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Title: Fertilizer Requirements of Wheat Grown Under Conservation Tillage.

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Nitrogen (N), phosphorus (P), and sulfur (S) fertilization trials with Stephens winter wheat (*Triticum aestivum* L.) were conducted on the Columbia Plateau under minimum and no tillage conditions. The crop rotation was either wheat-summer fallow (summer fallow) or wheat-wheat (recrop).

Nitrogen variables included: N rates, N timing, and N source treatments. The N fertilizer rate required to maximize yield depended on the amount of precipitation received, soil nitrate levels, and yield potential. Increasing precipitation increased yield potential (within limits partly determined by the available water holding capacity of the soil) which increased the N requirement for maximum grain yields. Soil nitrate varied in its ability to reduce the requirement for N fertilizer. At low soil nitrate levels, an increase in soil nitrate caused a corresponding decrease in N fertilizer requirement; however, at

moderate to high soil nitrate levels, N fertilizer requirements were reduced less than the increase in soil nitrate. Nitrogen timing treatments consisted of N applied in the spring of summer fallow (SS), at seeding (SD), and in the spring of the crop year (SC). In a wet year (1983-84), SC and SD applied N gave similar yield results. In a dry year (1984-85), SS and SD applied N gave similar yield results. Overall, N applied at SD gave the highest yields. Urea, ammonium chloride, ammonium sulfate, and urea phosphate were compared as N sources. Urea phosphate tended to increase yield more than urea plus phosphorus. Ammonium chloride tended to lower protein content and increase 300-kernel weight more than urea and ammonium sulfate, possibly because of chloride effects on plant water potentials.

Responses to phosphorus fertilizer were not accurately predicted by soil P test levels. Cold soil temperatures at planting (due to high elevation and/or late planting dates) in addition to high yield potentials, seemed to correspond to P responsive sites better than soil P test levels.

At experimental sites where S soil test levels were above 2 ppm in the top 30 cm, wheat did not respond to S fertilizer. When S soil test levels were below 2 ppm in the top 30 cm, a response to S fertilizer was recorded approximately 17% of the time.

Fertilizer Requirements of Wheat Grown Under Conservation Tillage

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INTRODUCTION

A survey by the National Association of Conservation Districts in 1984 estimated that of 412,000 hectares cropped on the Columbia Plateau, 31% or 126,600 hectares are managed under some form of conservation tillage. Minimum or no-till annual cropping (recrop) on shallow soils (<1 m) where rainfall is generally adequate to fill the soil profile is also increasing, creating a need for information on the nutritional requirements of winter wheat grown annually in a semi-arid region.

One of the reasons farmers are switching from moldboard plowing to minimum tillage practices is to reduce erosion. Erosional losses of soil on the Columbia Plateau average from 5 to 50 metric tons per hectare per year with losses as great as 224 metric tons per hectare (Zuzel et al., 1982). Fourteen erosion-producing runoff events were observed during the 1979-80 winter, twelve of which involved frozen soils associated with either snowmelt or rain on snow. Greenwalt et al. (1983) found soil frost penetration on no-till plots was significantly less and present for half as long as on conventionally tilled plots, thus reduing the erosion potential of no-till plots.

Straw residue left on the surface from conservation tillage not only reduces erosion but also can affect nutrient cycling and thus availability of nutrients (Rice and Smith, 1984; Smith *et al.*, 1978; Winterlin *et al.*, 1958). Timing of nitrogen (N) fertilizer applications can influence the availability of N due to immobilization by microbes decomposing straw residue, fixation by clays, volatilization, leaching of NO_3, and/or denitrification.

New winter wheat varieties (Stephens and Hill) are increasingly being grown under minimum tillage conditions which differ substantially from the conventional tillage systems prevalent when Oregon State University Fertilizer Guide 54, Winter Wheat Non-Irrigated -- Columbia Plateau was developed in 1969-74. Because of these changes, additional information is needed on the fertilizer requirements of wheat grown on the Columbia Plateau.

The objective of this research was to update fertilizer recommendations for winter wheat grown under minimum tillage and/or annually cropped systems on Oregon's Columbia Plateau.

LITERATURE REVIEW

Metabolic Roles of Nitrogen, Sulfur, and Phosphorus

Nitrogen, sulfur, and phosphorus were deficient approximately 75, 10, and 5 percent of the time, respectively, in fertility trials conducted on the Columbia Plateau (Rasmussen, 1981). Nitrogen (N) is essential for plant growth. Plant components of which N is an essential part include: proteins, amino acids, enzymes, and chlorophyll molecules. These components largely determine the pattern and rate of chemical transformation in plant cells (Mengel and Kirkby, 1982a; Olson and Kurtz, 1982; Salisbury and Ross, 1978). Sulfur (S) is present in two essential amino acids, cysteine and methionine which are components of nearly all proteins. The formation of disulphide bonds in polypeptides and proteins stabilizes these structures and contributes to the conformation of enzyme proteins. Sulfur groups are also important for their direct participation in enzyme reactions. Phosphorus (P) is an integral part of adenosine triphosphate (ATP), nucleic acids, membrane phospholipids and some proteins. ATP and other analogous compounds permit energy transfers which drive numerous metabolic processes (Mengel and Kirkby, 1982b; Olson and Kurtz, 1982; Salisbury and Ross, 1978).

Soil Organic Matter

Soil organic matter plays an important role in regulating the supply of nutrients to plants, especially N, S and P. Over 90% of the N in most soils is organically combined (Stevenson, 1982), with the remaining N generally found as ammonium-nitrogen (NH_4-N) or nitrate nitrogen (NO_3-N). Organic S may approach 100% of the total S in some soils. In arid regions, however, high levels of $CaSO_4$, $MgSO_4$, and/or Na_2SO_4 may accumulate. From 20 to 80% of the total P in soil may also be organically bound. When N and S are not organically combined they may be leached from the soil profile while P may form low solubility mineral complexes with calcium, iron or aluminum which reduce the availability of P to plants. Therefore, the immobilization and mineralization rates of N, S and P by organic matter play important roles in plant nutrition.

Water

Soft white winter (SWW) wheat production on the Columbia Plateau is limited primarily by water and available N (Leggett, 1959), both of which are affected by tillage practices and crop rotation. Straw residue left on the soil surface under minimum tillage or no-tillage systems can increase available soil water by increasing infiltration, reducing evaporation and/or altering the physical structure of soils by increasing the percentage of micropores (Blevins et al., 1971; Hill and Cruse, 1985; Hill et al., 1985; Smika, 1983). Straw residue left on the surface not only increases available water but can also slow down N mineralization, thus increasing fertilizer N requirements (Blevins et al., 1977; Dowdell and Cannell, 1975; Rice and Smith, 1984; Winterlin et al., 1958). Annual cropping where rainfall is adequate to replenish the soil profile, can increase the amount of N fertilizer required for optimum yield compared to a summer fallow rotation (Ramig and Ekin, 1983).

Soil Nitrogen

Soil N, usually the NO_3-N fraction, has been correlated with yield, and recommended rates of fertilizer N are reduced proportionate to the soil NO_3^- values (Halvorson and Kresge, 1982; Leggett, 1959). However, Haby et al. (1983) found that soil NO_3^- efficiency decreased as the rate of fertilizer N increased. Under dryland conditions in Montana, soil NO_3^- was approximately one-third as efficient as fertilizer N.

Nitrogen Fertilizer Rates

Nitrogen fertilizer recommendations for dryland wheat grown in semi-arid areas of the northwest U.S. have been based on estimated yield. The yield estimation is based on available water using the relationship $Y=6(SM+R-4)$, where Y = yield in bushels/acre, SM = inches of available soil moisture, and R = rainfall in inches (Leggett, 1959). Halvorson and Kresge (1982) calculated that $Y=6.50(X)-39.8$ where X = inches of estimated available water. Other researchers (Ramig and Pumphrey, 1977), found that the yield increase due to a unit of rainfall depended on the timing of that rainfall. The N fertilizer requirement is then calculated based on the relationship between available N and yield. Leggett (1959) used a ratio of 3 lbs N/bushel wheat above the check yield, thus N fertilizer recommendation = $3(\hat{Y}-Yc)$-soil NO_3-N, where $\hat{Y}$ = yield estimated by available water and Yc = check yield on recrop resulting from soil N mineralized during the growing season. Other researchers (Rasmussen, 1981) have shown a need for 2 to 5.8 lbs N/bushel of wheat per bushel yield increase over an unfertilized check plot. Another estimate for the Columbia Plateau (Gardner, 1980), was $F=2.4Y-S-30$ where F = fertilizer N requirement (lbs/A), Y = expected yield (bu/A), S = available soil N, and 30 = estimated mineralizable N (lbs/A).

Protein

Hunter *et al*. (1958) found that SWW wheat containing less than 8% protein likely indicated a deficiency of N fertilizer. Glenn *et al*. (1985) established a critical protein level of 8.8% to indicate a sufficiency of available N for SWW wheat.

Climate

Climate affects the efficiency of fertilizer applied at different times, or applied using different methods. Nelson and Uhland (1955) studied differences in the efficiency of fall and spring N fertilizer applications among different regions and attributed differences in N fertilizer efficiency to leaching losses resulting from percolating water. On the Columbia Plateau, anhydrous ammonia is frequently injected in the spring of the summer fallow year and can be converted to NO_3^- long before planting begins in mid-September. In a wet year this NO_3^- is subjected to leaching or reduction (personal communication with Paul Rasmussen).

Timing and Placement of Nitrogen Fertilizer

Responses from timing and placement of N fertilizer can be affected by climate, soil and N source. Christensen and Meints (1982) working in Montana, where rainfall occurs mainly in spring and summer, found that urea topdressed in the fall was only 69% as effective as fall topdressed ammonium nitrate (NH_4NO_3) while spring topdressed urea, fall topdressed NH_4NO_3, and spring topdressed NH_4NO_3 were equally effective. Volatilization of NH_3 was thought to account for the lower effectiveness of fall applied urea. On the Columbia Plateau 60-70% of the precipitation occurs from November through April (Ramig et al., 1983). Under these conditions Ramig and Ekin (1985) compared fall applications of broadcast versus banded N on conservation tillage and found no yield difference at one site and increased yields with banding at another site. Other researchers (Rice and Smith, 1984) have found immobilization of broadcast N to be greater on no-till soil compared to conventionally tilled soil, which may reduce crop recovery of fertilizer N under no-till conditions. They also suggest that "since organic matter is concentrated at the surface of the no-till soil, placement of N below this zone may decrease the potential for immobilization." This should also be true for conservation tillage where significant amounts of the soil surface is covered by plant residue after seeding. Ramig and Ekin (1985) did not observe significant differences in yield between conservation tillage and no-till treatments where N was banded below winter wheat seed. Reinertsen et al. (1984) working with no-till spring wheat near Pullman, WA, found banding N increased yield and decreased the wild oat population compared to broadcast N.

Another benefit observed with banded N has been increased P uptake when N and P were banded together (Leikam et al., 1983).

Phosphorus

Phosphorus fertilizer responses on the Columbia Plateau have been inconsistent. A few P responses have been observed on winter wheat, mostly when soil test values (sodium bicarbonate method) were below 8 ppm and yield levels were over 2700 kg ha^{-1}. The probability of a yield response to P fertilizer increases with late seeded winter wheat or early seeded spring wheat (Rasmussen, 1981). In Nebraska, McConnell et al. (1986) observed more frequent yield responses when P fertilizer was banded into the soil or placed close to the seed as compared to P banded on the surface between the rows.

Leikam et al. (1983) found that at sites responsive to P, ammonium polyphosphate (APP) applied in a band with an ammonium nitrogen increased both grain yield and leaf tissue P, but that APP alone did not increase P concentrations of leaf tissue as much as APP plus NH_4-N.

