.84	24.2	157
M 4, 3/7 (31 d)					
0	32.3	2.10	0.18	29.1	68
40	38.8	2.39	-	28.1	93
80	44.5	2.66	0.32	29.4	118
120	47.0	3.22	-	28.3	151
200	48.1	3.66	2.39	27.4	176
M 5, 10/7 (38 d)					
0	36.8	2.04	0.19	28.5	75
40	46.0	2.29	-	29.1	105
80	52.4	2.31	0.35	29.5	121
120	54.4	2.59	-	30.4	141
200	52.3	3.41	1.70	29.7	178
M 6, 20/7 (48 d)					
0	47.7	1.57	0.08	29.4	75
40	60.0	1.67	-	32.1	100
80	65.9	2.05	0.32	30.9	135
120	67.7	2.25	-	30.2	152
200	68.9	3.29	1.05	29.8	227

Annex 12 IS 4, pretreatment 120-80-80 kg N/ha
N + 20/6

N kg/ ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 1/7 (11 days)					
0	6.4	3.68	0.23	22.6	24
40	8.4	4.62	-	22.0	39
80	8.4	5.18	1.94	21.0	44
120	8.4	5.36	-	21.0	45
200	8.0	5.48	2.17	20.6	44
M 2, 10/7 (20 d)					
0	14.9	2.95	0.20	25.4	44
40	19.3	3.58	-	25.1	69
80	21.1	4.03	1.22	24.5	85
120	22.3	4.56	-	24.2	102
200	23.2	4.93	3.30	23.2	114
M 3, 20/7 (30 d)					
0	28.4	2.25	0.09	26.9	64
40	34.6	2.36	-	27.6	82
80	40.9	2.68	0.47	27.4	110
120	41.9	3.17	-	27.6	133
200	44.5	3.73	2.28	26.8	166
M 4, 31/7 (41 d)					
0	37.7	2.04	0.12	27.8	77
40	43.2	2.15	-	28.5	93
80	50.3	2.47	0.48	29.2	124
120	54.0	2.77	-	29.5	150
200	56.2	3.35	2.05	28.8	188
M 5, 7/8 (48 d)					
0	39.6	2.04	0.14	28.0	81
40	47.9	2.06	-	29.1	99
80	56.1	2.24	0.25	29.3	126
120	58.4	2.49	-	29.0	145
200	64.8	2.96	1.22	28.2	192
M 6, 16/8 (57 d)					
0	49.0	1.87	0.07	28.7	92
40	56.2	2.04	-	29.0	115
80	60.1	2.32	0.36	30.2	139
120	64.7	2.42	-	29.6	157
200	67.3	2.77	1.14	29.1	186

Annex 13-16 IB 1752, 1972. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of IS 5 - IS 8 series.

Annex 13 IS 5, pretreatment 120-80-80-80 kg N/ha N + 17/7

N kg/ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1a, 1/8 (15 days)					
0	6.3	4.30	0.66	21.4	27
40	7.0	4.92	-	20.1	34
80	7.8	5.40	2.76	19.8	42
120	6.7	5.44	-	20.5	36
200	5.9	5.73	2.51	20.1	34
M 1b, 7/8 (21 d)					
0	12.1	3.50	0.26	23.0	42
40	14.6	4.06	-	22.4	59
80	16.4	4.50	1.78	21.9	74
120	15.6	4.78	-	20.7	75
200	13.9	5.15	3.01	20.7	72
M 2, 9/8 (23 d)					
0	14.4	3.35	0.33	23.1	48
40	16.7	3.52	0.75	22.3	59
80	17.7	4.36	1.84	22.0	77
120	17.5	4.42	-	21.1	77
200	18.5	4.75	2.82	20.8	88
M 3, 16/8 (30 d)					
0	17.7	2.85	0.14	24.6	50
40	24.6	3.18	-	25.7	78
80	27.6	3.74	1.55	25.2	103
120	27.9	3.92	-	26.2	109
200	28.4	4.28	2.82	25.4	122
M 4, 24/8 (38 d)					
0	26.6	2.42	0.07	24.5	64
40	32.0	2.66	-	23.1	85
80	35.3	3.18	1.04	25.5	112
120	36.8	3.39	-	25.4	125
200	37.7	3.78	2.51	24.7	143
M 5, 4/9 (49 d)					
0	32.7	2.19	0.12	22.3	72
40	41.6	2.30	-	24.4	96
80	46.0	2.64	0.59	24.8	121
120	49.3	2.74	-	24.5	135
200	50.5	3.39	2.07	24.0	171
M 6, 14/9 (59 d)					
0	36.0	2.21	0.08	23.2	80
40	45.0	2.18	-	25.5	98
80	50.6	2.48	0.41	24.4	125
120	55.5	2.64	-	26.1	145
200	57.4	3.10	1.58	25.4	178

Annex 14 IS 6, pretreatment 120-80-80-80 kg N/ha N + 9/8

N kg/ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 21/8 (12 days)					
0	5.4	4.31	1.00	19.8	23
40	5.8	5.18	-	20.8	30
80	5.7	5.36	2.43	19.2	31
120	5.2	5.48	-	19.1	28
200	4.8	5.51	2.77	18.9	26
M 2, 28/8 (19 d)					
0	10.5	3.74	0.38	19.9	39
40	12.3	4.39	-	19.6	54
80	13.7	4.80	2.14	19.9	66
120	12.8	5.08	-	19.5	65
200	11.3	5.24	2.65	19.5	59
M 3, 6/9 (28 d)					
0	17.4	3.11	0.16	20.9	54
40	21.6	3.78	-	21.0	82
80	23.7	4.18	1.70	21.2	99
120	22.3	4.35	-	20.2	97
200	22.5	4.80	2.56	20.1	108
M 4, 14/9 (33 d)					
0	23.6	3.03	0.06	22.0	72
40	28.1	3.24	-	21.5	91
80	30.4	3.65	1.13	21.6	111
120	29.5	3.94	-	21.7	116
200	30.8	4.35	2.34	21.2	134
M 5, 22/9 (41 d)					
0	23.7	2.50	0.08	22.7	59
40	32.5	2.77	-	21.8	90
80	33.4	3.41	0.68	21.8	114
120	37.2	3.53	-	21.2	131
200	38.7	3.93	2.04	22.0	152
M 6, 6/10 (55 d)					
0	31.4	2.43	0.12	20.4	76
40	42.0	2.48	-	21.3	104
80	44.7	2.84	0.66	20.5	127
120	46.1	3.20	-	21.2	148
200	50.8	3.61	1.58	20.5	183

Annex 15 IS 7, pretreatment 120-80-80-80-80 kg N/ha N + 30/8

N kg/ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 14/9 (16 days)					
0	5.6	4.65	1.08	17.3	26
40	5.6	5.04	-	18.0	28
80	6.0	5.07	1.59	18.5	30
120	5.3	5.41	-	17.0	29
200	4.7	5.44	1.67	17.0	26
M 2, 20/9 (22 d)					
0	7.9	3.91	0.36	18.6	31
40	8.7	4.81	-	17.7	42
80	9.2	4.92	1.48	17.6	45
120	9.3	5.11	-	17.7	48
200	7.8	5.27	1.82	16.9	41
M 3, 22/9 (24 d)					
0	10.3	4.04	0.38	18.2	42
40	11.1	4.58	-	18.5	51
80	12.0	4.77	1.33	17.5	57
80*	11.5	4.97	-	17.6	57
80*	10.5	5.09	1.51	17.0	53
M 4, 2/10 (34 d)					
0	13.7	3.52	0.18	19.5	48
40	17.6	3.73	-	18.8	66
80	18.0	4.15	1.02	19.9	75
120	18.4	4.52	-	18.7	83
200	17.1	4.92	1.52	17.1	84
M 5, 10/10 (42 d)					
0	17.3	3.00	0.11	18.9	52
40	21.5	3.40	-	18.4	73
80	23.8	3.74	0.72	19.0	89
120	23.0	4.04	-	19.0	93
200	22.6	4.43	1.38	18.1	100
M 6, 26/10 (58 d)					
0	20.8	2.87	0.10	16.5	60
40	27.9	3.19	-	17.1	89
80	29.3	3.55	0.67	17.5	104
120	31.1	3.69	-	18.9	115
200	28.9	4.01	1.14	17.6	116

* 120 N and 200 N replaced by 80 N to have extra plots available for IS 8

Annex 16 IS 8, pretreatment 120-80-80-80-80-80 kg N/ha N + 22/9

N kg/ha	DM 100 kg/ha	% N	% NO_3	% CF	N-upt. kg/ha
M 1, 10/10 (18 days)					
0	5.0	4.72	0.59	15.4	24
40	5.0	5.02	-	15.6	25
80	5.2	5.16	0.92	15.8	27
M 2, 26/10 (34 d)					
0	8.9	4.18	0.36	15.5	37
40	10.3	4.42	-	15.6	46
80	9.8	4.64	0.59	15.3	45
M 3, 9/11 (48 d)					
0	10.4	4.45	0.57	18.4	46
40	12.5	4.33	-	18.1	54
80	13.6	4.61	1.05	18.1	63

Annex 17 IB 1752, 1972. Effect of pretreatment rate of nitrogen and date of cutting on regrowth of S 1 series after an overall application of 80 kg N/ha. See Annex 3 for pretreatment data.

