HGCA

PROJECT REPORT No. 114

A DATASET FOR VALIDATING THE ROTHAMSTED MODEL OF THE SOIL NITROGEN SUPPLY TO CEREALS

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A DATASET FOR VALIDATING THE ROTHAMSTED MODEL OF THE SOIL NITROGEN SUPPLY TO CEREALS

by

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Aim

To provide a data set of soil nitrogen and crop nitrogen uptake analyses through which the Rothamsted cereal nitrogen model could be validated for higher organic matter soils and in higher rainfall conditions than in Eastern England.

Background

The cereal nitrogen model developed at Rothamsted provides a method by which the nitrogen requirements of a cereal crop could be more accurately predicted than by traditional empirical methods based on field history and soil type. The model is based on an understanding of the principal factors affecting mineralisation and demineralisation of nitrogen in soils and the expected fate of fertilizer nitrogen (Bradbury *et al,* 1993 a and b). The model was developed from data sets largely gathered in Eastern England, and if the model is to have a wider application then it needs to be validated using data sets from a more comprehensive range of cereal growing areas.

This project was therefore undertaken with the view of providing a suitable data set from an area with a higher rainfall and from soils with a higher organic matter content than in Eastern England.

Reference: Bradbury, NJ, Whitmore, AP, Hart, PBS and Jenkinson, DS (1993a) Modelling the fate of nitrogen in crop and soil in years following application of ^{15}N-labelled fertilizer to winter wheat. Journal of Agricultural Science (Cambridge), 121, 363-379.

Bradbury, HJ, Tuck, G, Whitmore, AP and Jenkinson, DS, (1993b) Development and testing of a computer model for predicting the amount and timing of nitrogen release from soil. Home-Grown Cereals Authority, London,

Outline of the project

Field plot experiments were set up at the Agricultural Research Institute of Northern Ireland in which winter wheat or spring barley was grown at a range of nitrogen levels. A summary of the experiments is given in Table 1. Two experimental sites were established in the 1987/88 season, one following a long term ley and the other following a number of years of arable cropping. Details of the soils at each site are given in Table 2. The same plots were maintained until the final 1990/91 season. A third experimental site, also following ley and adjacent to the first site, was included in the 1989/90 and 1990/91 seasons only. Initially the project was planned to run for three seasons finishing in 1990, but a further year was approved in order to gather more data with spring barley rather than winter wheat.

The mineral nitrogen analyses for ammonium, nitrate and nitrite N were carried out on three soil cores to a depth of 90cm which were taken from the plots in May, June and September of each season. Additional sampling of the whole plot area, but not of individual plots, was carried out during the winter period. Clip samples were taken from the growing crop in May and June and at harvest to determine the uptake of nitrogen in the grain and straw.

In the first two years of the project two sites were monitored and soil samples were taken at all six levels of applied nitrogen and the soil cores were divided in three horizons, 0-30cm, 30-60cm and 60-90cm which were analysed separately. When the third site was included in the third year the analysis procedure was re-assessed. As it was felt useful to gain further information on the profile of the mineral N down the horizon it was decided to split the first horizon into two, 0-15cm and 15-30cm, giving four horizons in all, but to reduce the number of nitrogen treatments being monitored to four out of the six.

Table 1. Summary of experiments carried out under the HGCA nitrogen project

Year	*Site*	*Field*	*History*	*Crop*	*Nitrogen treatments (kgN/ha)*	*Horizons sampled (cm)*
1988	Site 1	Brown Hill	1st year after grass	Winter wheat	nil, 50, 100, 150, 200, 250	0-30, 30-60 and 60-90
1988	Site 2	Maginnis Hill	Wheat, wheat, barley	Winter wheat	nil, 50, 100, 150, 200, 250	0-30, 30-60 and 60-90
1989	Site 1	Brown Hill	2nd year after grass	Winter wheat	nil, 50, 100, 150, 200, 250	0-30, 30-60 and 60-90
1989	Site 2	Maginnis Hill	Wheat, wheat, wheat	Winter wheat	nil, 50, 100, 150, 200, 250	0-30, 30-60 and 60-90
1990	Site 1	Brown Hill	3rd year after grass	Winter wheat	nil, 50, 150, 200	0-15, 15-30, 30-60 and 60-90
1990	Site 2	Maginnis Hill	Wheat, wheat, wheat	Spring barley	nil, 40, 120, 200	0-15, 15-30, 30-60 and 60-90
1990	Site 3	Brown Hill	1st year after grass	Winter wheat	nil, 50, 150, 200	0-15, 15-30, 30-60 and 60-90
1991	Site 1	Brown Hill	4th year after grass	Spring barley	nil, 40, 120, 200	0-15, 15-30, 30-60 and 60-90
1991	Site 2	Maginnis Hill	Barley, wheat, wheat	Spring barley	nil, 40, 120, 200	0-15, 15-30, 30-60 and 60-90
1991	Site 3	Brown Hill	2nd year after grass	Spring barley	nil, 40, 120, 200	0-15, 15-30, 30-60 and 60-90

Table 2. Field soil characteristics

Brown Hill	**Soil type:** Sandy clay loam,	50% sand, 18% clay and 32% silt		
	Horizon	**0-30**	**30-60**	**60-90**
	Soil organic matter %	6.08	2.01	1.10
	pH	5.46	6.03	6.34
Maginnis Hill	**Soil type:** Clay Loam	48% sand, 21% clay and 30% silt		
	Horizon	**0-30**	**30-60**	**60-90**
	Soil organic matter %	5.94	1.60	0.69
	pH	6.34	6.26	5.70

Materials and Methods

Experimental design and layout

At each site the 24, 2m by 15m plots were layed out in four randomised blocks of the six treatments with a discard 10m wide between blocks.

Crop establishment, fertilizers and sprays

Seedbeds were prepared using conventional cultivation equipment and the 2m by 15m plots sown with a standard narrow row (12cm) Nordsten seed drill. Compound fertilizers containing phosphate and potash were broadcast onto the seedbed at the appropriate rate prior to the final cultivation and herbicides and fungicides were applied to the whole of each experimental site using a conventional hydraulic sprayer fitted with fan nozzles. Further details of the crop management for each site and in each year are given in Appendix 1.

Fertilizer nitrogen applications were applied by hand to each plot as calcium ammonium nitrate. The weighed quantity of fertilizer for each plot was divided into two equal lots and applied separately to ensure even application. The total N for the season was applied in two equal applications. With winter wheat the applications were made in early April and early May while with spring barley the applications were made about one week after brairding, and at four weeks after the first application.

Crop sampling

Dates of all samplings are given in Appendix 1. Clip samples were taken from two randomly placed $0.2m^2$ quadrats in each plot at the same time as soil sampling. The samples were divided into leaf, stem and ear and the total N in each fraction determined using Kjeldahl nitrogen analysis. Kjeldahl nitrogen determinations were also carried out on samples of the grain and straw taken at harvest.

The plots were harvested using a Claas Compact combine harvester adapted for plot use. The total grain yield from each plot was weighed on the combine and sampled for moisture content and grain N determination. The straw from each plot was baled, weighed and also sampled for moisture and N determination.

Soil nitrogen sampling and determination

Triplicate samples were taken from each plot using a Dutch auger at three different depths, 0-30cm, 30-60cm and 60-90 cm in the 1987/88 and 1988/89 seasons. For the 1989/90 and 1990/91 seasons the 0-30cm sample was divided into 0-15cm and 15-30cm horizons, but samples were only taken from four of the six nitrogen levels.

Each sample was placed in a polythene bag and the bags placed into a cool box in the field. The soil samples were either analysed fresh or placed into a deep freeze for later analysis. A 30g sample of the fresh or defrosted soil was prepared by passing through a coarse sieve and it was then placed into a screw-topped bottle to which was added 150ml of 2 Molar KCl to extract the mineral N. The bottles were placed on an orbital shaker for 2 h and the sample filtered using a Whatman's No 6 qualitative filter paper.

Triplicate determinations for nitrate, ammonium and nitrite were carried out colorimetrically using a Technicon auto-analyser according to the following techniques:

Ammonium nitrogen

The analysis was based on the sodium phenate and sodium hypochlorite reaction forming a blue complex with ammonium in an alkaline medium. Using standards in the range 0-10 ppm a standard graph was prepared and from this the concentration of ammonium in the samples read off in mg/kg of fresh soil.

Nitrate and nitrite nitrogen

Nitrite concentration was determined colourimetrically by the red dye formed by the reaction with sulphanilic acid and N-1-napthylethylenediamine dihydrochloride under acidic conditions. For nitrate determination the nitrate was first reduced to nitrite and then the nitrite determined as already described. The nitrate concentration was determined by the difference with the nitrite determination.

Initially the nitrate to nitrite reduction step was achieved by an alkaline solution of hydrazine sulphate containing a copper catalyst (Technicon Industrial Method 32/69W, Technicon Corporation, New York). Unfortunately, after being used for some time this technique was

found to be unreliable and was not reducing the nitrate completely. An improved technique was therefore set up in which the nitrate was reduced to nitrate using a copper cadmium coil which was replenished at regular intervals (litchfield, 1967; Technicon Industrial Method 158-71W/A, Technicon Industrial Systems, New York). The system of nitrate standards was also improved so that incomplete reduction could be more readily identified.

All the 1991 samples were analysed using the improved technique. Soil samples which had been kept in the deep freeze from the 1988, 1989 and 1990 seasons were also re-analysed for nitrate and nitrite, although in a small number of cases insufficient sample remained.

Other data

The bulk densities of the soils at each site were determined at the start of the project using a standard technique. A rectangular hole was dug to the depth of each horizon and the soil separated into stones and soil by sieving, weighed and sampled for moisture determination. The volume of the hole was determined by filling it with beads of known volume which were then counted to calculate the volume occupied.

Soil dry matter, pH and organic matter determinations

Soil dry matters were determined by drying for 24h at 100°C in a forced draught oven. Sub-samples of the soils were also air dried for pH and organic matter determinations.

Reference: Litchfield, M.H. (1967) The analysis of nitrate and nitrite in blood. The Analyst, **92**, 132-136.

Results and Discussion

Grain yields

The grain yields for all sites and years are presented in Figures 1 to 3 and in Appendix 2. The yields of the plots receiving no fertilizer nitrogen tended to reflect the expected fertility pattern of the sites with yields of 7.9 and 7.8 t/ha in the first year season after ploughing up and declining yields thereafter. With the spring barley crops in 1991 the 1st Brown Hill site, then in its 4th year of cereals yielded only 3.9 t/ha with no N while the other Brown Hill site in its 2nd year yielded 5.0 t/ha with no N. The Maginnis Hill site with its arable cropping history gave yields in the range 2.1 to 3.2 t/ha with no N over the 4 seasons.

The highest yields of wheat in the experiments ranged from 6.8 to 10.6 t/ha. On the Maginnis Hill site the highest yields tended to be achieved with the highest level of fertilizer N applied, while on the both Brown Hill sites the optimum level of N application was in the range 50 to 150 kgN/ha for winter wheat and 80 to 120 kg/ha for spring barley. The highest yields on the Maginnis site were generally lower than those on the Brown Hill sites.

Crop uptake of nitrogen

Uptakes of N in the grain and straw are presented in Figures 4 to 7 and in Appendix 3. Uptake from the zero fertilizer N plots ranged from 100 to 160 kgN/ha for winter wheat on Brown Hill (both sites) and 60 to 70 kgN/ha for spring barley. On Site 2 Maginnis Hill N uptake was about 50 kgN/ha for winter wheat and spring barley in the first three years, falling to 27 kgN/ha in 1991 with no fertilizer N.

The uptake of N on the fertilizer treated plots generally reflected the amount of fertilizer applied and the overall apparent utilization of fertilizer N averaged 35% in May, 58% in June and 63% at harvest. Differences in the utilization between winter wheat and spring barley were small with the later samplings but with the May sampling the spring barley utilization averaged only 7.2% while the winter wheat averaged 47%.

Soil mineral nitrogen

The soil mineral N analyses are given in Appendices 4 and 5, and Figures 8 to 11 summarise this data. In the appendices the NH_3, NO_3 and NO_2 contents for each of the horizons sampled and for the total depth sampled are given while the summary graphs present only the total mineral N in each horizon. The data has been prepared in the format originally requested by Rothamsted so that it would be in a suitable form for validation of the model.

In the first two seasons after ploughing out of grass Site 1 soil had a higher mineral N content at the May sampling than the soil of Site 2 which had been under arable cropping for a number of years (Figures 8 and 9), but by the 3rd and 4th seasons the situation had reversed with Site 2 tending to have the higher mineral N (Figures 10 and 11). Differences between the sites at the June and September sampling were generally less marked. Although Site 3 was ploughed out of grass for the 1990 season it did not show the high soil N content in May that Site 1 had shown, and crop uptake of N was no higher than on Site 1. Nevertheless the grain yields from Site 3 in were particularly high in 1990, and were still significantly higher than on the other sites in 1991.

In most cases the soil mineral N content at the May sampling also reflected the level of fertilizer N application as insufficient time had elapsed for the crop to take it up, particularly with the spring barley crops, and this was also reflected in the crop uptake figures already discussed. The effects of fertilizer N treatments appeared to persist to the September sampling at all three sites in 1990 and at the two Brown Hill sites in 1991. This trend was not evident in 1988 or 1989, however, and in 1988 the unfertilized plots had the higher mineral N content at the September sampling (Figure 8).

The high soil mineral N contents recorded in the autumn of 1988 on Site 1 declined from about 300 kgN/ha in September to 180 kgN/ha in November and 55 kgN/ha by January 1989 (Appendix 5). The pattern was similar on Site 2. In each of the subsequent seasons the autumn soil N contents which ranged from 150kgN/ha to 300 kgN/ha had declined to between 10 kgN/ha to 30 kgN/ha by the spring.

A consistent feature of all the soil samples was the relatively high proportion of NH_3 N recorded. In most samples NH_3 N formed between 30% and 60% of the total N. The amount of NO_2 N was, however, generally insignificant. Only with the May sampling in the first year at Site 1 (Pages 39 and 40), was there a significant amount present. The two sites differed in this, very little NO_2N being found on Site 2 and so the presence of NO_2N may have been related to the mineralisation of N from the ploughed grass sward.

Interpretation of the data

The data presented in this report has been passed on to the Institute of Arable Crops Research, Rothamsted Experimental Station, so that it can be used as intended for the validation of the cereal nitrogen model.

Figure 1.
Grain yields, 1st Site, Brown Hill

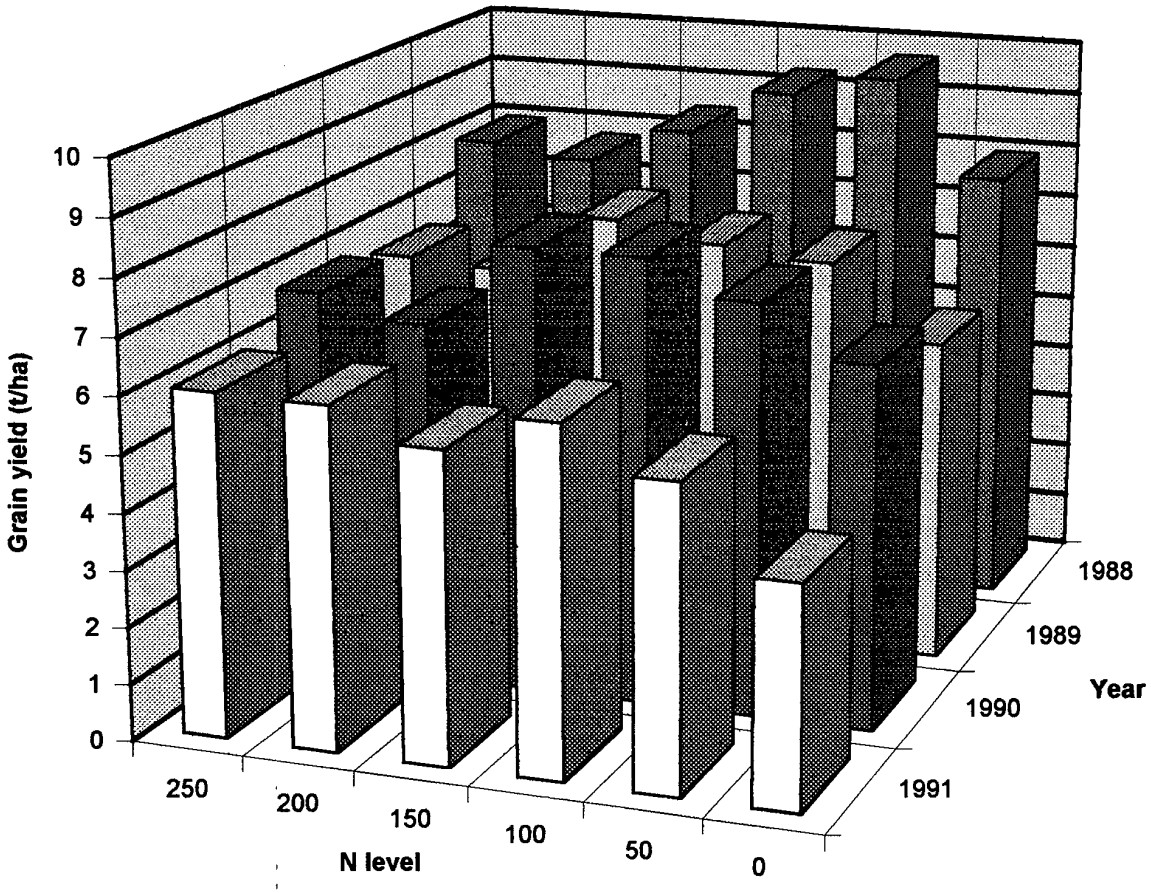


Figure 2.
Grain yields, 2nd Site, Maginnis Hill

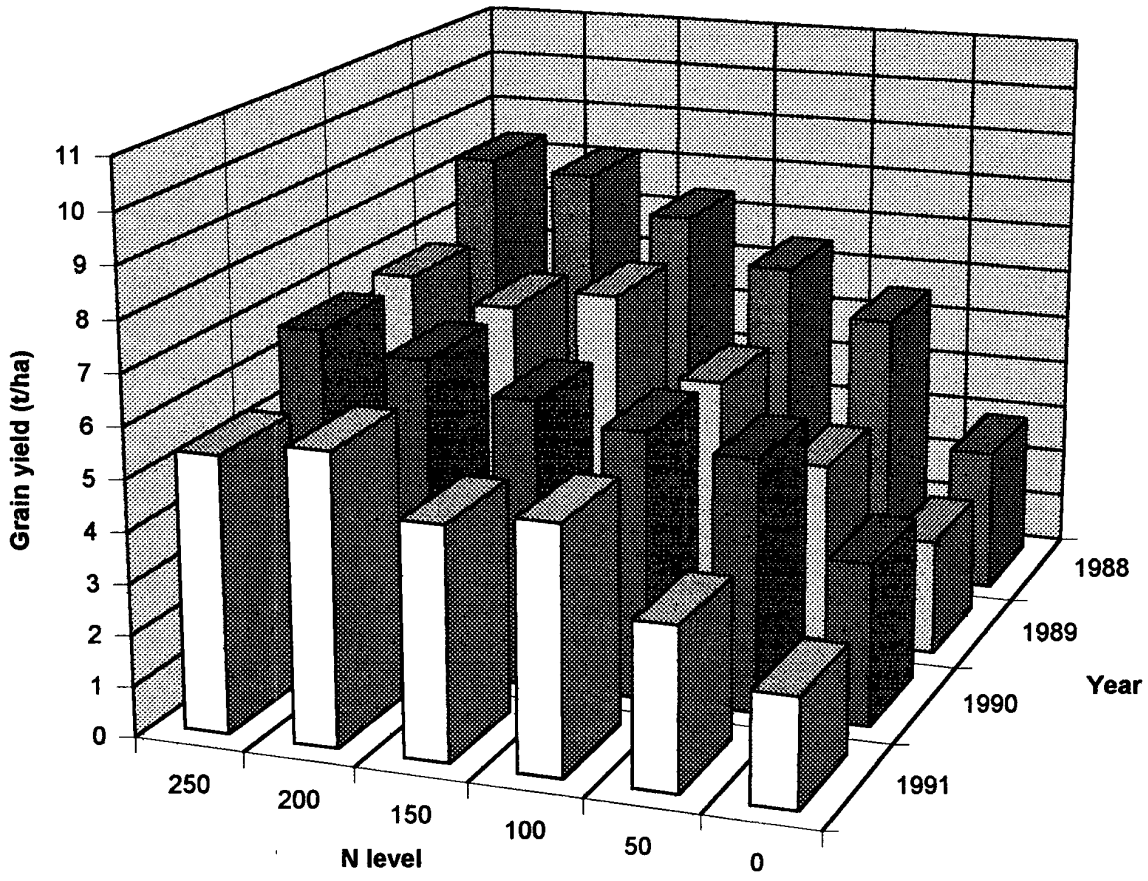


Figure 3.
Grain yields, 3rd Site, Brown Hill

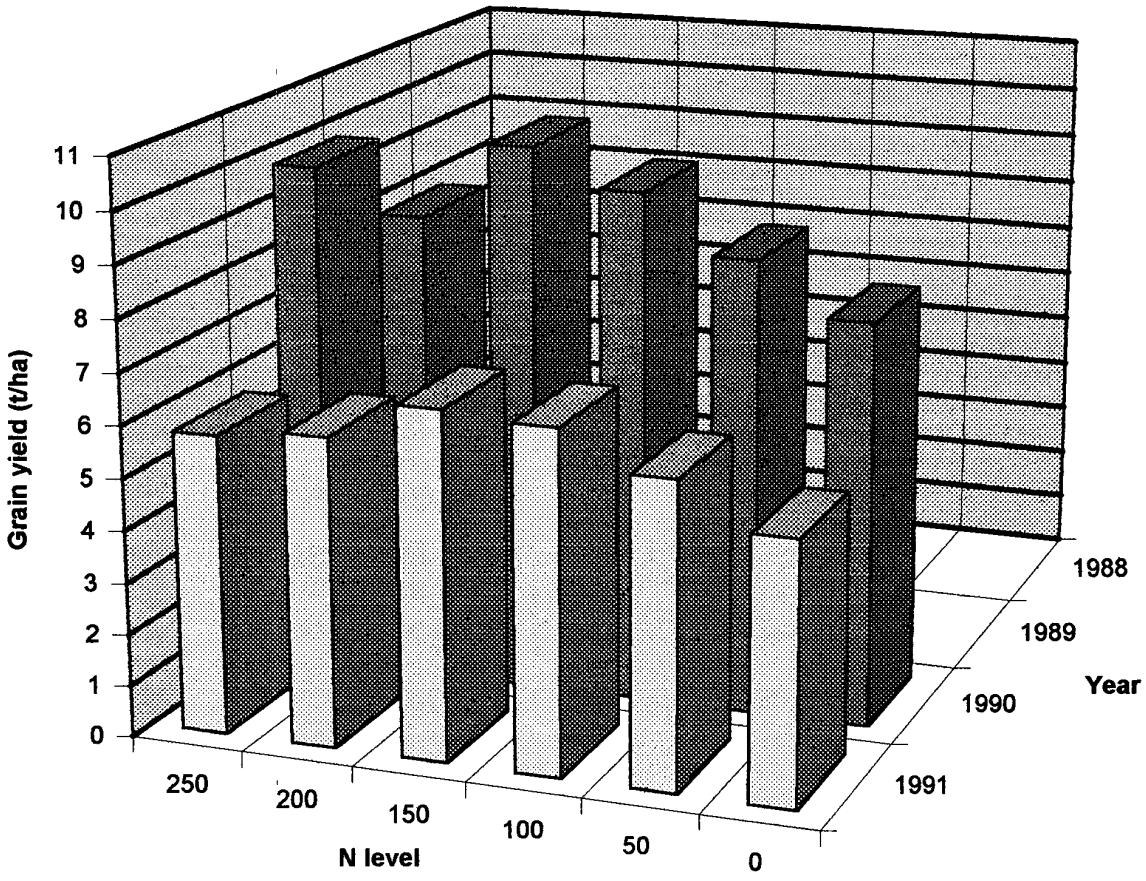
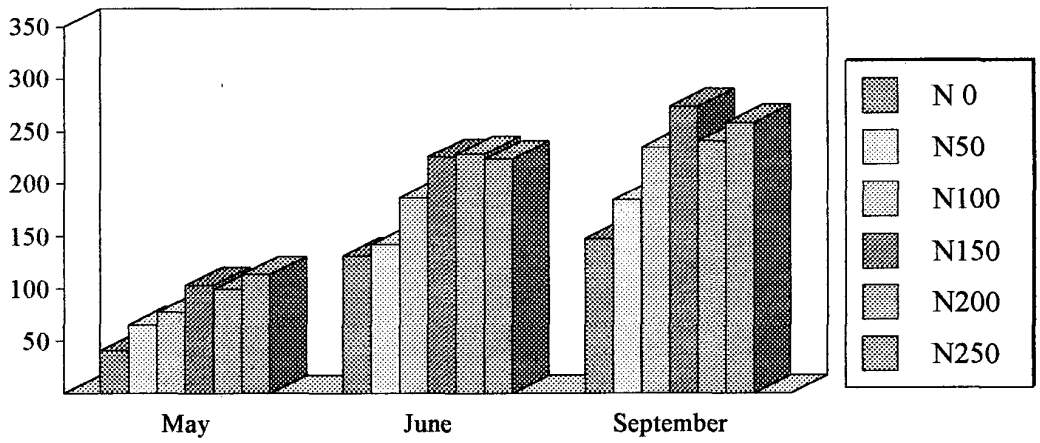


Figure 4. Uptake of nitrogen by the crop at three sampling dates in 1988
(kg N/ha)

a) Site 1. Brown Hill



b) Site 2. Maginnis Hill

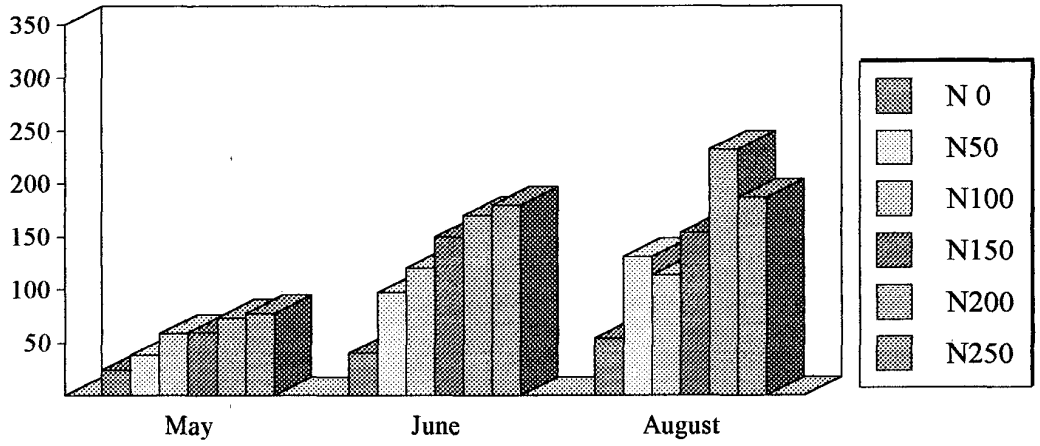
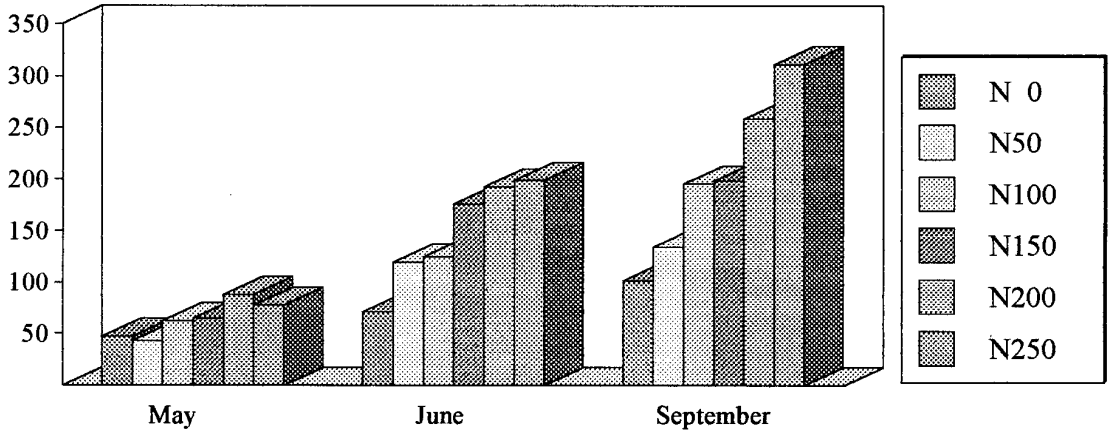