With minimum or no-tillage, P rates may need to be adjusted according to the amount of straw added and the P content of the straw. Black and Reitz (1972) determined that approximately 1.5 kg of P ha^{-1} would be required for each 1,100 kg ha^{-1} of straw incorporated to maintain sodium bicarbonate-soluble P at its previous level (straw had 0.06% P content). Phosphorus is immobilized by microbes when the P content of wheat is below 0.2% (Fuller et al., 1956). In a long term experiment, Dick (1983) found significantly higher organic P concentrations in the 0 to 7.5 cm soil depth and significantly lower organic P in the 22.5 to 30 cm soil increment with no tillage compared to conventional tillage.

Halvorson and Black (1985) measured a significant N X P interaction in two long term experiments. At low P rates (0 and 22 kg P ha^{-1}) N fertilizer usually reduced P uptake while at rates of 90 and 180 kg P ha^{-1} N fertilizer increased P uptake. Year X P interactions as well as year X N interactions were also significant in their experiment indicating the effects of varying climatic conditions on fertilizer response. The 90 and 180 kg P ha^{-1} treatments with N fertilizer gave the highest accumulated grain yields in Halvorson and Black's study and P recovery was still continuing after 17 years on the high P treatments. They postulated that P fertilizer rates as high as 90 kg P ha^{-1} may be an efficient way to meet crop P requirements.

In a greenhouse experiment Sutton _et_ _al_. (1983) found that by the first node stage wheat had taken up sufficient P to ensure maximum dry matter production of the mature plant. However, P availability was needed through the mealy-ripe stage (Feeke's Scale 11.2) to realize maximum grain yield. Sutton _et_ _al_. concluded that after noding, only a small amount of available P is needed for carbohydrate translocation mechanisms to function.

Sulfur

Sulfur deficiencies are highly variable, and like P, are usually manifested only when N is adequately supplied. Ramig _et al_. (1975) observed that residual S (from earlier S applications) may have availability characteristics beneficial to wheat grown under limited moisture supply, compared to the initial S application which supplied S in excess of that needed for grain protein. Ramig _et al_. experiments showed a need for less than 10 kg S ha^{-1} per year and that larger applications of equivalent amounts of S applied biennially gave satisfactory results compared to annual applications.

Rasmussen _et al_. (1975) found wheat grain yield to be poorly correlated with S concentration or N/S ratio in whole plant tissue. Soil tests in eastern Oregon and Washington have failed to reliably predict S deficiency. When sulfate-S values are above 2 ppm in the top 60 cm of soil, responses to fertilizer S are rare, and when S levels are below 2 ppm a S response is seen only infrequently (personal communication with Paul Rasmussen). Westermann (1974) found that S from 0 to 30 cm extracted with 0.1M LiCl had the best correlation for alfalfa grown on the agricultural soils found in the mountain valleys of Idaho.

Chloride

Chloride (Cl) has been shown to suppress take-all root rot (caused by Gaeumannomyces graminis var. tritici) of winter wheat grown in the Willamette Valley of western Oregon (Christensen and Brett, 1985, Taylor *et al.*, 1983). Christensen and Brett (1985) found that Cl reduced nitrification on unlimed soil (pH 5.5) but not on limed soil (pH 6.6). Chloride has also been shown to reduce the severity of stripe rust and reduce osmotic potentials on winter wheat in the Willamette Valley (Christensen *et al.*, 1981, 1982). Other investigators have shown that take-all root rot was reduced when wheat was fertilized with NH_4-N as compared to NO_3-N (Huber *et al.*, 1968; Smiley and Cook, 1973). In addition Smiley and Cook (1973) found that increasing rates of NH_4-N caused larger reductions in both rhizosphere pH and in disease rating.

MATERIALS AND METHODS

Nine experiments were established each of three years (1982-83, 1983-84, and 1984-85), on the Columbia Plateau to evaluate fertilizer requirements of wheat grown under conservation tillage. Summer fallow plots were seeded from late September to early October, recrop sites from mid to late October. 'Stephens' winter wheat was planted at all 27 sites. Individual site information and location are given in Table 1, soil classification is given in Table 2. All soils had silt loam texture and were derived from loess parent material.

Tillage and herbicide applications were provided at each site by the cooperating grower. Tillage on summer fallow sites generally consisted of one to three passes with a offset disk or chisel plow and two to three passes with a rod weeder as needed for weed control. Five recrop sites (Gt83, A84, Gt84, Mn84, Mn85) were planted with no tillage while the remaining five recrop sites were disked one to three times.

In 1982-83 the main nitrogen (N) and sulfur (S) treatments were injected 10 cm deep midway between 30 cm rows using an experimental drill equipped with a belt for dry fertilizer application. Phosphorus (P) was supplied using 10-34 solution (ammonium polyphosphate) injected with the seed by a CO_2 pressure system. For the P comparison treatment, solution 32 (ammonium nitrate plus urea) was injected with the seed to supply an equivalent amount of N. Ammonium sulfate was used as the main N

TABLE 1

EXPERIMENTAL SITES

Grower 1982-83	ID#	CR*	County	Legal Description	Soil Type	Soil[+] Depth (m)
Brewer	Br83	SF	Wasco	T.1N.,R.14E.	Walla Walla Sl	1.8
Borstal	Bl83	RC	Wasco	T.5S.,R.16E.	Condon Sl	0.6
Martin	Mn83	SF	Sherman	T.45.,R.18E.	Condon Sl	0.6
Simontel	Si83	SF	Sherman	T.1N.,R.18E.	Walla Walla Sl	0.9
Weatherford	W83	SF	Gilliam	T.1N.,R.21E.	Ritzville Sl	1.7
Beckett	Bt83	SF	Morrow	T.35.,R.24E.	Morrow Sl	0.6
Smouse	Sm83	SF	Morrow	T.1N.,R.26E.	Ritzville Sl	1.7
Reeder	R83	RC	Umatilla	T.4N.,R.33E.	Walla Walla Sl	1.8
Gilbert	Gt83	RC	Umatilla	T.1N.,R.33E.	Pilot Rock Sl	0.6
1983-84						
Hay	Hy84	SF	Wasco	T.1N.,R.14E.	Walla Walla Sl	1.8
Martin	Mn84	RC	Sherman	T.4S.,R.18E.	Condon Sl	0.6
Kaseberg	K84	SF	Sherman	T.1N.,R.16E.	Walla Walla Sl	1.8
Campbell	C84	RC	Gilliam	T.3S.,R.20E.	Condon Sl	0.8
Bergstrom	Bm84	SF	Morrow	T.3S.,R.24E.	Valby Sl	0.9
Anderson	A84	RC	Morrow	T.3S.,R.25E.	Valby Sl	0.9
Smouse	Sm84	SF	Morrow	T.1N.,R.26E.	Ritzville Sl	1.5
Harper	Hr84	SF	Umatilla	T.5N.,R.33E.	Walla Walla Sl	1.8
Gilbert	Gt84	RC	Umatilla	T.1N.,R.33E.	Pilot Rock Sl	0.6
1984-85						
Feist	F85	SF	Wasco	T.1S.,R.15E.	Condon Sl	1.1
Martin	Mn85	RC	Sherman	T.4S.,R.18E.	Condon Sl	0.8
Kaseberg	K85	SF	Sherman	T.1N.,R.16E.	Walla Walla Sl	1.8
Maley	My85	SF	Gilliam	T.45.,R.21E.	Condon Sl	1.0
Anderson	A85RC	RC	Morrow	T.3S.,R.24E.	Valby Sl	0.6
Anderson	A85SF	SF	Morrow	T.3S.,R.24E.	Valby Sl	0.6
Smouse	Sm85	SF	Morrow	T.1N.,R.26E.	Ritzville Sl	1.4
Goodwin	Gn85	SF	Umatilla	T.4N.,R.33E.	Walla Walla Sl	1.8
Newtson	N85	RC	Umatilla	T.1N.,R.33E.	McKay Sl	0.6

* CR = crop rotation; SF = summer fallow; RC = recrop

[+] Approximate soil depth (m).

TABLE 2

SOIL CLASSIFICATION

Condon Silt Loam - Fine-silty, mixed, mesic Typic Haploxerolls

McKay Silt Loam - Fine-silty, mixed, mesic Typic Natrixerolls

Morrow Silt Loam - Fine-silty, mixed mesic Calcic Argixerolls

Pilot Rock Silt Loam - Coarse-silty, mixed mesic Haplic Durixerolls

Ritzville Silt Loam - Coarse-silty, mixed, mesic Calciorthidic Haploxerolls

Valby Silt Loam - Fine-silty, mixed, mesic Calcic Haploxerolls

Walla Walla Silt Loam - Coarse-silty, mixed mesic Typic Haploxerolls source, urea was used for the S comparison treatment (Table 3, Treatments). Each experiment site was in a randomized complete block design.

In 1983-84 and 1984-85, a new experimental drill was used which banded fertilizer 5 cm below the seed, with 30-cm row spacing. Urea (U) was used as the main N source. Ammonium chloride (AC), ammonium sulfate (AS), and urea phosphate (UP) were used as N source comparisons (UP was evaluated only in 1983-84). Gypsum ($CaSO_4$*$2H_2O$) and concentrated super phosphate (0-45-0) were used as S and P sources, respectively. Spring of summer fallow (SS) N timing treatments were injected 9 cm deep with 30 cm spacing in June. Phosphorus and S were mixed with the appropriate N source and banded at seeding. Spring of crop year (SC) N applications were hand broadcast in late February (Table 3). In 1982-83, each plot was 2.4m (eight rows) X 27m and was replicated three times. In 1983-84 and 1984-85 each plot was 1.2m (four rows) X 27m, and was replicated four times. Plots were hand harvested ($3.0m^2$ area from the center two rows) in mid-July to early August and threshed with a Vogel thresher. The grain was then weighed, cleaned and tested for protein content, 300-kernel weight and test weight (kg m^{-3}). Protein content (% N*5.7=% protein) was determined using a "Technicon 'Infra Alyzer' 400." (Rotolo, 1979; Williams, 1975).

Precipitation on the Columbia Plateau decreases in an eastward direction from the Cascade Mountain range and then

TABLE 3

TREATMENTS

1982-83 Trt	High Potential Yield Summer Fallow Sites N Rate	P	S	Low Potential Yield and Recrop Sites N Rate	P	S
	------kg ha^{-1}------			--------kg ha^{-1}--------		
1	0	0	0	0	0	0
2	62	8.3	67	28	8.3	27
3	118	8.3	134	50	8.3	54
4	174	8.3	202	73	8.3	81
5	118	0	134	50	0	54
6	118	8.3	0	50	8.3	0
7	6	8.3	27	6	8.3	27

	High Potential Yield Sites			Low Potential Yield and Recrop Sites			All Sites		
1983-84	---N Timing--			---N Timing---			N		
Trt	SS	SD	SC	SS	SD	SC	Source	P	S
	---kg ha^{-1}---			---kg ha^{-1}----			-----kg ha^{-1}----		
1	0	0	0	0	0	0	-	0	0
2	0	56	0	0	28	0	U	10	22
3	0	112	0	0	56	0	U	10	22
4	0	168	0	0	112	0	U	10	22
5	0	112	0	0	56	0	U	0	22
6	0	112	0	0	56	0	U	10	0
7	0	0	0	0	0	0	-	10	22
8	56	0	56	28	0	28	U	10	22
9	112	0	0	56	0	0	U	10	22
10	0	0	112	0	0	56	U	10	22
11	0	28	84	0	28	28	U	10	22
12	0	28	84	0	28	28	AC	10	22
13	0	28	84	0	28	28	AS	10	22
14*	0	168	0	0	112	0	UP	16	22
15*	0	168	0	0	112	0	U	16	22

* Trt 14 and 15 on High Potential Yield sites received 24 kg P ha^{-1} instead of 16.

[1] On recrop sites treatments 8 and 9 were deleted.