Pretr. N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
	3-weeks' regrowth				*5-weeks' regrowth*			
M 5, 23/5-13/6					*M 5, 23/5-27/6*			
0	15.2	3.47	21.2	53	34.2	2.34	23.7	80
40	12.8	3.69	19.5	47	31.9	2.48	24.4	79
80	11.8	3.81	19.4	45	31.0	2.57	24.1	80
120	11.4	4.27	20.6	49	30.1	2.70	24.3	81
200	13.5	4.19	20.8	57	32.8	3.11	24.5	102
M 6, 30/5-20/6					*M 6, 30/5-4/7*			
0	10.6	3.63	20.7	38	30.9	2.72	27.8	84
40	9.9	3.44	22.2	34	28.6	2.64	26.6	76
80	7.8	4.05	19.4	32	29.2	2.99	27.3	87
120	7.6	4.35	19.8	33	26.8	3.21	27.0	86
200	6.0	4.62	20.0	28	25.0	3.70	25.1	92

Annex 18 IB 1752, 1972. Effect of pretreatment rate of nitrogen and date of cutting on regrowth of ES 2 series after an overall application of 80 kg N/ha.
See Annex 4 for pretreatment data.

Pretr. N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
3-weeks' regrowth					*5-weeks' regrowth*			
M 2, 5/6-26/6					*M 2, 5/6-10/7*			
0	18.6	3.21	22.1	60	41.2	2.19	27.8	90
40	22.2	3.34	22.7	74	40.3	2.42	28.1	98
80	23.3	3.40	23.1	79	41.9	2.58	28.5	108
120	23.9	3.85	22.7	92	42.9	2.68	27.9	115
200	23.5	4.48	24.6	105	45.8	3.10	27.9	142
M 3, 13/6-4/7					*M 3, 13/6-18/7*			
0	15.7	4.10	24.1	64	34.3	2.48	26.0	85
40	16.4	4.43	23.1	73	36.4	2.56	26.0	93
80	14.5	4.57	22.6	66	37.4	2.68	26.4	100
120	11.2	4.97	22.6	56	37.0	2.83	25.5	105
200	11.8	5.21	21.3	61	37.0	3.17	24.7	117
M 4, 20/6-11/7					*M 4, 20/6-25/7*			
0	15.4	3.72	23.0	57	31.8	2.61	28.0	83
40	13.2	3.96	21.9	52	31.1	2.70	29.2	84
80	13.3	4.25	21.7	57	31.6	2.82	29.7	89
120	12.5	4.43	21.7	55	29.8	2.82	29.5	84
200	11.5	4.52	21.7	52	30.6	3.37	28.7	103
M 5, 27/6-18/7					*M 5, 27/6-1/8*			
0	15.6	3.68	22.4	57	30.8	2.88	27.6	89
40	14.4	3.91	22.1	56	28.1	2.78	27.4	78
80	14.2	4.17	22.9	59	30.4	3.06	26.4	93
120	12.4	4.66	20.8	58	31.0	3.13	27.0	97
200	11.0	4.75	20.7	52	31.2	3.41	25.7	106
M 6, 10/7-31/7					*M 6, 10/7-14/8*			
0	17.1	3.77	23.4	64	31.8	2.92	26.7	93
40	15.1	3.98	23.6	60	31.6	3.00	26.7	95
80	12.6	4.67	22.0	59	30.6	3.16	26.6	97
120	9.2	4.91	19.0	45	28.9	3.46	25.6	100
200	7.5	5.11	19.9	38	27.9	3.73	25.7	104

Annex 19 IB 1752, 1972. Effect of pretreatment rate of nitrogen and date of cutting on regrowth of ES 3 series after an overall application of 80 kg N/ha.
See Annex 5 for pretreatment data.

Pretr. N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
3-weeks' regrowth					*5-weeks' regrowth*			
M 2, 26/6-17/7					*M 2, 26/6-31/7*			
0	18.4	3.26	22.6	60	34.0	2.70	28.2	92
40	21.7	3.46	23.0	75	37.8	2.63	27.7	99
80	21.8	3.36	23.8	73	38.2	2.67	28.0	102
120	22.8	3.79	22.3	86	39.9	2.84	27.7	113
200	23.1	4.07	22.7	94	42.5	3.37	29.7	143
M 3, 3/7-24/7					*M 3, 3/7-7/8*			
0	19.8	3.74	24.1	74	33.8	2.72	27.1	92
40	19.4	3.72	24.7	72	34.1	2.58	26.6	88
80	17.8	4.00	23.7	71	34.2	2.69	27.2	92
120	18.3	4.18	25.1	76	34.7	2.98	27.2	103
200	18.2	4.70	23.0	86	35.5	3.45	27.7	122
M 4, 10/7-31/7					*M 4, 10/7-14/8*			
0	18.5	3.77	24.1	70	33.1	3.00	26.5	99
40	17.5	4.02	23.6	70	34.8	3.06	25.6	106
80	14.5	4.43	22.4	64	30.8	3.28	24.7	101
120	13.8	4.49	23.1	62	30.3	3.40	25.7	103
200	11.3	5.03	20.9	57	27.5	3.87	25.4	106
M 5, 20/7-10/8					*M 5, 20/7-24/8*			
0	15.1	4.19	22.1	63	29.6	3.00	24.8	89
40	13.3	4.28	22.0	57	28.6	3.02	25.4	86
80	10.2	4.56	20.1	47	26.7	3.50	24.4	93
120	9.4	4.97	20.3	47	27.2	3.69	24.2	100
200	8.9	4.93	19.3	44	26.4	3.85	25.3	102
M 6, 31/7-21/8					*M 6, 31/7-4/9*			
0	15.4	4.21	22.7	65	31.0	2.94	24.2	91
40	13.9	4.28	21.2	59	30.5	3.04	24.8	93
80	12.3	4.47	20.9	55	29.2	3.14	24.8	92
120	10.7	4.67	21.4	50	28.6	3.52	24.0	101
200	8.9	4.98	19.4	44	26.5	3.87	24.1	103

Annex 20 IB 1752, 1972. Effect of pretreatment rate of nitrogen and date of cutting on regrowth of ES 4 series after an overall application of 80 kg N/ha.
See Annex 6 for pretreatment data.

Pretr. N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
3-weeks' regrowth					*5-weeks' regrowth*			
M 2, 25/7-15/8					*M 2, 25/7-29/8*			
0	19.3	3.53	21.8	68	35.1	2.86	24.8	100
40	19.7	3.62	22.7	71	33.0	2.78	25.8	92
80	21.0	3.91	22.4	82	36.2	2.93	24.5	106
120	19.9	4.07	22.2	81	36.4	3.10	24.1	113
200	20.0	4.26	21.8	85	37.6	3.64	24.1	137
M 3, 1/8-22/8					*M 3, 1/8-4/9*			
0	18.1	3.76	21.9	68	31.7	2.79	22.7	88
40	16.6	3.83	21.6	64	32.7	2.99	22.5	98
80	15.7	4.22	21.4	66	30.6	3.11	23.3	95
120	17.0	4.06	21.7	69	32.1	3.21	23.0	103
200	15.1	4.37	20.5	66	29.8	3.55	22.4	106
M 4, 7/8-28/8					*M 4, 7/8-11/9*			
0	18.1	3.89	22.6	70	28.9	2.82	23.5	81
40	17.0	4.09	22.3	70	28.6	2.93	23.4	84
80	16.1	4.42	21.7	71	27.6	3.12	23.7	86
120	14.2	4.77	21.8	68	26.9	3.43	22.6	92
200	12.7	4.46	21.1	57	23.3	3.79	23.6	88

Annex 21 IB 1752, 1972. Effect of pretreatment rate of nitrogen and date of cutting on regrowth of IS 2 series after an overall application of 80 kg N/ha.
See Annex 10 for pretreatment data.