Figure 5. Uptake of nitrogen by the crop at three sampling dates in 1989
(kg N/ha)

a) Site 1. Brown Hill



b) Site 2. Maginnis Hill

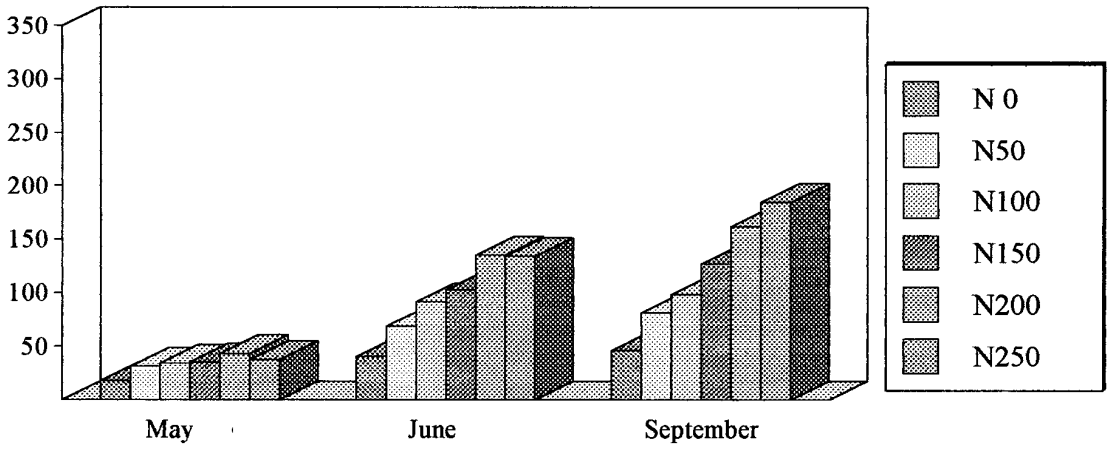
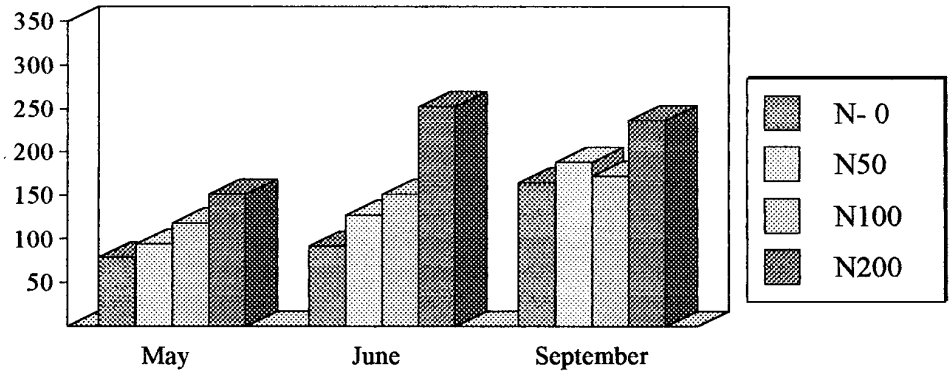
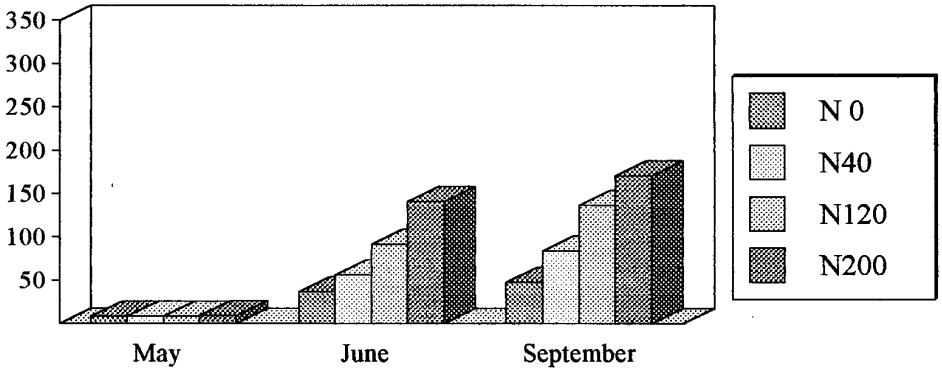


Figure 6. Uptake of nitrogen by the crop at three sampling dates in 1990
(kg N/ha)

a) Site 1. Brown Hill



b) Site 2. Maginnis Hill



c) Site 3. Brown Hill

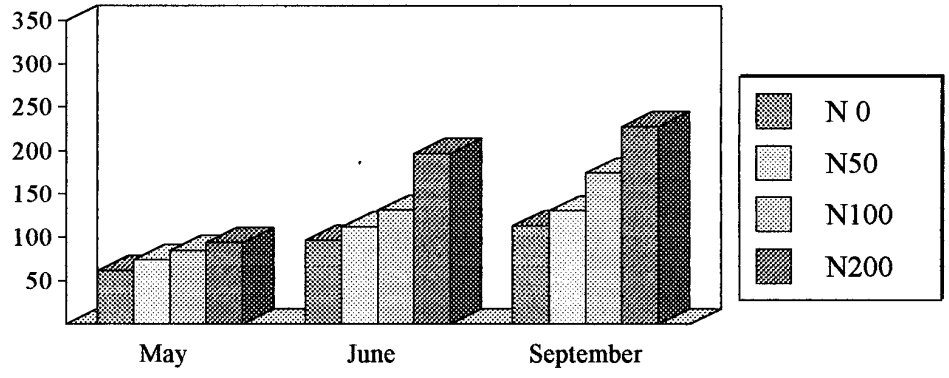
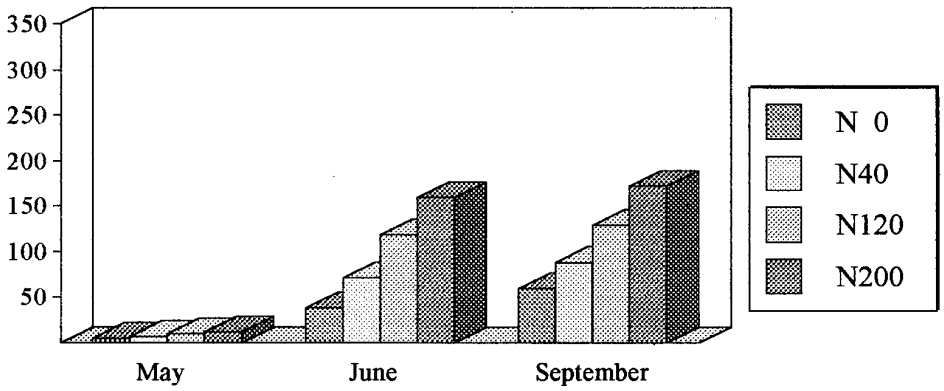
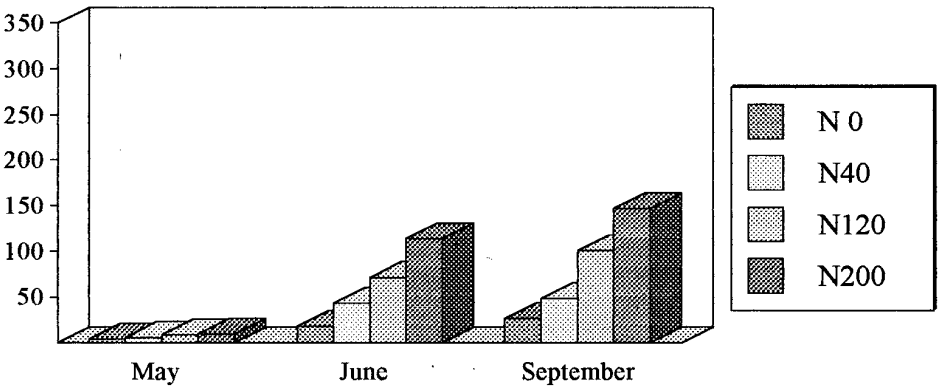


Figure 7. Uptake of nitrogen by the crop at three sampling dates in 1991
(kg N/ha)

a) Site 1. Brown Hill



b) Site 2. Maginnis Hill



c) Site 3, Brown Hill

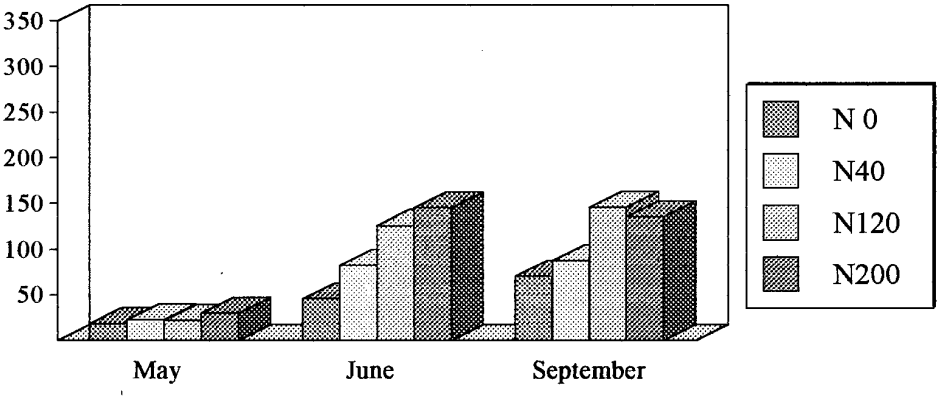
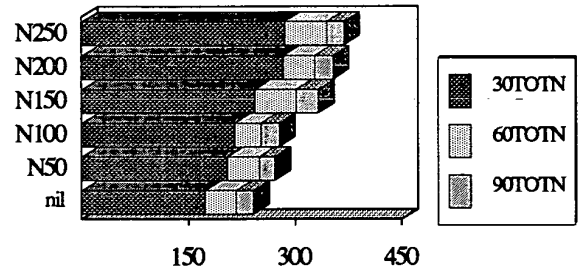


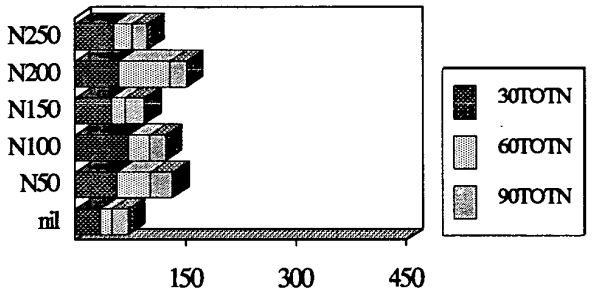
Table 8. Total soil mineral N in each horison at each sampling date in 1988 (kgN/ha)

Site 1. Brown Hill

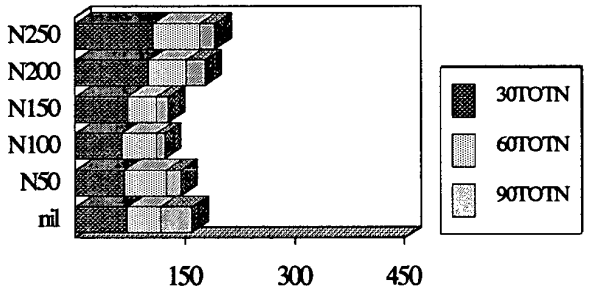
Site 2. Maginnis Hill

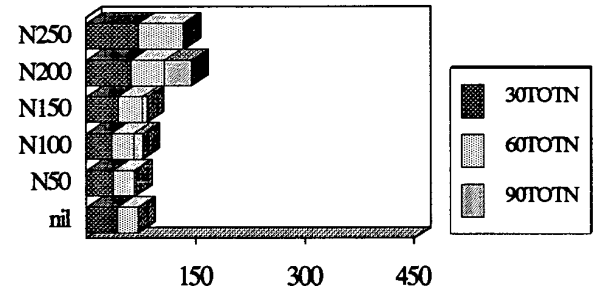
May



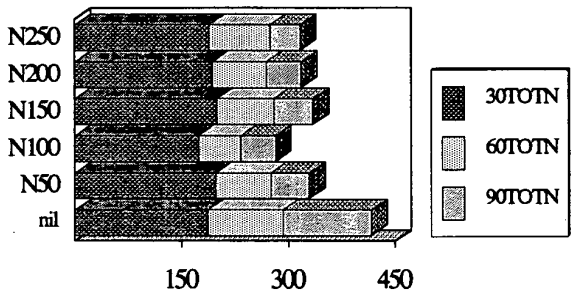


June





September



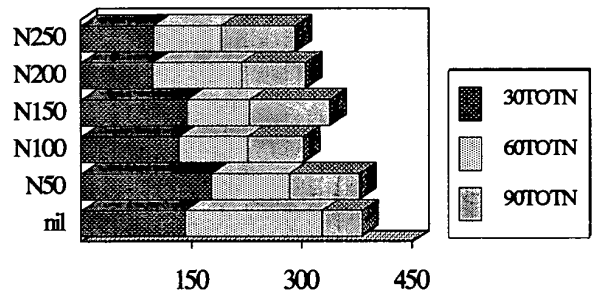


Figure 9. Total soil mineral N in each horizon at each sampling date in 1989 (kg N/ha)

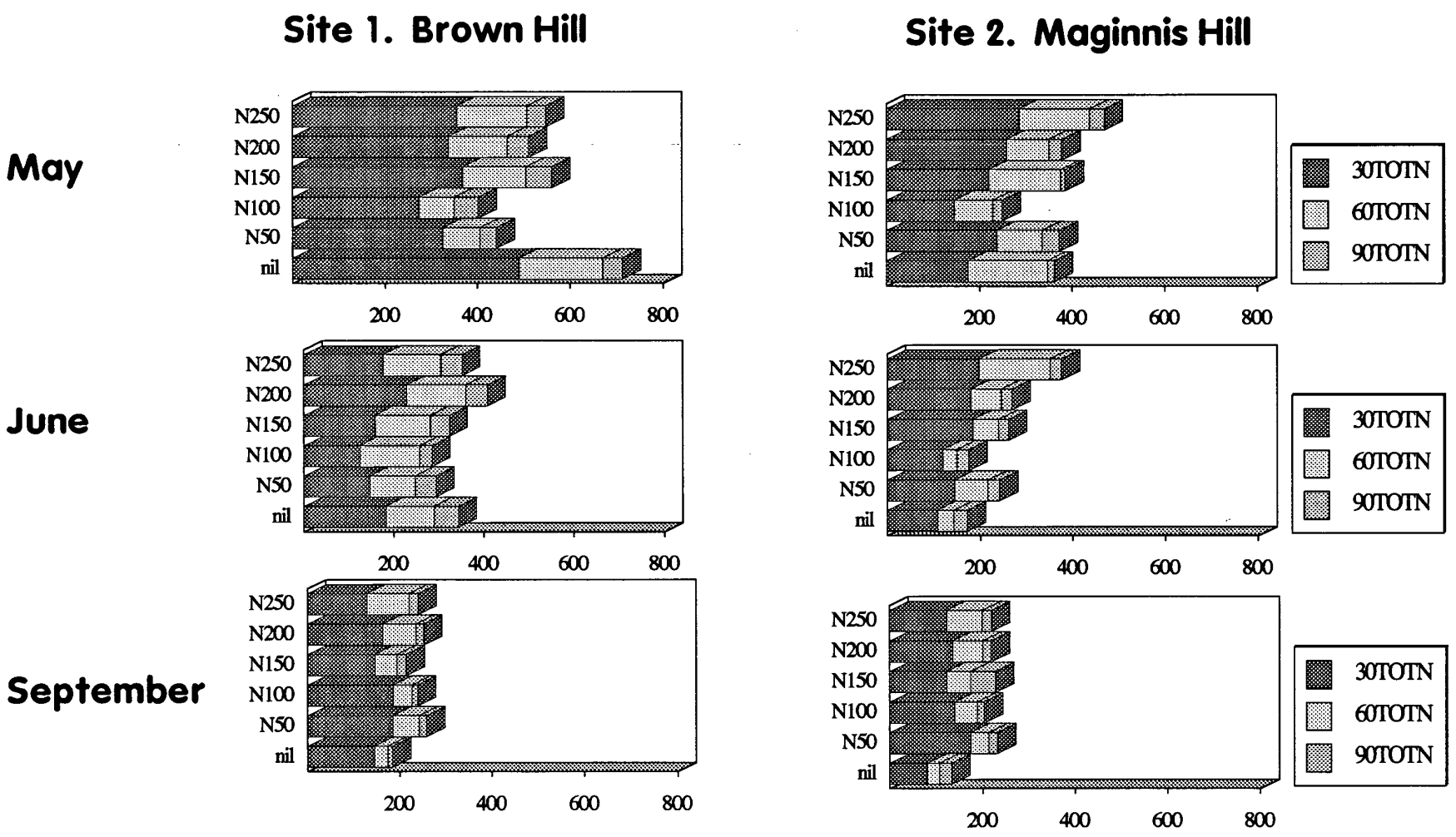


Figure 10. Total soil mineral N in each horizon at each sampling date in 1990 (kg N/ha)

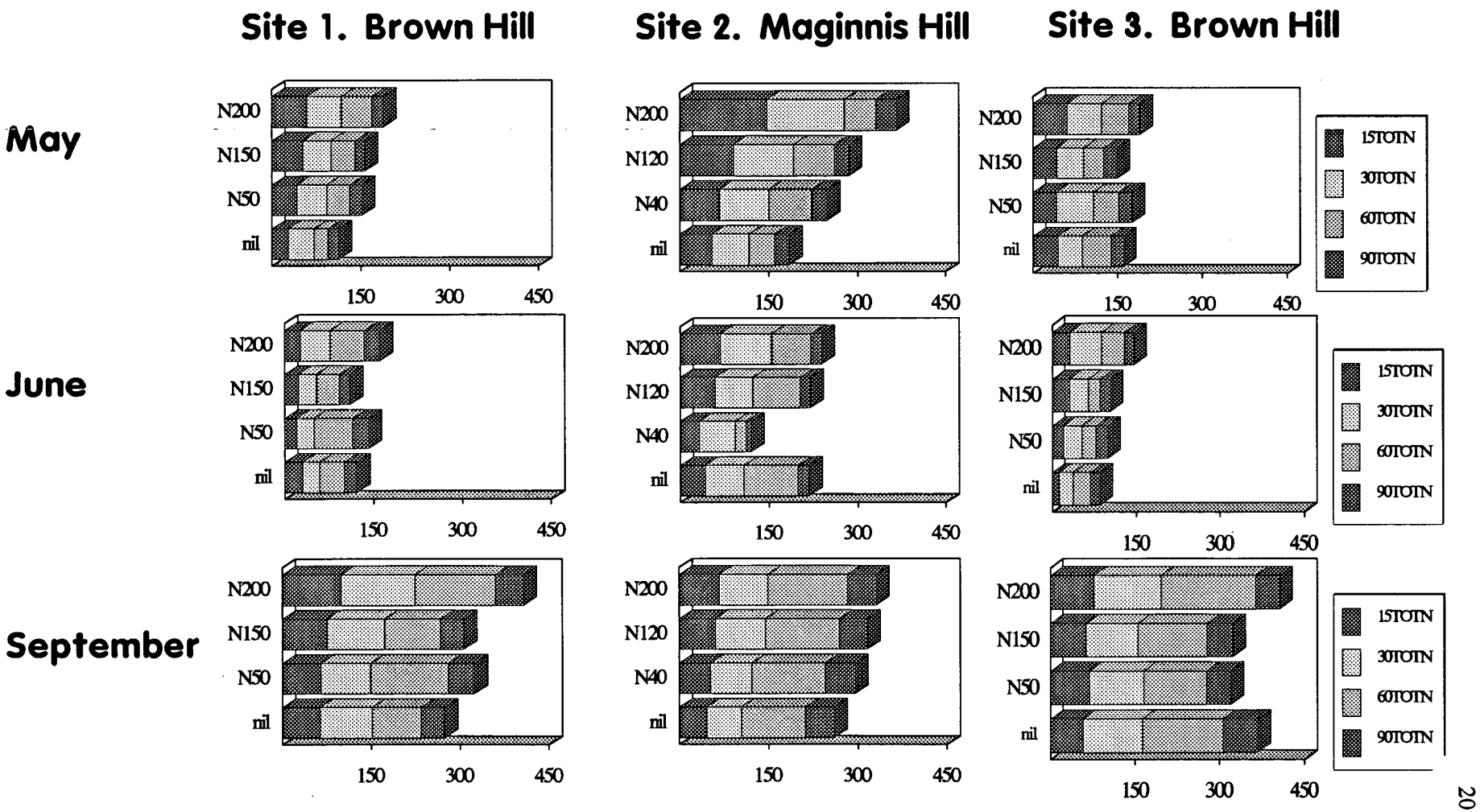
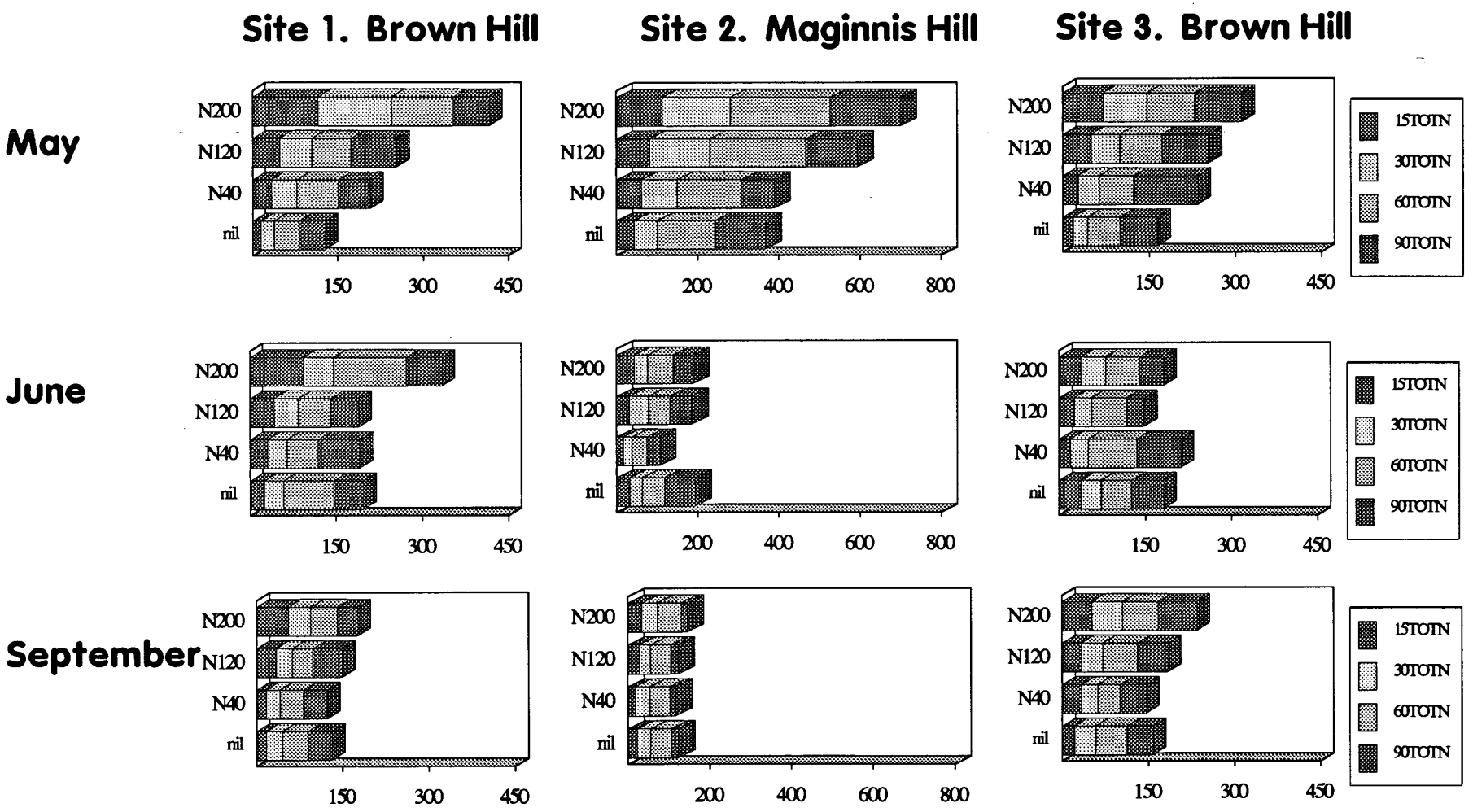


Figure 11. Total soil mineral N in each horizon at each sampling date in 1991 (kg N/ha)



Appendix 1.