TABLE 3 continued

	High Potential Yield Sites			Low Potential Yield and Recrop Sites			All Sites		
1984-85	---N Timing--			---N Timing---			N		
Trt	SS	SD	SC	SS	SD	SC	Source	P	S
	---kg ha^{-1}---			---kg ha^{-1}----			-----kg ha^{-1}----		
1	0	0	0	0	0	0	-	10	22
2	0	56	0	0	28	0	U	10	22
3	0	112	0	0	56	0	U	10	22
4	0	168	0	0	84	0	U	10	22
5	0	224	0	0	112	0	U	10	22
6	0	280	0	0	140	0	U	10	22
7	0	0	112	0	0	56	U	10	22
8	56	0	56	28	0	28	U	10	22
9	112	0	0	56	0	0	U	10	22
10	0	56	56	0	28	28	U	10	22
11	0	112	0	0	56	0	U	0	22
12	0	112	0	0	56	0	U	10	0
13	0	56	56	0	28	28	AC	10	22
14	0	56	56	0	28	28	AS	10	22
15	0	0	0	0	0	0	-	0	0

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[1] On recrop sites treatments 8 and 9 were deleted.

increases with proximity to the Blue Mountains on the east side. Annual precipitation averages 23 to 55 cm per year depending on location. Growing season precipitation (August 1 to July 31) for each site was calculated from data supplied by Dr. Kelly Redmond, State Climatologist, using the weather station nearest to each research site.

Soil moisture was measured with a neutron probe starting in April and continuing every 2 weeks until harvest (Appendices A and B). Soil samples were taken at appropriate depths when the neutron probe access tubes were installed. These samples were weighed, oven dried, re-weighed, and % moisture by weight calculated, this was repeated when the neutron probe access tubes were removed. Percent moisture was then regressed against neutron probe counts to calibrate the neutron probe, (% moisture = -3.5 + 0.00158 (neutron probe counts), coefficient of determination (R^2) = 0.90).

Soil samples for chemical analysis were taken from the plot areas in mid-September before planting with a Giddings hydraulic probe equipped with a 3.18 cm diameter tube. Soil samples were composited in 30 cm segments to 180 cm or bedrock at each site. These soil samples were analyzed for sulfate-sulfur (SO_4-S), ammonium (NH_4-N) and nitrate (NO_3-N), the 0 to 30 cm depth were also analyzed for pH, phosphorus (P), and potassium (K). Further soil samples were taken in April with a hand probe from the check plot, mid, and high N treatments and tested for NO_3-N and NH_4-N. All analyses were conducted by methods outlined in Table C.

TABLE 4

METHODS OF SOIL ANALYSIS*

Analysis	Method
pH	Supernatant of 1:2 soil:water ratio by Jackson (1958)
Phosphorus (P)	Sodium bicarbonate by Olsen and Dean (1965)
Potassium (K)	Ammonium acetate by Pratt (1965)
Sulfur (SO_4-S)	Extractable sulfate sulfur by Johnson and Nishita (1952)
Ammonium (NH_4-N)	Automatic analyzer by Technicon Method #334-74A/A (NH_4-N and NO_3-N were extracted with 2 N KCl)
Nitrate (NO_3-N)	Automatic analyzer by Technicon Method #329-74W/A

* Procedures described in detail in "Methods of Soil Analysis Used in the Soil Testing Laboratory at Oregon State University," Berg and Gardner, Special Progress Report 321, Revised September 1978 (currently under revision).

RESULTS

Nitrogen Rate Comparisons.

Potentially high-yielding sites had deep soil and relatively high average rainfall. Low-potential yield sites had shallow soil and/or low average rainfall. Recrop sites were cropped annually. In all cases, neutron probe measurements indicated that soil moisture tended to be depleted sooner, and to a greater extent, with increasing nitrogen fertilizer rates (Appendices A and B).

High-Potential Yield Sites. Nitrogen fertilizer increased grain yield at six of seven high yield sites (Figures 1 and 2). The site where wheat did not respond to N fertilizer (Figure 2, K85) had a high soil N level of 120 kg N ha^{-1} in addition to below average crop year precipitation (CYP) (Table 5). The low N fertilizer response of wheat at the Hr84 site (Figure 1) can be attributed to a severe weed problem in addition to a high level of available soil N (69 kg N ha^{-1}).

Low Potential Yield Sites. Nitrogen fertilizer increased grain yields significantly at all ten low potential yield sites (Figures 3-5).

TABLE 5

GENERAL SOIL AND RAINFALL DATA

Grower 1982-83	ID#	Soil NO_3-N ($kg\ ha^{-1}$)	Summer Fallow Precip. (cm)	Crop Year Precip. (cm)	Total Precip. (cm)	Soil Series	Depth (m)
Brewer	Br83	35	41.4	55.6	97.0	Walla Walla Silt Loam	1.8+
Beckett	Be83	30	37.1	46.0	83.1	Morrow Silt Loam	0.6
Martin	Mn83	25	36.8	42.2	79.0	Condon Silt Loam	0.6
Simental	Si83	41	38.1	42.2	80.0	Walla Walla Silt Loam	0.8
Smouse	Sm83	51	34.9	46.7	81.5	Ritzville Silt Loam	1.7
Weatherford	W83	56	33.8	40.4	53.9	Ritzville Silt Loam	1.7
Borstal (RC)	B183	26	--	42.2	42.2	Condon Silt Loam	0.6
Gilbert (RC)	Gt83	30	--	60.2	60.2	Pilot Rock Silt Loam	0.6
Reeder (RC)	R83	20	--	60.2	60.2	Walla Walla Silt Loam	1.8+
1983-84							
Harper	Hr84	69	60.2	55.9	116.1	Walla Walla Silt Loam	1.8+
Hay	Hy84	69	55.4	42.9	99.3	Walla Walla Silt Loam	1.8+
Kaseberg	K84	43	46.0	36.3	82.3	Walla Walla Silt Loam	1.8+
Bergstrom	Bm84	43	46.0	44.5	90.4	Valby Silt Loam	0.9
Smouse	Sm84	156	46.7	45.7	92.5	Walla Walla Silt Loam	1.5
Anderson (RC)	A84	9	--	44.5	44.5	Valby Silt Loam	0.9
Campbell (RC)	C84	37	--	43.4	43.4	Condon Silt Loam	0.8
Gilbert (RC)	Gt84	40	--	55.9	55.9	Pilot Rock Silt Loam	0.6
Martin (RC)	Mn84	7	--	37.3	37.3	Condon Silt Loam	0.6
1984-85							
Feist	F85	64	37.6	27.2	64.8	Condon Silt Loam	1.4
Goodwin	Gn85	30	55.9	38.9	94.7	Walla Walla Silt Loam	1.8+
Kaseberg	K85	120	36.3	25.7	62.0	Walla Walla Silt Loam	1.8+
Anderson	A85SF	33	44.5	28.4	72.9	Valby Silt Loam	0.8
Maley	My85	64	43.4	25.7	69.1	Condon Silt Loam	1.1
Smouse	Sm85	54	45.7	31.2	72.0	Ritzville Silt Loam	1.4
Anderson (RC)	A85RC	8	--	28.4	28.4	Valby Silt Loam	0.6
Martin (RC)	Mn85	9	--	23.1	23.1	Condon Silt Loam	0.7
Newtson (RC)	N85	20	--	38.9	38.9	McKay Silt Loam	0.6

RC = Recrop

Recrop Sites. A significant increase in grain yield from N fertilizer occurred at all recrop sites (Figures 6-8); however, in the third year (1984-85) yields were considerably lower than in the two preceding years. This was mainly due to below average CYP in 1984-85 (Table 5). Of the four recrop sites in 1983-84 (Figures 6 and 7), three sites had linear grain yield responses from 0 to 112 kg N ha^{-1} while the fourth (Mn84) site's yield response was quadratic and grain yield did not increase at N rates beyond 55 kg N ha^{-1}. The Mn84 site received from 6 to 18 cm less precipitation than the other three 1983-84 recrop sites. In 1982-83 at all three recrop sites (Figure 6), wheat yield responses were quadratic with the higher N fertilizer rates failing to increase yields over the lower rates of N. Soil moisture was depleted at high N rates before the grain was completely filled at the three 1982-83 recrop sites.

Soil Nitrogen.

Available soil N is predominantly NO_3-N and NH_4-N. Check plot yields were regressed against both NO_3-N and NH_4-N; NO_3-N accounted for more of the variation in yield than NH_4-N. Different combinations of NH_4-N and NO_3-N were tested using multiple regression but none reduced the residual (error) term or increased the coefficient of determination (R^2) more than NO_3-N alone (Appendix C).

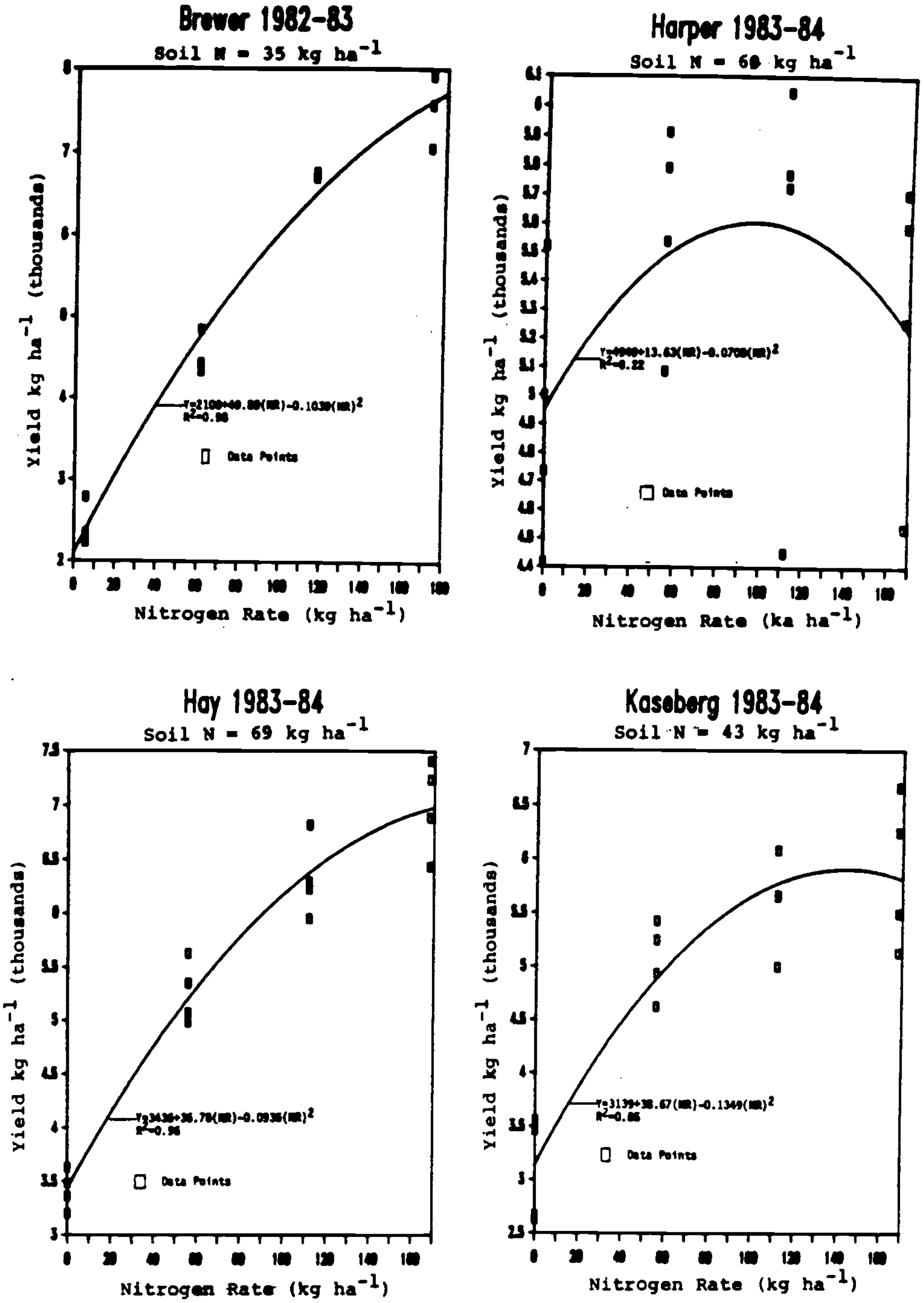

Figure 1. High Potential Yield Sites, N Rate Response Curves

(Br83, Hr84, Hy84, and K84)