Pretr. N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
3-weeks' regrowth					*5-weeks' regrowth*			
M 1, 23/5-13/6					*M 1, 23/5-27/6*			
0	22.2	3.58	21.6	79	45.6	2.46	27.2	112
40	25.6	3.63	22.7	93	47.9	2.72	26.5	130
80	26.8	4.14	22.5	111	51.5	2.86	28.3	147
120	28.2	4.33	22.7	122	54.9	3.14	26.9	172
200	29.7	4.80	22.4	143	55.6	3.73	27.7	207
M 2, 30/5-20/6					*M 2, 30/5-4/7*			
0	21.8	3.27	22.8	71	40.6	2.44	28.0	99
40	23.4	3.34	24.1	78	43.1	2.60	28.5	112
80	26.7	3.59	21.9	96	46.0	2.85	29.6	131
120	28.2	3.77	21.7	106	48.0	2.80	29.0	134
200	29.6	4.43	21.2	131	50.1	3.45	29.6	173
M 3, 6/6-27/6					*M 3, 6/6-11/7*			
0	19.7	3.52	22.5	69	37.8	2.62	28.4	99
40	18.7	3.34	23.4	62	36.9	2.60	29.0	96
80	19.2	3.85	22.6	74	39.2	2.55	29.2	100
120	18.5	4.04	22.6	75	40.1	2.88	29.2	115
200	19.0	4.74	22.2	90	39.8	3.38	28.7	135
M 4, 13/6-4/7					*M 4, 13/6-18/7*			
0	15.2	4.25	24.1	65	35.4	2.52	25.2	89
40	12.5	4.52	23.1	56	35.0	2.71	25.1	95
80	11.4	4.77	23.0	54	34.5	2.87	25.7	99
120	10.5	5.03	22.6	53	33.8	2.98	24.6	101
200	8.5	5.38	20.8	46	35.7	3.55	24.7	127
M 5, 20/6-11/7					*M 5, 20/6-25/7*			
0	13.9	3.85	23.2	54	30.0	2.64	26.1	79
40	12.3	4.16	20.8	51	28.5	2.84	26.1	81
80	10.8	4.49	21.6	48	28.4	2.87	27.6	82
120	10.0	4.58	21.0	46	29.4	2.98	28.2	88
200	9.4	4.73	19.9	44	31.7	3.25	25.7	103
M 6, 3/7-24/7					*M 6, 3/7-7/8*			
0	15.5	3.79	26.1	59	29.2	2.55	25.9	74
40	12.7	4.09	24.5	52	26.9	2.72	25.9	73
80	11.8	4.77	23.5	56	27.9	2.96	26.1	83
120	10.9	4.85	24.0	53	28.9	2.99	26.2	86
200	9.2	4.89	23.4	45	30.0	3.50	26.3	105

Annex 22 IB 1752, 1972. Effect of pretreatment rate of nitrogen and date of cutting on regrowth of IS 3 series after an overall application of 80 kg N/ha.
See Annex 11 for pretreatment data.

Pretr. N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
3-weeks' regrowth					*5-weeks' regrowth*			
M 2, 19/6-10/7					*M 2, 19/6-24/7*			
0	20.8	3.64	25.4	76	40.7	2.78	27.0	113
40	21.5	3.78	25.0	81	43.6	2.86	29.4	125
80	21.8	4.19	24.2	91	44.0	2.86	28.2	126
120	23.6	4.31	23.9	102	45.5	2.80	29.0	127
200	24.0	4.45	24.0	107	48.9	3.45	28.0	169
M 3, 26/6-17/7					*M 3, 26/6-31/7*			
0	19.3	3.49	22.8	67	33.3	2.71	28.9	90
40	19.4	3.63	22.5	70	35.4	2.82	29.4	100
80	18.2	4.23	21.3	77	34.5	3.01	28.9	104
120	17.0	4.26	20.9	72	36.2	2.90	27.4	105
200	16.8	4.52	20.2	76	36.5	3.59	27.8	131
M 4, 3/7-24/7					*M 4, 3/7-7/8*			
0	18.8	3.76	23.8	71	31.9	2.88	26.6	92
40	17.1	3.96	23.8	68	33.5	2.83	27.6	95
80	15.3	4.41	24.4	67	32.1	3.10	26.2	100
120	14.5	4.54	21.7	66	32.5	3.52	25.7	114
200	14.9	4.77	21.7	71	34.0	3.70	26.4	126
M 5, 10/7-31/7					*M 5, 10/7-14/8*			
0	16.0	4.14	23.3	66	30.7	3.09	27.1	95
40	14.1	4.57	20.8	64	31.2	3.48	26.4	109
80	11.9	4.84	21.5	58	29.4	3.53	26.1	104
120	8.9	5.03	19.9	45	28.7	3.85	25.9	110
200	7.5	5.09	20.5	38	25.9	4.20	24.0	109
M 6, 20/7-10/8					*M 6, 20/7-24/8*			
0	14.3	4.18	21.4	60	29.6	3.08	25.4	91
40	10.2	4.78	21.3	49	28.1	3.33	25.3	94
80	9.4	5.05	21.1	47	27.0	3.61	24.9	97
120	9.7	4.50	20.5	44	27.6	4.18	25.8	115
200	8.8	5.28	20.3	46	26.3	3.86	23.1	102

Annex 23 IB 1752, 1972. Effect of pretreatment rate of nitrogen and date of cutting on regrowth of IS 4 series after an overall application of 80 kg N/ha.
See Annex 12 for pretreatment data.

Pretr. N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
3-weeks' regrowth					*5-weeks' regrowth*			
M 1, 1/7-22/7					*M 1, 1/7-5/8*			
0	17.7	3.54	24.4	63	35.7	2.68	26.7	96
40	24.6	3.89	25.0	96	40.1	2.90	26.6	116
80	25.6	4.16	23.5	106	47.3	3.16	26.7	149
120	26.2	4.34	23.8	114	43.2	3.53	27.6	152
200	26.8	4.48	24.0	120	45.0	3.80	27.6	171
M 2, 10/7-31/7					*M 2, 10/7-14/8*			
0	20.9	4.02	23.5	84	35.8	2.92	25.9	105
40	20.4	4.09	22.5	83	35.6	3.16	25.7	112
80	20.2	4.30	22.3	87	35.7	3.41	25.9	122
120	20.3	4.46	23.9	91	38.8	3.52	25.9	137
200	19.7	4.79	22.6	94	39.4	4.00	25.0	158
M 3, 20/7-10/8					*M 3, 20/7-24/8*			
0	12.4	4.43	21.5	55	31.0	3.24	23.9	100
40	11.2	4.73	21.3	53	29.8	3.22	23.2	96
80	9.7	4.84	20.5	47	29.8	3.50	24.7	104
120	7.9	5.11	18.4	40	29.5	3.76	24.0	111
200	9.2	5.12	18.7	47	28.6	4.07	22.2	116
M 4, 31/7-21/8					*M 4, 31/7-4/9*			
0	15.7	3.98	21.2	62	31.8	3.05	23.9	97
40	14.8	4.27	21.5	63	31.0	3.16	23.9	98
80	11.9	4.64	20.4	55	28.2	3.44	23.5	97
120	11.1	4.82	20.0	54	27.9	3.55	21.3	99
200	11.5	4.81	20.2	55	26.7	3.95	21.5	105
M 5, 7/8-28/8					*M 5, 7/8-11/9*			
0	15.3	4.40	21.1	67	27.4	3.10	23.4	85
40	11.7	4.74	21.6	55	24.2	3.56	23.2	86
80	10.4	4.98	20.0	52	22.8	3.74	22.2	85
120	11.3	4.89	20.5	55	20.8	3.89	22.3	81
200	8.6	5.03	19.5	43	17.4	4.33	21.7	75
M 6, 16/8-6/9					*M 6, 16/8-20/9*			
0	10.1	4.55	19.2	46	21.2	3.47	20.1	74
40	4.6	5.22	17.4	24	16.8	4.06	20.4	68
80	5.2	4.83	17.8	25	16.5	4.25	19.6	70
120	5.2	4.94	17.5	26	12.0	4.28	19.7	51
200	4.4	4.92	17.0	22	11.9	4.56	19.6	54

Annex 24 IB 1752, 1972. Effect of pretreatment rate of nitrogen and date of cutting on regrowth of IS 5 series after an overall application of 80 kg N/ha.
See Annex 13 for pretreatment data.