Crop management
and
sampling dates

		Zadok's G. Stage	Rate	Dates
Crop	W. Wheat			
Previous crop	4 year intensively managed ley			
Sowing date				14 October
Variety	Slejpner			
TGWT			39.55 g	
Seed rate			180 kg/ha	
P & K	(0:24:24)		60 kg/ha	
1st N dressing			50%	11 April
2nd N dressing			50%	16 May
Herbicide (Twin-Tak DF)			3.5 kg/ha	19 April
1st Fungicide (Sportak Alpha)			1.5 l/ha	27 May
2nd Fungicide (Radar)			0.5 l/ha	24 June
Growth Regulator (Terpal)		2nd Node	1.0 l/ha	6 May
Plant count				26 November
Tiller count				1 June
Head count				15 July
1st Lodging score				29 July
2nd Lodging score				5 September
Harvest date				15 September

Sampling Dates	Whole area	18 November 1987 28 January 1988 23 March 1988
	Plots	10 May 1988 29 June 1988 19 September 1988

		Zadok's G. Stage	Rate	Dates
Crop	W. Wheat			
Previous crop	Wheat, Wheat, Barley			
Sowing date				14 October
Variety	Slejpner			
TGWT			39.55 g	
Seed rate			180 kg/ha	
P & K	(0:24:24)		60 kg/ha	
1st N dressing			50%	11 April
2nd N dressing			50%	16 May
Herbicide (Twin-Tak DF)			3.5 kg/ha	19 April
1st Fungicide (Sportak Alpha)			1.5 l/ha	27 May
2nd Fungicide (Radar)			0.5 l/ha	24 June
Growth Regulator (Terpal)		2nd Node	1.0 l/ha	26 May
Plant count				28 January
Tiller count				1 June
Head count				15 July
1st Lodging score				29 July
2nd Lodging score				5 September
Harvest date				15 September

Sampling Dates	Whole area	25 November 1987 3 February 1988 29 March 1988
	Plots	13 May 1988 4 July 1988 22 September 1988

		Zadok's G. Stage	Rate	Dates
Crop	W. Wheat			
Previous crop	W. Wheat			
Sowing date				2 November
Variety	Slejpner			
TGWT			42.39 g	
Seed rate			191 kg/ha	
P & K	(0:20:32)		80 kg/ha	
1st N dressing				4 April 10 April
2nd N dressing				11 May
Herbicide (Twin-Tak DF)			3.5 kg/ha	18 April
1st Fungicide (Tilt)			1.0 l/ha	17 May
2nd Fungicide (Radar)			0.5 l/ha	16 June
3rd Fungicide (Mistral)			750 ml/ha	11 July
Growth Regulator (Terpal)		2nd Node	1.0 l/ha	17 May
Plant count				20 December
Tiller count				24 May
Head count				21 June
1st Lodging score				8 September
Harvest date				11 September

Sampling Dates	Whole area	31 January 1989 3 March 1989
	Plots	9 May 1989 26 June 1989 15 September 1989

		Zadok's G. Stage	Rate	Dates
Crop	W. Wheat			
Previous crop	W. Wheat			
Sowing date				31 October
Variety	Slejpner			
TGWT			42.39 g	
Seed rate			191 kg/ha	
P & K	(0:20:32)		80 kg/ha	
1st N dressing				4 April 10 April
2nd N dressing				11 May
Herbicide (Twin-Tak DF)			3.5 kg/ha	18 April
1st Fungicide (Tilt)			1.0 l/ha	17 May
2nd Fungicide (Radar)			0.5 l/ha	16 June
3rd Fungicide (Mistral)			750 ml/ha	11 July
Growth Regulator (Terpal)		2nd Node	1.0 l/ha	17 May
Plant count				14 December
Tiller count				18 May
Head count				22 June
1st Lodging score				2 September
Harvest date				2 September

Sampling Dates	Whole area	1 February 1989 3 March 1989
	Plots	8 May 1989 16 June 1989 21 September 1989

		Zadok's G. Stage	Rate	Dates
Crop	W. Wheat			
Previous crop	W. Wheat			
Sowing date				28 September
Variety	Slejpner			
TGWT			46.71 g	
Seed rate			204 kg/ha	
P & K	(0:23:24)		80 kg/ha	28 September
1st N dressing				4 April
2nd N dressing				4 May
Herbicide (Astrol)			3.5 kg/ha	16 November
Insecticide (Talstar)			75 ml/ha	16 November
1st Fungicide (Radar)			0.5 l/ha	24 April
2nd Fungicide (Sprint)			1.5 l/ha	21 May
Growth Regulator (Terpal)			1.0 l/ha	1 May
3rd Fungicide (Mistral)			1.0 l/ha	14 June
Plant count				30 October
Tiller count				3 May
Head count				29 June
1st Lodging score				10 September
2nd Lodging score				
Crop height				17 July
Harvest date				10 September
Herbicide (Roundup)			3 l/ha	25 September

Sampling Dates	Whole area	3 October 1989 8 January 1990 5 March 1990
	Plots	30 April 1990 13 June 1990 25 September 1990

HGCAN 2 1990 (M. Hill) Spring Barley

		Zadok's G. Stage	Rate	Dates
Crop	S. Barley			
Previous crop	W. Wheat			
Sowing date				20 March
Variety	Dandy C_1			
TGWT			41.88 g	
Seed rate			173 kg/ha	
P & K	(0:23:24)		80 kg/ha	12 March
Emergence				9 April
1st N dressing		<11		11 April
2nd N dressing		11		27 April
Herbicide (Ally)			30 g/ha	11 May
Insecticide (Spannit)			700 ml/ha	21 May
Fungicide (Radar)			0.5 l/ha	21 May
Growth Regulator (Terpal)		2nd Node	1.0 l/ha	30 May
Plant count				19 April
Tiller count				17 May
Head count				9 July
Crop height				16 July
1st Lodging score				28 August
2nd Lodging score				-
Harvest date				28 August
Herbicide (Roundup)			3 l/ha	25 September

Sampling Dates	Whole area	3 October 1989 9 January 1990 8 March 1990
	Plots	25 April 1990 11 June 1990 19 September 1990

		Zadok's G. Stage	Rate	Dates
Crop	W. Wheat			
Previous crop	Grass			
Sowing date				28 September
Variety	Slejpner			
TGWT			46.71 g	
Seed rate			204 kg/ha	
P & K	(0:23:24)		80 kg/ha	28 September
1st N dressing				4 April
2nd N dressing				4 May
Herbicide (Astrol)			3.5 kg/ha	16 November
Insecticide (Talstar)			75 ml/ha	16 November
1st Fungicide (Radar)			0.5 l/ha	24 April
2nd Fungicide (Sprint)			1.5 l/ha	21 May
Growth regulator (Terpal)			1.0 l/ha	1 May
3rd Fungicide (Mistral)			1.0 l/ha	14 June
Plant count				30 October
Tiller count				3 May
Head count				2 July
1st Lodging score				10 September
Crop height				18 July
Harvest date				10 September
Herbicide (Roundup)			3 l/ha	25 September

Sampling Dates	Whole area	3 October 1989 8 January 1990 6 March 1990
	Plots	2 May 1990 20 June 1990 * September 1990

		Zadok's G. Stage	Rate	Dates
Crop	S. Barley			
Previous crop	W. Wheat			
Sowing date				28 March
Variety	Dandy C_2			
TGWT			46.61 g	
Seed rate			187.8 kg/ha	
P & K	(0:23:24)		100 kg/ha	26 March
Emergence				11 April
1st N dressing		11	50%	1 May
2nd N dressing			50%	28 May
Herbicide (Ally)			30 g/ha	23 May
Fungicide (Radar)			0.5 l/ha	7 June
Plant count				30 April
Tiller count				3 June
Head count				29 July
1st Lodging score				30 July
2nd Lodging score				26 August
Crop height				17 August
Harvest date				26 August

Sampling Dates	Whole area	19 March 1991
	Plots	15 May 1991 25 June 1991 23 September 1991

		Zadok's G. Stage	Rate	Dates
Crop	S. Barley			
Previous crop	S. Barley			
Sowing date				28 March
Variety	Dandy C_2			
TGWT			46.61 g	
Seed rate			187.8 kg/ha	
P & K	(0:23:24)		100 kg/ha	26 March
Emergence				11 April
1st N dressing		11	50%	1 May
2nd N dressing			50%	28 May
Herbicide (Ally)			30 g/ha	23 May
Fungicide (Radar)			0.5 l/ha	7 June
Plant count				30 April
Tiller count				4 June
Head count				29 July
1st Lodging score				30 July
2nd Lodging score				27 August
Crop height				17 August
Harvest date				27 August

Sampling Dates	Whole area	19 March 1991
	Plots	17 May 1991 28 June 1991 20 September 1991

		Zadok's G. Stage	Rate	Dates
Crop	S. Barley			
Previous crop	W. Wheat			
Sowing date				28 March
Variety	Dandy C_2			
TGWT			46.61 g	
Seed rate			187.8 kg/ha	
P & K	(0:23:24)		100 kg/ha	26 March
Emergence				11 April
1st N dressing		11		1 May
2nd N dressing				28 May
Herbicide (Ally)			30 g/ha	23 May
Fungicide (Radar)			0.5 l/ha	7 June
Plant count				30 April
Tiller count				4 June
Head count				29 July
1st Lodging score				30 July
2nd Lodging score				27 August
Crop height				17 August
Harvest date				27 August

Sampling Dates	Whole area	19 March 1991
	Plots	22 May 1991 2 July 1991 25 September 1991

Appendix 2.

Grain yields

Appendix 2.

Grain yields in the 1988 to 1991 seasons at the three sites. (t/ha at 15% moisture content)

Year		1988	1989	1990	1991
		Site 1. Brown Hill			
N Level W. Wheat	N Level S Barley	W. Wheat	W. Wheat	W. Wheat	S. Barley
nil	nil	7.9	5.8	6.4	3.9
50	40	9.7	7.1	7.3	5.3
100	80	9.3	7.3	7.9	6.1
150	120	8.4	7.6	7.9	5.4
200	160	7.7	6.5	6.4	6.0
250	200	7.9	6.6	6.8	6.0
		Site 2. Maginnis Hill			
		W. Wheat	W. Wheat	S. Barley	S. Barley
nil	nil	2.9	2.3	3.2	2.1
50	40	5.5	3.6	5.0	3.2
100	80	6.5	5.1	5.3	4.8
150	120	7.4	6.7	5.7	4.6
200	160	8.1	6.3	6.3	5.7
250	200	8.3	6.8	6.7	5.4
		Site 3. Brown Hill			
				W. Wheat	S. Barley
nil	nil			7.8	5.0
50	40			8.8	5.9
100	80			9.9	6.6
150	120			10.6	6.7
200	160			9.1	6.0
250	200			9.9	5.8

Appendix 3.

Nitrogen uptake in grain and straw

Appendix 3. Uptake of nitrogen in grain and straw

a) Crop Uptake of nitrogen (kgN/ha), 1988

Site 1. Brown Hill

Treatment	May	June	August
Nil	41.0	131.5	147.6
N50	65.8	142.4	184.4
N100	77.4	186.5	234.8
N150	103.4	225.4	273.1
N200	99.4	228.1	240.9
N250	113.7	223.6	258.0

Site 2. Maginnis Hill

Treatment	May	June	August
Nil	24.1	40.5	54.3
N50	38.7	97.2	130.7
N100	58.9	120.1	113.4
N150	60.1	149.6	153.8
N200	73.8	170.2	232.4
N250	77.5	179.6	186.9

b) Crop Uptake of nitrogen (kgN/ha), 1989

Site 1. Brown Hill

Treatment	May	June	September
Nil	47.1	70.9	101.2
N50	43.2	119.1	133.6
N100	62.3	124.7	195.2
N150	64.5	175.4	198.0
N200	88.1	192.1	258.0
N250	77.3	198.9	310.9

Site 2. Maginnis Hill

Treatment	May	June	September
Nil	18.1	40.3	46.4
N50	31.7	68.4	80.9
N100	34.4	91.2	98.1
N150	35.2	102.5	126.6
N200	43.1	135.3	161.8
N250	37.6	134.0	184.4

c) Crop Uptake of nitrogen (kgN/ha) 1990

Site 1. Brown Hill

Treatment	May	June	September
Nil	78.6	91.9	164.7
N50	94.2	127.1	187.9
N100	117.9	151.3	171.8
N200	151.6	252.5	236.7

Site 2. Maginnis Hill

Treatment	May	June	September
Nil	8.2	36.6	48.0
N40	8.3	56.5	83.7
N120	8.3	91.7	136.5
N200	9.0	140.7	170.8

Site 3. Brown Hill

Treatment	May	June	September
Nil	62.2	96.5	113.5
N50	74.6	111.7	130.6
N100	84.7	131.6	174.9
N200	94.1	197.0	227.8

d) Crop Uptake of nitrogen (kgN/ha) 1991

Site 1. Brown Hill

Treatment	May	June	September
Nil	4.9	38.2	59.3
N40	6.9	71.2	88.3
N120	9.9	118.2	128.6
N200	11.9	159.0	171.6

Site 2. Maginnis Hill

Treatment	May	June	September
Nil	4.1	18.2	26.7
N40	5.8	43.0	48.3
N120	8.6	71.1	100.3
N200	9.3	113.6	146.5

Site 3. Brown Hill

Treatment	May	June	September
Nil	18.3	45.8	70.8
N40	22.5	82.4	88.0
N120	21.8	125.8	145.8
N200	29.8	145.3	135.3

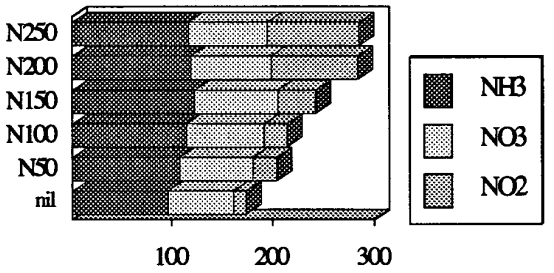
Appendix 4.

Mineral N analyses of soil cores; Samplings during the growing season

Site 1 Brown Hill 1988 Soil nitrogen kg/ha
10th May

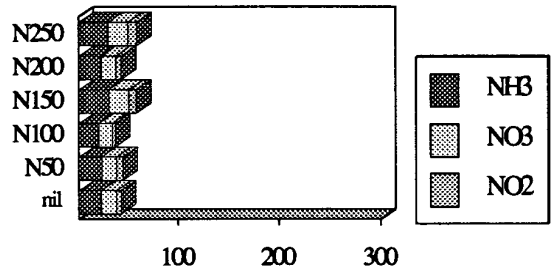
0-30 horizon

		nil	N50	N100	N150	N200	N250	sem	df
30	NH3	96.4	107.7	114.6	122.7	119.0	116.6	13.21	72
30	NO3	64.6	72.2	76.8	82.2	79.7	78.1	8.85	72
30	NO2	12.6	24.2	22.7	37.5	84.5	90.0	5.57	72
30	TOTN	173.5	204.1	214.1	242.4	283.3	284.8	19.23	72



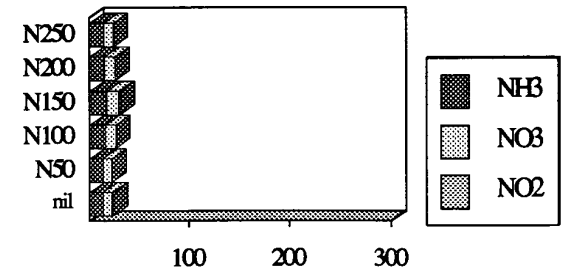
30-60 horizon

		nil	N50	N100	N150	N200	N250	sem	df
60	NH3	22.7	22.8	20.2	30.2	22.6	30.0	11.32	72
60	NO3	15.2	15.3	13.5	20.2	15.1	20.1	7.58	72
60	NO2	4.8	6.4	3.2	8.2	5.7	9.0	1.23	72
60	TOTN	42.7	44.4	36.9	58.6	43.5	59.1	11.54	72



60-90 horizon

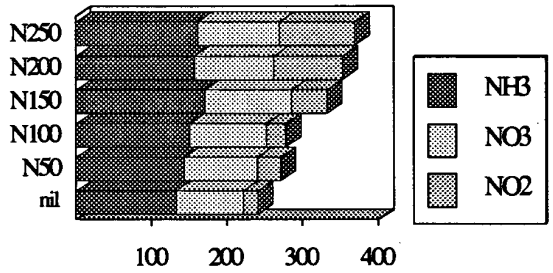
		nil	N50	N100	N150	N200	N250	sem	df
90	NH3	13.7	13.5	15.9	17.9	15.5	14.7	13.15	59
90	NO3	9.2	9.0	10.7	12.0	10.4	9.8	8.81	59
90	NO2	1.4	0.0	0.1	1.7	0.3	0.0	0.62	60
90	TOTN	24.3	22.6	26.6	31.6	26.2	24.5	13.6	59



Site 1 Brown Hill 1988 Soil nitrogen kg/ha
10th May

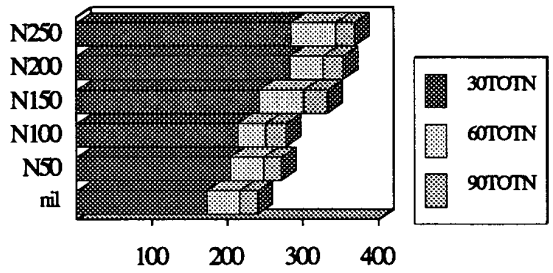
Total, all horizons

-	-	nil	N50	N100	N150	N200	N250	sem	df
TOT	NH3	132.8	144.0	150.7	170.8	157.1	161.3	24.28	72
TOT	NO3	89.0	96.5	101.0	114.4	105.3	108.1	16.27	72
TOT	NO2	18.7	30.6	26.0	47.4	90.6	99.0	6.23	72
TOT	TOTN	240.5	271.1	277.6	332.6	353.0	368.4	28.93	72



Total N for each horizon

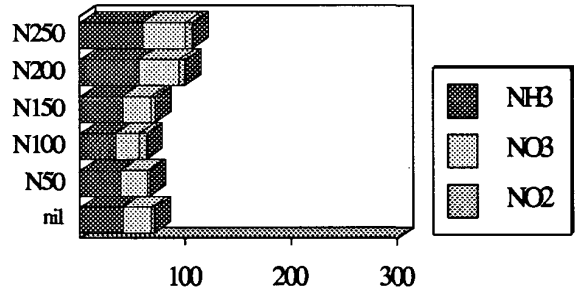
	nil	N50	N100	N150	N200	N250	sem	df
30TOTN	173.5	204.1	214.1	242.4	283.3	284.8	19.2	72
60TOTN	42.7	44.4	36.9	58.6	43.5	59.1	11.5	72
90TOTN	24.3	22.6	26.6	31.6	26.2	24.5	13.6	72



Site 1 Brown Hill 1988 Soil nitrogen kg/ha
29th June

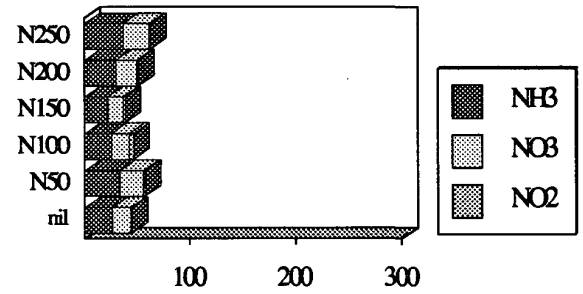
0-30cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
30	NH3	40.6	38.5	33.9	40.6	56.6	60.3	13.21	72
30	NO3	27.2	25.8	22.7	27.2	37.9	40.4	8.85	72
30	NO2	3.1	2.5	7.2	4.2	5.7	6.3	5.57	72
30	TOTN	70.9	66.8	63.8	72.0	100.3	107.0	19.23	72



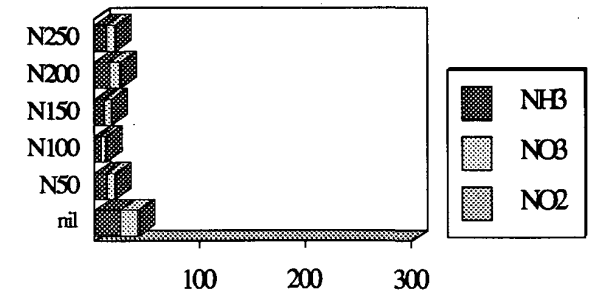
30-60cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
60	NH3	26.2	33.4	25.2	22.1	29.7	36.9	11.32	72
60	NO3	17.6	22.4	16.9	14.8	19.9	24.7	7.58	72
60	NO2	1.8	2.0	4.8	2.1	2.1	1.8	1.23	72
60	TOTN	45.5	57.8	46.8	39.0	51.7	63.4	11.54	72



60-90cm horizon

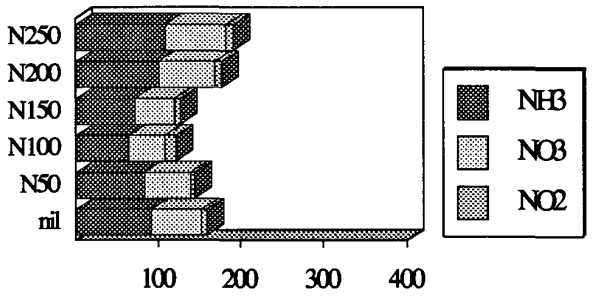
		nil	N50	N100	N150	N200	N250	sem	df
90	NH3	24.8	11.6	5.9	9.4	14.6	12.0	13.15	59
90	NO3	16.6	7.8	4.0	6.3	9.8	8.0	8.81	59
90	NO2	1.6	0.9	1.7	1.0	1.3	0.9	0.62	60
90	TOTN	43.0	20.3	11.6	16.7	25.7	20.9	13.6	59



Site 1 Brown Hill 1988 Soil nitrogen kg/ha 29th June

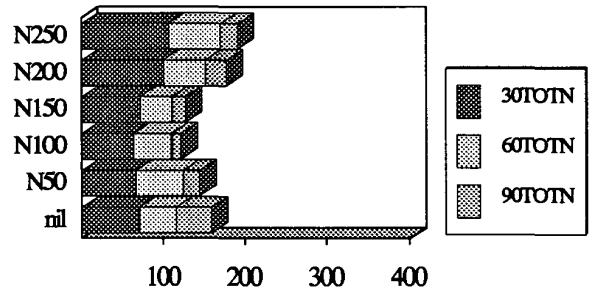
Total N, all horizons

		nil	N50	N100	N150	N200	N250	sem	df
TOT	NH3	91.6	83.5	65.0	72.1	100.9	109.2	24.28	72
TOT	NO3	61.4	55.9	43.6	48.3	67.6	73.2	16.27	72
TOT	NO2	6.5	5.4	13.7	7.2	9.1	9.0	6.23	72
TOT	TOTN	159.4	144.8	122.2	127.6	177.6	191.3	28.93	72



Total N in each horizon

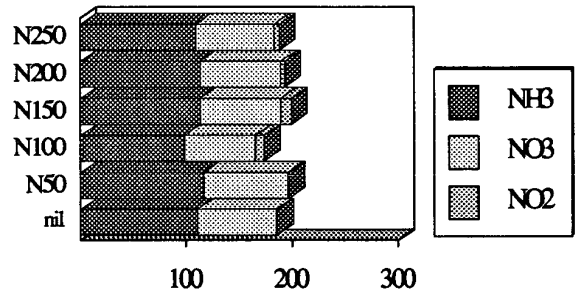
	nil	N50	N100	N150	N200	N250	sem	df
30TOTN	70.9	66.8	63.8	72.0	100.3	107.0	19.23	72
60TOTN	45.5	57.8	46.8	39.0	51.7	63.4	11.54	72
90TOTN	43.0	20.3	11.6	16.7	25.7	20.9	13.6	72



Site 1 Brown Hill 1988 Soil nitrogen kg/ha
19th September

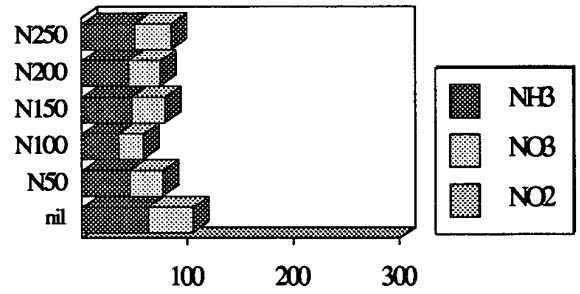
0-30cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
30	NH3	110.7	117.1	99.1	113.6	113.7	109.7	13.21	72
30	NO3	74.2	78.5	66.4	76.1	76.2	73.5	8.85	72
30	NO2	1.4	1.9	8.4	9.9	3.7	5.4	5.57	72
30	TOTN	186.3	197.5	173.9	199.7	193.6	188.6	19.23	72



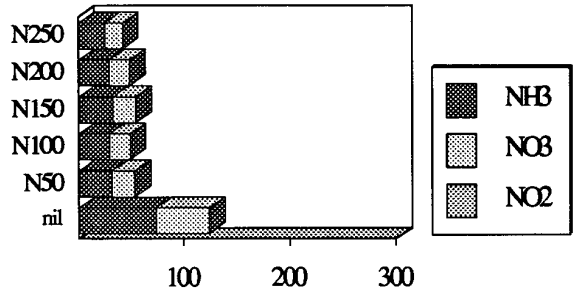
30-60cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
60	NH3	63.2	46.0	35.0	47.5	44.8	51.0	11.32	72
60	NO3	42.3	30.8	23.5	31.8	30.0	34.2	7.58	72
60	NO2	0.3	0.5	0.2	0.2	0.3	0.2	1.23	72
60	TOTN	105.8	77.3	58.7	79.5	75.1	85.3	11.54	72



60-90cm horizon

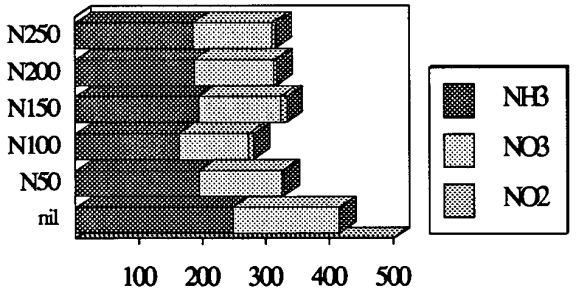
		nil	N50	N100	N150	N200	N250	sem	df
90	NH3	74.0	31.7	29.3	32.5	29.1	25.2	13.15	59
90	NO3	49.6	21.2	19.6	21.8	19.5	16.9	8.81	59
90	NO2	0.7	1.0	0.1	0.3	0.4	0.3	0.62	60
90	TOTN	124.3	53.9	49.0	54.6	49.0	42.4	13.6	59



Site 1 Brown Hill 1988 Soil nitrogen kg/ha 19th September

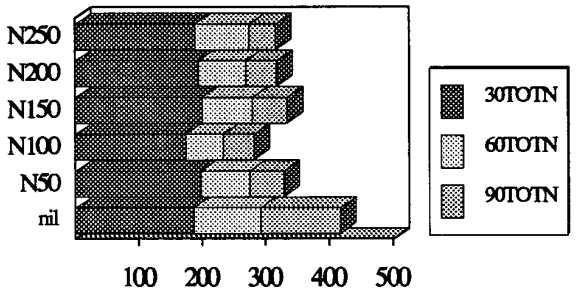
Total N, all horizons

		nil	N50	N100	N150	N200	N250	sem	df
TOT	NH3	247.9	194.8	163.4	193.6	187.6	185.9	24.28	72
TOT	NO3	166.1	130.5	109.5	129.7	125.7	124.6	16.27	72
TOT	NO2	2.4	3.4	8.7	10.4	4.4	5.9	6.23	72
TOT	TOTN	416.4	328.7	281.6	333.7	317.7	316.3	28.93	72



Total N for each horizon

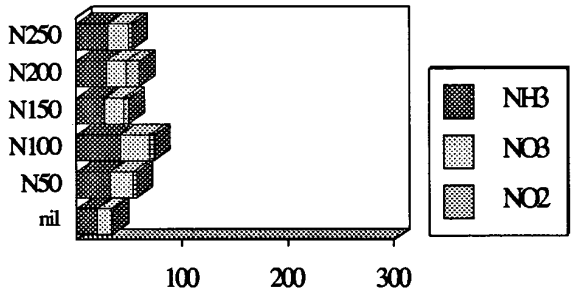
	nil	N50	N100	N150	N200	N250	sem	df
30TOTN	186.3	197.5	173.9	199.7	193.6	188.6	19.23	72
60TOTN	105.8	77.3	58.7	79.5	75.1	85.3	11.54	72
90TOTN	124.3	53.9	49.0	54.6	49.0	42.4	13.6	72



Site 2 Maginnis Hill 1988 Soil nitrogen kg/ha
13th May

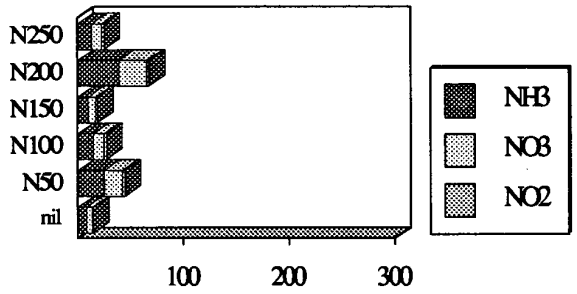
0-30cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
30	NH3	19.6	32.2	41.7	26.8	28.6	29.7	13.2	72.0
30	NO3	13.1	21.6	27.9	18.0	19.1	19.9	8.9	72.0
30	NO2	2.0	3.9	4.4	5.1	12.5	3.4	5.6	72.0
30	TOTN	34.7	57.6	74.0	49.8	60.2	52.9	19.2	72.0



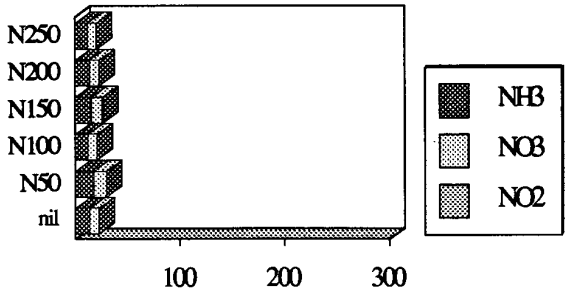
30-60cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
60	NH3	8.2	25.3	14.8	10.0	39.4	13.7	11.32	72
60	NO3	5.5	17.0	9.9	6.7	26.4	9.2	7.58	72
60	NO2	1.4	2.7	2.9	2.0	2.2	2.4	1.23	72
60	TOTN	15.1	45.0	27.6	18.7	68.0	25.3	11.54	72