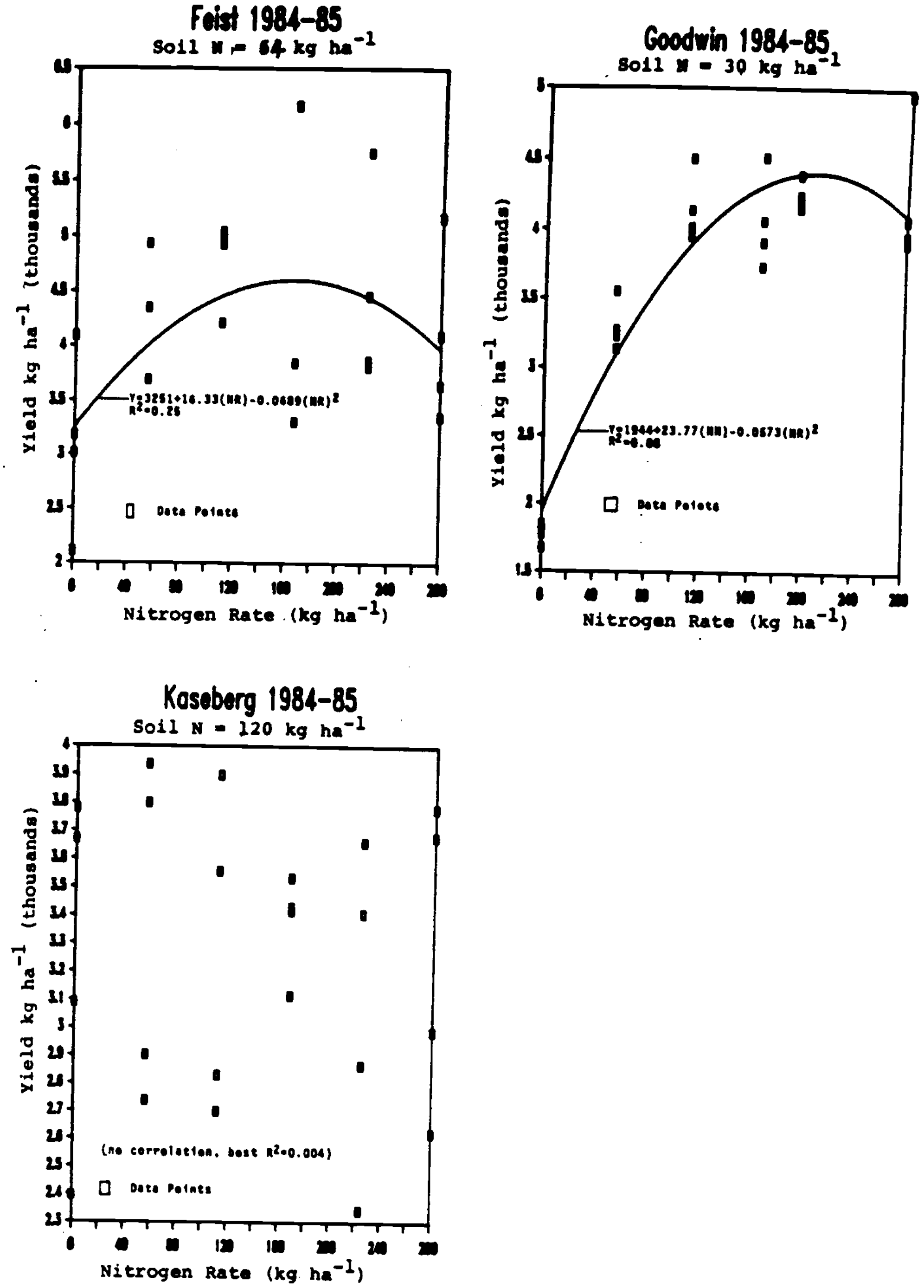

Figure 2. High Potential Yield Sites, N Rate Response Curves

(F85, Gn85, and K85)

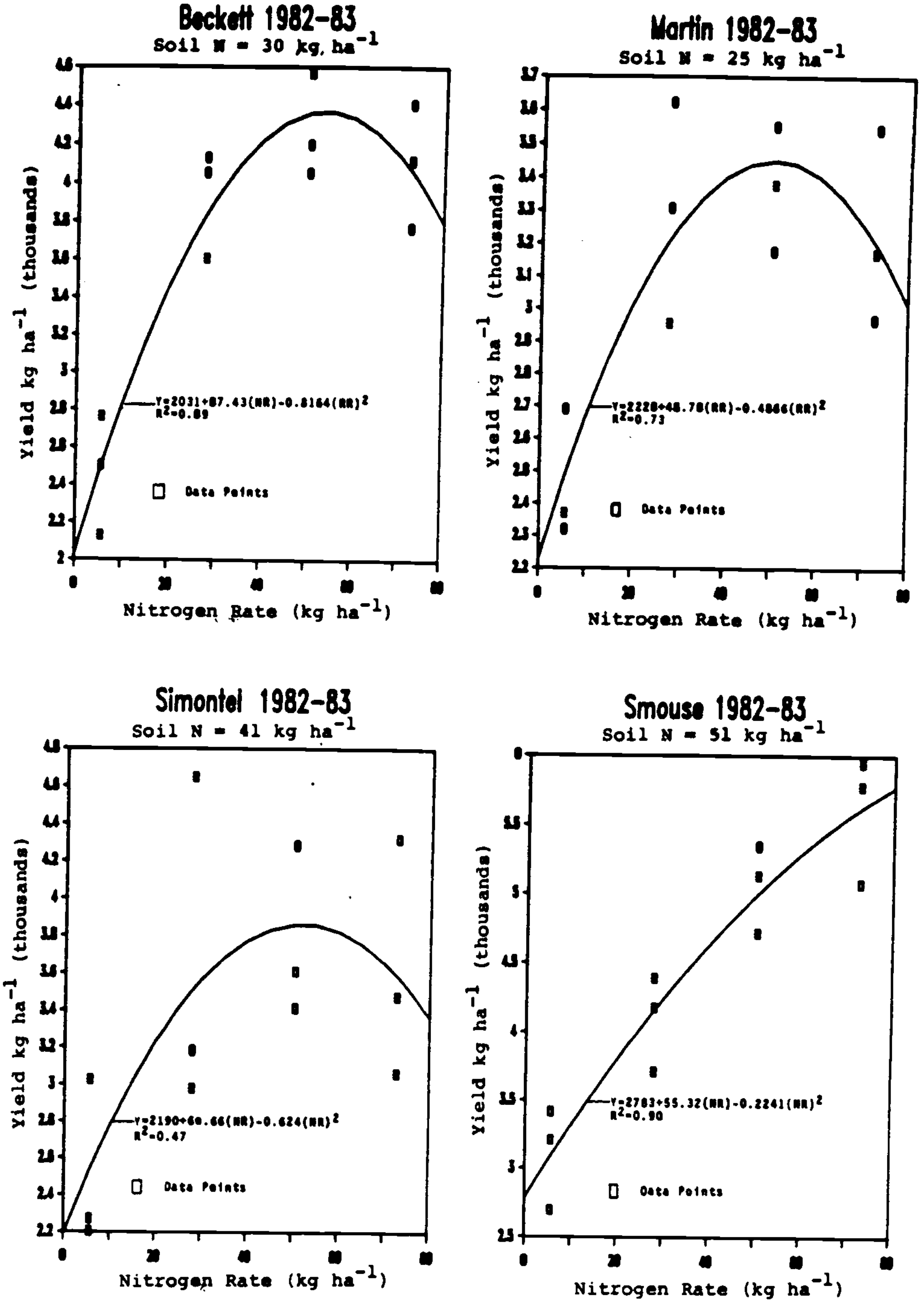

Figure 3. Low Potential Yield Sites, N Rate Response Curves

(Be83, Mn83, Si83, and Sm83)

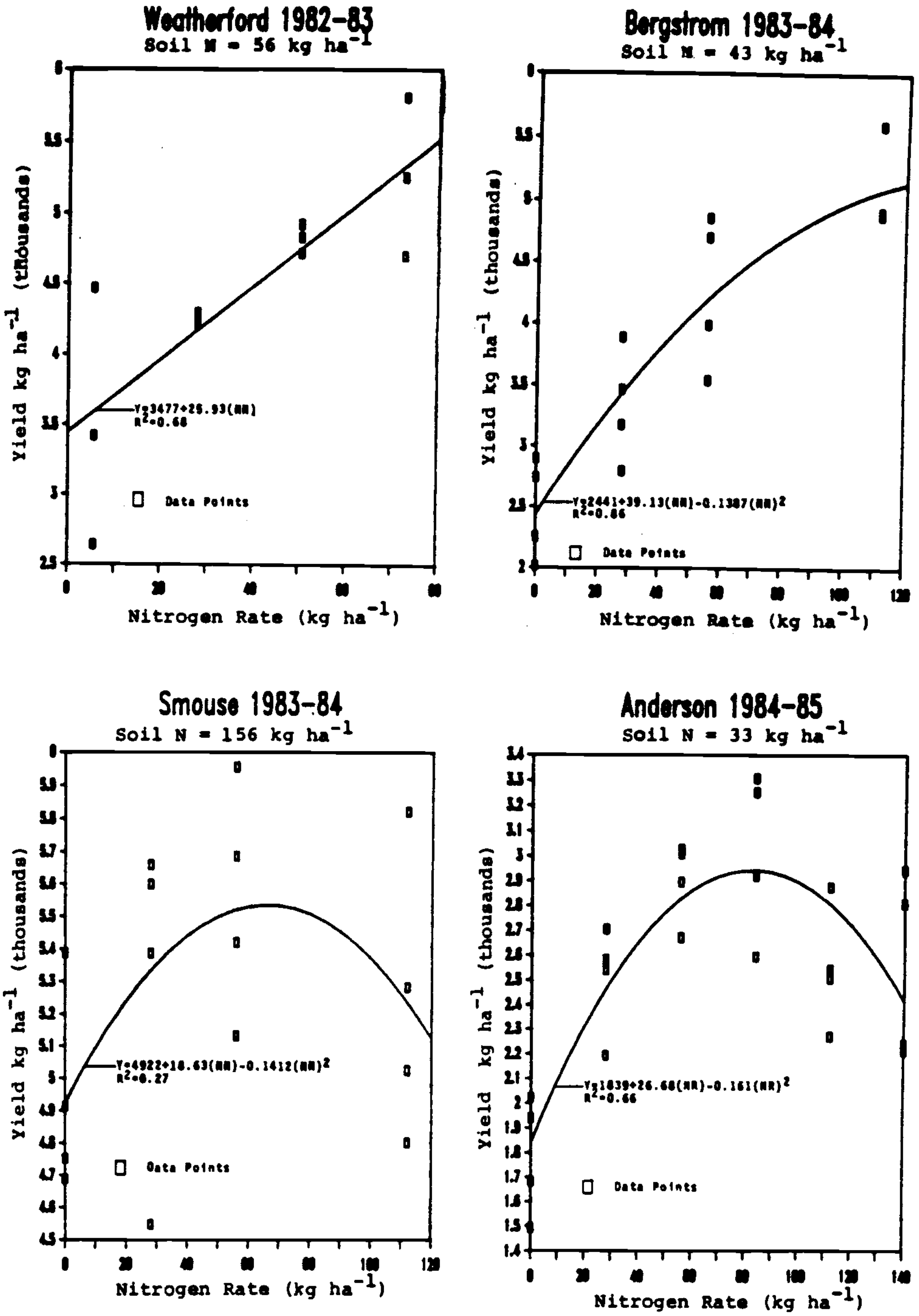

Figure 4. Low Potential Yield Sites, N Rate Response Curves

(W83, Bm84, Sm84, and A85SF)