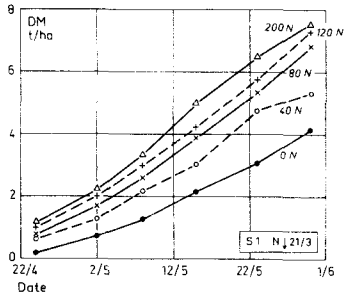
Pretr. N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
	3-weeks' regrowth				*5-weeks' regrowth*			
	M 2, 9/8-30/8				*M 2, 9/8-13/9*			
0	14.3	4.48	20.0	64	27.0	3.36	21.2	91
40	14.0	4.37	21.4	61	27.5	3.31	21.8	91
80	13.3	4.73	19.1	63	29.7	3.65	21.5	108
120	13.3	4.82	20.5	64	29.3	3.84	21.4	113
200	15.6	4.77	20.2	74	32.5	4.08	20.9	133
	M 3, 16/8-6/9				*M 3, 16/8-20/9*			
0	10.7	4.74	19.1	51	23.0	3.15	20.4	72
40	10.2	4.66	18.9	48	25.3	3.53	18.6	89
80	10.5	4.82	18.3	51	24.0	3.76	19.4	90
120	10.6	4.67	19.1	50	22.6	3.93	18.5	89
200	11.2	4.98	18.7	56	23.3	4.28	20.4	100
	M 4, 24/8-14/9				*M 4, 24/8-28/9*			
0	8.4	4.55	18.0	38	21.1	3.86	20.4	81
40	8.5	4.60	17.4	39	20.7	3.85	19.9	80
80	7.4	4.52	18.5	33	18.7	4.20	18.1	79
120	8.0	4.68	17.2	37	19.1	4.19	18.4	80
200	8.0	4.79	18.8	38	20.1	4.32	21.0	87

Annex 25 IB 1752, 1972. DOM in vitro of E- and I-series at different rates of nitrogen and dates of cutting.

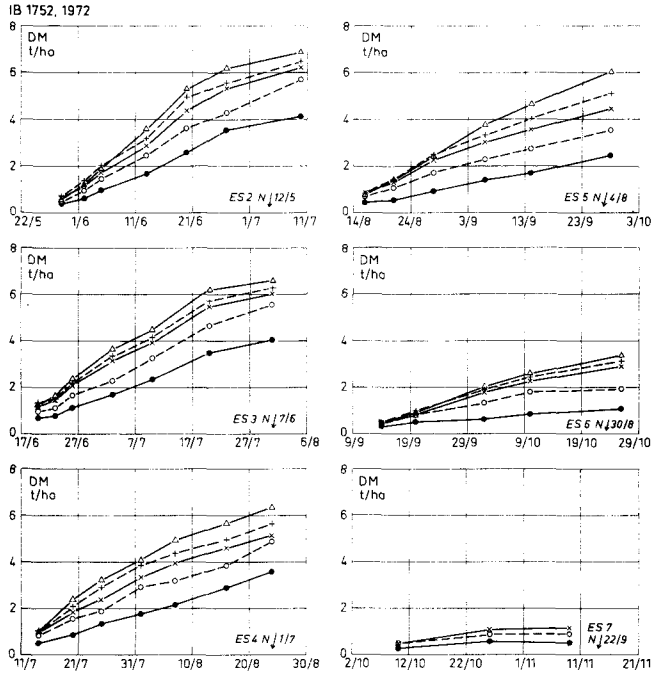
Series	Mowing sequence	Mowing date	N kg/ha	DM 100 kg/ha	% DOM in vitro	Series	Mowing sequence	Mowing date	N kg/ha	DM 100 kg/ha	% DOM in vitro
S 1	M 2	2/5	0	7.3	79.0						
			80	17.0	75.4						
	M 4	15/5	0	21.6	77.8						
			80	38.7	69.8						
	M 6	30/5	0	41.5	75.3						
			80	68.3	64.8						
ES 2	M 2	5/6	0	9.7	74.9	IS 2	M 2	30/5	0	7.2	73.8
			80	17.3	74.0				80	12.5	76.6
	M 4	20/6	0	25.7	74.4		M 4	13/6	0	23.4	71.4
			80	43.7	67.1				80	35.1	70.8
	M 6	10/7	0	41.3	67.6		M 6	3/7	0	45.1	68.4
			80	62.1	63.8				80	65.9	64.5
ES 3	M 2	26/6	0	11.5	75.2	IS 3	M 1b	15/6	0	9.4	76.2
			80	21.0	73.0				80	13.4	80.0
	M 4	10/7	0	23.7	70.5		M 3	26/6	0	23.9	74.8
			80	39.2	68.7				80	34.4	71.6
	M 6	31/7	0	40.4	63.4		M 6	20/7	0	47.7	63.3
			80	60.3	64.1				80	65.9	61.5
ES 4	M 1b	20/7	0	8.5	69.4	IS 4	M 2	10/7	0	14.9	69.9
			80	18.5	68.5				80	21.1	73.4
	M 3	1/8	0	17.7	67.7		M 3	20/7	0	28.4	67.0
			80	33.5	65.7				80	40.9	67.4
	M 5	16/8	0	28.9	62.6		M 5	7/8	0	39.6	63.2
			80	46.0	67.5				80	56.1	62.8
ES 5	M 2	21/8	0	5.7	71.8	IS 5	M 2	9/8	0	14.4	70.6
			80	13.2	74.6				80	17.7	75.3
	M 4	6/9	0	14.2	76.1		M 4	24/8	0	26.6	68.2
			80	30.4	70.9				80	35.3	68.7
	M 6	28/9	0	24.8	76.3		M 6	14/9	0	36.0	72.6
			80	44.6	70.7				80	50.6	71.0
ES 6	M 3	22/9	80	11.4	75.0	IS 6	M 2	28/8	0	10.5	76.7
	M 4	2/10	80	17.8	73.8				80	13.7	78.2
	M 6	26/10	80	29.0	77.6		M 4	14/9	0	23.6	75.0
									80	30.4	74.9
							M 6	6/10	0	31.4	75.8
									80	44.7	75.8
						IS 7	M 3	22/9	80	12.0	77.4
							M 4	2/10	80	18.0	75.0
							M 6	26/10	80	29.3	76.4

ANNEX 26 IB 1752, 1972. Herbage growth at different rates of nitrogen at each date of nitrogen application, from S 1 (= ES 1 = IS 1) to ES 7 and IS 8, respectively. The growth curves show a) the effect of nitrogen on dry-matter production at a certain date (vertical reading), and b) the effect of nitrogen on number of days to reach a certain production stage (horizontal reading).

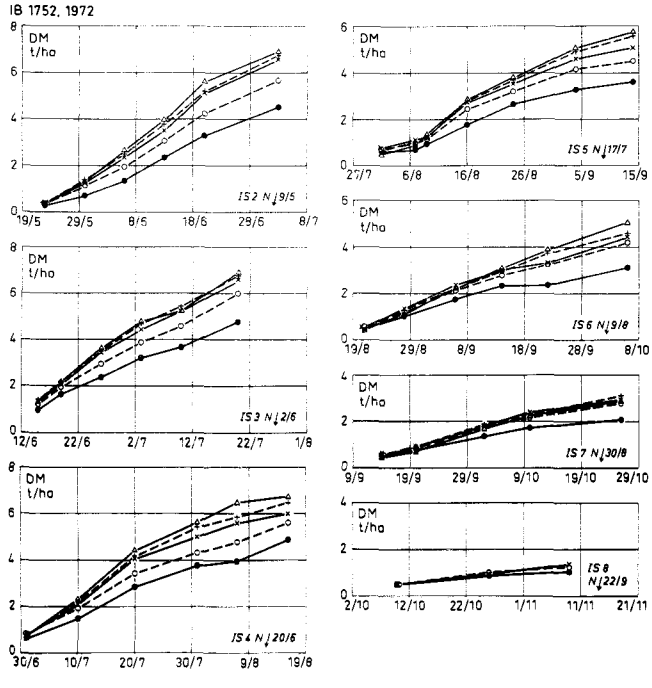
IB 1752, 1972



IB 1752, 1972



IB 1752, 1972



Annex 27 IB 2032, 1973. Herbage yield, herbage composition and nitrogen uptake of E- and I-pretreatment cuts plus final cut of last series.