60-90cm horizon

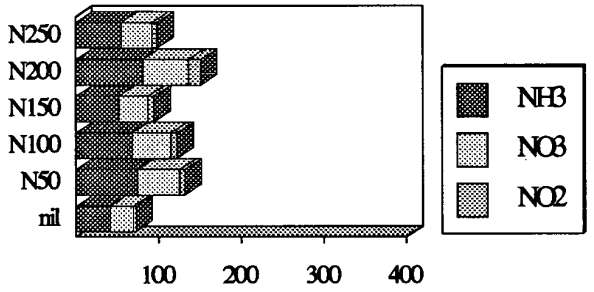
		nil	N50	N100	N150	N200	N250	sem	df
90	NH3	13.5	17.7	12.2	15.6	13.6	12.0	13.15	59
90	NO3	9.0	11.9	8.2	10.5	9.1	8.0	8.81	59
90	NO2	0.4	0.1	0.6	0.3	0.2	0.5	0.62	60
90	TOTN	23.0	29.6	21.0	26.3	22.9	20.5	13.6	59



Site 2 Maginnis Hill, 1988 Soil nitrogen kg/ha
13th May

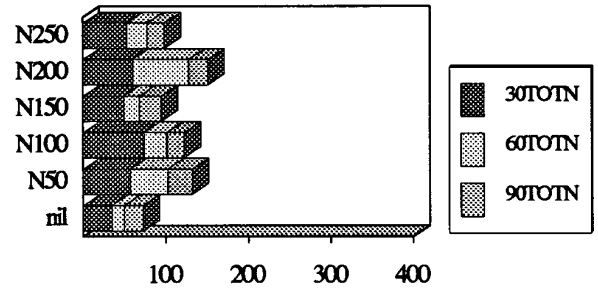
Total N, all horizons

		nil	N50	N100	N150	N200	N250	sem	df
TOT	NH3	41.3	75.2	68.7	52.4	81.6	55.4	24.3	72
TOT	NO3	27.7	50.4	46.0	35.1	54.7	37.1	16.27	72
TOT	NO2	3.8	6.6	7.9	7.3	14.9	6.2	6.23	72
TOT	TOTN	72.7	132.2	122.6	94.8	151.1	98.7	28.93	72



Total N, each horizon

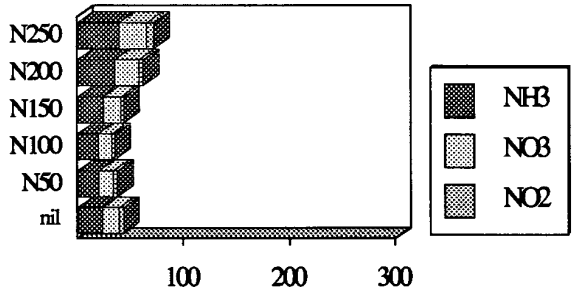
	nil	N50	N100	N150	N200	N250	sem	df
30TOTN	34.7	57.6	74.0	49.8	60.2	52.9	19.23	72
60TOTN	15.1	45.0	27.6	18.7	68.0	25.3	11.54	72
90TOTN	23.0	29.6	21.0	26.3	22.9	20.5	13.6	72



Site 2 Maginnis Hill, 1988 Soil nitrogen kg/ha
4th July

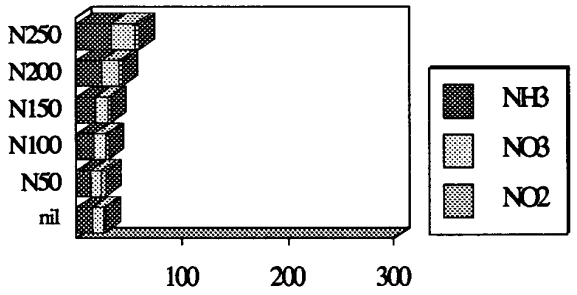
0-30cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
30	NH3	23.7	20.5	19.5	24.7	35.2	39.7	13.21	72
30	NO3	15.9	13.7	13.1	16.5	23.6	26.6	8.85	72
30	NO2	4.4	4.0	3.0	3.1	4.1	6.5	5.57	72
30	TOTN	44.0	38.2	35.6	44.4	62.8	72.8	19.23	72



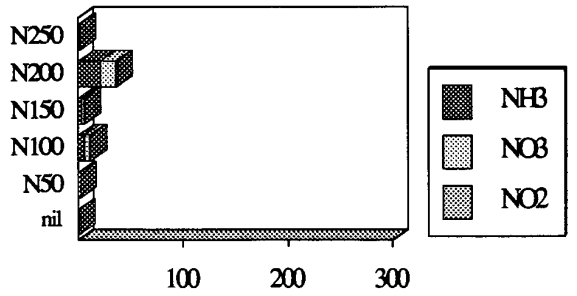
30-60 horizon

		nil	N50	N100	N150	N200	N250	sem	df
60	NH3	15.4	14.1	17.0	18.2	24.6	33.9	11.32	72
60	NO3	10.3	9.4	11.4	12.2	16.5	22.7	7.58	72
60	NO2	1.9	4.7	2.5	2.9	3.5	3.9	1.23	72
60	TOTN	27.6	28.2	30.9	33.3	44.5	60.5	11.54	72



60-90 horizon

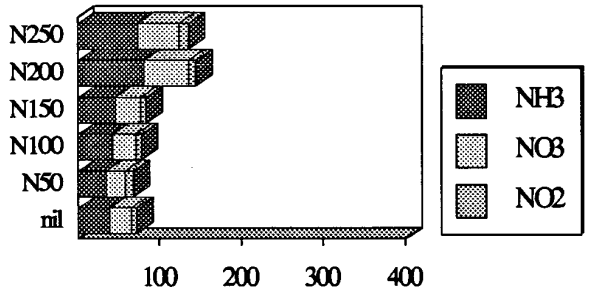
		nil	N50	N100	N150	N200	N250	sem	df
90	NH3	0.0	0.0	6.2	3.2	21.6	0.7	13.15	59
90	NO3	0.0	0.0	4.2	2.1	14.5	0.5	8.81	59
90	NO2	0.9	2.3	1.9	1.2	1.7	1.3	0.62	60
90	TOTN	0.9	2.3	12.3	6.5	37.8	2.5	13.6	59



Site 2 Maginnis Hill, 1988 Soil nitrogen kg/ha
4th July

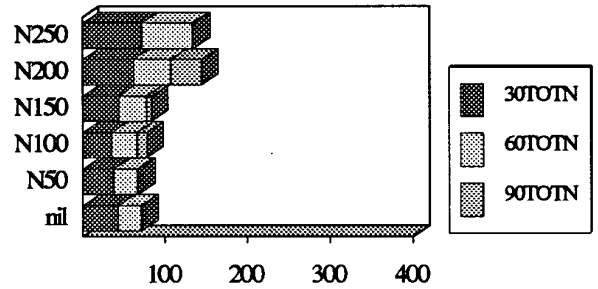
Total N, all horizons

		nil	N50	N100	N150	N200	N250	sem	df
TOT	NH3	39.1	34.6	42.7	46.1	81.4	74.3	24.28	72
TOT	NO3	26.2	23.2	28.6	30.9	54.5	49.8	16.27	72
TOT	NO2	7.2	10.9	7.4	7.2	9.2	11.7	6.23	72
TOT	TOTN	72.5	68.7	78.7	84.2	145.2	135.8	28.93	72



Total N, each horizon

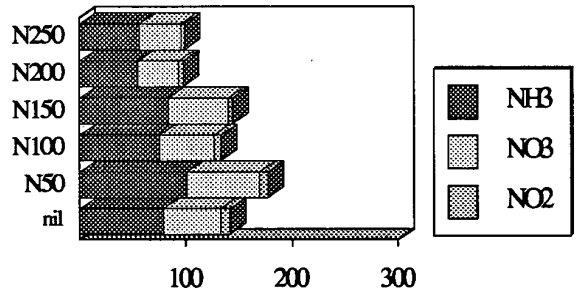
	nil	N50	N100	N150	N200	N250	sem	df
30TOTN	44.0	38.2	35.6	44.4	62.8	72.8	19.23	72
60TOTN	27.6	28.2	30.9	33.3	44.5	60.5	11.54	72
90TOTN	0.9	2.3	12.3	6.5	37.8	2.5	13.6	72



Site 2 Maginnis Hill, 1988 Soil nitrogen kg/ha
22 September

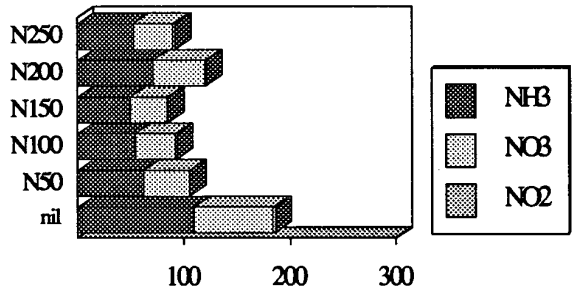
0-30cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
30	NH3	79.2	101.3	75.9	83.8	56.0	57.1	13.21	72
30	NO3	53.1	67.9	50.9	56.1	37.5	38.3	8.85	72
30	NO2	8.9	7.6	6.4	3.9	4.2	3.5	5.57	72
30	TOTN	141.1	176.8	133.1	143.8	97.7	98.8	19.23	72



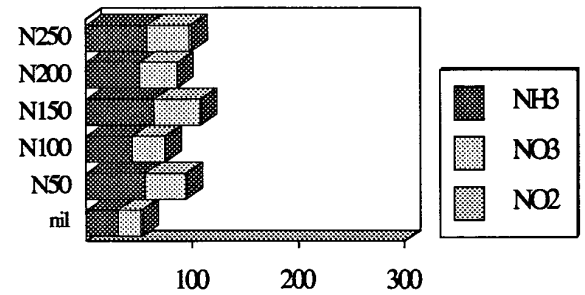
30-60cm horizon

		nil	N50	N100	N150	N200	N250	sem	df
60	NH3	109.9	62.9	55.2	50.6	71.8	53.8	11.32	72
60	NO3	73.6	42.1	37.0	33.9	48.1	36.0	7.58	72
60	NO2	2.7	1.1	1.7	1.3	1.4	2.7	1.23	72
60	TOTN	186.2	106.2	93.9	85.8	121.3	92.6	11.54	72



60-90cm horizon

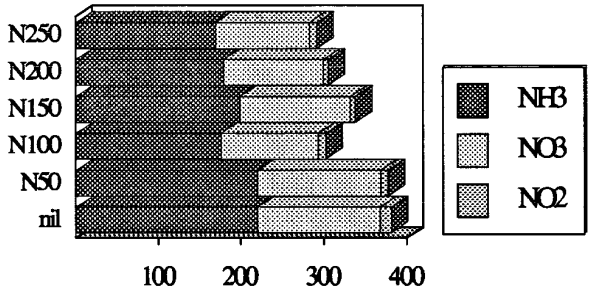
		nil	N50	N100	N150	N200	N250	sem	df
90	NH3	31.1	56.2	44.5	64.3	51.5	58.3	13.15	59
90	NO3	20.8	37.7	29.8	43.1	34.5	39.1	8.81	59
90	NO2	1.9	0.7	1.0	0.9	0.4	2.6	0.62	60
90	TOTN	53.9	94.5	75.3	108.3	86.4	99.9	13.6	59



Site 2 Maginnis Hill, 1988 Soil nitrogen kg/ha 22 September

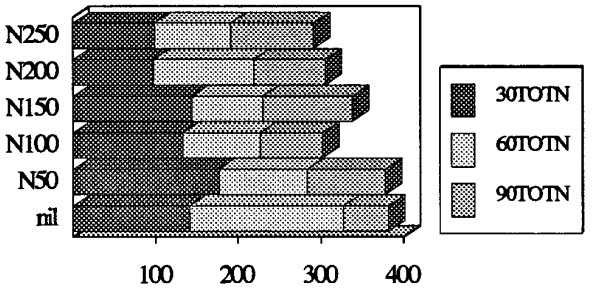
Total N for all horizons

		nil	N50	N100	N150	N200	N250	sem	df
TOT	NH3	220.2	220.4	175.6	198.7	179.3	169.2	24.28	72
TOT	NO3	147.5	147.7	117.7	133.1	120.1	113.4	16.27	72
TOT	NO2	13.5	9.5	9.1	6.1	6.0	8.8	6.23	72
TOT	TOTN	381.2	377.5	302.4	338.0	305.4	291.3	28.93	72



Total N, each horizon

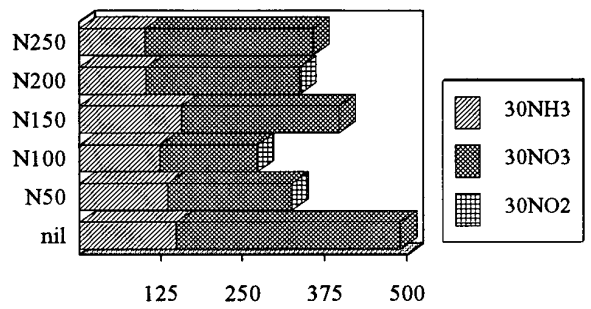
	nil	N50	N100	N150	N200	N250	sem	df
30TOTN	141.1	176.8	133.1	143.8	97.7	98.8	19.23	72
60TOTN	186.2	106.2	93.9	85.8	121.3	92.6	11.54	72
90TOTN	53.9	94.5	75.3	108.3	86.4	99.9	13.6	59



Brown Hill 1st Experiment Soil Nitrogen 1989 kg/ha
9th May

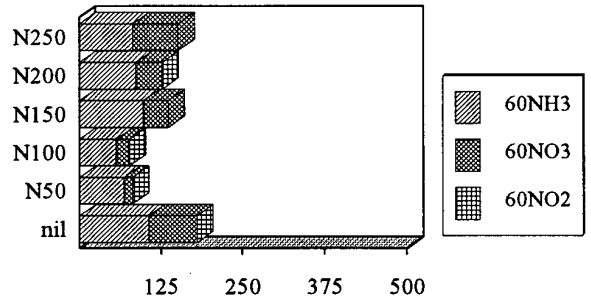
0-30cm Horizon

	nil	N50	N100	N150	N200	N250	sem
30NH3	148.	135.	123.	156.	102.	100.	
30NO3	342.	190.	149.	241.	235.	257.	73.5
30NO2	0.00	0.59	1.00	0.00	0.28	0.00	0.271
30TOTN	490.	325.	273.	396.	337.	356.	83.6



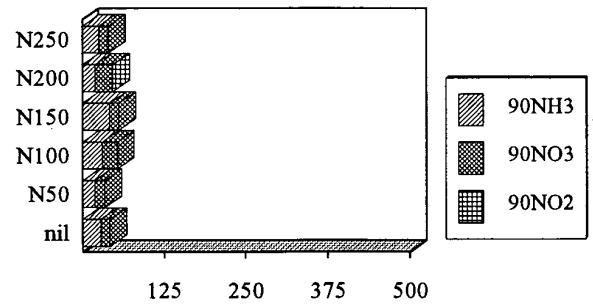
30-60cm Horizon

	nil	N50	N100	N150	N200	N250	sem
60NH3	105.3	67.9	56.6	97.3	86.2	81.3	22.52
60NO3	74.7	12.5	19.0	38.8	40.3	69.8	22.82
60NO2	0.283	0.707	0.533	0.000	0.507	0.000	.2298
60TOTN	180.	81.	76.	136.	127.	151.	35.8



60-90cm Horizon

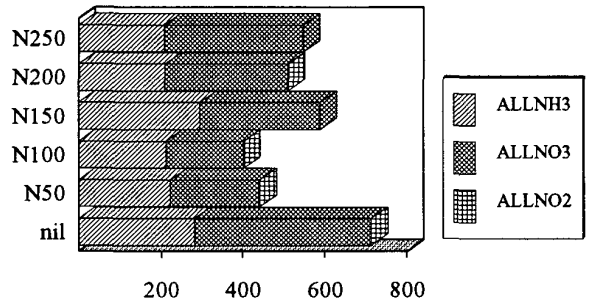
	nil	N50	N100	N150	N200	N250	sem
90NH3	27.8	18.0	30.6	41.7	19.2	25.1	6.52
90NO3	14.1	16.4	22.3	13.8	27.2	15.0	7.81
90NO2	0.000	0.100	0.103	0.000	0.197	0.000	0.1026
90TOTN	41.9	34.6	53.0	55.4	46.5	40.1	7.26



Brown Hill 1st Experiment Soil Nitrogen 1989 kg/ha
9th May

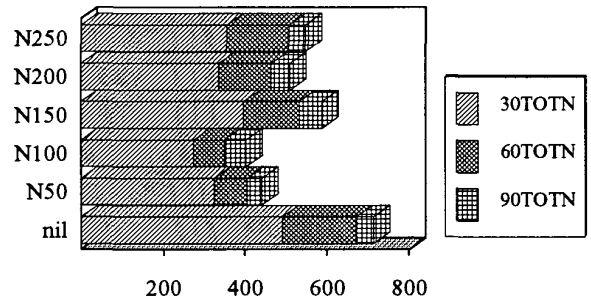
Total, all horizons

	nil	N50	N100	N150	N200	N250	sem
ALLNH3	281.	221.	210.	295.	207.	206.	37.6
ALLNO3	431.	219.	191.	293.	302.	341.	91.3
ALLNO2	0.28	1.39	1.64	0.00	0.98	0.00	0.440
ALLN	712.	441.	402.	588.	510.	548.	115.1



Total N for each horizon

	nil	N50	N100	N150	N200	N250	sem
30TOTN	490.	325.	273.	396.	337.	356.	83.6
60TOTN	180.	81.	76.	136.	127.	151.	35.8
90TOTN	41.9	34.6	53.0	55.4	46.5	40.1	7.26



Site 1. Brown Hill Soil Nitrogen 1989 kg/ha
26th June

0-30 cm horizon

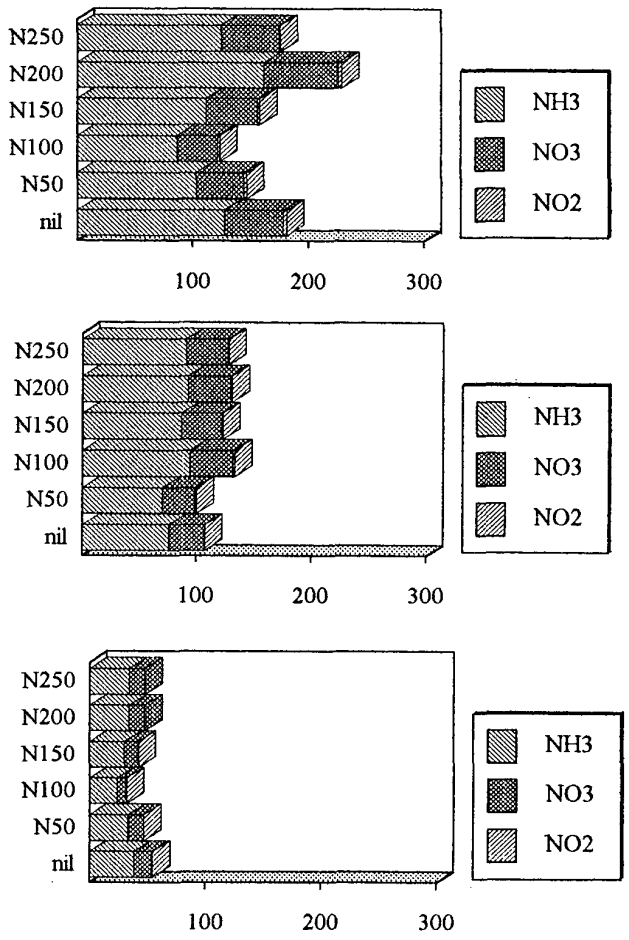
	nil	N50	N100	N150	N200	N250	sem
NH3	127.2	102.9	86.9	111.6	161.4	124.7	32.50
NO3	50.9	41.2	34.8	44.6	64.6	49.9	13.03
NO2	3.3	2.6	2.0	1.7	3.2	1.4	0.27
TOTAL	181.4	146.6	123.6	157.9	229.2	175.9	83.60

30-60 cm horizon

	nil	N50	N100	N150	N200	N250	sem
NH3	76.4	70.4	93.9	86.8	92.6	90.8	22.52
NO3	30.5	28.2	37.6	34.7	37.0	36.3	9.08
NO2	0.4	1.3	1.7	1.3	1.3	0.9	0.23
TOTAL	107.3	99.9	133.1	122.8	130.9	128.0	35.80

60-90 cm horizon

	nil	N50	N100	N150	N200	N250	sem
NH3	38.5	33.7	23.9	30.3	34.5	34.5	6.52
NO3	15.4	13.5	8.1	12.1	13.8	13.8	7.81
NO2	1.0	0.2	0.1	0.2	0.0	0.0	0.10
TOTAL	55.0	47.3	28.0	42.6	48.3	48.3	7.26



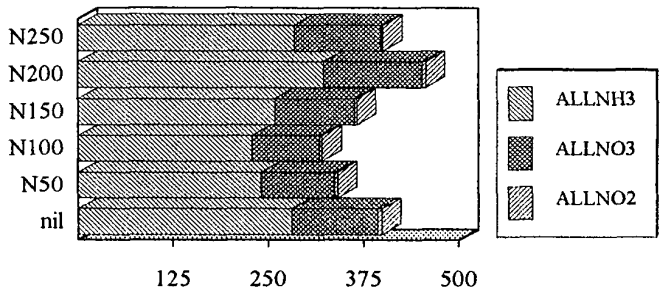
Site 1. Brown Hill Soil Nitrogen 1989 kg/ha
26th June

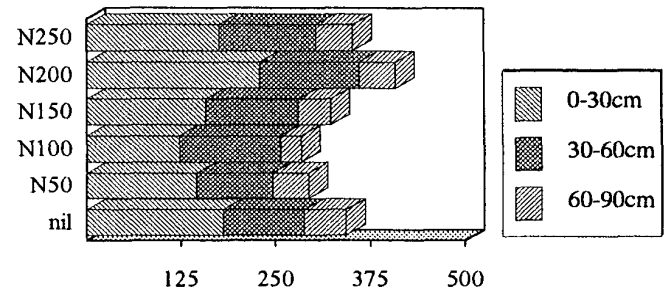
Total N, all horizons

	nil	N50	N100	N150	N200	N250	sem
ALLNH3	280.6	240.6	228.5	259.0	323.0	284.4	37.60
ALLNO3	112.2	96.3	88.5	103.6	129.2	113.8	15.00
ALLNO2	5.8	4.3	3.9	3.3	4.5	2.4	0.44
ALLTOTALN	398.6	341.2	312.8	366.0	456.7	400.5	115.10

Total N for each horizon

	nil	N50	N100	N150	N200	N250	sem
0-30cm	181.4	146.6	123.6	157.9	229.2	175.9	42.30
30-60cm	107.3	99.9	133.1	122.8	130.9	128.0	35.80
60-90cm	55.0	47.3	28.0	42.6	48.3	48.3	7.26

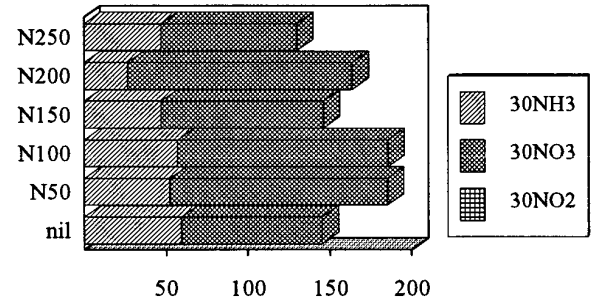




Brown Hill 1st Experiment Soil Nitrogen 1989 kg/ha
15th September

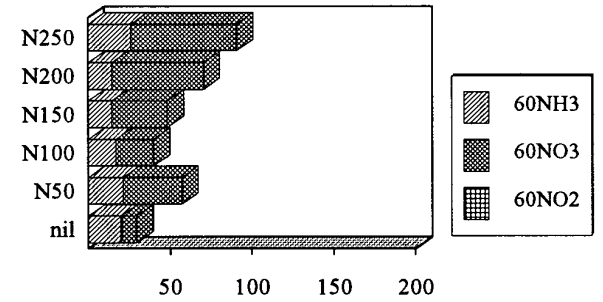
0-30cm Horizon

	nil	N50	N100	N150	N200	N250	sem
30NH3	58.9	52.0	56.6	46.7	26.6	46.7	8.26
30NO3	86.	133.	129.	99.	137.	83.	28.4
30NO2	0.00	0.00	0.00	0.00	0.00	0.00	0.000
30TOT N	145.	185.	186.	146.	164.	129.	32.1



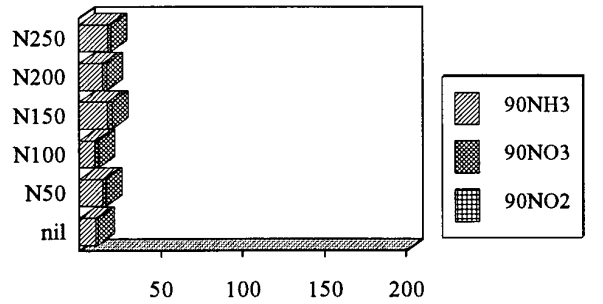
0-30cm Horizon

	nil	N50	N100	N150	N200	N250	sem
60NH3	19.98	21.34	16.86	14.32	14.29	26.07	2.178
60NO3	9.5	35.5	22.8	33.5	56.3	64.6	14.36
60NO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60TOT N	29.4	56.9	39.6	47.8	70.6	90.7	14.61



0-30cm Horizon

	nil	N50	N100	N150	N200	N250	sem
90NH3	9.81	14.17	9.80	17.22	14.46	17.73	2.269
90NO3	1.50	2.06	1.94	2.87	2.41	1.85	0.410
90NO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90TOT N	11.31	16.22	11.75	20.08	16.87	19.59	2.286



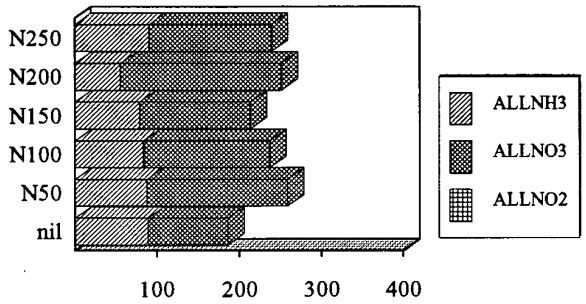
Brown Hill 1st Experiment Soil Nitrogen 1989 kg/ha
15th September

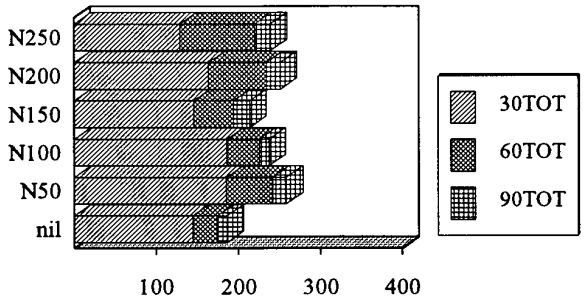
Total, all horizons

	nil	N50	N100	N150	N200	N250	sem
ALLNH3	88.7	87.5	83.3	78.3	55.3	90.5	9.55
ALLNO3	97.	171.	154.	135.	196.	149.	25.8
ALLNO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALLTOT N	186.	258.	237.	214.	251.	240.	29.3

Total N for each horizon

	nil	N50	N100	N150	N200	N250	sem
30TOT N	145.	185.	186.	146.	164.	129.	32.1
60TOT N	29.4	56.9	39.6	47.8	70.6	90.7	14.61
90TOT N	11.31	16.22	11.75	20.08	16.87	19.59	2.286