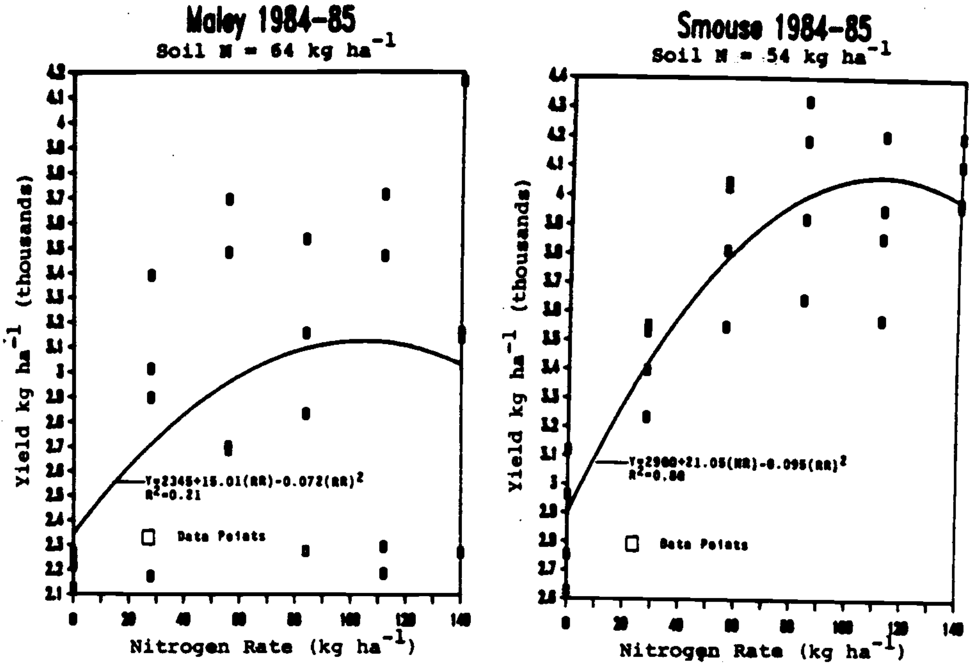

Figure 5. Low Potential Yield Sites, N Rate Response Curves

(My85 and Sm85)

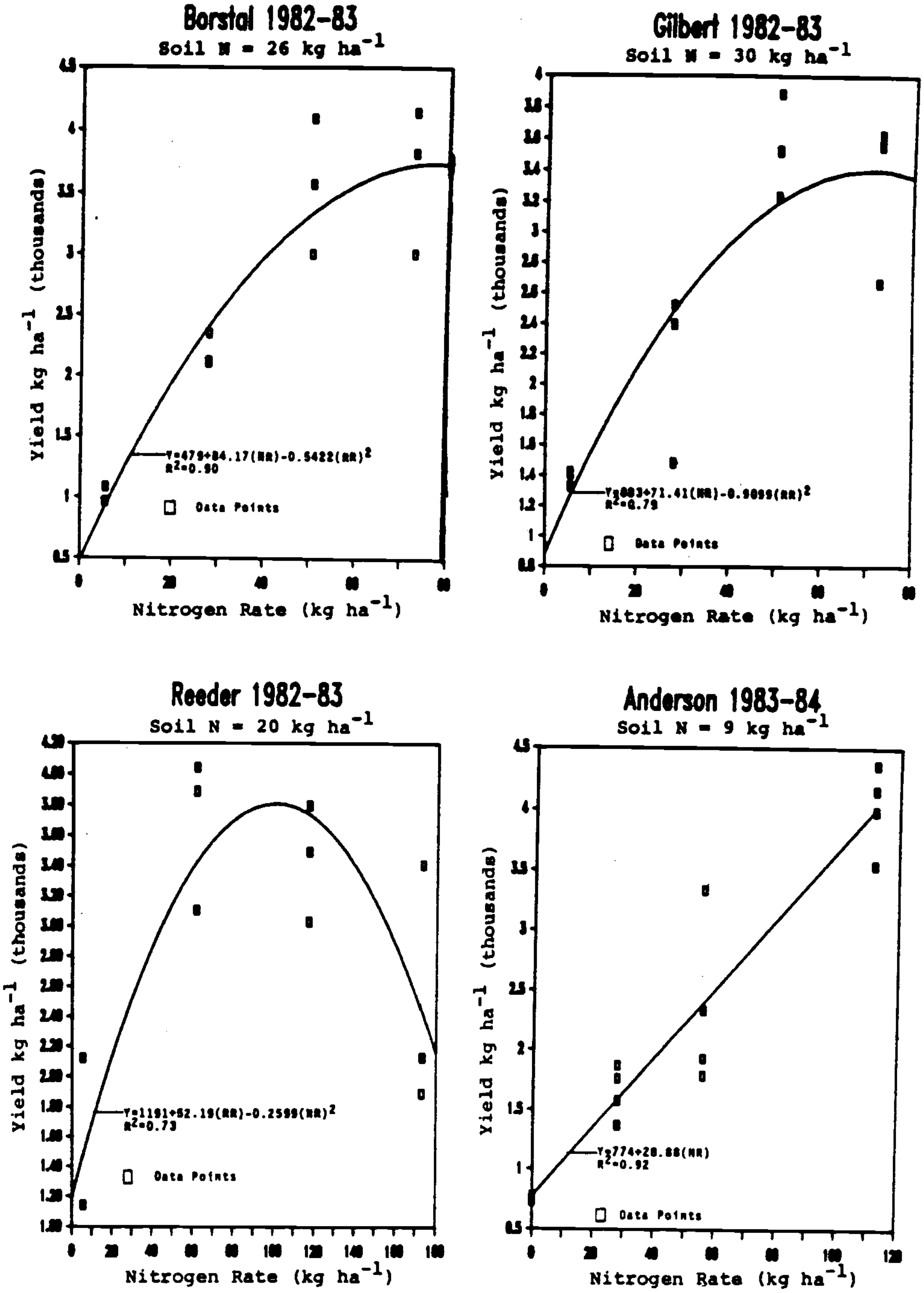

Figure 6. Recrop Sites, N Rate Response Curves

(B183, Gt83, R83, and A84)

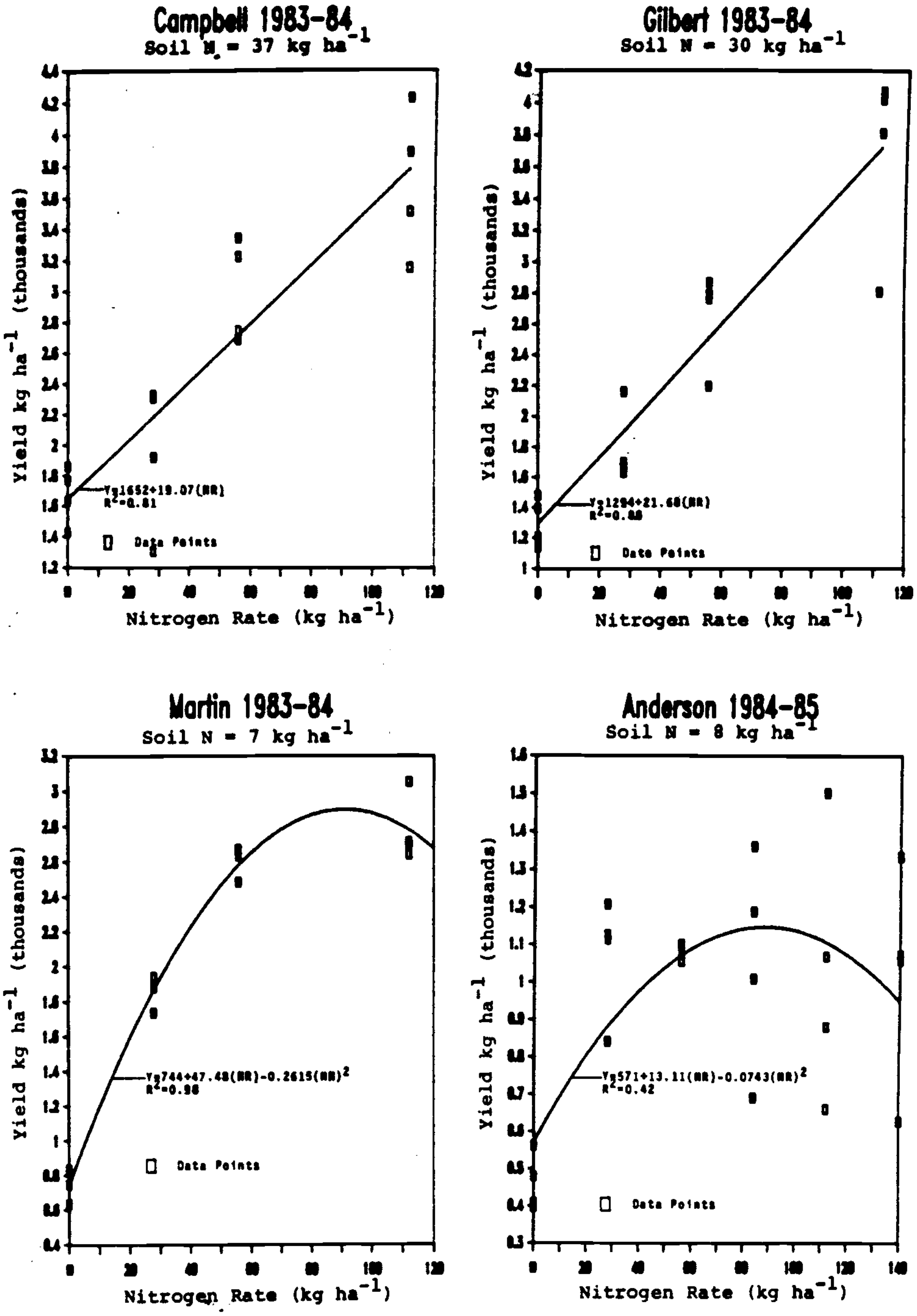

Figure 7. Recrop Sites, N Rate Response Curves

(C84, Gt84, Mn84 and A85RC)

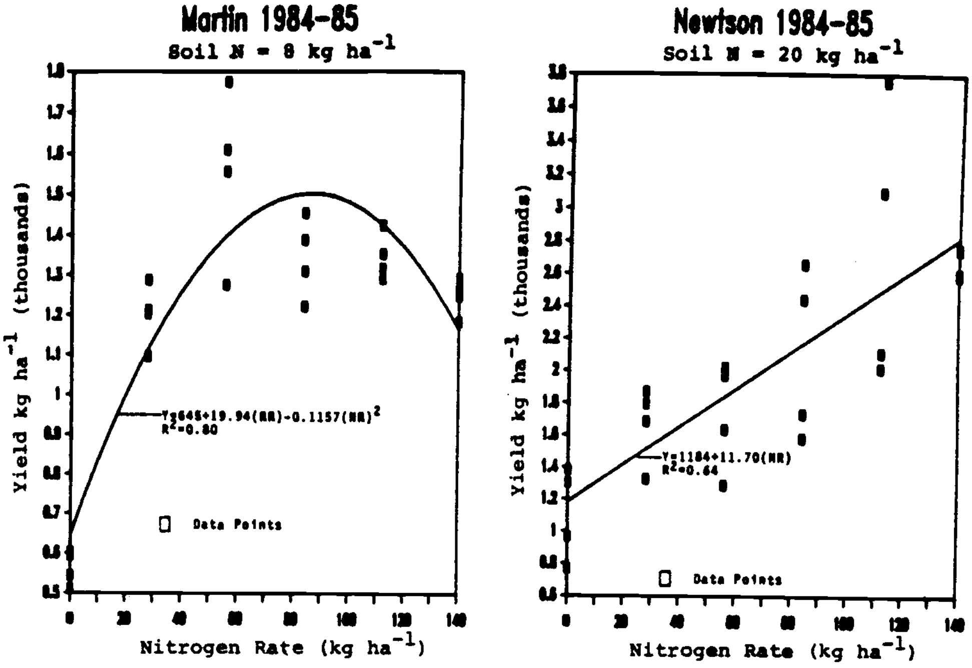

Figure 8. Recrop Sites, N Rate Response Curves

(Mn85 and N85)

Soil N levels, regardless of N form used (NO_3-N + NH_4-N or NO_3-N), had a better correlation with check plot yields when soil samples were taken in the fall (mid to late September, before planting) than when soil samples were taken in the spring (mid April) of the crop year (Appendix C). The poor correlation between spring-sampled soil N levels and check plot yields may be due to the wheat crop taking up different amounts of soil N at each plot site. If soil samples are taken in the spring of the crop year, plant samples may also need to be taken and analyzed for total N, to improve correlation with yield. Soil N, in this thesis, refers to soil NO_3-N from soil samples taken in mid-September of the crop year unless otherwise noted.