Start of series	N kg/ha	Mowing date	DM 100 kg/ha	% N	% NO_3	DOM in vitro	% CF	% Ash	VEM **	N-upt. kg/ha
ES2	40	16/5	25.2	2.18	0.02	76.5	17.9	8.72	1020	55
ES3	40	7/6	20.9	2.74	0.03	67.5	25.2	11.60	866	57
ES4	40	5/7	17.6	2.73	0.06	69.0	22.8	12.02	896	48
ES5	40	2/8	23.6	2.91	0.05	64.7	26.3	12.69	820	69
ES6	40	29/8	16.6	2.82	0.06	71.3	22.1	11.88	881	47
ES7	40	19/9	10.8	3.45	0.33	72.8	22.9	13.44	854	37
"ES7 M2"*	40	12/11	12.5	3.66	0.26	76.0	22.4	11.23	898	46
total	280		127.2							359
IS2	80	9/5	24.0	2.92	0.02	77.7	20.5	10.35	961	70
IS3	80	29/5	21.3	3.56	0.34	77.3	21.8	11.51	948	76
IS4	80	20/6	22.0	3.36	0.37	71.4	21.4	11.80	947	74
IS5	80	17/7	24.8	3.30	0.38	70.5	25.4	11.30	871	82
IS6	80	7/8	22.8	4.05	1.04	72.3	24.7	13.49	858	92
IS7	80	29/8	15.8	3.78	1.28	74.6	22.1	11.16	923	60
IS8	80	19/9	17.2	4.43	1.28	75.5	22.4	11.65	921	76
"IS8 M2"*	80	12/11	13.6	3.99	0.62	76.8	20.9	12.02	924	54
total	640		161.5							584

* Final cuts, see Annexes 34 and 41
** See note on page 3

Annex 28 IB 2032, 1973. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of S 1 series.

S 1, N + 22/3

N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 2/5 (41 days)				
0	5.0	2.69	16.3	13
40	9.3	2.88	17.8	27
80	14.1	3.36	17.7	47
120	16.7	3.68	18.0	61
M 2, 7/5 (46 d)				
0	8.5	2.87	18.7	24
40	13.0	2.74	18.8	36
80	18.6	3.05	20.0	57
120	22.0	3.31	20.0	73
M 3, 14/5 (53 d)				
0	12.2	2.25	17.7	27
40	21.0	2.40	18.9	50
80	28.4	2.58	19.9	73
120	32.3	2.88	20.3	93
M 4, 25/5 (64 d)				
0	26.2	2.05	22.4	54
40	36.0	1.91	24.6	69
80	48.6	2.28	25.2	111
120	52.4	2.33	26.2	122
M 5, 5/6 (75 d)				
0	42.4	1.61	27.4	68
40	58.0	1.53	28.9	89
80	69.4	1.70	29.2	118
120	75.1	1.61	29.4	121

Annex 29-30 IB 2032, 1973. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of ES 2 - ES 3 series.

Annex 29 ES 2, pretreatment 40 kg N/ha

N + 16/5

N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 28/5 (12 days)				
0	5.4	3.13	22.2	17
40	7.5	3.74	21.0	28
80	9.0	4.58	19.8	41
120	9.3	4.91	20.6	46
M 2, 4/6 (19 d)				
0	9.6	3.03	23.5	29
40	14.7	3.28	23.6	48
80	18.3	3.81	23.5	70
120	20.0	4.39	23.3	88
M 3, 12/6 (27 d)				
0	20.9	2.22	26.6	46
40	27.8	2.49	27.2	69
80	32.8	2.77	26.7	91
120	35.8	3.18	26.2	114
M 4, 21/6 (36 d)				
0	29.9	1.78	27.2	53
40	41.3	1.75	28.4	72
80	46.4	2.02	28.7	94
120	51.8	2.31	29.0	120
M 5, 29/6 (44 d)				
0	36.8	1.52	27.5	56
40	48.2	1.52	28.1	73
80	57.1	1.75	28.2	100
120	57.7	2.00	29.8	115
M 6, 6/7 (51 d)				
0	42.0	1.38	27.7	58
40	55.4	1.40	29.8	78
80	62.0	1.58	29.1	98
120	66.7	1.79	29.4	119

Annex 30 ES 3, pretreatment 40-40 kg N/ha

N + 7/6

N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 21/6 (14 days)				
0	4.7	2.99	20.2	14
40	6.9	3.49	19.5	24
80	8.2	3.98	18.7	33
120	8.6	4.27	17.9	37
M 2, 29/6 (22 d)				
0	7.5	2.90	22.4	22
40	13.3	2.97	23.1	40
80	14.6	3.35	23.0	49
120	15.4	3.79	22.2	58
M 3, 6/7 (29 d)				
0	11.4	2.49	23.5	28
40	18.8	2.51	24.8	47
80	22.4	2.93	24.4	66
120	26.0	3.20	24.8	83
M 4, 12/7 (35 d)				
0	12.6	2.31	24.7	29
40	20.6	2.46	24.6	51
80	29.2	2.69	25.9	79
120	32.2	2.88	25.8	93
M 5, 20/7 (43 d)				
0	19.5	2.17	26.0	42
40	28.9	2.19	27.3	63
80	39.6	2.45	27.1	97
120	44.7	2.53	27.5	113
M 6, 30/7 (53 d)				
0	26.1	1.98	26.4	52
40	35.4	2.04	27.2	72
80	47.3	2.10	30.1	99
120	54.4	2.20	29.8	120

Annex 31-34 IB 2032, 1973. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of ES 4 - ES 7 series.

Annex 31 ES 4, pretreatment 40-40-40 kg N/ha

N + 5/7

N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 20/7 (15 days)				
0	5.7	3.18	23.6	18
40	9.8	3.75	23.5	37
80	11.2	4.43	23.1	50
120	12.4	4.92	22.1	61
M 2, 30/7 (25 d)				
0	12.4	2.79	23.9	35
40	19.2	2.92	25.1	56
80	23.3	3.29	25.5	77
120	27.4	3.74	24.4	102
M 3, 7/8 (33 d)				
0	18.3	2.54	25.7	46
40	27.5	2.50	27.2	69
80	34.4	2.82	27.9	97
120	36.4	3.00	28.3	109
M 4, 13/8 (39 d)				
0	23.0	2.37	23.9	55
40	33.9	2.39	27.1	81
80	39.8	2.52	27.5	100
120	44.4	2.68	27.0	119
M 5, 20/8 (46 d)				
0	25.6	2.09	27.7	54
40	36.8	2.12	27.5	78
80	44.2	2.31	28.4	102
120	49.2	2.58	28.7	127
M 6, 27/8 (53 d)				
0	31.2	2.04	23.9	64
40	42.6	2.01	27.0	86
80	50.4	2.22	26.3	112
120	52.4	2.44	27.8	128

Annex 32 ES 5, pretreatment 40-40-40-40 kg N/ha

N + 2/8

N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 13/8 (11 days)				
0	3.5	3.31	22.6	12
40	6.3	4.08	21.0	26
80	6.4	4.97	20.8	32
120	7.5	5.18	20.3	39
M 2, 20/8 (18 d)				
0	5.6	3.26	23.4	18
40	10.9	3.59	23.7	39
80	14.3	4.12	23.6	59
120	15.7	4.66	23.1	73
M 3, 27/8 (25 d)				
0	8.7	2.84	21.8	25
40	14.7	3.04	22.4	45
80	19.5	3.42	22.4	67
120	23.2	3.71	22.8	86
M 4, 6/9 (35 d)				
0	12.6	2.58	24.0	33
40	21.8	2.63	25.7	57
80	28.7	2.93	26.3	84
120	32.2	3.19	25.9	103
M 5, 14/9 (43 d)				
0	16.1	2.48	24.8	40
40	26.8	2.44	25.9	65
80	33.3	2.55	26.5	85
120	37.1	2.91	26.0	108
M 6, 1/10 (60 d)				
0	20.2	2.33	25.5	47
40	29.4	2.42	27.1	71
80	35.0	2.51	26.8	88
120	37.0	2.83	27.6	105

Annex 33 ES 6, pretreatment 40-40-40-40-40 kg N/ha

N + 29/8

N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 14/9 (16 days)				
0	5.1	3.17	23.2	16
40	8.8	3.84	21.6	34
80	11.0	4.24	22.2	47
120	12.2	4.60	21.4	56
M 2, 24/9 (26 d)				
0	7.6	2.94	21.7	22
40	13.5	3.09	22.7	42
80	18.7	3.60	22.8	67
120	21.2	4.00	23.3	85
M 3, 5/10 (37 d)				
0	11.4	2.89	22.5	33
40	19.1	2.98	23.9	57
80	24.4	3.21	24.7	78
120	27.0	3.65	24.7	99
M 4, 24/10 (56 d)				
0	12.4	2.84	22.8	35
40	20.2	2.90	24.3	59
80	25.1	3.12	24.8	78
120	28.6	3.44	24.6	98

Annex 34 ES 7, pretreatment 40-40-40-40-40-40 kg N/ha

N + 19/9

N kg/ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 24/10 (36 days)				
0	6,0	3.30	21.1	20
40	11.1	3.74	19.7	42
80	13.5	4.11	20.8	55
120	13.9	4.29	20.4	60
M 2, 12/11 (54 d)				
0	6.1	3.50	20.9	21
40	12.5	3.66	22.4	46
80	15.3	3.68	20.8	56
120	16.0	3.92	21.2	63

Annex 35-38 IB 2032, 1973. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of IS 2 - IS 5 series.