Maginis Hill 2nd Experiment Soil Nitrogen 1989 kg/ha 9th May

0-30cm Horizon

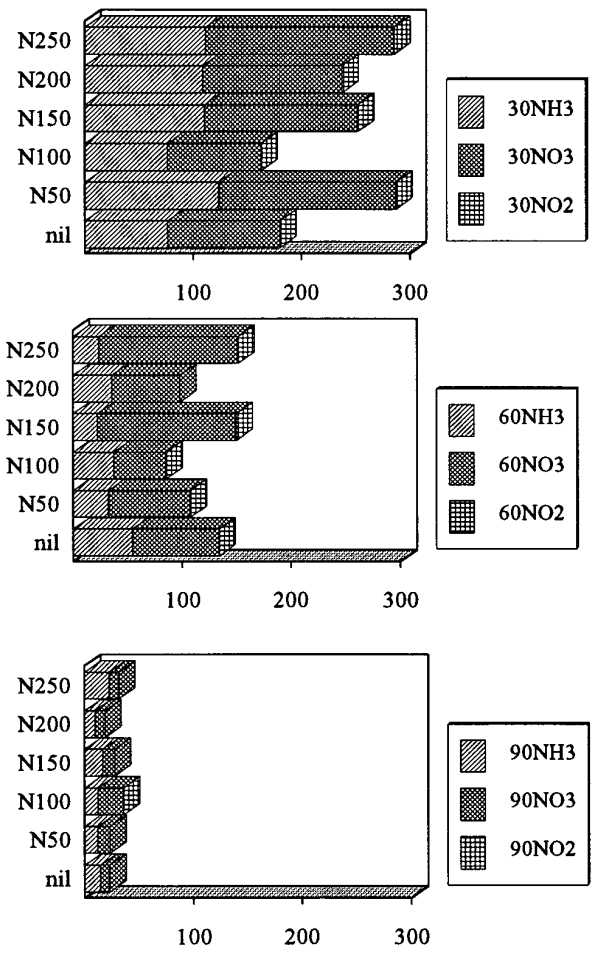
	nil	N50	N100	N150	N200	N250	sem
30NH3	76.	123.	76.	110.	108.	111.	28.8
30NO3	104.20	163.08	87.06	141.48	129.15	173.57	
30NO2	0.25	0.58	0.24	0.25	0.25	0.42	
30TOTN	174.46	237.29	146.31	219.69	257.62	285.31	

30-60cm Horizon

	nil	N50	N100	N150	N200	N250	sem
60NH3	54.0	31.8	36.8	22.1	35.4	23.3	14.39
60NO3	79.42	74.77	47.55	127.53	62.35	127.81	
60NO2	0.70	0.24	0.38	0.52	0.07	0.54	
60TOT N	170.91	96.88	81.65	154.99	92.20	151.62	

60-90 Horizon

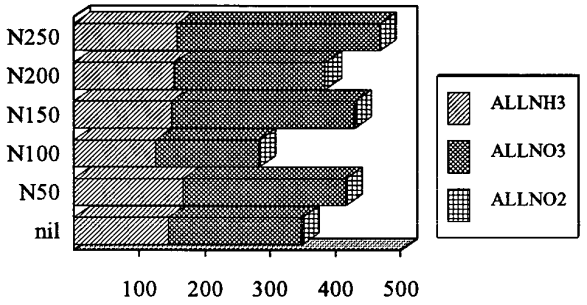
	nil	N50	N100	N150	N200	N250	sem
90NH3	14.4	11.8	12.2	16.5	9.5	22.4	6.63
90NO3	8.48	11.26	23.52	11.14	9.19	9.20	
90NO2	0.00	0.00	0.14	0.00	0.00	0.00	
90TOT N	15.44	38.18	20.58	10.27	29.26	31.61	



Maginis Hill 2nd Experiment Soil Nitrogen 1989 kg/ha 9th May

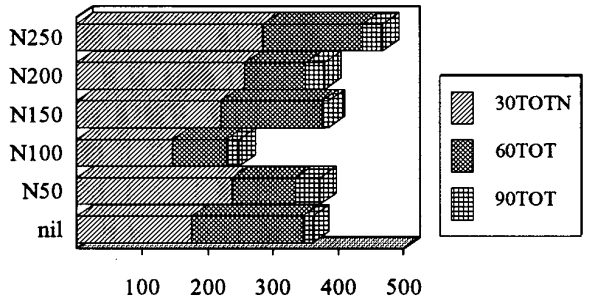
Total all horizons

	nil	N50	N100	N150	N200	N250	sem
ALLNH3	144.	166.	125.	149.	153.	157.	32.4
ALLNO3	204.42	249.12	158.11	280.13	231.25	310.58	
ALLNO2	0.94	0.83	0.75	0.76	0.19	0.96	
ALLTOT N	360.80	372.35	248.54	384.94	379.08	468.54	



Total for each horizon

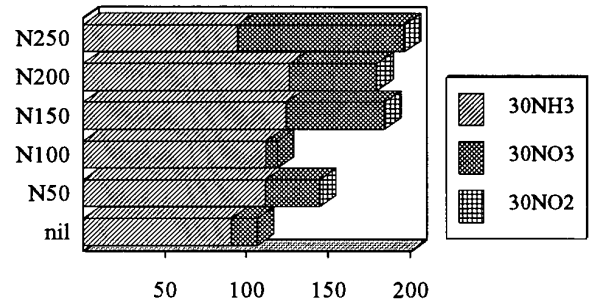
	nil	N50	N100	N150	N200	N250	sem
30TOTN	174.46	237.29	146.31	219.69	257.62	285.31	
60TOT N	170.91	96.88	81.65	154.99	92.20	151.62	
90TOT N	15.44	38.18	20.58	10.27	29.26	31.61	



Maginis Hill 2nd Experiment Soil Nitrogen 1989 kg/ha
26th June

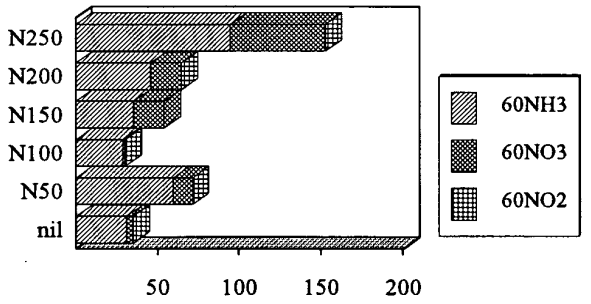
0-30cm Horizon

	nil	N50	N100	N150	N200	N250	sem
30NH3	90.7	111.5	112.1	124.0	126.4	94.8	17.21
30NO3	16.	33.	7.	60.	53.	101.	30.6
30NO2	0.000	0.155	0.000	0.305	0.170	0.615	0.1855
30TOT N	107.	145.	119.	184.	180.	197.	38.2



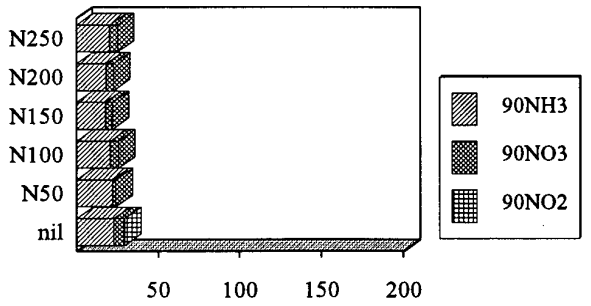
30-60cm Horizon

	nil	N50	N100	N150	N200	N250	sem
60NH3	30.7	59.1	28.6	35.3	45.5	94.6	10.31
60NO3	3.9	12.2	1.2	18.5	18.8	57.8	17.26
60NO2	0.22	0.16	0.43	0.00	0.16	0.37	0.257
60TOT N	34.8	71.4	30.3	53.8	64.4	152.7	18.96



60-90cm Horizon

	nil	N50	N100	N150	N200	N250	sem
90NH3	22.8	21.9	20.5	17.6	18.2	20.3	3.57
90NO3	6.43	2.23	5.12	4.41	4.56	5.08	1.081
90NO2	0.145	0.000	0.000	0.000	0.000	0.000	0.0592
90TOT N	29.4	24.2	25.6	22.0	22.8	25.4	3.23



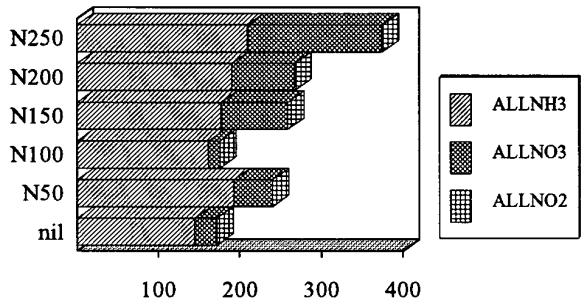
Maginis Hill 2nd Experiment Soil Nitrogen 1989 kg/ha
26th June

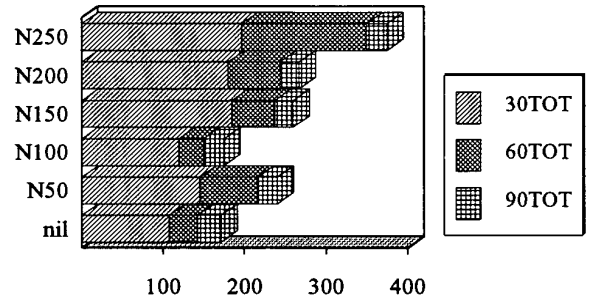
0-30cm Horizon

	nil	N50	N100	N150	N200	N250	sem
ALLNH3	144.2	192.5	161.2	176.9	190.1	209.7	15.9
ALLNO3	27.	48.	14.	82.	77.	164.	46.3
ALLNO2	0.38	0.31	0.43	0.31	0.33	0.99	0.395
ALLTOT N	171.	240.	175.	260.	267.	375.	47.9

Total N for each horizon

	nil	N50	N100	N150	N200	N250	sem
30TOT N	107.	145.	119.	184.	180.	197.	38.2
60TOT N	34.8	71.4	30.3	53.8	64.4	152.7	18.96
90TOT N	29.4	24.2	25.6	22.0	22.8	25.4	3.23

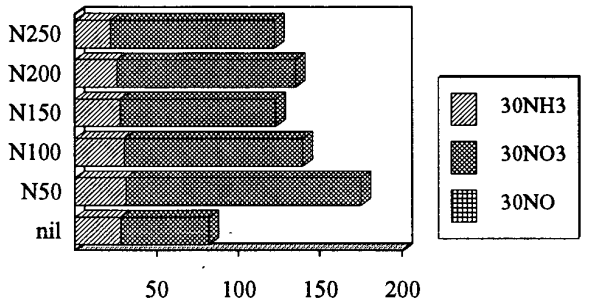




Maginis Hill 2nd Experiment Soil Nitrogen 1989 kg/ha 22nd September

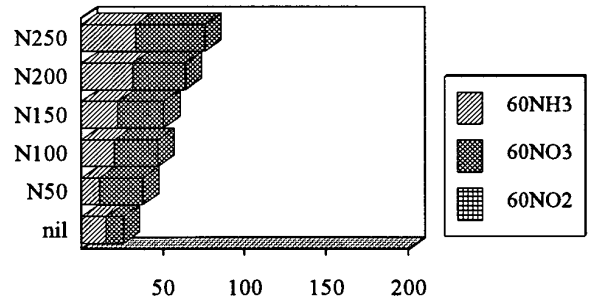
0-30cm Horizon

	nil	N50	N100	N150	N200	N250	sem
30NH3	27.7	30.8	29.7	27.0	25.2	21.4	6.96
30NO3	54.	144.	110.	96.	110.	101.	39.1
30NO	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30TOT N	81.	174.	140.	123.	135.	122.	41.2



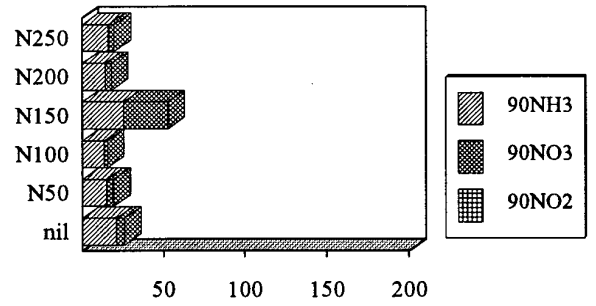
30-60cm Horizon

	nil	N50	N100	N150	N200	N250	sem
60NH3	14.6	10.7	19.8	22.2	31.2	32.9	4.59
60NO3	10.6	26.9	26.9	28.0	32.5	42.7	12.61
60NO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60TOT N	25.3	37.6	46.7	50.2	63.7	75.6	10.97



60-90cm Horizon

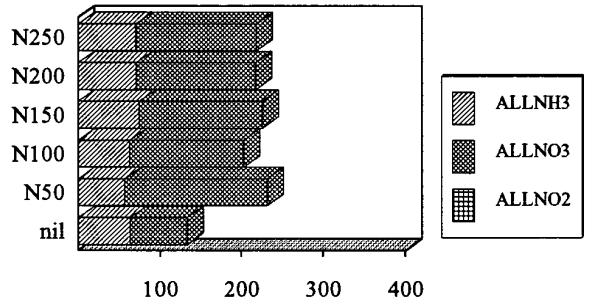
	nil	N50	N100	N150	N200	N250	sem
90NH3	20.9	14.8	13.2	25.4	14.0	16.0	4.75
90NO3	5.0	4.4	2.2	27.1	4.2	3.7	9.36
90NO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90TOT N	25.9	19.2	15.4	52.6	18.2	19.7	13.81



Maginis Hill 2nd Experiment Soil Nitrogen 1989 kg/ha 22nd September

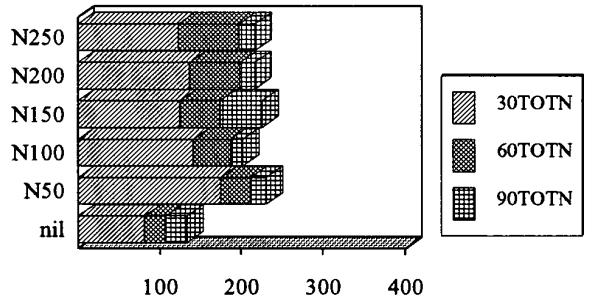
Total for all horizons

	nil	N50	N100	N150	N200	N250	sem
ALLNH3	63.2	56.3	62.7	74.6	70.4	70.2	11.15
ALLNO3	69.	175.	140.	151.	147.	148.	48.4
ALLNO2	0.00	0.00	0.00	0.00	0.00	0.00	0.000
ALLTOT N	132.	231.	202.	226.	217.	218.	49.4



Total for each horizon

	nil	N50	N100	N150	N200	N250	sem
30TOTN	81.	174.	140.	123.	135.	122.	41.2
60TOTN	25.3	37.6	46.7	50.2	63.7	75.6	10.97
90TOTN	25.9	19.2	15.4	52.6	18.2	19.7	13.81



Brown Hill 1st Experiment Soil Nitrogen 1990 kg/ha 30th April

0-15cm horizon

	nil	N50	N150	N200	sem
15NH3	11.4	14.2	17.3	20.9	2.78
15NO3	15.4	28.1	36.0	38.5	4.51
15NO2	0.00	0.00	0.00	0.00	0.000
15TOTN	26.7	42.2	53.3	59.3	6.55

15-30cm horizon

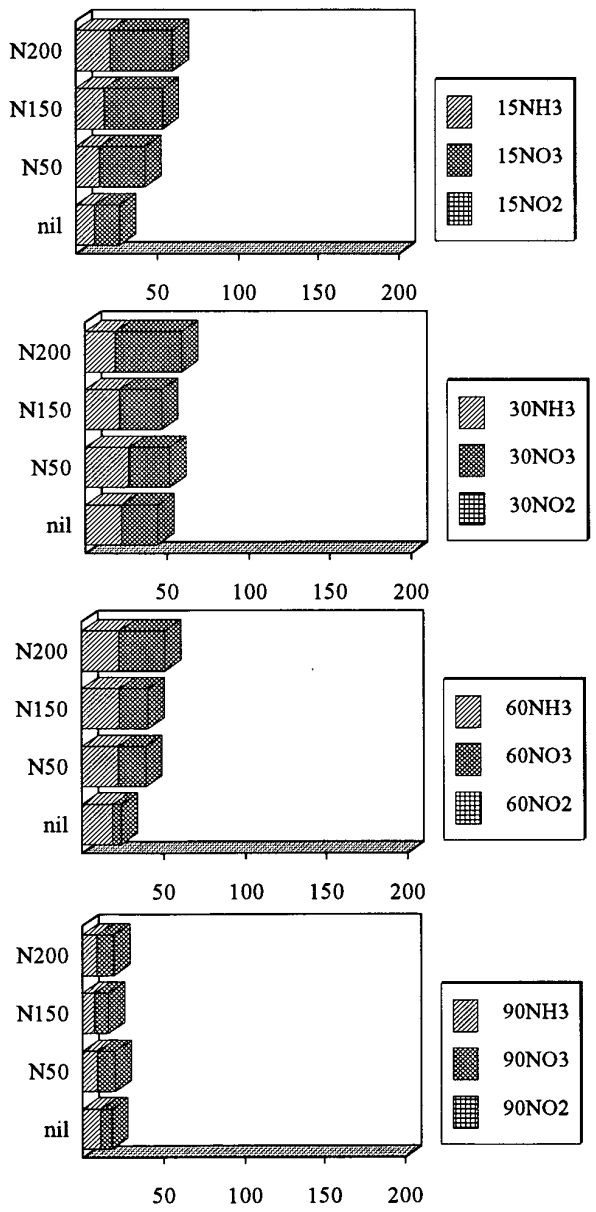
	nil	N50	N150	N200	sem
30NH3	21.8	26.5	20.8	18.3	4.09
30NO3	22.4	25.0	26.0	40.7	3.18
30NO2	0.00	0.00	0.00	0.00	0.000
30TOTN	44.3	51.5	46.8	59.0	4.86

30-60cm horizon

	nil	N50	N150	N200	sem
60NH3	18.6	21.7	22.8	22.6	3.84
60NO3	5.2	17.2	17.7	28.2	4.56
60NO2	0.00	0.00	0.00	0.00	0.000
60TOTN	23.8	38.9	40.5	50.8	7.46

60-90cm horizon

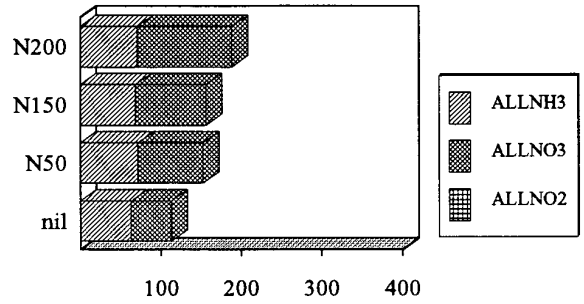
	nil	N50	N150	N200	sem
90NH3	11.0	9.0	7.1	8.6	2.36
90NO3	6.9	10.8	8.6	10.5	2.08
90NO2	0.00	0.00	0.00	0.00	0.000
90TOTN	17.9	19.8	15.7	19.1	2.75



Brown Hill 1st Experiment Soil Nitrogen 1990 kg/ha
30th April

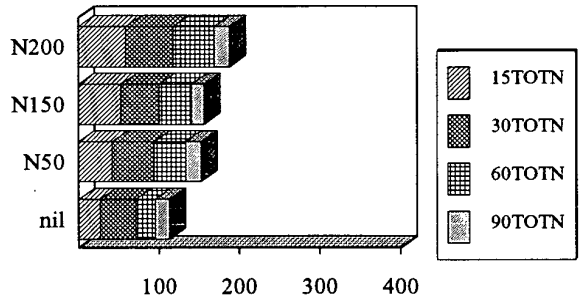
Total, all horizons

	nil	N50	N150	N200	sem
ALLNH3	62.8	71.3	67.9	70.4	4.23
ALLNO3	49.9	81.1	88.4	117.9	
ALLNO2	0.00	0.00	0.00	0.00	0.000
ALLTOTN	112.7	152.4	156.3	188.3	9.30



Total N for each horizon

	nil	N50	N150	N200	sem
15TOTN	26.7	42.2	53.3	59.3	6.55
30TOTN	44.3	51.5	46.8	59.0	4.86
60TOTN	23.8	38.9	40.5	50.8	7.46
90TOTN	17.9	19.8	15.7	19.1	2.75



Brown Hill 1st Experiment Soil Nitrogen 1990 kg/ha 13th June

0-15cm horizon

	nil	N50	N150	N200	sem
15NH3	6.8	11.4	7.4	12.4	2.59
15NO3	23.3	8.3	15.0	13.3	5.68
15NO2	0.000	0.115	0.075	0.000	0.0574
15TOTN	30.1	19.9	22.5	25.8	6.26

15-30cm horizon

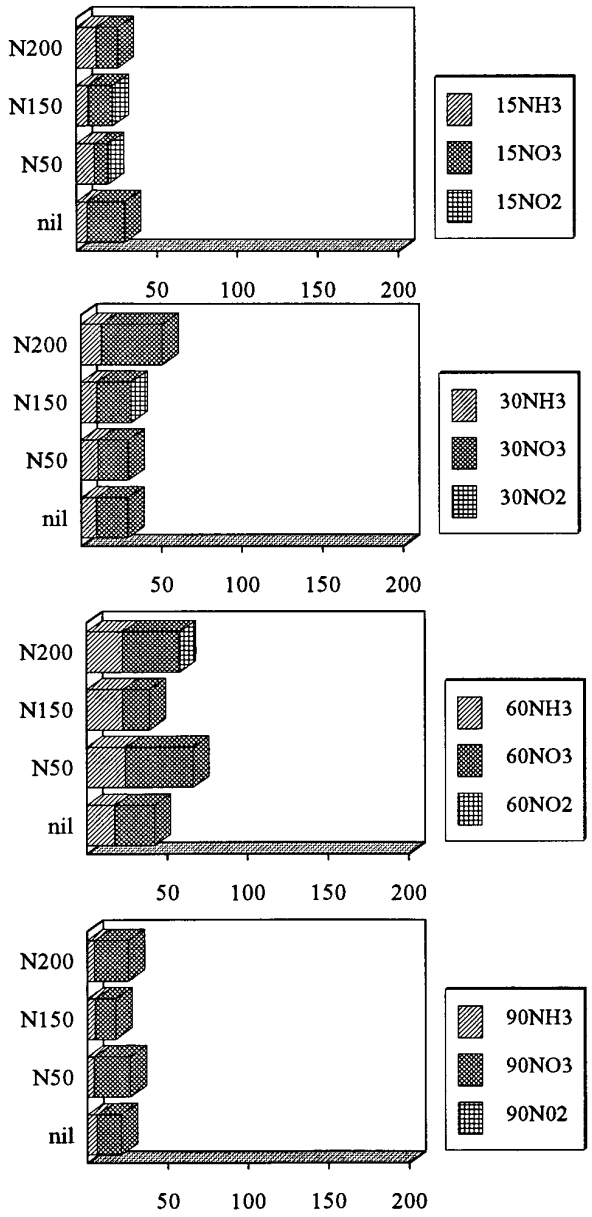
	nil	N50	N150	N200	sem
30NH3	9.26	10.60	9.86	12.60	1.534
30NO3	19.7	18.7	21.1	37.9	3.93
30NO2	0.000	0.000	0.123	0.047	0.0476
30TOTN	29.0	29.3	31.1	50.6	4.66

30-60cm horizon

	nil	N50	N150	N200	sem
60NH3	17.4	24.1	22.3	22.3	3.46
60NO3	24.5	41.6	16.5	35.2	8.92
60NO2	0.000	0.000	0.000	0.313	0.1563
60TOTN	42.0	65.7	38.8	57.9	10.49

60-90cm horizon

	nil	N50	N150	N200	sem
90NH3	6.10	4.41	4.93	4.64	1.385
90NO3	15.1	22.1	12.9	21.0	3.44
90N02	0.00	0.00	0.00	0.00	0.000
90TOTN	21.2	26.5	17.9	25.7	3.83



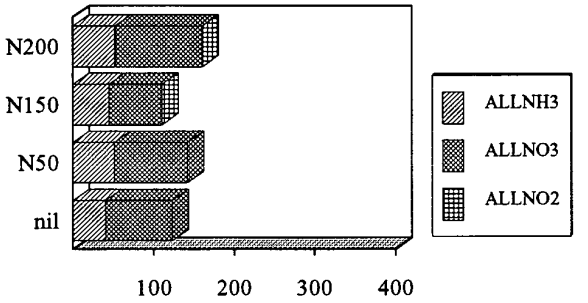
Brown Hill 1st Experiment Soil Nitrogen 1990 kg/ha
13th June

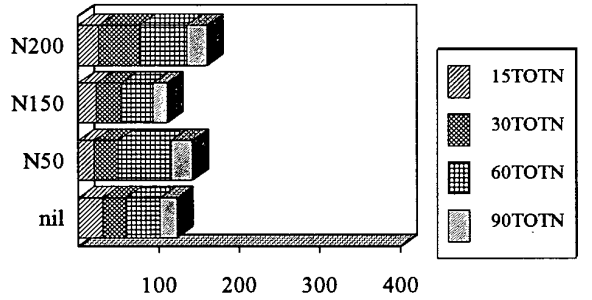
0-15cm horizon

	nil	N50	N150	N200	sem
ALLNH3	39.6	50.6	44.5	52.0	5.83
ALLNO3	82.7	90.6	65.5	107.5	13.73
ALLNO2	0.000	0.115	0.198	0.360	0.1796
ALLTOTN	122.2	141.4	110.2	159.9	16.12

Total N for each horizon

	nil	N50	N150	N200	sem
15TOTN	30.1	19.9	22.5	25.8	6.26
30TOTN	29.0	29.3	31.1	50.6	4.66
60TOTN	42.0	65.7	38.8	57.9	10.49
90TOTN	21.2	26.5	17.9	25.7	3.83





Brown Hill 1st Experiment Soil Nitrogen 1990 kg/ha
25th September

0-15cm horizon

	nil	N50	N150	N200	sem
15NH3	37.5	37.4	31.7	30.9	5.67
15NO3	26.6	28.4	44.6	68.7	6.32
15NO2	0.00	0.00	0.00	0.00	0.00
15TOTN	64.2	65.7	76.3	99.6	6.20

15-30cm horizon

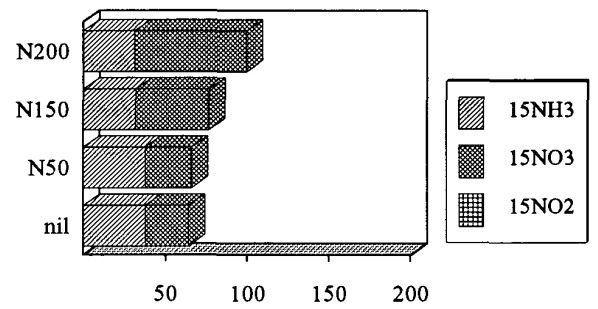
	nil	N50	N150	N200	sem
30NH3	40.6	46.8	39.3	40.6	3.74
30NO3	46.0	36.4	58.1	83.6	8.50
30NO2	0.00	0.00	0.00	0.00	0.000
30TOTN	86.6	83.2	97.4	124.1	8.60

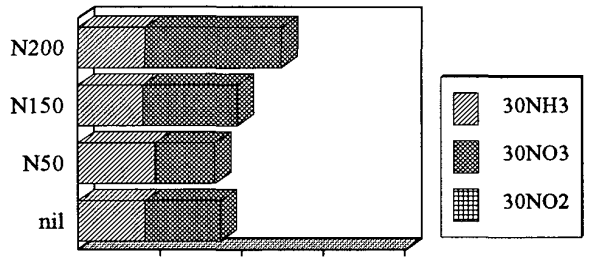
30-60cm horizon

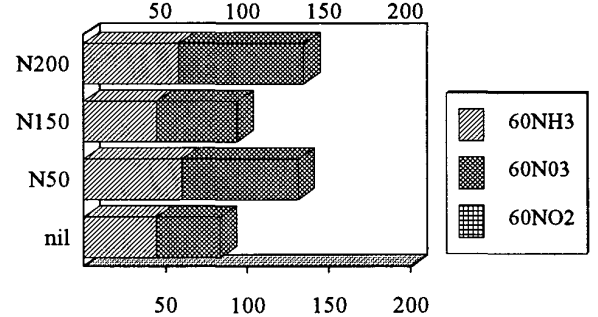
	nil	N50	N150	N200	sem
60NH3	44.1	59.7	44.4	57.9	7.42
60N03	39.1	71.5	49.2	76.6	10.45
60NO2	0.00	0.00	0.00	0.00	0.000
60TOTN	83.2	131.2	93.5	134.5	13.17