Combining all the summer fallow sites (1982-83 through 1984-85), the regression equation for soil N versus check plot yields is $Y=1222+ 39.19(SN)-0.1256(SN)^2$, $R^2=0.40$, where Y = yield in kg ha^{-1} and SN = soil NO_3-N (kg ha^{-1}). The recrop sites responded differently, with the regression model $Y=634+0.7245 (SN)^2$, $R^2=0.64$. Combining the summer fallow sites with the recrop sites gave a wider range of soil N levels and a better fit; $Y=134+64.45(SN)-0.247(SN)^2$ with $R^2=0.70$ (Figure 9). Taking the first derivative of this equation predicts a maximum grain yield when the available soil N level is 130 kg N ha^{-1}. Of the two sites near this level, yield at K85 site with 120 kg SN ha^{-1} did not increase with the application of N, whereas at Sm84 (156 kg SN ha^{-1}, Figure 4) grain yields increased with N fertilizer up

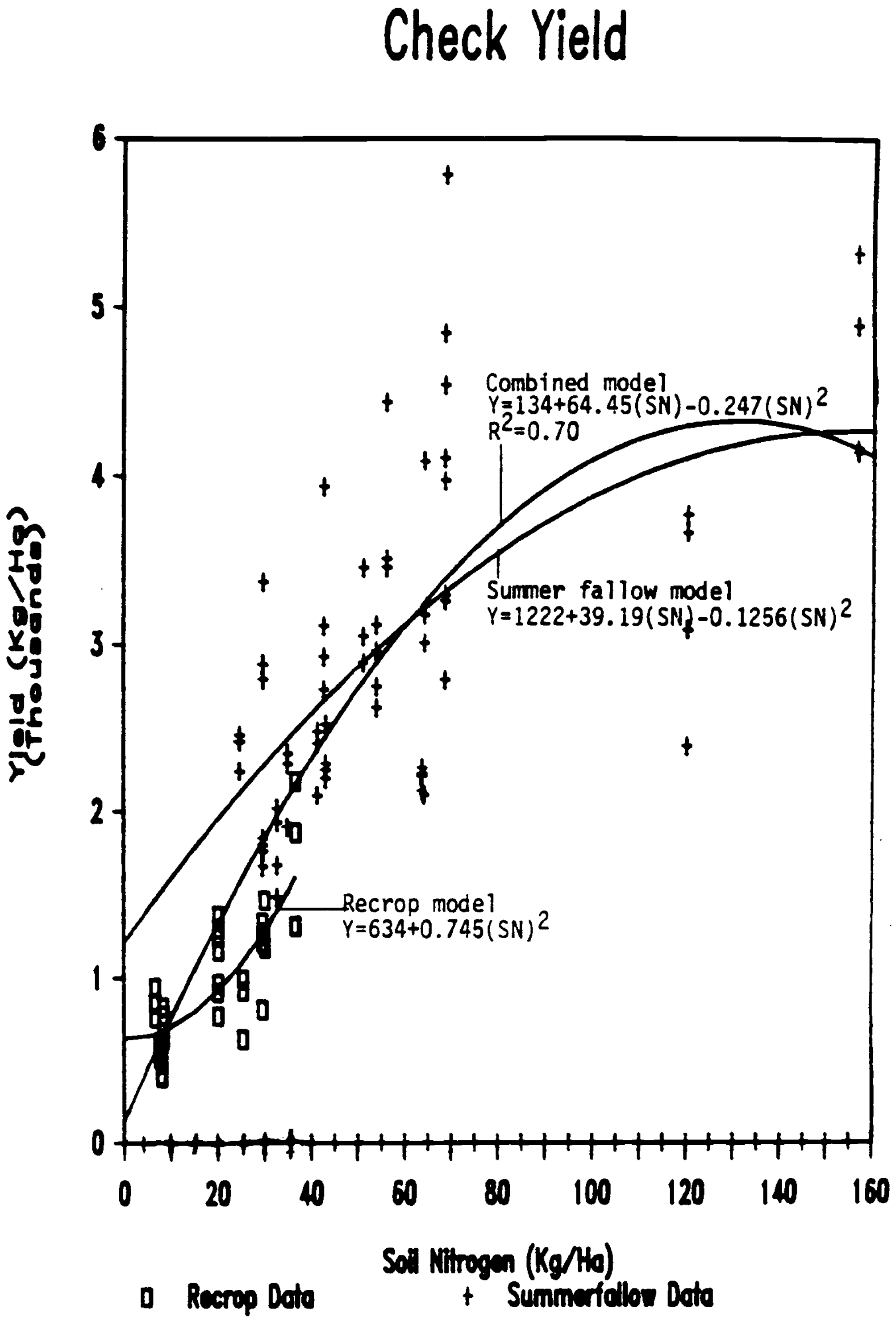

Figure 9. Check Yield vs. Soil NO_3-N

to the 56 kg N ha^{-1} rate. However, the Sm84 site received more precipitation than the K85 site (92.5 versus 62.0 cm).

Regression Models for Predicting Yield

Yield data from the 17 summer fallow sites (summer fallow data), the 10 recrop sites (recrop data), or from all 27 sites (combined data) were analyzed using multiple regression. The regression models and coefficient of determination for each are reported below.

Summer Fallow Data:

$$Y = -2424+27.01(NF)-0.0524(NF)^2+56.62(SN)-0.2157(SN)^2-0.1227(NF*SN)+81.15(CYP) \qquad R^2 = 0.65$$

Y = grain yield kg ha^{-1}; NF = nitrogen fertilizer; SN = soil NO_3-N; CYP = crop year precipitation; and NF*SN = NF times SN interaction term.

Recrop Data:

$$Y = 603+17.10(NF)-0.1966(NF)^2+0.6219(SN)^2+0.5150(NF*CYP) \qquad R^2 = 0.71$$

NF*CYP = NF times CYP interaction term.

Combined Data:

$$Y=-129-1553(RCSFIND)+21.63(NF)-0.0660(NF)^2+19.11(SN)-0.0619(SN)^2+ 59.89(CYP) \qquad R^2 = 0.73$$

RCSFIND is an indicator variable equal to 0 and 1 for summer fallow and recrop sites, respectively.

Using the relevant regression equations, tables to predict N fertilizer rates based on: 1) expected yield (Y); 2) available soil N (SN); and 3) expected precipitation were made for summer fallow, recrop, and the combined model (Tables 6, 7, and 8). These tables are based on the yield response of 17, 10 or 27 sites, respectively, and so reflect an "average" N fertilizer requirement. Individual sites may require more or less N fertilizer.

Nitrogen Timing Comparisons.

Banding N below the seed at planting gave higher yields more frequently than other methods of application (Table 9). In 1984-85 (a drier spring than normal), N application in the spring to summer fallow (SS) and banding N at seeding (SD) gave similar results, while N applied in the spring of the crop year (SC) generally gave lower yields. Relatively poor response to the SC application was likely due to a dry soil surface in the spring, and a lack of major rainfall events to move the N fertilizer

TABLE 6

SUMMER FALLOW NITROGEN REQUIREMENT PREDICTION*

Expected+ Yield kg ha^{-1}	Soil Nitrogen kg ha^{-1}						60 cm Rainfall Area			
	30	40	50	60	70	80	90	100	110	120
8000	134	127	120	114	110	106	103	102	101	101
7500	120	112	105	98	92	88	84	82	81	81
7000	106	97	89	81	74	68	63	59	57	57
6500	91	81	72	63	54	46	39	33	29	27
6000	75	64	53	43	32	22	12	-	-	-
							50 cm Rainfall Area			
6500	115	106	99	92	86	80	76	73	72	71
6000	100	91	82	74	67	60	54	50	47	46
5500	85	75	65	55	46	37	30	23	17	14
5000	69	58	46	35	23	12	-	-	-	-
4500	52	39	26	12	-	-	-	-	-	-
							40 cm Rainfall Area			
5000	95	85	76	67	59	52	45	40	36	35
4500	79	68	58	48	38	28	19	11	-	-
4000	63	51	39	26	14	-	-	-	-	-
3500	46	32	18	-	-	-	-	-	-	-
3000	27	11	-	-	-	-	-	-	-	-
							30 cm Rainfall Area			
4000	89	79	69	60	51	43	36	30	25	22
3500	73	62	51	40	29	19	9	-	-	-
3000	56	44	31	18	-	-	-	-	-	-
2500	39	24	9	-	-	-	-	-	-	-
2000	20	-	-	-	-	-	-	-	-	-

* Nitrogen requirement = kg N ha^{-1}

\+ Use highest yield for each rainfall division unless yield is limited by the available water holding capacity of the soil.

TABLE 7

RECROP NITROGEN REQUIREMENT PREDICTION[*]

Expected[+] Yield kg ha^{-1}	Soil Nitrogen kg ha^{-1}				
	10	20	30	40	50
				60 cm Rainfall Area	
4000	155	130	100	70	48
3500	100	84	67	50	32
3000	67	59	48	34	19
				50 cm Rainfall Area	
3000	109	78	59	40	22
2500	59	50	38	24	8
2000	38	31	22	10	-
				40 cm Rainfall Area	
2500	88	67	47	28	10
2000	47	38	26	11	-
1500	26	19	9	-	-
				30 cm Rainfall Area	
2000	75	51	32	13	-
1500	32	23	11	-	-
1000	11	5	-	-	-

[*] Nitrogen requirement = kg N ha^{-1}

[+] Use highest yield for each rainfall division unless yield is limited by the available water holding capacity of the soil.

TABLE 8

COMBINED MODEL FOR: SUMMER FALLOW NITROGEN REQUIREMENT PREDICTION*

Expected+ Yield kg ha^{-1}	Soil Nitrogen kg ha^{-1}						60 cm Rainfall Area			
	30	40	50	60	70	80	90	100	110	120
6000	205	170	140	115	100	89	81	74	69	66
5500	102	86	74	64	56	49	44	39	35	33
5000	57	47	38	31	25	20	15	12	9	6
							50 cm Rainfall Area			
5000	115	96	82	72	63	56	50	45	41	38
4500	64	54	45	37	31	25	21	17	14	11
4000	32	23	16	10	5	-	-	-	-	-
							40 cm Rainfall Area			
4500	135	108	92	80	71	63	57	52	48	44
4000	72	61	51	43	36	31	26	22	19	16
3500	37	29	21	15	9	5	-	-	-	-
							30 cm Rainfall Area			
3500	81	68	58	49	42	36	31	27	24	21
3000	43	34	27	20	14	10	5	-	-	-
2500	15	8	-	-	-	-	-	-	-	-

* Nitrogen requirement = kg N ha^{-1}

\+ Use highest yield for each rainfall division unless yield is limited by the available water holding capacity of the soil.