Annex 35 IS 2, pretreatment 80 kg N/ha N + 9/5

N kg/ ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 22/5 (13 days)				
0	5,5	3,62	21,2	20
40	7.7	4.06	21.5	31
80	9.4	4.76	20.2	45
120	8.8	5.06	20.6	45
M 2, 28/5 (19 d)				
0	11.6	2.92	22.2	34
40	16.2	3.41	20.9	55
80	20.6	3,53	23.5	73
120	20.6	4.20	21.3	87
M 3, 4/6 (26 d)				
0	18.9	2,72	25,2	51
40	25.9	2.83	25,7	73
80	29,9	3.11	26.2	93
120	32,0	3,56	26,2	114
M 4, 12/6 (34 d)				
0	28.9	2.04	28.6	59
40	37.5	2.21	28.2	83
80	42.6	2.37	29.5	101
120	43.7	2.62	28.8	114
M 5, 21/6 (43 d)				
0	45.6	1.73	29.4	79
40	52.4	1.61	29.0	84
80	57.3	1.85	29.6	106
120	59.0	2.04	29.4	120
M 6, 29/6 (51 d)				
0	52.5	1.51	29.3	79
40	60.4	1.62	30.1	98
80	61.8	1.76	30.5	109
120	66.3	1.76	29.8	117

Annex 36 IS 3, pretreatment 80-80 kg N/ha N + 29/5

N kg/ ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 12/6 (14 days)				
0	6.1	3.46	21.2	21
40	9.2	4.28	20.3	39
80	10.0	4.96	19.9	50
120	10.6	5.38	19.7	57
M 2, 21/6 (23 d)				
0	15.2	2.50	22.1	38
40	21.6	2.86	22.3	62
80	24.5	3.32	22.5	81
120	26.6	3.66	23.1	97
M 3, 29/6 (31 d)				
0	22.6	2.14	23.9	48
40	28.4	2.38	23.4	68
80	34.6	2.54	23.4	88
120	36.6	3.08	25.6	113
M 4, 6/7 (38 d)				
0	28.4	1.83	25.4	52
40	35.4	2.01	25.0	71
80	43.8	2.22	26.8	97
120	48.2	2.48	28.5	120
M 5, 12/7 (44 d)				
0	31.2	1.92	27.3	60
40	44.1	1.84	27.9	81
80	48.0	2.11	27.9	101
120	53.0	2.38	28.0	126
M 6, 20/7 (52 d)				
0	40.0	1.75	27.3	70
40	50.3	1.79	28.8	90
80	53.1	1.96	30.0	104
120	57.0	2.18	29.8	124

Annex 37 IS 4, pretreatment 80-80-80 kg N/ha N + 20/6

N kg/ ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 6/7 (16 days)				
0	7.4	3,30	22.3	24
40	8.4	3.86	22.5	32
80	10.3	4.19	22.8	43
120	9.9	4.46	21.9	44
M 2, 12/7 (22 d)				
0	10.0	2.97	24.4	30
40	13.0	3.34	24.2	43
80	14.4	3,65	23.9	53
120	14.9	4.18	23.2	62
M 3, 20/7 (30 d)				
0	17.0	2.65	26.0	45
40	25,3	2.96	26.6	75
80	27.5	3.25	26.0	89
120	30,1	3.60	26,1	108
M 4, 30/7 (40 d)				
0	27.6	2.43	28.3	67
40	35.8	2.45	29.0	88
80	41.0	2,71	28.7	111
120	43,6	3.00	27.6	131
M 5, 7/8 (48 d)				
0	35.0	2.03	28,0	71
40	43.8	2.29	29.2	100
80	46.8	2.53	28.2	118
120	50,4	2.77	29,4	140
M 6, 13/8 (54 d)				
0	39.9	2.06	29.8	82
40	46.3	2.19	29.5	101
80	49.1	2.50	29.5	123
120	54.1	2.63	29.7	142

Annex 38 IS 5, pretreatment 80-80-80-80 kg N/ha N + 17/7

N kg/ ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 30/7 (13 days)				
0	7.8	3.58	21.5	28
40	10.8	4.40	21.7	48
80	11.5	4.86	20.0	56
120	12.0	5.11	19.9	61
M 2, 7/8 (21 d)				
0	14.4	2.99	23.1	43
40	18.8	3.54	24.3	67
80	23.6	3.94	24.2	93
120	25.5	4.14	23.6	106
M 3, 13/8 (27 d)				
0	20.1	2.64	24.8	53
40	26.6	3.04	24.7	81
80	31.2	3.34	24.9	104
120	33.4	3.80	24.5	127
M 4, 20/8 (34 d)				
0	22.3	2.39	24.6	53
40	30.8	2.72	26.2	84
80	36.5	2.97	26.3	108
120	38.9	3.17	26.7	123
M 5, 27/8 (41 d)				
0	31.8	2.20	25.2	70
40	37.9	2.37	25.7	90
80	44.4	2.55	25.9	113
120	48.2	2.73	26.3	132
M 6, 6/9 (51 d)				
0	32.1	2.13	27.2	68
40	40.1	2.33	27.5	93
80	45.1	2.52	27.9	114
120	46.8	2.79	29.0	131

Annex 39-41 IB 2032, 1973. Effect of rate of nitrogen and date of cutting on herbage DM yield, herbage composition and N-uptake of IS 6 - IS 8 series.

Annex 39 IS 6, pretreatment 80-80-80-80-80 kg N/ha
N ↓ 7/8

N kg/ ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 20/8 (13 days)				
0	5.1	3.98	21.6	20
40	6.6	4.51	21.1	30
80	7.0	5.04	21.0	35
120	7.3	5.27	21.5	38
M 2, 27/8 (20 d)				
0	9.4	3.17	20.5	30
40	12.4	3.59	20.5	45
80	13.6	3.97	19.9	54
120	14.0	4.39	20.2	61
M 3, 6/9 (30 d)				
0	14.8	3.01	24.7	45
40	19.4	3.60	23.9	70
80	22.2	3.91	24.9	87
120	24.0	4.31	24.0	103
M 4, 14/9 (38 d)				
0	21.4	2.82	23.7	60
40	25.7	3.04	25.0	78
80	30.5	3.40	24.8	104
120	32.2	3.85	25.2	124
M 5, 24/9 (48 d)				
0	24.1	2.57	24.6	62
40	30.4	2.74	25.5	83
80	32,9	3.07	26.3	101
120	36,6	3.51	26.2	128
M 6, 5/10 (59 d)				
0	23.1	2.57	26.3	59
40	29.6	2.63	27.8	78
80	33.8	3.00	27.6	101
120	35.0	3.30	27.0	116

Annex 40 IS 7, pretreatment 80-80-80-80-80-80 kg N/ha
N ↓ 29/8

N kg/ ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 14/9 (16 days)				
0	10.8	4.04	18.9	44
40	11.4	4.06	20.0	46
80	12.0	4.20	19.8	50
120	12.6	4.38	19.4	55
M 2, 24/9 (26 d)				
0	17.0	3.29	23.2	56
40	20.6	3.76	22.9	77
80	21.4	4.06	23.2	87
120	22.5	4.28	23.4	96
M 3, 5/10 (37 d)				
0	20.4	3.15	25.2	64
40	24.6	3.53	24.8	87
80	26.4	3.86	25.2	102
120	28.6	4.18	24.4	120
M 4, 24/10 (56 d)				
0	20.6	3.06	25.5	63
40	25.6	3.34	24.4	86
80	28.0	3.54	24.8	99
120	27.6	3.79	24.5	105

Annex 41 IS 8, pretreatment 80-80-80-80-80-80 kg N/ha
N ↓ 19/9

N kg/ ha	DM 100 kg/ha	% N	% CF	N-upt. kg/ha
M 1, 24/10 (35 days)				
0	10.2	3.83	21.4	39
40	11.2	4.44	20.9	50
80	11.4	4.78	20.8	54
120	11.8	4.84	20.8	57
M 2, 12/11 (54 d)				
0	11.2	3.78	21.2	42
40	13.0	3.97	21.3	52
80	13.6	3.99	20.9	54
120	14.0	3.97	21.2	56

Annex 42 IB 2032, 1973. Effect of rate of nitrogen application on herbage yield, herbage composition, feeding value and nitrogen uptake with 3-weeks' cutting frequency (regrowth of S1 M3 plots) and 6-weeks' cutting frequency (regrowth of S1 M5 plots).