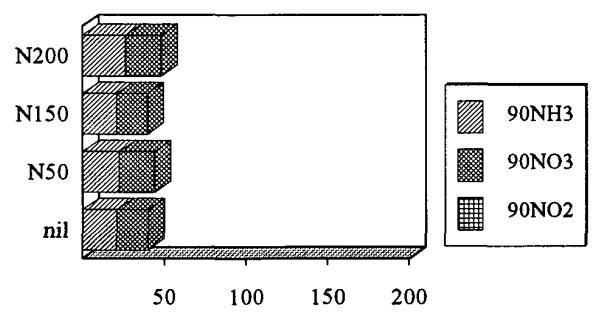
60-90cm horizon

	nil	N50	N150	N200	sem
90NH3	20.41	21.88	20.54	25.69	1.679
90NO3	19.24	21.88	18.70	22.32	1.470
90NO2	0.00	0.00	0.00	0.00	0.000
90TOTN	39.7	43.8	39.2	48.0	2.56









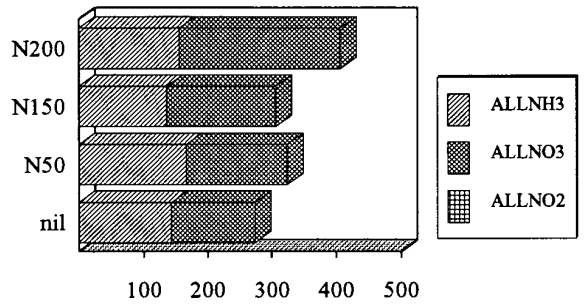
Brown Hill 1st Experiment Soil Nitrogen 1990 kg/ha
25th September

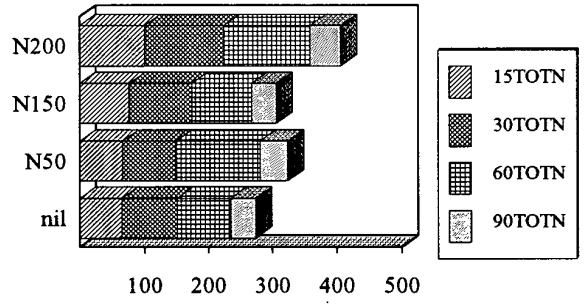
Total, all horizons

	nil	N50	N150	N200	sem
ALLNH3	142.7	165.7	135.9	155.0	11.19
ALLNO3	130.9	158.2	170.5	251.3	14.98
ALLNO2	0.00	0.00	0.00	0.00	0.00
ALLTOTN	273.6	323.9	306.4	406.2	11.02

Total N for each horizon

	nil	N50	N150	N200	sem
15TOTN	64.2	65.7	76.3	99.6	6.20
30TOTN	86.6	83.2	97.4	124.1	8.60
60TOTN	83.2	131.2	93.5	134.5	13.17
90TOTN	39.7	43.8	39.2	48.0	2.56





Maginis Hill 2nd Experiment Soil Nitrogen 1990 kg/ha 25th April

0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	20.7	25.9	46.1	80.5	6.39
15NO3	26.9	40.9	43.8	64.6	5.87
15NO2	0.760	0.525	0.510	1.725	0.1755
15 TOT N	54.4	67.3	91.4	146.8	6.74

15-30cm horizon

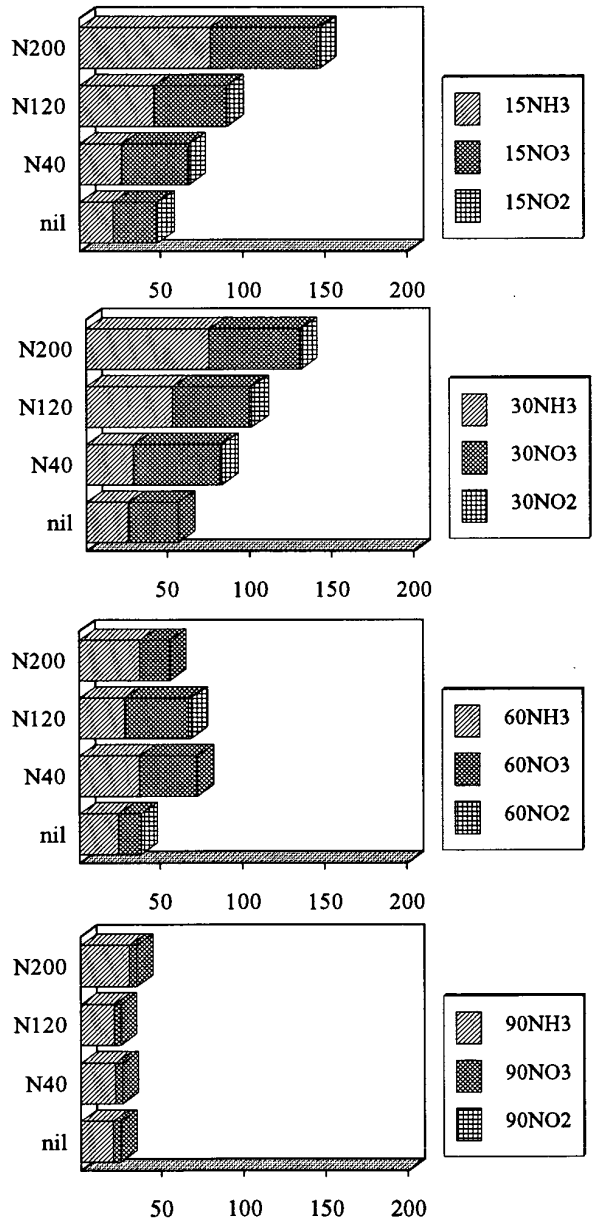
	nil	N40	N120	N200	sem
30NH3	25.9	28.9	53.3	75.4	10.67
30NO3	30.8	53.3	46.6	55.1	4.80
30NO2	0.00	0.82	1.25	0.55	0.350
30 TOT N	63.5	83.1	101.1	131.0	12.23

30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	23.7	37.0	28.0	37.6	6.32
60NO3	14.5	35.4	39.4	18.2	12.02
60NO2	0.14	0.00	1.29	0.00	0.656
60 TOT N	42.8	73.2	68.7	54.8	11.88

60-90 cm horizon

	nil	N40	N120	N200	sem
90NH3	19.9	21.4	20.4	30.2	4.70
90NO3	4.73	4.26	4.32	4.46	0.232
90NO2	0.00	0.00	0.00	0.00	0.000
90TOTN	24.63	25.66	24.72	34.66	



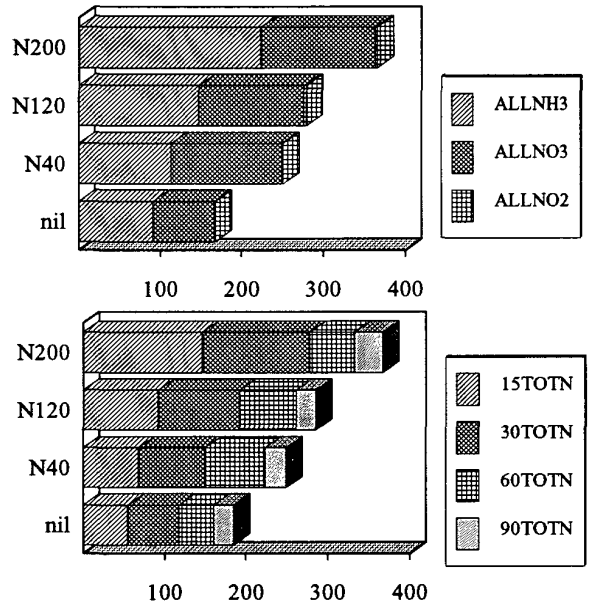
Maginis Hill 2nd Experiment Soil Nitrogen 1990 kg/ha 25th April

Total for all horizons

	nil	N40	N120	N200	sem
ALLNH3	90.3	113.3	147.7	223.7	17.31
ALLNO3	76.2	136.4	128.7	139.4	8.11
ALLNO2	1.67	1.34	3.04	2.28	0.969
ALL TOT N	189.	249.	268.	363.	27.0

Total N by horizon

	nil	N40	N120	N200	sem
15TOTN	54.4	67.3	91.4	146.8	6.74
30TOTN	63.5	83.1	101.1	131.0	12.23
60TOTN	42.8	73.2	68.7	54.8	11.88
90TOTN	24.63	25.66	24.72	34.66	



Maginis Hill 2nd Experiment Soil Nitrogen 1990 kg/ha 11th June

0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	8.10	9.86	14.78	21.49	1.440
15NO3	33.6	23.1	44.0	46.3	4.68
15NO2	0.00	-0.08	0.69	0.06	0.229
15TOT N	41.7	31.9	59.4	68.3	6.15

15-30cm horizon

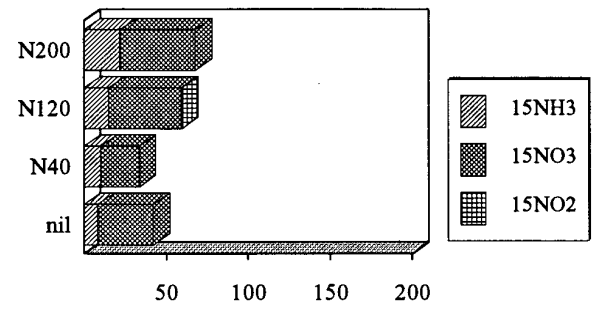
	nil	N40	N120	N200	sem
30NH3	12.51	14.22	13.95	22.61	1.327
30NO3	53.3	47.9	50.3	62.4	4.31
30NO2	0.46	-0.08	0.00	0.84	0.350
30TOT N	66.3	61.1	64.2	86.2	6.03

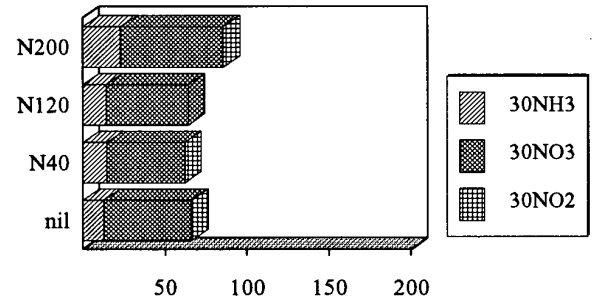
30-60cm horizon

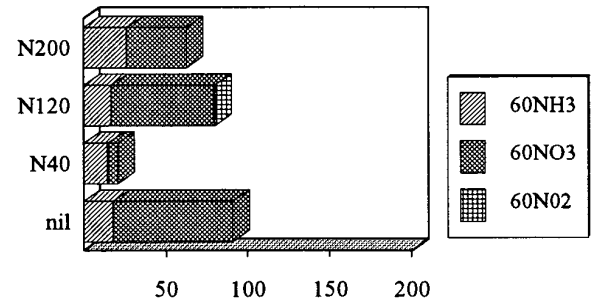
	nil	N40	N120	N200	sem
60NH3	17.7	14.5	16.5	25.9	3.89
60NO3	73.2	6.0	63.3	36.7	13.86
60N02	0.000	-0.026	0.155	-0.060	0.0919
60TOT N	90.9	17.6	80.0	66.8	16.50

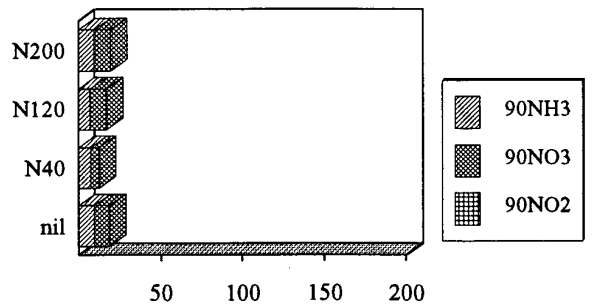
60-90cm horizon

	nil	N40	N120	N200	sem
90NH3	9.4	7.2	6.9	9.7	2.91
90NO3	9.39	5.17	10.05	9.75	1.445
90NO2	0.00	0.00	0.00	0.00	0.00
90TOT N	18.8	8.8	17.0	17.9	2.76









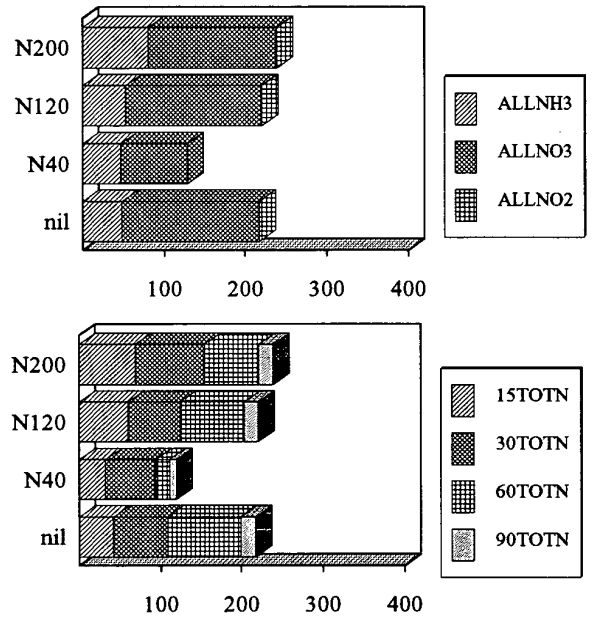
Maginis Hill 2nd Experiment Soil Nitrogen 1990 kg/ha
11th June

All horizons

	nil	N40	N120	N200	sem
ALLNH3	47.7	45.7	52.2	79.7	7.23
ALLNO3	169.6	83.4	167.5	158.6	18.91
ALLNO2	0.46	-0.22	0.85	1.06	0.447
ALLTOTN	218.	120.	221.	242.	24.4

By Horizon

	nil	N40	N120	N200	sem
15TOTN	41.7	31.9	59.4	68.3	6.15
30TOTN	66.3	61.1	64.2	86.2	6.03
60TOTN	90.9	17.6	80.0	66.8	16.50
90TOTN	18.8	8.8	17.0	17.9	2.76



Maginis Hill 2nd Experiment Soil Nitrogen 1990 kg/ha 19th September

0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	25.82	25.62	24.40	23.24	1.093
15NO3	19.8	27.6	36.5	43.8	8.13
15NO2	0.00	0.00	0.00	0.00	0.000
15TOTN	45.6	53.2	60.9	67.0	7.37

15-30cm horizon

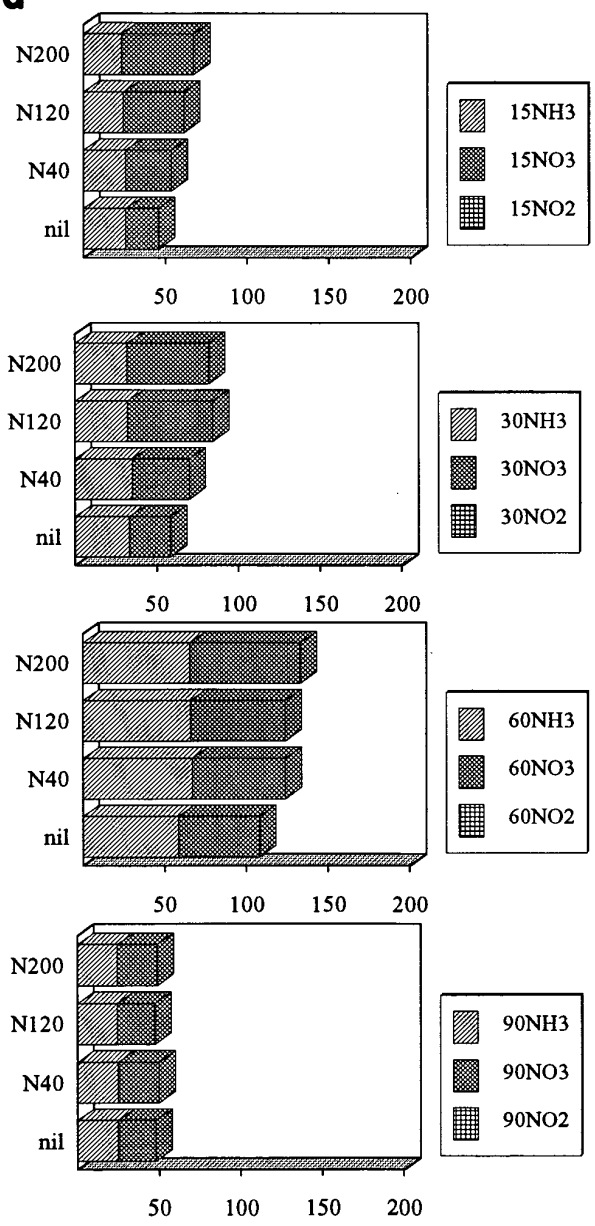
	nil	N40	N120	N200	sem
30NH3	33.00	34.81	31.90	31.76	0.909
30NO3	25.1	34.6	52.0	49.8	10.22
30NO2	0.00	0.00	0.00	0.00	0.000
30TOTN	58.1	69.4	83.9	81.5	9.79

30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	58.0	66.5	65.3	65.1	4.56
60NO3	50.1	57.4	58.6	67.8	7.68
60NO2	0.00	0.00	0.00	0.00	0.000
60TOTN	108.2	123.9	124.0	132.9	10.24

60-90cm horizon

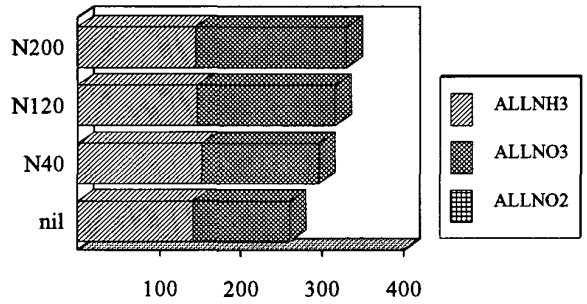
	nil	N40	N120	N200	sem
90NH3	24.75	24.74	24.30	24.22	0.201
90NO3	23.05	24.92	22.82	24.40	1.285
90NO2	0.00	0.00	0.00	0.00	0.000
90TOTN	47.80	49.66	47.13	48.61	1.394



Maginis Hill 2nd Experiment Soil Nitrogen 1990 kg/ha 19th September

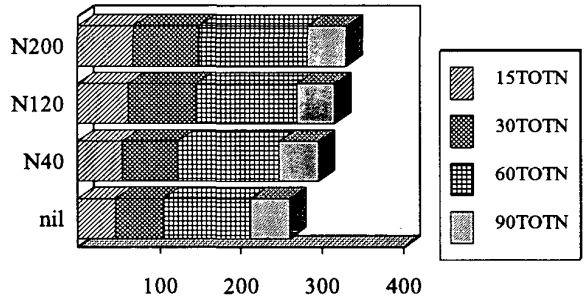
Total for all horizons

	nil	N40	N120	N200	sem
ALLNH3	141.6	151.7	145.9	144.3	5.17
ALLNO3	118.1	144.5	170.0	185.8	18.89
ALLNO2	0.00	0.00	0.00	0.00	0.000
ALLTOTN	260.	296.	316.	330.	20.3



Total N for each horizon

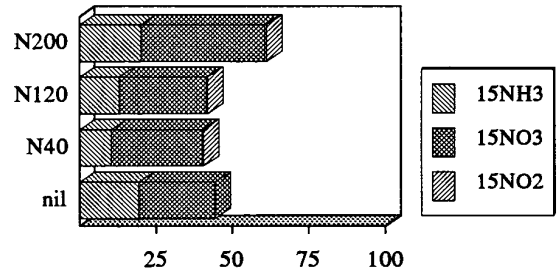
	nil	N40	N120	N200	sem
15TOTN	45.6	53.2	60.9	67.0	7.37
30TOTN	58.1	69.4	83.9	81.5	9.79
60TOTN	108.2	123.9	124.0	132.9	10.24
90TOTN	47.80	49.66	47.13	48.61	1.394



Brown Hill 3rd Experiment Soil Nitrogen 1990 kg/ha
2nd May

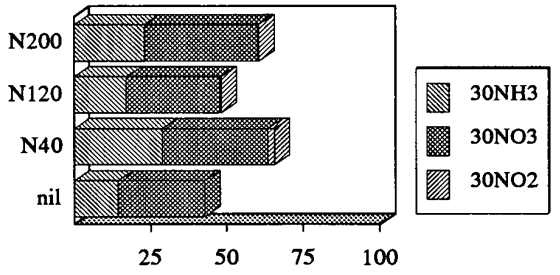
0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	19.2	10.3	12.8	19.9	5.47
15NO3	25.2	29.9	28.8	40.8	2.72
15NO2	0.00	0.46	0.44	0.67	0.315
15TOTN	44.4	40.6	42.0	61.4	6.41



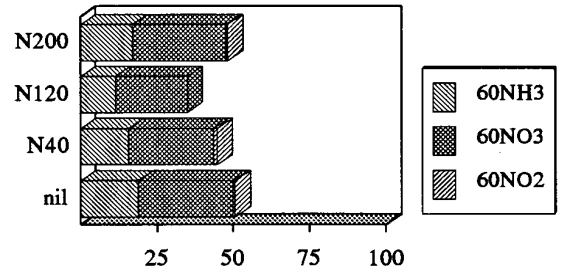
15-30cm horizon

	nil	N40	N120	N200	sem
30NH3	14.3	28.7	17.0	22.8	6.02
30NO3	28.49	34.64	30.93	37.13	1.688
30NO2	0.00	2.19	0.28	0.58	1.065
30TOTN	42.8	65.5	48.2	60.5	6.94



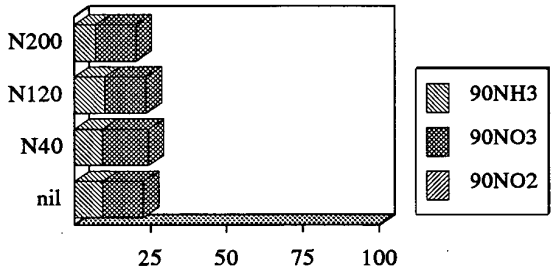
30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	18.8	15.6	11.5	17.0	3.80
60NO3	31.3	28.2	23.5	30.8	3.55
60NO2	0.66	1.10	0.00	0.54	0.703
60TOTN	50.7	44.9	35.0	48.4	6.79



60-90cm horizon

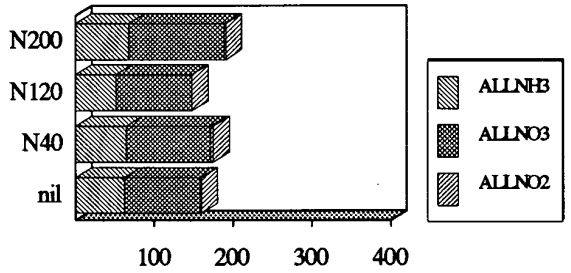
	nil	N40	N120	N200	sem
90NH3	9.32	9.28	10.03	7.15	1.128
90NO3	13.16	14.93	13.45	13.14	0.765
90NO2	0.00	0.00	0.00	0.00	0.000
90TOTN	22.49	24.20	23.47	20.28	1.439



Brown Hill 3rd Experiment Soil Nitrogen 1990 kg/ha
2nd May

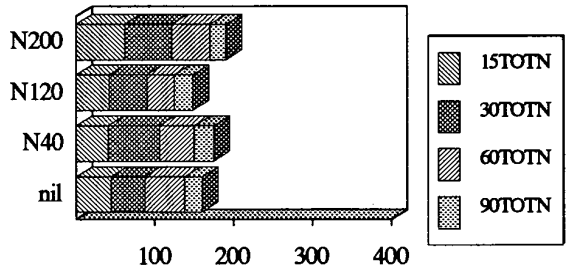
Total N, all horizons

	nil	N40	N120	N200	sem
ALLNH3	61.7	63.8	51.3	66.9	10.92
ALLNO3	98.1	107.7	96.6	121.9	5.20
ALLNO2	0.66	3.75	0.72	1.79	1.055
ALLTOTN	160.5	175.2	148.6	190.5	14.71



Total for each horizon

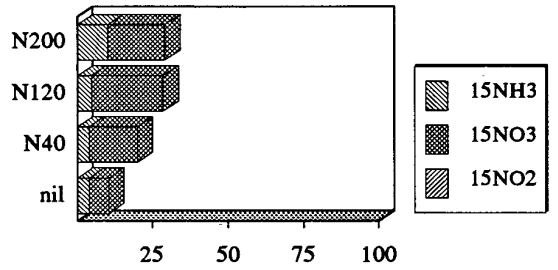
	nil	N40	N120	N200	sem
15TOTN	44.4	40.6	42.0	61.4	6.41
30TOTN	42.8	65.5	48.2	60.5	6.94
60TOTN	50.7	44.9	35.0	48.4	6.79
90TOTN	22.49	24.20	23.47	20.28	1.439



Brown Hill 3rd Experiment Soil Nitrogen 1990 kg/ha
20th JUNE

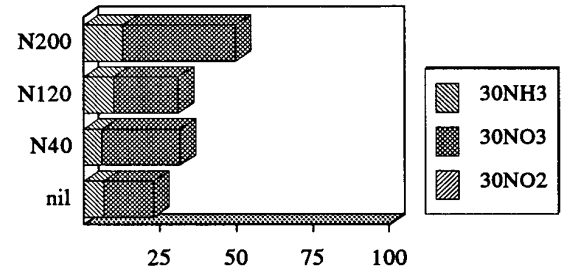
0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	3.84	3.90	4.65	10.09	1.716
15NO3	6.6	16.2	23.9	19.0	2.07
15NO2	0.00	0.00	0.00	0.00	0.00
15TOTN	11.7	19.9	30.9	31.7	2.86



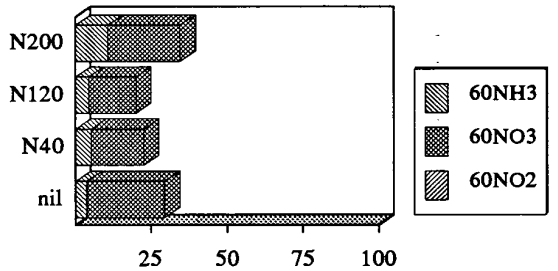
15-30cm horizon

	nil	N40	N120	N200	sem
30NH3	6.52	6.05	9.82	12.91	1.423
30NO3	16.5	25.5	21.2	36.8	5.77
30NO2	0.00	0.00	0.00	0.00	0.00
30TOTN	25.0	32.8	34.2	55.5	6.40



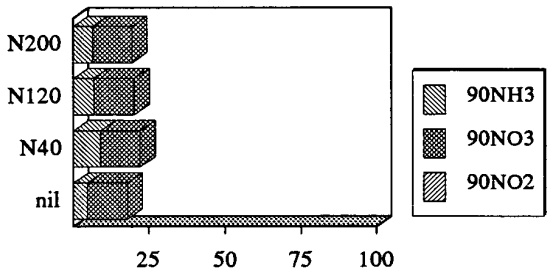
30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	3.76	5.14	4.43	10.75	1.587
60NO3	25.7	17.5	15.6	23.8	2.05
60NO2	0.00	0.00	0.00	0.00	0.00
60TOTN	30.9	25.3	21.0	40.8	2.46



60-90cm horizon

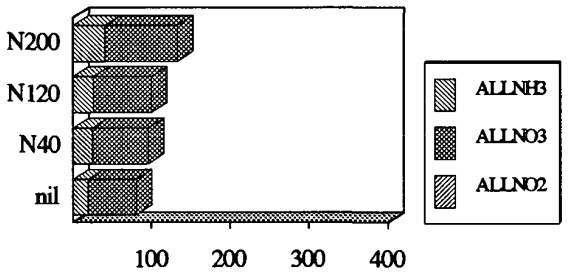
	nil	N40	N120	N200	sem
90NH3	4.6	8.9	6.8	6.5	2.06
90NO3	13.300	13.230	13.370	13.060	0.1542
90NO2	0.00	0.00	0.00	0.00	0.000
90TOTN	17.8	22.0	18.2	17.4	3.11