TABLE 8 continued

COMBINED MODEL FOR: RECROP NITROGEN REQUIREMENT PREDICTION[*]

Expected[+] Yield kg ha^{-1}	Soil Nitrogen kg ha^{-1}			60 cm Rainfall Area	
	10	20	30	40	50
4000	179	139	109	91	78
3500	89	73	61	50	42
3000	49	38	29	21	14
				50 cm Rainfall Area	
3000	100	82	68	57	48
2500	56	44	35	26	19
2000	25	16	8	-	-
				40 cm Rainfall Area	
2500	113	92	77	65	55
2000	63	51	41	32	24
1500	31	21	13	6	-
				30 cm Rainfall Area	
2000	131	103	86	72	62
1500	71	58	47	38	30
1000	36	27	18	11	-

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[*] Nitrogen requirement = kg N ha^{-1}

[+] Use highest yield for each rainfall division unless yield is limited by the available water holding capacity of the soil.

TABLE 9

NITROGEN TIMING COMPARISONS

All N treatments received 10 kg ha^{-1} P and 22 kg ha^{-1} S

High Potential Yield Summer Fallow Sites (1983-84)

Treatment No.	Nitrogen Timing[+] SS		SC	Hr84	Hy84	K84
		SD				
	kg N ha^{-1}			Yield kg ha^{-1}		
3	0	112	0	5498	6326	5601
8	56	0	56	5475	4586	5300
9	112	0	0	5623	4101	5083
10	0	0	112	5258	5988	5343
11	0	28	84	5214	6347	5530
LSD$_{95}$				NSD	768	835
LSD$_{99}$				NSD	1027	1125

High Potential Yield Summer Fallow Sites (1984-85)

Treatment No.	Nitrogen Timing[+] SS		SC	F85	K85	Gn85
		SD				
	kg N ha^{-1}			Yield kg ha^{-1}		
3	0	112	0	4797	3247	4057
7	0	0	112	4530	2596	4488
8	56	0	56	4273	3413	4310
9	112	0	0	5110	2920	4561
10	0	56	56	4158	2967	4292
LSD$_{95}$				895	NSD	356
LSD$_{99}$				1198	NSD	476

[+] Nitrogen Timing. SS = Nitrogen applied in spring of summer fallow year; SD = Nitrogen applied at seeding; SC = Nitrogen applied in spring of crop year.

NSD = No Significant Difference

TABLE 9 continued

NITROGEN TIMING COMPARISONS

Low Potential Yield Summer Fallow Sites (1983-84)

Treatment No.	Nitrogen Timing+ SS	SD	SC	Sm84	Bm84
	kg N ha^{-1}			Yield kg ha^{-1}	
3	0	56	0	5549	4271
8	28	0	28	5518	3810
9	56	0	0	5461	3876
10	0	0	56	5695	4310
11	0	28	28	5536	4173
LSD_{95}				526	503
LSD_{99}				704	673

Low Potential Yield Summer Fallow Sites (1984-85)

Treatment No.	Nitrogen Timing+ SS	SD	SC	Sm85	My85	A85SF
	kg N ha^{-1}			Yield kg ha^{-1}		
3	0	56	0	3858	3141	2900
7	0	0	56	3310	2637	2525
8	28	0	28	3661	2933	2963
9	56	0	0	3795	2890	3169
10	0	28	28	3748	2896	2873
LSD_{95}				357	492	404
LSD_{99}				478	658	541

[+] Nitrogen Timing. SS = Nitrogen applied in spring of summer fallow year; SD = Nitrogen applied at seeding; SC = Nitrogen applied in spring of crop year.

TABLE 9 continued

NITROGEN TIMING COMPARISONS

Recrop Sites (1983-84)

Treatment No.	Nitrogen Timing[+] SD	SC	Mn84	C84	A84	Gt84
	kg N ha^{-1}		Yield kg ha^{-1}			
3	56	0	2617	3006	2347	2654
10	0	56	1879	2033	1913	2401
11	28	28	2338	3090	2120	2179
LSD_{95}			389	560	496	446
LSD_{99}			520	752	666	598

Recrop Sites (1984-85)

Treatment No.	Nitrogen Timing[+] SD	SC	N85	Mn85	A85RC
	kg N ha^{-1}		Yield kg ha^{-1}		
3	56	0	1727	1554	1085
7	0	56	1577	786	737
10	28	28	2055	1342	949
LSD_{95}			570	185	280
LSD_{99}			765	249	376

[+] Nitrogen Timing. SS = Nitrogen applied in spring of summer fallow year; SD = Nitrogen applied at seeding; SC = Nitrogen applied in spring of crop year.

farther down in the profile where it would be available later in the growing season. Nitrogen immobilization by the straw residues on the surface could have also decreased the availability of surface applied N.

In 1983-84 (wetter than average), SD and SC applications of N gave similar results on summer fallow sites, while the SS application generally gave lower yields. Two possible reasons for lower yields from the SS application are: 1) 1983-84 was wetter and soil profiles contained more moisture, thus SS-applied N could have been leached and/or denitrified more readily than SD or SC-applied N; 2) SC-applied N was utilized to a greater extent in 1983-84 than 1984-85 because of spring rains that either moved the N fertilizer down or kept the soil surface moist so that shallow roots could still function.

Source of N.

Ammonium chloride (AC), ammonium sulfate (AS), and urea (U) were compared as N sources in 1983-84 and 1984-85. In 1983-84 urea phosphate (UP) was also evaluated as a N source. Urea phosphate increased grain yield slightly at seven and nine sites, compared to urea plus phosphorus (Table 10). Ammonium chloride, AS, and U appeared to be equally effective as N fertilizer sources from yield responses.

Phosphorus and Sulfur Comparisons.

In 1982-83, wheat yields at two sites responded to both phosphorus (P) and sulfur (S) fertilizers (Table 11). These were the Gt83 recrop site and the Br83 deep summer fallow site. Soil test P and SO_4 levels were 6.0 ppm P and 1.0 ppm S at 0 to 30 cm and 3.6 ppm S in the 30 to 60 cm depth at the Gt83 site and 13.0 ppm P with less than 0.9 ppm S in the soil profile at the Br83 site (Appendix D).

In 1983-84, when P and SO_4 soil test values (Appendix D) ranged from 7 to 16 ppm and 0.6 to 5.0 ppm, respectively, there was no response to P or S fertilizers.

In 1984-85, responses from P fertilizer were recorded at the F85 and My85 sites (Table J). Soil test values for P were 14 and 16 ppm for the F85 and My85 sites, respectively. These P levels were above the suggested critical level of 10 ppm, and much higher than P levels of 7-11 ppm P at other sites where no significant P response was noted. Both the F85 and My85 sites were at high elevations where cold soils possibly slowed root development and P uptake (Power et al., 1963; 1964).

Response to P fertilizer was highly variable, and appeared to depend more on growing conditions than on the soil P test level. When soil P levels were above 17 ppm, P responses were not observed. Where P soil test values were from 6-16 ppm, P fertilizer responses depended on climatic and soil conditions.

TABLE 10

NITROGEN SOURCE COMPARISONS

High Potential Yield Summer Fallow Sites (1984-85)

	Nitrogen Timing$^+$			Source of	P	SO_4	Hr84	Hy84	K84
NO.	SS	SD	SC	N*	kg ha^{-1}			Yield kg ha^{-1}	
11	0	28	84	U	10	22	5214	6347	5530
12	0	28	84	AC	10	22	5254	6327	6407
13	0	28	84	AS	10	150	4941	6309	5959
14	0	168	0	UP	24	22	5392	7021	6530
15	0	168	0	U	24	22	5310	6700	5982
LSD_{95}							NSD	768	835
LSD_{99}							NSD	1027	1125

High Potential Yield Summer Fallow Sites (1984-85)

	Nitrogen Timing$^+$			Source of	P	SO_4	F85	K85	Gn85
NO.	SS	SD	SC	N*	kg ha^{-1}			Yield kg ha^{-1}	
10	0	56	56	U	10	22	4158	2967	4292
13	0	56	56	AC	10	22	3530	2820	4652
14	0	56	56	AS	10	150	3889	3297	4323
LSD_{95}							895	NSD	356
LSD_{99}							1198	NSD	476

* AC = Ammonium Chloride; AS = Amonium Sulfate; U = Urea; UP = Urea Phosphate.

$^+$ Nitrogen Timing Rates in kg ha^{-1}. SS = Nitrogen applied in spring of summer fallow year; SD = Nitrogen applied at seeding; SC = Nitrogen applied in spring of crop year.

NSD = No Significant Difference

TABLE 10 continued

NITROGEN SOURCE COMPARISONS

Low Potential Yield Summer Fallow Sites (1983-84)

	Nitrogen Timing+			Source of	P	SO_4	Sm84	Bm84
NO.	SS	SD	SC	N*	kg ha^{-1}		Yield kg ha^{-1}	
11	0	28	28	U	10	22	5536	4173
12	0	28	28	AC	10	22	5569	4363
13	0	28	28	AS	10	86	5792	4370
14	0	112	0	UP	16	22	5623	4679
15	0	112	0	U	16	22	5293	4784
LSD_{95}							526	503
LSD_{99}							704	673

Low Potential Yield Summer Fallow Sites (1984-85)

	Nitrogen Timing+			Source of	P	SO_4	Sm85	My85	A85SF
NO.	SS	SD	SC	N*	kg ha^{-1}		Yield kg ha^{-1}		
10	0	28	28	U	10	22	3748	2896	2873
13	0	28	28	AC	10	22	3516	2725	3172
14	0	28	28	AS	10	86	3532	2664	2918
LSD_{95}							357	492	404
LSD_{99}							478	658	541

* AC = Ammonium Chloride; AS = Amonium Sulfate; U = Urea; UP = Urea Phosphate.

+ Nitrogen Timing Rates in kg ha^{-1}. SS = Nitrogen applied in spring of summer fallow year; SD = Nitrogen applied at seeding; SC = Nitrogen applied in spring of crop year.

TABLE 10 continued

NITROGEN SOURCE COMPARISONS

Recrop Sites (1983-84)

Nitrogen Timing$^+$			Source of N*	P	SO_4	Mn84	C84	A84	Gt84
NO.	SD	SC		kg ha^{-1}		Yield kg ha^{-1}			
11	28	28	U	10	22	2338	3090	2120	2179
12	28	28	AC	10	22	2398	3111	2061	2415
13	28	28	AS	10	86	2335	2943	1883	2212
14	112	0	UP	16	22	2735	3669	4036	3811
15	112	0	U	16	22	2934	3416	3821	3311
LSD$_{95}$						389	560	496	446
LSD$_{99}$						520	752	666	598

Recrop Sites (1984-85)

Nitrogen Timing$^+$			Source of N*	P	SO_4	N85	Mn85	A85RC
NO.	SD	SC		kg ha^{-1}		Yield kg ha-1		
10	28	28	U	10	22	2055	1342	949
13	28	28	AC	10	22	2271	1302	1308
14	28	28	AS	10	86	1806	1185	1133
LSD$_{95}$						570	185	280
LSD$_{99}$						765	249	376

* AC = Ammonium Chloride; AS = Amonium Sulfate; U = Urea; UP = Urea Phosphate.

$^+$ Nitrogen Timing Rates in kg ha^{-1}. SS = Nitrogen applied in spring of summer fallow year; SD = Nitrogen applied at seeding; SC = Nitrogen applied in spring of crop year.

The variable P response may be due to organic P being released in higher quantities at non-responsive sites in comparison to P responsive sites. Organic matter decomposition rates would be higher in warmer soils. Also, in addition, more rapid root growth in warmer soils would enhance P uptake.

In 1984-85, a response to S was apparent on recrop wheat at the Mn85 and A85RC sites (Table 11); S soil test values for Mn85 was 0.9, 1.2, and 1.1 ppm for the 0-30, 30-60, 60-71 cm soil depths, respectively. Sulfur soil test data are not available for the A85RC site. During the three years of this research, of 15 sites with S levels below 2 ppm in the top 60 cm of soil, only two responded to S fertilizer. The third site that responded had 1.0 and 3.6 ppm S in the 0-30 and 30-60 cm depths, respectively. The S level at the fourth S responsive site (A85RC) is unknown.