Mowing date	N kg/ha	DM 100 kg/ha	% N	% CF	% Ash	VEM	N-upt. kg/ha
3-weeks' cutting frequency							
14/5	0	12.2	2.25	17.7	9.61	1007	27
	40	21.0	2.40	18.9	9.46	989	50
	80	28.4	2.58	19.9	9.31	980	73
	120	32.3	2.88	20.3	9.36	984	93
5/6	0	12.6	2.33	24.1	9.93	894	29
	0	13.4	2.64	22.6	10.69	915	35
	0	14.0	2.64	22.3	11.14	915	37
	0	14.6	2.69	22.4	10.98	917	39
26/6	0	4.2	2.74	20.5	12.27	928	12
	20	7.5	2.82	20.0	12.01	943	21
	40	10.5	2.87	20.8	11.33	945	30
	60	13.3	3.18	20.0	10.91	976	42
18/7	0	6.2	2.70	24.0	11.44	868	17
	20	10.8	2.87	24.3	11.50	871	31
	40	15.0	3.08	24.9	11.14	872	46
	60	20.1	3.30	25.2	11.73	866	66
7/8	0	5.0	3.13	21.8	12.50	903	16
	20	11.5	3.10	22.3	12.81	889	36
	40	16.1	3.30	22.5	12.51	897	53
	60	19.1	3.60	23.0	12.57	898	69
28/8	0	3.8	3.19	21.1	12.92	897	12
	20	6.5	3.31	20.5	12.37	916	22
	40	10.4	3.43	19.9	11.19	949	36
	60	14.4	3.55	19.3	10.60	971	51
19/9	0	5.0	3.21	22.2	12.10	874	16
	20	9.0	3.18	23.7	11.60	858	29
	40	12.6	3.46	23.6	11.13	876	44
	60	16.4	3.60	22.9	10.79	894	59
9/10	0	4.6	3.00	24.0	11.57	845	14
	20	7.2	3.74	23.6	12.06	871	27
	40	9.2	4.26	23.8	11.39	698	39
	60	9.3	4.70	22.7	10.59	959	44
total	0	53.6					143
8 x 3 weeks	160	86.9					251
	320	116.2					358
	480	139.5					463
6-weeks' cutting frequency							
5/6	0	42.4	1.61	27.4	9.49	838	68
	40	58.0	1.53	28.9	8.73	845	89
	80	69.4	1.70	29.1	9.01	819	118
	120	75.1	1.61	29.4	8.31	825	121
18/7	0	15.2	2.42	25.0	11.87	832	37
	40	23.4	2.81	25.7	11.79	839	66
	80	29.6	3.04	27.2	11.81	819	90
	120	33.3	3.34	26.1	10.76	866	111
28/8	0	16.4	2.41	21.1	11.87	875	40
	40	31.3	2.20	23.1	11.53	849	69
	80	40.6	2.48	23.2	11.21	863	101
	120	46.0	2.84	22.8	11.44	877	131
9/10	0	9.8	2.90	23.5	11.92	842	28
	40	17.9	2.93	24.6	12.42	820	52
	80	23.5	3.46	25.1	11.87	838	81
	120	25.7	3.93	26.0	11.58	848	101
total	0	83.8					173
4 x 6 weeks	160	130.6					276
	320	163.1					390
	480	180.1					464

Annex 43 IB 2032, 1973. Effect of rate of nitrogen and date of cutting on DOM in vitro, CF, Ash and VEM.

Series	Mowing sequence	Mowing date	N kg/ha	DM 100 kg/ha	% DOM	% CF	% Ash	VEM	Series	Mowing sequence	Mowing date	N kg/ha	DM 100 kg/ha	% DOM	% CF	% Ash	VEM
ES 2	M 1	28/5	80	9.0	77.8	19.8	11.03	969	IS 2	M 2	28/5	80	20.6	75.5	23.5	11.39	924
	M 2	4/6	0	9.6	72.2	23.5	11.83	897		M 3	4/6	0	18.9	72.4	25.2	11.75	859
	M 2	4/6	80	18.3	72.8	23.5	12.06	922		M 3	4/6	80	29.9	70.5	26.2	11.67	859
	M 3	12/6	0	20.9	67.6	26.6	11.07	828		M 4	12/6	0	28.9	69.9	28.6	10.90	794
	M 3	12/6	80	32.8	69.2	26.7	11.47	841		M 4	12/6	80	42.6	65.6	29.5	11.13	789
	M 4	21/6	0	29.9	67.3	27.2	10.84	822		M 5	21/6	0	45.6	62.9	29.4	11.22	777
	M 5	29/6	80	57.1	61.4	28.2	10.82	806		M 6	29/6	80	61.8	59.1	30.5	9.89	779
	M 6	6/7	0	42.0	61.6	27.7	10.32	821									
									IS 3	M 3	29/6	80	34.6	72.4	23.4	11.72	883
										M 3	29/6	120	36.6	68.0	25.6	11.38	872
										M 4	6/7	40	35.4	68.0	25.0	11.49	848
										M 5	12/7	0	31.2	66.0	27.3	11.19	815
ES 4	M 1	20/7	80	11.2	72.6	23.1	11.65	943	IS 4	M 1	6/7	80	10.3	72.6	22.8	11.62	957
	M 2	30/7	0	12.4	70.1	23.9	12.34	861		M 2	12/7	0	10.0	68.4	24.4	12.60	869
	M 2	30/7	80	23.3	68.7	25.5	12.42	851		M 3	20/7	80	27.5	67.7	26.0	12.33	839
	M 3	7/8	80	34.4	65.8	27.9	12.66	789		M 4	30/7	0	27.6	64.6	28.3	11.47	790
	M 4	13/8	0	23.0	68.0	23.9	12.59	839		M 4	30/7	80	41.0	63.5	28.7	12.11	781
	M 6	27/8	0	31.2	68.2	23.9	11.94	830		M 6	13/8	0	39.9	61.1	29.8	11.77	751
	M 6	27/8	80	50.4	64.7	26.3	12.53	780		M 6	13/8	80	49.1	62.1	29.5	12.19	757
									IS 5	M 3	13/8	80	31.2	71.2	24.9	12.34	857
										M 3	13/8	120	33.4	71.8	24.5	12.37	884
										M 4	20/8	40	30.8	67.1	26.2	12.84	799
										M 5	27/8	0	31.8	71.7	25.2	12.30	802

Annex 44 IB 1752, 1972. Effect of rate of nitrogen on stubble DM weight, % N in stubble and stubble N-uptake of ES 5 - M 6 and IS 6 - M 6 grass.

Series	N +	N kg/ha	Mowing time	Stubble harvest	Stubble		
					DM 100 kg/ha	% N	N-upt. kg/ha
ES 5	4/8	0	M 6		17.7	1.30	23
		80	28/9	29/9	16.3	1.66	27
		200			14.8	2.16	32
IS 6	9/8	0	M 6		11.5	1.65	19
		80	6/10	6/10	9.8	2.14	21
		200			9.9	2.73	27

Annex 45 IB 2032, 1973. Effect of rate of nitrogen application on stubble DM weight (100 kg/ha), as measured immediately after cutting the herbage; *A* E-and I-series and *B* 3- and 6-weeks' cutting frequency series.

	Mowing date	Series	Mowing sequence	N, kg/ha.cut			
				0	40	80	120
A	4/6	ES 2	M 2		13.8		
	6/7	ES 2	M 6	13.8			12.9
	6/7	ES 3	M 3		13.6		
	30/7	ES 3	M 6	16.2			15.5
	30/7	ES 4	M 2		14.8		
	7/8	ES 4	M 3		14.7		
	27/8	ES 4	M 6	19.8			13.4
	27/8	ES 5	M 3		18.9		
	1/10	ES 5	M 6	15.1			14.6
	24/9	ES 6	M 2		17.4		
	24/10	ES 7	M 1		16.5		
	28/5	IS 2	M 2			12.3	
	21/6	IS 3	M 2			12.4	
	13/8	IS 4	M 6	10.5			10.6
	7/8	IS 5	M 2			13.0	
	6/9	IS 5	M 6	16.4			15.7
	27/8	IS 6	M 2			12.5	
	5/10	IS 6	M 6	12.0			13.2
	24/9	IS 7	M 2			12.1	
	24/10	IS 8	M 1			10.6	

			N, kg/ha.year			
			0	160	320	480
B	9/10	3-weeks' frequency	21.5	18.2	15.3	11.2
		6-weeks' frequency	18.4	14.6	12.4	9.8

Annex 46 IB 1752 (1972) and IB 2032 (1973). Effect of pretreatment on mineral N in soil, kg/ha, during season. Soil samples taken at start of each time of application.