Brown Hill 3rd Experiment Soil Nitrogen 1990 kg/ha
20th JUNE

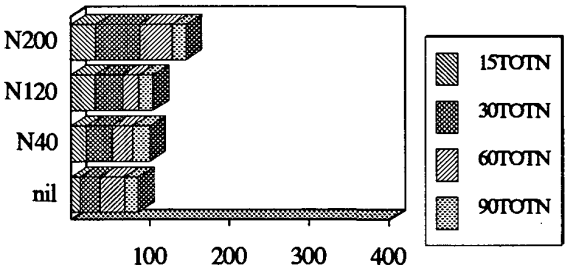
Total N, all horizons

	nil	N40	N120	N200	sem
ALLNH3	18.7	24.0	25.7	40.3	3.47
ALLNO3	62.1	72.4	74.0	92.7	5.36
ALLNO2	0.00	0.00	0.00	0.00	0.00
ALLTOTN	85.4	100.1	104.3	145.3	3.26



Total for each horizon

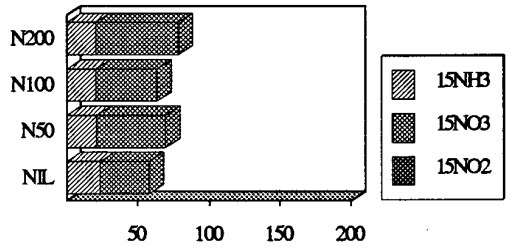
	nil	N40	N120	N200	sem
15TOTN	11.7	19.9	30.9	31.7	2.86
30TOTN	25.0	32.8	34.2	55.5	6.40
60TOTN	30.9	25.3	21.0	40.8	2.46
90TOTN	17.8	22.0	18.2	17.4	3.11



Brown Hill 3rd Experiment Soil Nitrogen 1990 kg/ha
20th September

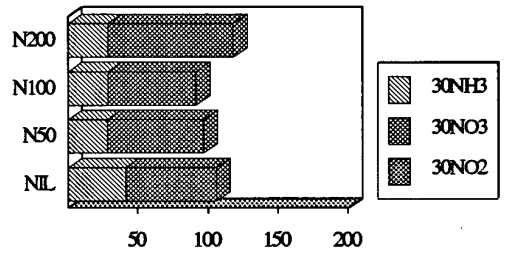
0-15cm horizon

	nil	N40	N120	N200	sem
15nh3	23.28	20.95	20.40	20.27	1.335
15no3	34.7	48.4	43.1	58.0	5.54
15no2	0.00	0.00	0.00	0.00	0.000
15totN	58.0	69.3	63.5	78.3	6.33



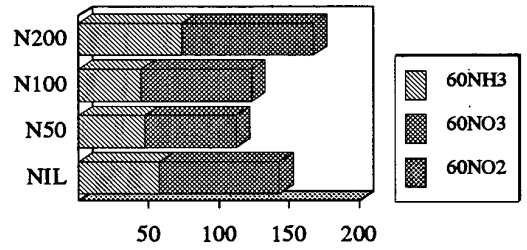
15-30cm horizon

	nil	N40	N120	N200	sem
30HN3	41.2	28.1	28.4	28.3	4.05
30NO3	64.2	68.3	62.8	89.3	6.13
30NO2	0.00	0.00	0.00	0.00	0.00
30TOTN	105.4	96.4	91.2	117.6	8.45



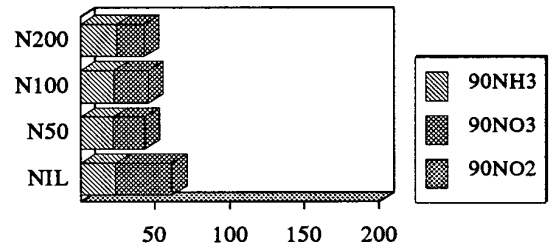
30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	57.8	47.6	44.6	73.4	8.84
60NO3	85.2	64.4	78.5	94.0	6.29
60NO2	0.00	0.00	0.00	0.00	0.000
60TOTN	143.0	112.0	123.1	167.4	11.41



60-90cm horizon

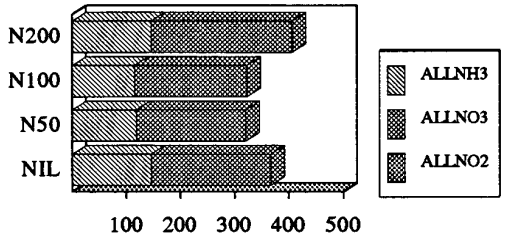
	nil	N40	N120	N200	sem
90NH3	23.74	22.02	22.25	24.20	1.362
90NO3	37.6	21.2	23.4	18.6	6.89
90NO2	0.00	0.00	0.00	0.00	0.000
90TOTN	61.3	43.3	45.6	42.8	6.85



Brown Hill 3rd Experiment Soil Nitrogen 1990 kg/ha
20th September

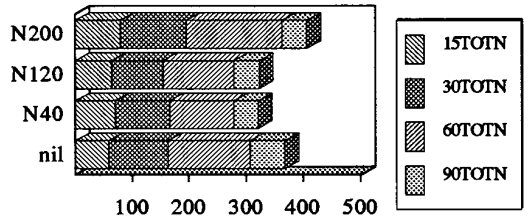
Total N, all depths

	nil	N40	N120	N200	sem
ALLNH3	145.9	118.7	115.6	146.1	12.61
ALLNO3	221.7	202.3	207.8	260.0	14.63
ALLNO2	0.00	0.00	0.00	0.00	0.00
ALLTOTN	368.	321.	323.	406.	24.1



Total for each Horizon

	nil	N40	N120	N200	sem
15TOTN	58.0	69.3	63.5	78.3	6.33
30TOTN	105.4	96.4	91.2	117.6	8.45
60TOTN	143.0	112.0	123.1	167.4	11.41
90TOTN	61.3	43.3	45.6	42.8	6.8



Brown Hill 1st Experiment Soil Nitrogen 1991 kg/ha
15th May

0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	4.9	14.8	23.7	54.1	4.86
15NO2	0.112	0.192	0.180	0.085	0.0334
15NO3	10.1	19.4	24.4	61.7	5.92
15TOTN	15.2	34.4	48.2	115.8	10.60

15-30cm horizon

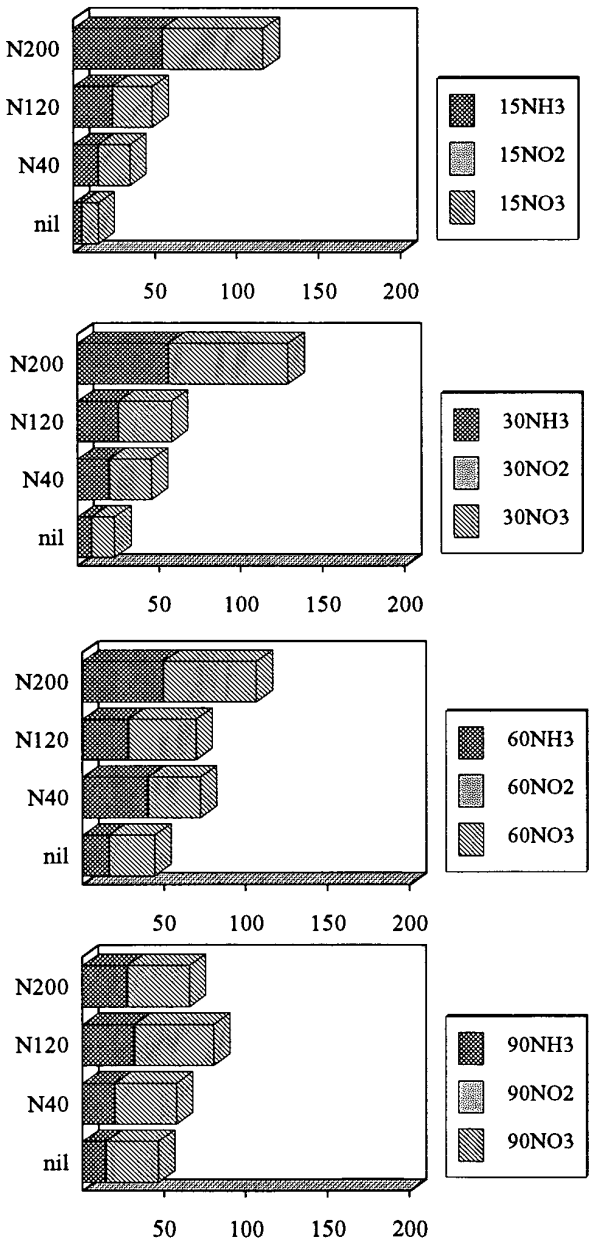
	nil	N40	N120	N200	sem
30NH3	8.2	19.0	24.8	55.5	4.93
30NO2	0.113	0.263	0.185	0.113	0.0627
30NO3	14.3	26.0	32.3	73.2	5.88
30TOTN	22.6	45.3	57.2	128.8	10.23

30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	15.9	39.5	27.7	49.2	10.60
60NO2	0.415	0.928	0.543	0.483	0.1489
60NO3	27.8	31.6	41.1	56.9	3.35
60TOTN	44.1	72.0	69.4	106.6	10.46

60-90cm horizon

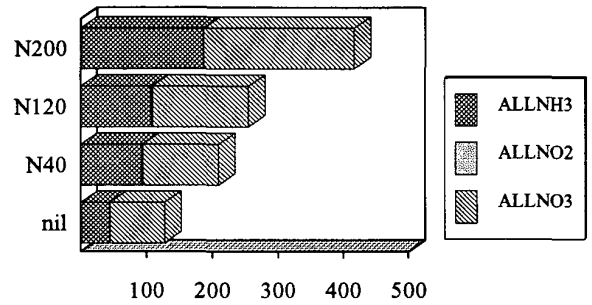
	nil	N40	N120	N200	sem
90NH3	14.0	19.4	31.3	27.2	5.90
90NO2	0.463	0.530	0.755	0.298	0.1854
90NO3	31.8	37.5	48.2	37.9	4.26
90TOTN	46.3	57.4	80.3	65.4	8.39



Brown Hill 1st Experiment Soil Nitrogen 1991 kg/ha
15th May

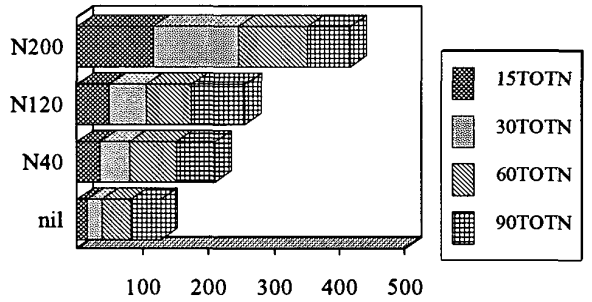
Total N, all depths

	nil	N40	N120	N200	sem
ALLNH3	43.0	92.7	107.4	185.9	16.76
ALLNO2	1.11	1.91	1.66	0.98	0.348
ALLNO3	84.1	114.5	146.0	229.7	12.07
ALLTOTN	128.	209.	255.	417.	22.4



Total N for each horizon

	nil	N40	N120	N200	sem
15TOTN	15.2	34.4	48.2	115.8	10.60
30TOTN	22.6	45.3	57.2	128.8	10.23
60TOTN	44.1	72.0	69.4	106.6	10.46
90TOTN	46.3	57.4	80.3	65.4	8.39



Brown Hill 1st Experiment Soil Nitrogen 1991 kg/ha
25th June

0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	17.4	21.5	31.1	55.3	8.10
15NO2	0.135	0.095	0.115	0.238	0.0498
15NO3	7.4	9.1	11.9	38.5	5.80
15TOTN	25.0	30.7	43.1	94.1	11.53

15-30cm horizon

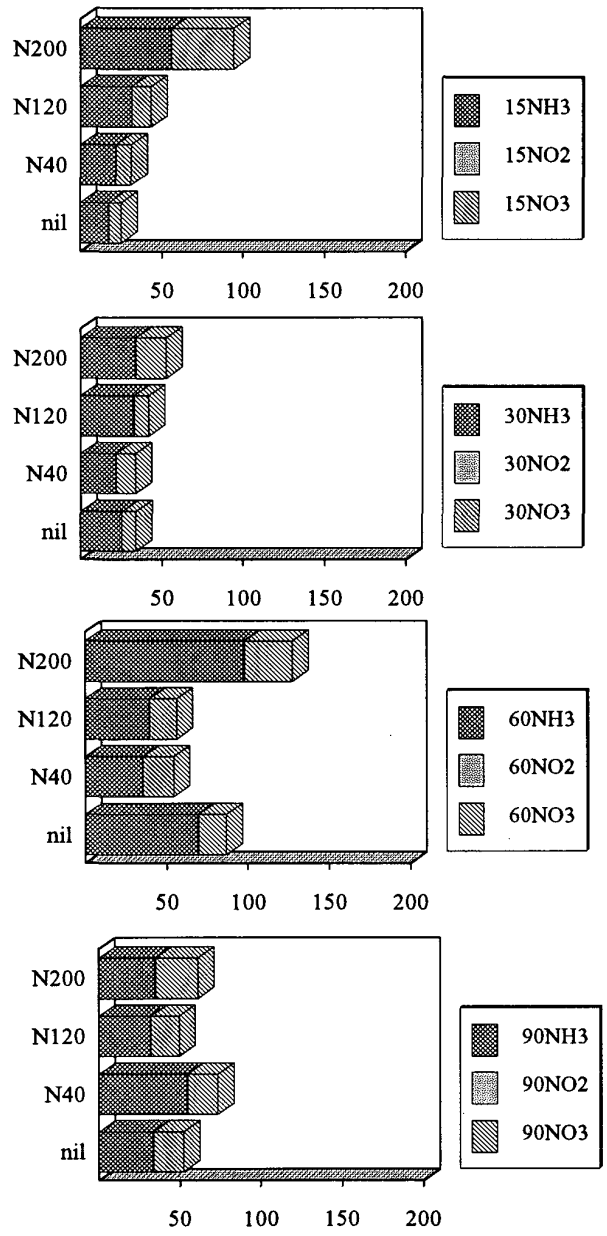
	nil	N40	N120	N200	sem
30NH3	25.0	21.4	32.3	33.4	7.65
30NO2	0.355	0.118	0.172	0.215	0.0633
30NO3	8.54	11.97	9.19	18.66	1.703
30TOTN	33.9	33.5	41.7	52.3	8.82

30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	68.8	34.9	38.7	97.1	9.04
60NO2	0.800	0.192	0.387	0.775	0.1088
60NO3	17.1	18.9	16.9	29.3	3.16
60TOTN	86.7	54.0	56.0	127.1	10.19

60-90cm horizon

	nil	N40	N120	N200	sem
90NH3	32.9	54.1	31.6	34.2	18.86
90NO2	0.66	0.35	0.28	0.43	0.235
90NO3	18.5	18.8	17.5	26.6	3.33
90TOTN	52.	73.	49.	61.	20.9



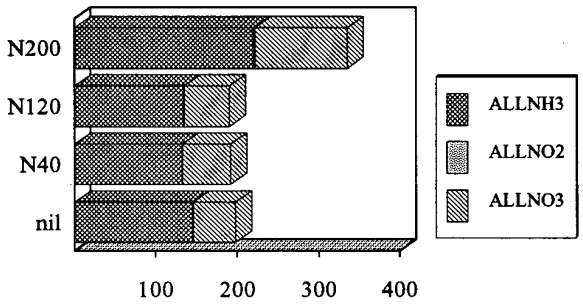
Brown Hill 1st Experiment Soil Nitrogen 1991 kg/ha
25th June

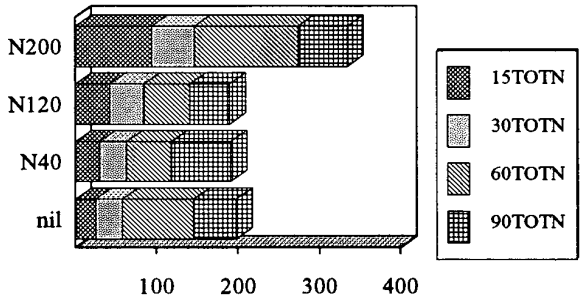
Total N, all depths

	nil	N40	N120	N200	sem
ALLNH3	144.	132.	134.	220.	33.6
ALLNO2	1.95	0.76	0.96	1.66	0.343
ALLNO3	51.6	58.8	55.4	113.1	10.68
ALLTOTN	198.	192.	190.	335.	39.8

Total N for each horizon

	nil	N40	N120	N200	sem
15TOTN	25.0	30.7	43.1	94.1	11.53
30TOTN	33.9	33.5	41.7	52.3	8.82
60TOTN	86.7	54.0	56.0	127.1	10.19
90TOTN	52.	73.	49.	61.	20.9





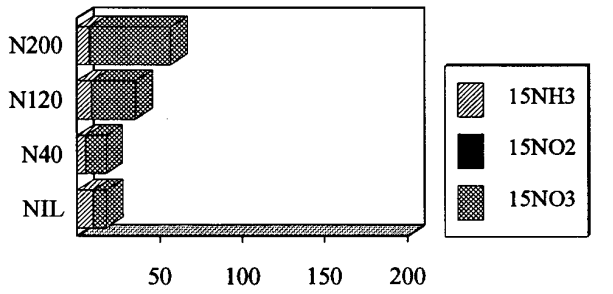
Brown Hill 1st Experiment Soil Nitrogen 1991 kg/ha
23rd September

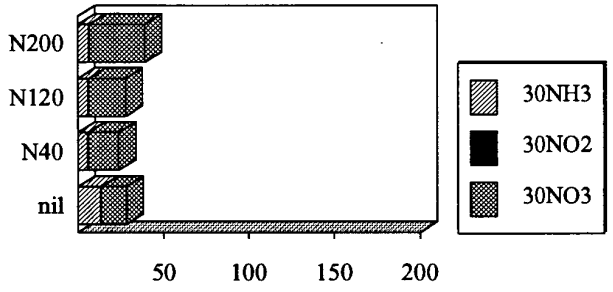
0-15cm horizon	nil	N40	N120	N200	sem
15NH3	9.32	5.00	8.46	7.30	1.486
15NO2	0.252	0.122	0.175	0.227	0.0626
15NO3	7.8	12.2	26.7	48.8	3.36
15TOTN	17.3	17.3	35.4	56.3	3.63

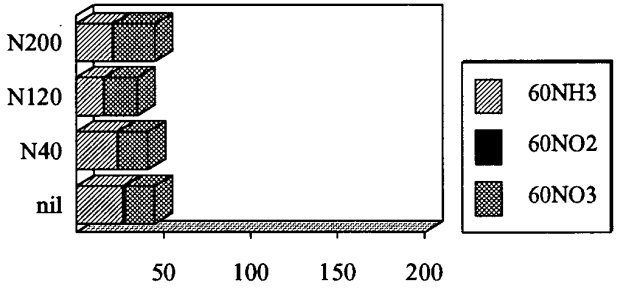
15-30cm horizon	nil	N40	N120	N200	sem
30NH3	13.2	5.7	6.2	6.6	2.63
30NO2	0.308	0.220	0.237	0.135	0.0722
30NO3	14.6	18.0	21.5	32.4	2.89
30TOTN	28.1	23.9	27.9	39.1	4.76

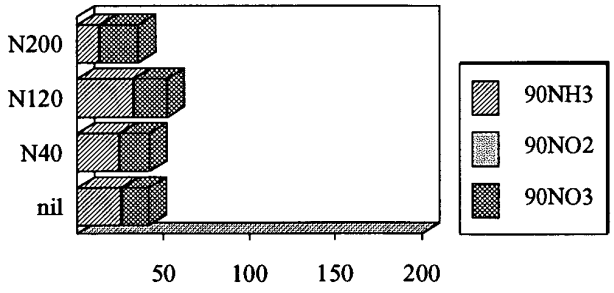
30-60cm horizon	nil	N40	N120	N200	sem
60NH3	26.6	23.3	15.5	20.8	4.74
60NO2	0.890	0.670	0.445	0.640	0.1879
60NO3	17.5	17.3	19.4	24.0	2.21
60TOTN	44.9	41.3	35.3	45.5	5.92

60-90cm horizon	nil	N40	N120	N200	sem
90NH3	25.2	24.1	32.5	12.7	7.40
90NO2	0.940	0.755	0.665	0.700	0.1067
90NO3	15.5	17.1	19.1	22.4	2.23
90TOTN	41.7	42.0	52.2	35.9	7.75





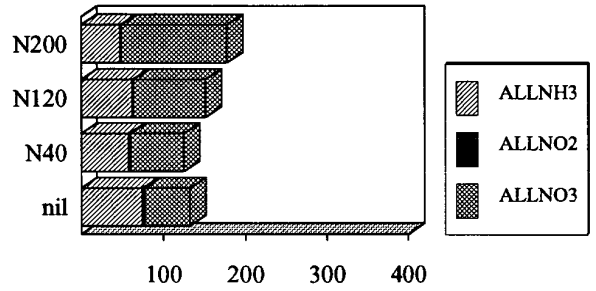




Brown Hill 1st Experiment Soil Nitrogen 1991 kg/ha
23rd September

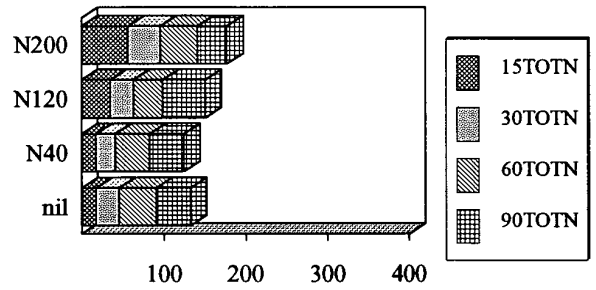
Total N, all depths

	nil	N40	N120	N200	sem
ALLNH3	74.3	58.0	62.5	47.4	11.67
ALLNO2	2.39	1.77	1.52	1.70	0.324
ALLNO3	55.4	64.6	86.8	127.6	8.63
ALLTOTN	132.0	124.4	150.8	176.7	17.32



By Horizon

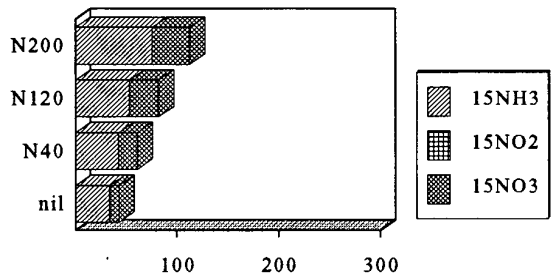
	nil	N40	N120	N200	sem
15TOTN	17.3	17.3	35.4	56.3	3.63
30TOTN	28.1	23.9	27.9	39.1	4.76
60TOTN	44.9	41.3	35.3	45.5	5.92
90TOTN	41.7	42.0	52.2	35.9	7.75



Maginis Hill 2nd Experiment Soil Nitrogen 1991 kg/ha
15th May

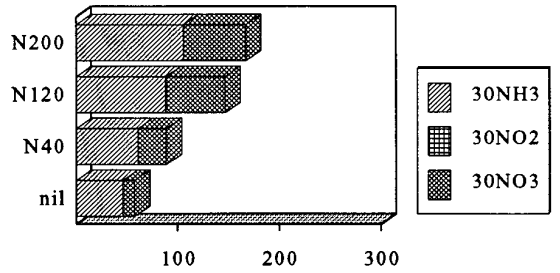
0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	33.7	42.2	53.0	75.3	5.64
15NO2	0.148	0.065	0.045	0.075	0.0644
15NO3	8.9	18.4	28.7	37.1	5.57
15TOTN	42.8	60.6	81.8	112.5	10.07

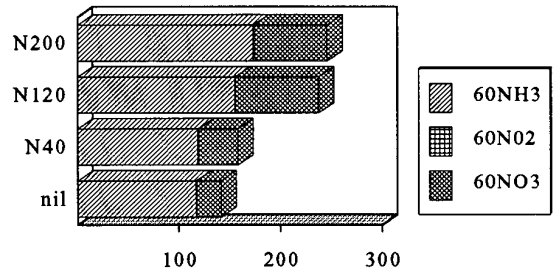


15-30cm horizon

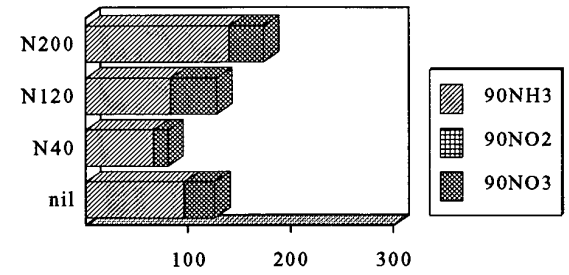
	nil	N40	N120	N200	sem
30NH3	45.9	60.7	88.3	105.8	9.93
30NO2	0.172	0.110	0.050	0.085	0.0846
30NO3	11.5	27.9	58.2	60.9	10.05
30TOTN	57.6	88.7	146.5	166.8	19.13



	NIL	40	120	200	SEM
30-60cm horizon					
	nil	N40	N120	N200	sem
60NH3	117.	119.	155.	173.	21.9
60N02	0.45	0.21	0.11	0.15	0.209
60NO3	23.8	38.8	82.0	72.5	14.35
60TOTN	141.	158.	237.	246.	32.0



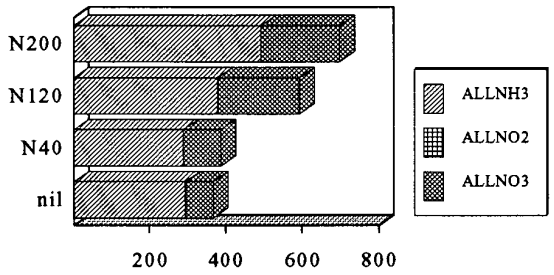
	NIL	40	120	200	SEM
60-90cm horizon					
	nil	N40	N120	N200	sem
90NH3	96.	66.	83.	140.	28.8
90NO2	0.293	0.225	0.072	0.145	0.1651
90NO3	29.7	14.3	45.0	33.4	6.88
90TOTN	126.	81.	128.	174.	31.7



Maginis Hill 2nd Experiment Soil Nitrogen 1991 kg/ha
15th May

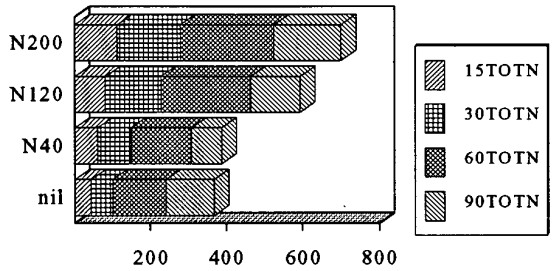
Total, all horizons

	nil	N40	N120	N200	sem
ALLNH3	293.	288.	379.	494.	51.8
ALLNO2	1.06	0.61	0.27	0.45	0.504
ALLNO3	74.	99.	214.	204.	33.0
ALLTOTN	368.	388.	594.	699.	71.7



Total N for each horizon

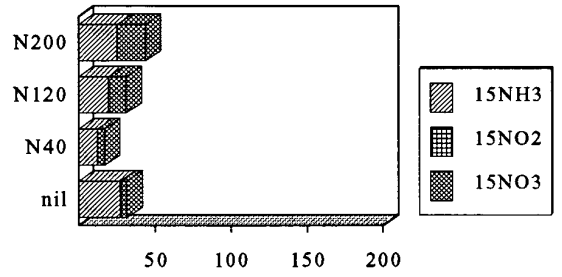
	nil	N40	N120	N200	sem
15TOTN	42.8	60.6	81.8	112.5	10.07
30TOTN	57.6	88.7	146.5	166.8	19.13
60TOTN	141.	158.	237.	246.	32.0
90TOTN	126.	81.	128.	174.	31.7



Maginis Hill 2nd Experiment Soil Nitrogen 1991 kg/ha 25th June

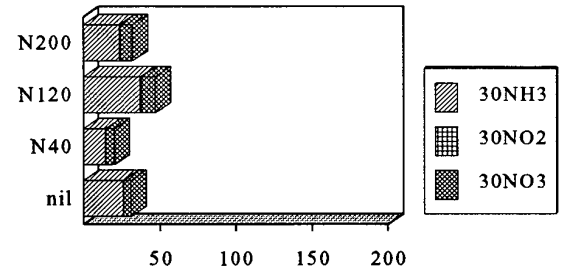
0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	27.1	12.2	19.4	25.2	3.35
15NO2	0.468	0.180	0.390	0.110	0.1788
15NO3	4.0	4.8	11.4	18.2	3.85
15TOTN	31.5	17.2	31.2	43.6	5.89



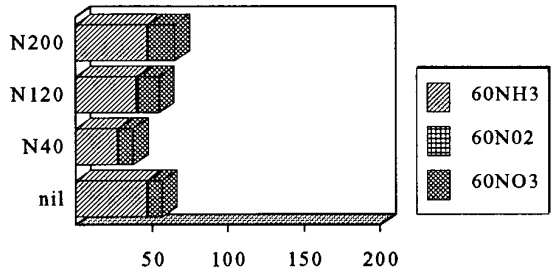
15-30cm horizon

	nil	N40	N120	N200	sem
30NH3	25.8	14.5	37.0	23.4	4.85
30NO2	0.575	0.288	0.683	0.233	0.1962
30NO3	4.64	5.43	8.98	8.26	1.996
30TOTN	31.0	20.2	46.7	31.9	4.80



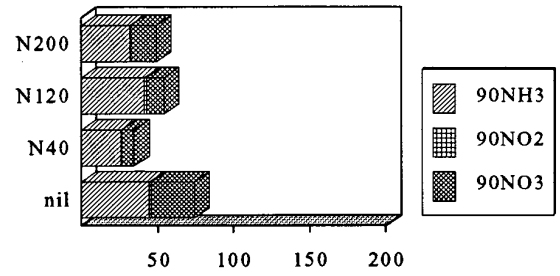
30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	45.8	26.9	39.4	46.5	10.25
60N02	1.20	0.69	1.35	0.53	0.403
60NO3	9.1	9.6	13.5	17.7	2.78
60TOTN	56.2	37.2	54.3	64.8	11.37



60-90cm horizon

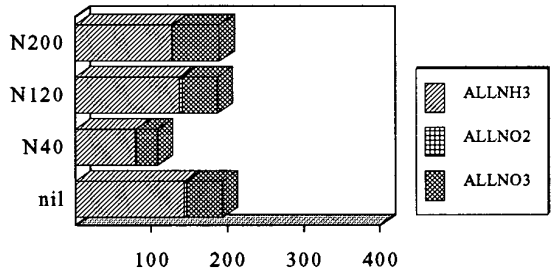
	nil	N40	N120	N200	sem
90NH3	44.2	25.8	40.8	31.6	13.29
90NO2	1.34	0.57	1.47	0.28	0.389
90NO3	28.6	8.0	11.6	16.9	10.54
90TOTN	74.	34.	54.	49.	21.4



Maginis Hill 2nd Experiment Soil Nitrogen 1991 kg/ha
25th June

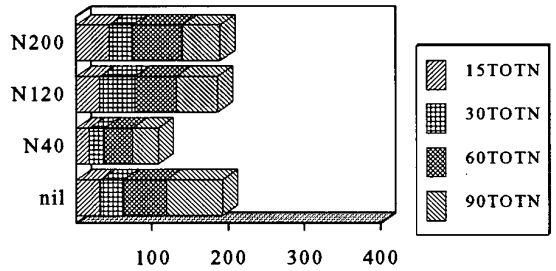
Total, all horizons

	nil	N40	N120	N200	sem
ALLNH3	143.	79.	137.	127.	23.9
ALLNO2	3.59	1.74	3.89	1.16	1.126
ALLNO3	46.4	27.8	45.5	61.1	11.95
ALLTOTN	193.	109.	186.	189.	32.5



Total N for each horizon

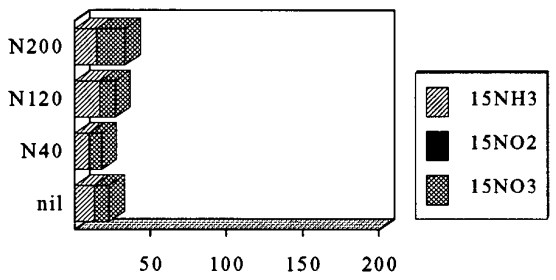
	nil	N40	N120	N200	sem
15TOTN	31.5	17.2	31.2	43.6	5.89
30TOTN	31.0	20.2	46.7	31.9	4.80
60TOTN	56.2	37.2	54.3	64.8	11.37
90TOTN	74.	34.	54.	49.	21.4



Maginis Hill 2nd Experiment Soil Nitrogen 1991 kg/ha 20th September

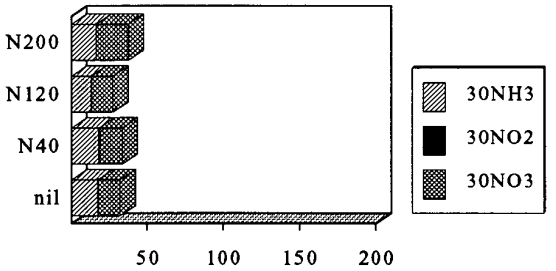
0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	12.7	9.2	16.6	14.3	2.22
15NO2	0.188	0.205	0.270	0.207	0.0336
15NO3	10.03	8.33	10.10	18.99	1.000
15TOTN	22.9	17.7	27.0	33.5	2.47



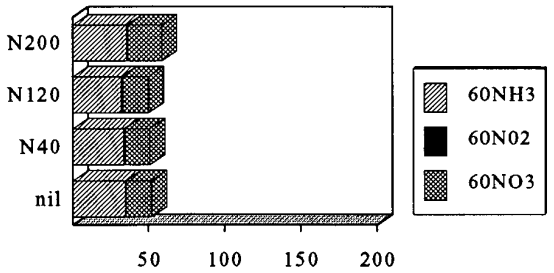
15-30cm horizon

	nil	N40	N120	N200	sem
30NH3	17.2	18.0	12.7	16.2	2.20
30NO3	.293	0.378	0.278	0.282	0.0311
30NO2	14.9	15.4	14.6	21.1	2.22
30TOTN	32.4	33.8	27.6	37.6	3.87



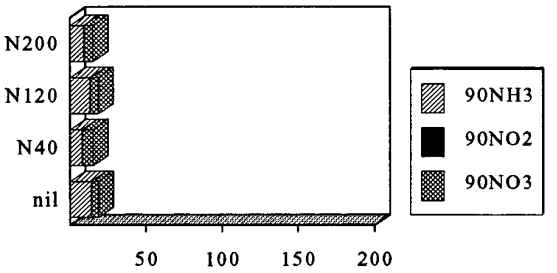
30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	34.8	33.6	32.1	35.8	7.31
60N02	0.598	0.655	0.655	0.670	0.0570
60NO3	16.45	16.41	17.17	22.09	1.666
60TOTN	51.8	50.7	50.0	58.6	7.5



60-90cm horizon

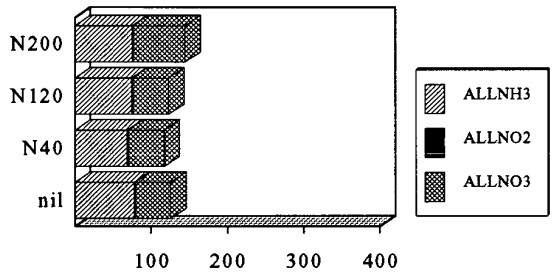
	nil	N40	N120	N200	sem
90NH3	13.4	7.7	12.9	8.7	2.93
90NO3	0.168	0.165	0.235	0.233	0.0427
90NO2	4.84	6.84	5.29	5.90	1.258
90TOTN	18.4	14.7	18.5	14.8	2.83



Maginis Hill 2nd Experiment Soil Nitrogen 1991 kg/ha 20th September

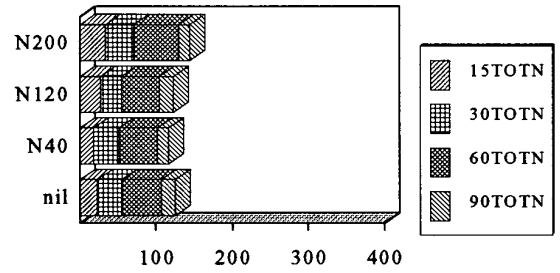
Total, all horizons

	nil	N40	N120	N200	sem
ALLNH3	78.0	68.5	74.4	75.0	10.51
ALLNO2	1.248	1.405	1.438	1.395	0.0975
ALLNO3	46.2	47.0	47.2	68.1	5.15
ALLTOTN	125.5	116.9	123.0	144.4	10.86



Total N for each horizon

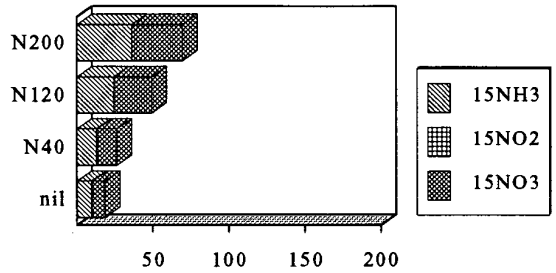
	nil	N40	N120	N200	sem
15TOTN	22.9	17.7	27.0	33.5	2.47
30TOTN	32.4	33.8	27.6	37.6	3.87
60TOTN	51.8	50.7	50.0	58.6	7.5
90TOTN	18.4	14.7	18.5	14.8	2.83



Brown Hill 3rd Experiment Soil Nitrogen 1991 kg/ha
22 nd May

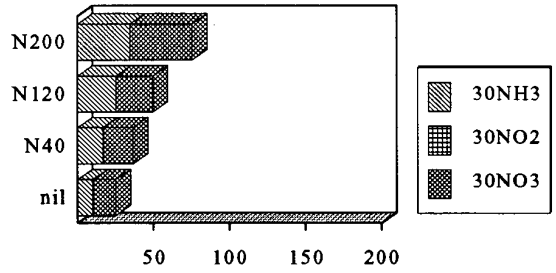
0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	9.7	12.9	24.3	36.1	3.56
15NO2	0.140	0.153	0.065	0.055	0.0443
15NO3	8.6	13.2	24.8	33.7	5.14
15TOTN	18.4	26.2	49.1	69.9	7.80



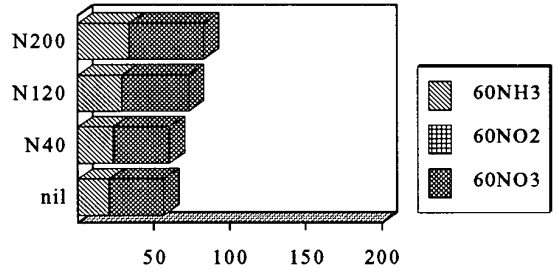
15-30cm horizon

	nil	N40	N120	N200	sem
30NH3	10.2	16.9	25.5	34.4	3.46
30NO2	0.210	0.222	0.060	0.097	0.0640
30NO3	14.6	19.5	24.1	41.2	2.96
30TOTN	25.0	36.7	49.7	75.7	5.70



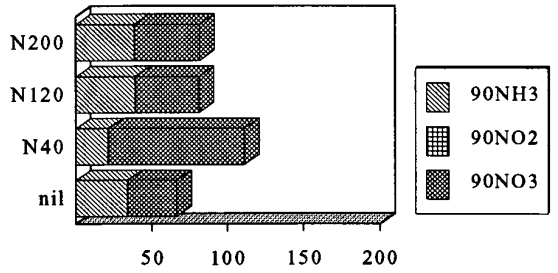
30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	20.5	23.0	28.9	33.8	5.92
60NO2	0.560	0.413	0.255	0.155	0.1379
60NO3	35.4	36.9	44.0	49.3	2.31
60TOTN	56.4	60.4	73.2	83.2	5.86



60-90cm horizon

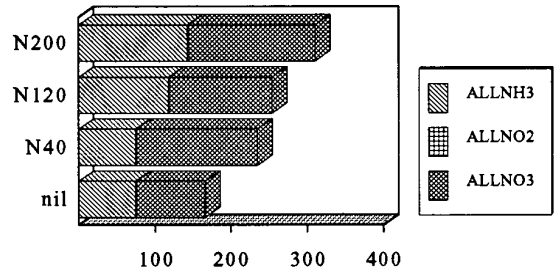
	nil	N40	N120	N200	sem
90NH3	33.6	21.2	38.9	38.4	8.97
90NO2	0.465	0.608	0.377	0.142	0.1623
90NO3	32.	89.	42.	43.	21.8
90TOTN	66.	111.	81.	82.	21.2



Brown Hill 3rd Experiment Soil Nitrogen 1991 kg/ha
22nd May

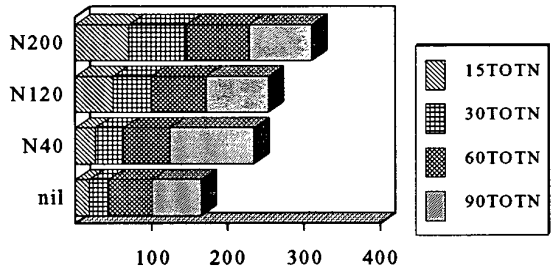
Total, all horizons

	nil	N40	N120	N200	sem
ALLNH3	74.0	74.0	117.6	142.8	13.85
ALLNO2	1.37	1.39	0.76	0.45	0.376
ALLNO3	91.	159.	135.	167.	25.8
ALLTOTN	166.	234.	253.	311.	25.4



Total N for each horizon

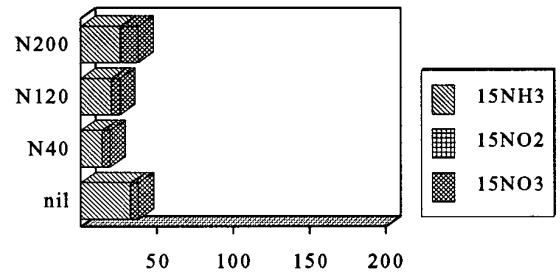
	nil	N40	N120	N200	sem
15TOTN	18.4	26.2	49.1	69.9	7.80
30TOTN	25.0	36.7	49.7	75.7	5.70
60TOTN	56.4	60.4	73.2	83.2	5.86
90TOTN	66.	111.	81.	82.	21.2



Brown Hill 3rd Experiment Soil Nitrogen 1991 kg/ha
2nd July

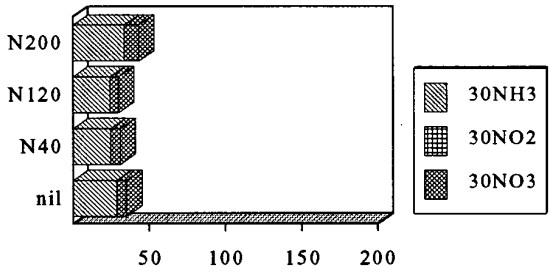
0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	32.8	14.1	19.9	26.0	5.43
15NO2	0.235	0.055	0.045	0.130	0.0541
15NO3	4.84	5.25	5.70	11.65	1.744
15TOTN	37.9	19.4	25.6	37.7	5.12



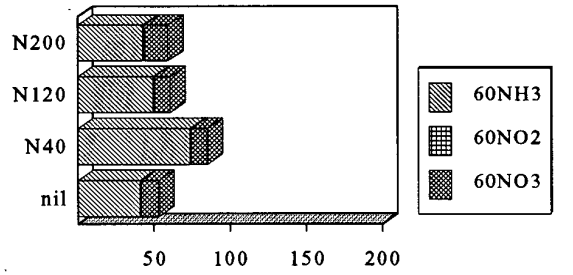
15-30cm horizon

	nil	N40	N120	N200	sem
30NH3	28.7	24.6	24.3	33.7	6.70
30NO2	0.203	0.095	0.093	0.185	0.0432
30NO3	6.28	6.36	5.63	9.32	0.931
30TOTN	35.2	31.0	30.1	43.2	7.06



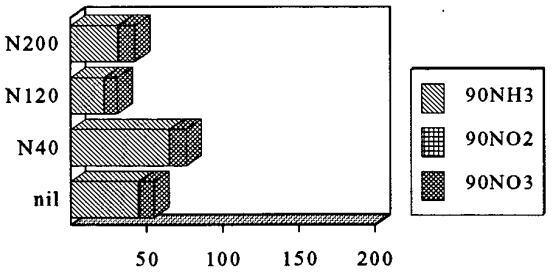
30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	40.9	73.8	49.8	43.0	13.32
60NO2	0.52	0.59	0.27	0.54	0.229
60NO3	11.7	10.8	10.5	15.8	2.09
60TOTN	53.1	85.2	60.6	59.3	14.12



60-90cm horizon

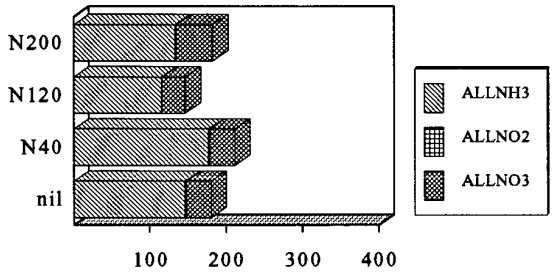
	nil	N40	N120	N200	sem
90NH3	44.5	64.5	22.1	31.2	16.04
90NO2	0.72	0.52	0.29	0.51	0.221
90NO3	9.40	10.99	8.43	10.70	0.801
90TOTN	54.7	76.0	30.8	42.4	15.98



Brown Hill 3rd Experiment Soil Nitrogen 1991 kg/ha
2nd July

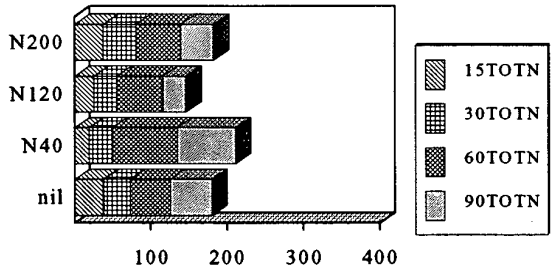
Total, all horizons

	nil	N40	N120	N200	sem
ALLNH3	147.	177.	116.	134.	24.6
ALLNO2	1.69	1.25	0.70	1.37	0.442
ALLNO3	32.2	33.4	30.3	47.4	4.64
ALLTOTN	181.	212.	147.	183.	25.3



Total N for each horizon

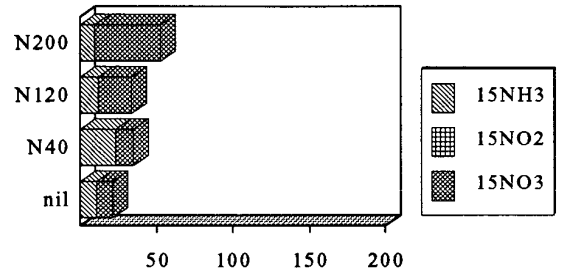
	nil	N40	N120	N200	sem
15TOTN	37.9	19.4	25.6	37.7	5.12
30TOTN	35.2	31.0	30.1	43.2	7.06
60TOTN	53.1	85.2	60.6	59.3	14.12
90TOTN	54.7	76.0	30.8	42.4	15.98



Brown Hill 3rd Experiment Soil Nitrogen 1991 kg/ha
25th September

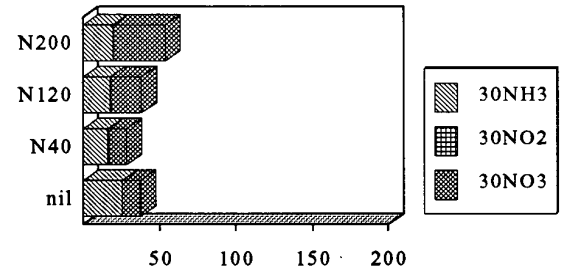
0-15cm horizon

	nil	N40	N120	N200	sem
15NH3	10.8	23.1	11.8	9.6	4.48
15NO2	0.0450	0.1000	0.0650	0.0800	0.01961
15NO3	10.2	11.2	21.4	42.5	3.50
15TOTN	21.0	34.4	33.2	52.2	5.33



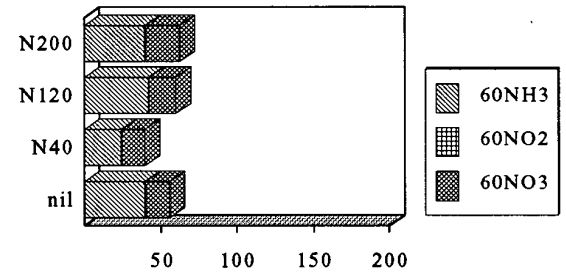
15-30cm horizon

	nil	N40	N120	N200	sem
30NH3	25.3	16.0	17.7	19.4	5.94
30NO2	0.153	0.080	0.083	0.175	0.0685
30NO3	11.8	12.1	20.1	33.8	2.08
30TOTN	37.2	28.2	37.9	53.4	7.46



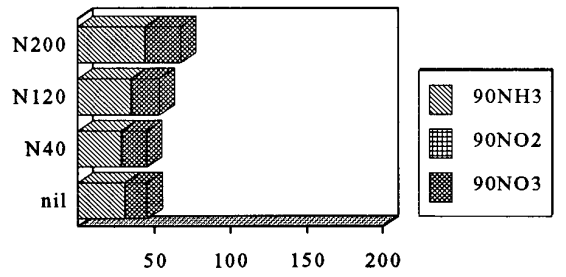
30-60cm horizon

	nil	N40	N120	N200	sem
60NH3	39.3	23.9	41.5	39.4	10.30
60NO2	0.265	0.263	0.267	0.330	0.0842
60NO3	15.74	15.02	17.74	22.30	1.088
60TOTN	55.3	39.2	59.5	62.0	10.23



60-90cm horizon

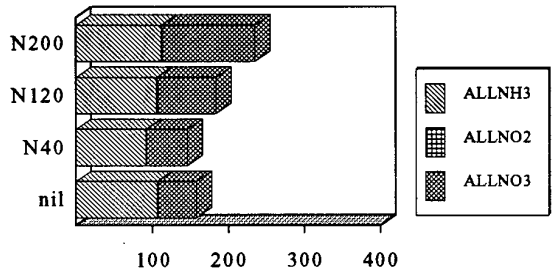
	nil	N40	N120	N200	sem
90NH3	30.6	28.1	34.5	43.7	10.46
90NO2	0.312	0.310	0.212	0.335	0.1216
90NO3	14.11	16.27	18.35	23.24	1.614
90TOTN	45.0	44.6	53.1	67.2	11.48



Brown Hill 3rd Experiment Soil Nitrogen 1991 kg/ha
25th September

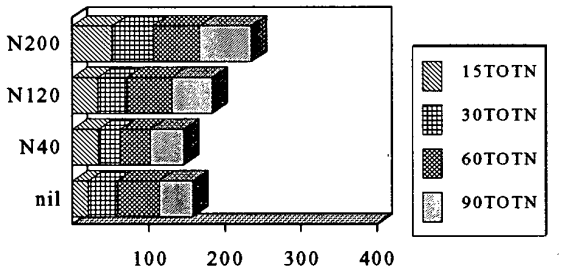
Total, all horizons

	nil	N40	N120	N200	sem
ALLNH3	106.0	91.1	105.5	112.0	19.27
ALLNO2	0.77	0.75	0.63	0.92	0.230
ALLNO3	51.8	54.6	77.6	121.9	6.17
ALLTOTN	159.	146.	184.	235.	22.8



Total N for each horizon

	nil	N40	N120	N200	sem
15TOTN	21.0	34.4	33.2	52.2	5.33
30TOTN	37.2	28.2	37.9	53.4	7.46
60TOTN	55.3	39.2	59.5	62.0	10.23
90TOTN	45.0	44.6	53.1	67.2	11.48



Appendix 5.

Mineral N analyses of soil cores;

Winter samplings

Soil nitrogen, winter samplings (kg/ka)

Site 1, Brown Hill

	Date of sampling								
	Nov87	Jan88	Mar88	Nov88	Jan89	Mar89	Nov89	Jan.90	Mar91
0 to 30 cm									
NH3	14.87	63.02	17.11	57.42	20.22	15.42	42.40	14.96	1.89
NO3	0.68	3.86	0.26	1.22	1.29	0.89	0.40	1.20	9.20
NO2	0.63	1.67	3.03	6.86	5.98	3.39	2.79	0.41	0.01
Total 0-30	16.18	68.55	20.40	65.5	27.49	19.70	45.59	16.57	5.49
30 to 60 cm									
NH3	0.63	9.32	12.34	79.78	13.99	32.02	41.36	6.49	0.60
NO3	0.76	4.16	0.76	2.54	1.49	0.30	0.37	0.56	9.65
NO2	0.31	0.63	0.63	0.25	1.49	1.79	0.32	0.53	0.26
Total 30-60	1.70	14.11	13.73	82.57	16.97	34.11	42.05	7.58	10.52
60 to 90 cm									
NH3	0.00	5.14	4.52	30.74	7.43	5.28	27.07	4.93	0.49
NO3	0.18	2.75	0.71	1.54	1.93	1.93	0.76	0.55	5.35
NO2	0.04	0.62	0.13	0.86	1.43	6.58	0.32	0.93	0.07
Total 60-90	0.22	8.51	5.36	33.14	10.79	13.79	28.15	6.41	5.91
0-90cm									
NH3	15.5	77.48	33.97	167.94	41.64	52.72	110.83	26.38	2.98
NO3	1.62	10.77	1.73	5.30	4.71	3.12	1.53	2.31	24.21
NO2	0.98	2.92	3.79	7.97	8.90	11.76	3.43	1.87	0.34
Total 0-90	18.1	91.17	39.49	181.21	55.25	67.6	115.79	30.56	27.53

Soil nitrogen, winter samplings (kg/ka)

Site 2, Maginnis Hill

	Date of sampling							
	Nov87	Jan 88	Mar88	Nov88	Jan89	Jan90	Mar90	Mar91
0 to 30 cm								
NH3	9.54	4.57	10.31	37.82	33.06	12.49	3.83	4.62
NO3	0.15	3.81	0.56	1.55	2.14	0.47	0.63	2.56
NO2	2.25	1.01	0.20	2.73	1.48	1.93	0.80	0.03
Total 0-30	11.94	9.39	11.07	42.10	36.68	14.89	6.25	7.21
30 to 60 cm								
NH3	5.28	5.67	9.28	49.45	21.07	6.85	2.57	4.56
NO3	0.00	5.22	0.58	2.64	0.45	0.19	1.10	4.98
NO2	3.29	0.71	0.64	3.34	5.58	1.49	1.37	0.70
Total 30-60	8.57	11.6	10.5	55.43	27.1	8.53	5.04	10.23
60 to 90 cm								
NH3	0.00	2.67	3.63	18.64	15.59	13.09	0.00	3.43
NO3	0.9	2.58	0.00	1.07	0.43	1.15	1.05	2.79
NO2	1.40	0.74	0.53	1.39	8.05	0.94	0.63	0.00
Total 60-90	2.30	5.99	4.16	21.1	24.07	15.18	1.68	6.22
0-90cm								
NH3	14.82	12.91	23.22	105.91	69.72	32.43	6.40	12.61
NO3	1.05	11.61	1.14	5.26	3.02	1.81	2.78	10.33
NO2	6.94	2.46	1.37	7.46	15.11	4.36	2.80	0.73
Total 0-90	22.81	26.98	25.73	118.63	87.85	38.6	11.98	23.67

Soil nitrogen, winter samplings (kg/ka)

Site 3, Brown Hill

	Nov89	Jan90	Mar90	Mar91
0 to 30 cm				
NH3	27.3	4.29	9.42	4.04
NO3	1.81	0.15	0.05	5.96
NO2	1.96	0.92	0.66	0.12
Total 0-30	31.07	5.36	10.13	10.07
30 to 60 cm				
NH3	21.64	3.97	10.7	2.83
NO3	1.78	1.97	0.00	8.15
NO2	1.39	1.04	0.51	0.19
Total 30-60	24.81	6.98	11.21	11.16
60 to 90 cm				
NH3	10.20	2.41	4.53	1.64
NO3	0.85	1.01	0.28	5.94
NO2	1.38	4.92	3.22	0.14
Total 60-90	12.43	8.34	8.03	7.72
0-90cm				
NH3	59.14	10.67	24.65	8.46
NO3	4.44	3.13	0.33	20.04
NO2	4.73	6.88	4.39	0.45
Total 0-90	68.31	20.68	29.37	28.95