Soil layer (cm)	IB 1752 (1972)				IB 2032 (1973)			
	E-series		I-series		E-series		I-series	
	S 1	*20/3*	S 1	*20/3*	S 1	*22/3*	S 1	*22/3*
0 - 5		20		20		17		17
5 - 15		21		21		23		23
15 - 25		-*		-		-		-
	ES 2	*12/5*	IS 2	*9/5*	ES 2	*16/5*	IS 2	*9/5*
0 - 5		15		18		14		18
5 - 15		17		22		21		23
15 - 25		-		-		12		14
	ES 3	*7/6*	IS 3	*2/6*	ES 3	*7/6*	IS 3	*29/5*
0 - 5		22		31		19		26
5 - 15		25		30		21		26
15 - 25		-		-		18		17
	ES 4	*1/7*	IS 4	*20/6*	ES 4	*5/7*	IS 4	*20/6*
0 - 5		13		24		16		21
5 - 15		21		25		12		21
15 - 25		-		-		10		10
	ES 5	*4/8*	IS 5	*17/7*	ES 5	*2/8*	IS 5	*17/7*
0 - 5		17		14		21		23
5 - 15		16		36		21		17
15 - 25		-		-		10		10
			IS 6	*9/8*			IS 6	*7/8*
0 - 5				31				29
5 - 15				23				29
15 - 25				-				17
	ES 6	*30/8*	IS 7	*30/8*	ES 6	*29/8*	IS 7	*29/8*
0 - 5		11		24		12		31
5 - 15		17		34		9		18
15 - 25		-		-		7		10
	ES 7	*22/9*	IS 8	*22/9*	ES 7	*19/9*	IS 8	*19/9*
0 - 5		21		32		14		22
5 - 15		17		31		10		25
15 - 25		-		-		7		17
					end	*15/11*	end	*15/11*
0 - 5					of	16	of	39
5 - 15					ES 7	17	IS 8	16
15 - 25					**	10	**	12
25 - 35						6		14
35 - 50						6		23

* - Not determined
** Sampled just after the last cut

Annex 47 IB 1752 (1972) and IB 2032 (1973). Soil moisture content (weight %) and groundwaterlevel (cm below soil surface level).

Date	Soil moisture content, Soil layer, cm		Date	Groundwater level	Date	Soil moisture content, Soil layer, cm			Date	Groundwater level
	2 - 5	5 - 15				2 - 5	5 - 10	10 - 15		
1972					1973					
15/5	54.8	36.4	27/3	105	22/3	55.4	35.8		27/3	74
23/5	52.0	34.4	5/4	51	5/4	62.5	38.8		5/4	41
30/5	61.3	36.2	11/4	51	16/4	62.1	37.0		16/4	60
7/6	60.2	36.4	17/4	51	27/4	53.4	32.2		27/4	66
13/6	49.2	34.6	24/4	66	11/5	81.0	44.5	31.4	11/5	70
20/6	41.6	29.7	2/5	81	16/5	63.0	41.0	29.9	16/5	70
27/6	47.9	30.5	8/5	87	29/5	43.6	36.5	28.4	29/5	78
3/7	55.8	35.7	15/5	71	8/6	55.3	40.5	28.6	8/6	82
11/7	60.0	37.4	23/5	70	15/6	39.2	30.8	24.9	15/6	90
19/7	43.1	30.4	29/5	76	21/6	32.8	27.1	22.2	21/6	96
25/7	49.2	30.9	5/6	83	26/6	22.2	23.8	26.5	26/6	105
1/8	50.2	32.1	12/6	71	29/6	34.6	26.4	21.1	29/6	65
7/8	45.6	31.2	19/6	77	5/7	28.9	24.6	20.0	5/7	89
14/8	48.8	31.6	26/6	84	18/7	55.6	38.2	26.2	18/7	108
21/8	53.8	35.0	3/7	40	24/7	57.8	41.0	29.3	24/7	70
24/8	49.0	30.4	10/7	51	31/7	55.8	39.7	28.6	31/7	60
29/8	45.3	32.6	17/7	69	8/8	62.8	42.3	30.6	8/8	55
6/9	34.2	25.2	24/7	55	16/8	36.6	31.2	26.0	16/8	76
11/9	51.7	33.9	31/7	70	23/8	32.1	26.0	21.5	23/8	85
20/9	54.8	35.1	2/8	72	31/8	41.1	26.7	22.4	31/8	86
28/9	54.6	34.8	7/8	72	6/9	49.3	35.4	25.8	14/9	98
2/10	46.2	31.4	14/8	83	14/9	36.0	28.9	22.5	24/9	108
10/10	43.3	30.9	21/8	77	24/9	57.1	39.8	27.3	1/10	35
18/10	42.0	30.5	24/8	81	1/10	59.2	41.8	30.1	9/10	60
26/10	50.6	34.2	29/8	85	9/10	65.9	42.9	30.0	24/10	14
1/11	52.2	34.2			24/10	69.8	45.9	31.6		
9/11	60.5	38.3			12/11	74.0	46.3	33.0		

Annex 48 Meteorological data of 1972 and 1973. Stations Ten Boer, Garmerwolde, Zeerijp and Eelde 1.5, 1.5, 11.5 and 15 km respectively from trial site.

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Rainfall (mm) per decade, measured at Ten Boer till August, thereafter at Zeerijp									
1972									
I	8.0	40.6	28.9	26.3	68.0	17.6	17.0	0.3	10.2
II	0	30.4	28.5	8.2	1.4	38.5	24.6	6.8	77.7
III	33.2	8.1	31.4	14.6	38.5	3.7	1.8	29.7	28.4
Month	41.2	79.1	88.8	49.1	107.9	59.8	43.4	36.8	116.3
1973, measured at Zeerijp in March and November, at Garmerwolde from April - October									
I	19.9	31.5	26.1	17.6	1.8	30.4	14.3	16.3	23.7
II	3.6	17.0	10.6	0.2	72.2	0.6	14.6	58.7	47.1
III	8.8	2.8	13.7	39.3	62.3	15.5	53.8	21.9	40.5
Month	32.3	51.3	50.4	57.1	136.3	46.5	82.7	96.9	111.3
30 yr mean measured at Eelde									
	40.8	48.4	52.6	56.4	90.8	87.0	73.2	73.8	73.2
Mean daily temperature (°C) per decade, measured at Eelde									
1972									
I	3.9	8.4	12.9	13.2	14.9	16.4	14.1	8.6	9.8
II	6.4	6.5	9.2	13.0	18.3	15.4	10.0	7.5	3.5
III	6.1	6.8	12.4	14.3	17.8	14.8	10.9	8.4	4.0
Month	5.5	7.2	11.5	13.5	17.1	15.5	11.7	8.2	5.8
1973									
I	4.9	4.7	9.7	12.0	19.3	16.6	16.8	11.3	7.5
II	4.4	5.2	9.9	14.8	16.2	18.0	14.3	5.2	5.2
III	6.3	7.3	13.5	18.3	14.8	14.4	11.1	7.7	1.8
Month	5.2	5.7	11.1	15.1	16.7	16.3	14.0	8.1	4.8
Hours sunshine per decade, measured at Eelde									
1972									
I	28.2	41.3	44.2	62.7	35.0	53.4	54.3	78.5	7.2
II	86.6	30.9	51.0	73.8	107.0	52.1	42.2	22.6	25.3
III	55.5	62.5	63.0	41.5	44.9	71.7	42.8	18.7	13.4
Month	170.3	134.7	158.2	178.0	186.9	177.2	139.3	119.8	45.9
1973									
I	31.9	37.9	28.8	48.4	88.3	73.3	52.6	25.8	19.1
II	39.4	56.3	86.2	81.1	35.9	93.3	56.4	27.1	26.2
III	60.8	46.9	55.9	111.5	42.2	85.2	16.3	29.6	26.5
Month	132.1	141.1	170.9	241.0	166.4	251.8	125.3	82.5	71.8
Radiation (J/cm²) per decade, measured at Eelde									
1972									
I	6578	10383	14830	18167	12922	16696	13225	10140	2033
II	12855	10759	15741	20948	23617	15249	10221	5315	3105
III	11455	16158	18513	15106	16027	16260	9577	4237	2103
Month	30888	37300	49084	54221	52566	48205	33023	19692	7241
1973									
I	6382	10513	11252	14184	20779	17231	11252	5457	3208
II	8622	13292	20239	20663	12999	18598	10958	5757	3307
III	11953	13955	16510	23379	14309	17303	6311	5013	2786
Month	26957	37760	48001	58226	48087	53132	28521	16227	9301

No. 11. The seasonal response of grassland to nitrogen at different levels of nitrogen pretreatment. I. Experiments 1972 and 1973.
W.H. PRINS and P.F.J. VAN BURG (July 1979).