Sulfur responses were highly variable. Sulfur levels in the 0-30 cm depth ranged from 0.8 to 1.0 ppm at the three sites responsive to S fertilizer, while at fifteen sites where SO_4-S levels ranged from 0.1 to 1.9 ppm in the 0-30 cm depth, responses to S fertilizer were not recorded. Conditions such as cold and/or wet soils, which decrease microbial activity and thus, organic S cycling, may be as important to S availability as the inorganic S level in the soil.

TABLE 11

PHOSPHORUS AND SULFUR COMPARISONS

High Potential Yield Summer Fallow Sites (1982-83)

	N	P	S	Br83	R83
NO.		$kg\ ha^{-1}$		Yield $kg\ ha^{-1}$	
3	118	8.3	134	6738	3441
5	118	0	134	5884	3824
6	118	8.3	0	4187	3461
LSD_{95}				521	997
LSD_{99}				731	1398

Low Potential Yield Summer Fallow Sites (1982-83)

	N	P	S	Sm83	W83
NO.		$kg\ ha^{-1}$		Yield $kg\ ha^{-1}$	
3	50	8.3	54	5067	4828
5	50	0	54	5462	4379
6	50	8.3	0	4872	4876
LSD_{95}				638	676
LSD_{99}				895	947

Low Potential Yield Summer Fallow Sites (1982-83)

	N	P	S	Si83	Mn83	Bt83
NO.		$kg\ ha^{-1}$			Yield $kg\ ha^{-1}$	
3	50	8.3	54	3771	3369	4274
5	50	0	54	3756	3355	4007
6	50	8.3	0	3733	3485	4260
LSD_{95}				482	430	599
LSD_{99}				675	603	840

TABLE 11 continued

PHOSPHORUS AND SULFUR COMPARISONS

1982-83 Recrop Sites (1982-83)

NO.	N	P	S	Gt83	Bl83
	kg ha^{-1}			Yield kg ha^{-1}	
3	50	8.3	54	3550	3560
5	50	0	54	2873	3163
6	50	8.3	0	2654	3354
LSD$_{95}$				515	528
LSD$_{99}$				722	740

1983-84 High Potential Yield Summer Fallow Sites (1983-84)

NO.	N	P	S	Hr84	Hy84	K84
	kg ha^{-1}			Yield kg ha^{-1}		
3	112	8.3	22	5498	6326	5601
5	112	0	22	5472	6105	5777
6	112	8.3	0	5525	6651	5347
LSD$_{95}$				NSD	768	835
LSD$_{99}$				NSD	1027	1125

1983-84 Low Potential Yield Summer Fallow Sites

NO.	N	P	S	Sm84	Bm84
	kg ha^{-1}			Yield kg ha^{-1}	
3	56	8.3	22	5549	4271
5	56	0	22	5605	4334
6	56	8.3	0	5985	4487
LSD$_{95}$				526	503
LSD$_{99}$				704	673

NSD = Not Significant Data

TABLE 11 continued

PHOSPHORUS AND SULFUR COMPARISONS

1983-84 Recrop Sites

	N	P	S	Mn84	C84	A84	
Gt84							
NO.		kg ha^{-1}			Yield kg ha^{-1}		
3	56	8.3	22	2617	3006	2347	2654
5	56	0	22	2525	2986	2918	2249
6	56	8.3	0	2800	3195	2591	2707
LSD$_{95}$				389	560	496	446
LSD$_{99}$				520	752	666	598

1984-85 High Potential Yield Summer Fallow Sites (1984-85)

	N	P	S	Gn85	K85	F85
NO.		kg ha^{-1}			Yield kg ha^{-1}	
3	112	8.3	22	4057	3247	4797
11	112	0	22	4220	3402	3544
12	112	8.3	0	3878	3426	4709
LSD$_{95}$				356	NSD	895
LSD$_{99}$				476	NSD	1198

Low Potential Yield Summer Fallow Sites (1984-85)

	N	P	S	Sm85	My85	A85SF
NO.		kg ha^{-1}			Yield kg ha^{-1}	
3	56	8.3	22	3858	3141	2900
11	56	0	22	3664	2668	2749
12	56	8.3	0	3870	3103	2999
LSD$_{95}$				357	492	404
LSD$_{99}$				478	658	541

NSD = Not Significant Data

TABLE 11 continued

PHOSPHORUS AND SULFUR COMPARISONS

1984-85 Recrop Sites

NO.	N	P	S	N85	Mn85	A85RC
	kg ha^{-1}			Yield kg ha^{-1}		
3	56	8.3	22	1727	1554	1085
11	56	0	22	1668	1414	1054
12	56	8.3	0	1883	1363	712
LSD_{95}				570	185	280
LSD_{99}				765	249	376

Grain Quality.

Protein content of the grain increased with increasing N fertilizer rates at all 27 sites. At five sites, the first increment of N fertilizer lowered protein concentration while increasing yield. In 1982-83, grain yields tended to peak with protein levels between 8-9% while in 1983-84 and 1984-85, yields tended to peak with protein levels between 9-10%. When protein levels exceeded 10%, yield declined with additional N fertilizer (Appendix E). Protein data from all 27 sites were correlated to N fertilizer, crop year precipitation (CYP), soil N, and several interaction variables using multiple regression. A linear relation with N fertilizer and CYP gave the best correlation, % Protein = 9.98+0.025(NF)-0.067(CYP), R^2=0.54. Protein increased with increasing N fertilizer and decreased with increasing CYP.

When only data from summer fallow (SF) sites were used, soil N was just as effective at increasing protein content as N fertilizer, % Protein = 7.91+0.022(NF)+0.024 (soil N)-0.056(CYP), R^2 = 0.75.

On recrop sites, N fertilizer increased protein content exponentially, % Protein = 11.36+0.0003$(NF)^2$-0.088(CYP), R^2=0.68, while soil N had little effect on protein content. The different protein responses for summer fallow and recrop may be a result of summer fallow sites generally having a deeper soil with more moisture in the profile and a wider range of soil NO_3-N levels than recrop sites.

Results from multiple regression of 300 kernel weight data (Appendix E) indicate that kernel weight was affected most by N fertilizer and CYP. Kernel weight decreased with the addition of N fertilizer and increased with increasing CYP. For summer fallow sites, 300 kernel weight = 11.5-0.013(NF)+0.081(CYP), R^2 = 0.36. At recrop sites, 300 kernel weight = 9.2-0.028(NF)+0.132 (CYP), R^2 = 0.62.

Test weight (kg grain/m^3) (Appendix E) did not correlate strongly with N fertilizer, soil N, CYP, or other variables but for each site, test weight often paralleled grain yield response. When N fertilizer increased yield, the test weight increased and when additional N fertilizer decreased yield, the test weight decreased.

Effect of N Timing on Grain Quality

In 1983-84 (wet crop year), N applied at SD and SC increased protein levels compared to N fertilizer applied at SS (Appendix F). In 1984-85 (dry crop year), N applied at SD and SS tended to give higher protein levels than SC. Protein responses paralleled grain yield responses; N timing treatments that increased grain yield tended to increase protein.

300 kernel weight, which decreased with increasing N rates, tended to be lower when N fertilizer was applied at SD than when N was applied at SS or SC. Grain yield, protein content, and 300

kernel weight all indicate that N banded at SD tended to increase N efficiency compared to N applied at SS or SC.

Test weight (kg/m^3) tended to be higher when N fertilizer was applied at SC than when N fertilizer was applied at SD or SS.

Effect of N Source on Grain Quality

In both 1983-84 and 1984-85, AC treatments tended to have lower protein levels and higher 300 kernel weights than U and AS treatments (Appendix G). These responses to AC could be due to Cl^- effects on plant-water relations (Christensen *et al.*, 1981). Test weight was not affected by U, AC, or AS. Urea phosphate did not differ from U in its effect on protein, 300 kernel weight, or test weight.

DISCUSSION

Nitrogen Rate

The optimum nitrogen (N) fertilizer rate depends on several factors; i.e., climate, crop rotation, available soil N levels, weed control, time of N application, price of grain, price of N, etc. Many of these interact with one another to further complicate the ability to predict the optimum N rate. Economically the optimum N fertilizer rate occurs when the increase in cost of adding additional N fertilizer equals the increased value of the crop. However, because of the wide variation in response to N applications due to many other factors which influence yield, it seems, at best, superfluous to fine tune fertilizer N rates to the nearest kg ha^{-1} on an economic basis.

Some N requirement predictions based on expected yield, expected precipitation, and soil N are reported in Tables 6, 7, and 8. A farmer can use the appropriate table as a general guide, modifying the N fertilizer rates according to personal experience. Fertilizer test plots in individual fields should also be employed as a means of evaluating one's own fertilizer practices.

In these fertilizer trials, N application rates below or above those needed for optimum returns were reported. Excessive N fertilizer rates may result because of unpredicted high available N levels in the soil. Soil tests should be used on a regular basis on each field with the results plotted over time (year). This would give a farmer a better idea of how the fertility status of his fields has changed over time, as affected by his fertility program and climate. Weather and yield records should be kept in addition to the amount of fertilizer applied.

After harvest, grain protein levels could also be used to evaluate the N rate used. Other researchers (Glenn _et al._, 1985; Hunter _et al._, 1958) have shown that protein levels in soft white wheat below 8-9% indicate a N deficiency. In this research, grain yield generally increased until protein levels reached 9-10%. When protein levels exceeded 10% grain yield decreased. Thus, if protein levels are below 8-9%, N rates should be increased. If protein levels are between 9-10%, N rates are sufficient and if protein levels are above 10%, N rates should be decreased, _IF_ precipitation does not change.

Timing of N Application.

Nitrogen timing comparisons were made in 1983-84 and 1984-85. The best time to apply N depends on the climate. In a wet year (1983-84), N applied in the spring of summer fallow (SS) yielded less than N applied at seeding (SD) at four of five sites. The site where N applied at seeding did not exceed SS-applied N had a severe weed infestation which probably reduced crop response to N fertilizer. NH_4-N applied to warm moist soils (such as in SS) is nitrified. Under wet soil conditions NO_3-N can then be leached and/or denitrified. When NH_4-N is not applied until fall (when seeding starts), less N is apt to be nitrified, thus less N is subject to leaching and/or denitrification.

In 1983-84, N applied in the spring of crop year (SC) and N applied at SD gave similar yields at summer fallow sites (Table H). On the 1983-84 recrop sites, SC-applied N gave lower yields than SD applied N at all four recrop sites. This could be due to immobilization of the broadcast N by the straw residue on the surface, or the lower yield response to SC-applied N could be due to inadequate rain to move N downwards into the rooting zone.

In a dry year (1984-85), the level of yield response to N applied at SS was similar to N applied at SD. Spring of crop year N applications in 1984-85 resulted in the lowest yields at eight of nine sites. The lower yield response from SC applications was probably due to the SC N application being positionally unavailable because of below average spring precipitation.

Nitrogen applied at SD tended to give greater yield increases, higher protein levels, and lower 300 kernel weight than SS or SC applied N, indicating that SD-applied N is more efficient than SS or SC applied N.

Source of N.

When yields from ammonium chloride (AC), ammonium sulfate (AS) and urea (U) are compared, no consistent differences between these sources of N were apparent. However, AC treatments tended to have lower protein levels and higher 300 kernel weights compared to U and AS. The change in grain quality may be a result of Cl^- decreasing the water potential in the wheat plants. AC was used as a source to see if Cl^- would increase yield due to effects on disease and water relationships. In the Willamette Valley, Cl^- applied to fields where take-all root rot is present can help reduce the disease severity and increase yields (Christensen *et*. *al*., 1981; Taylor *et* *al*., 1983).

Urea phosphate (UP), made by TVA (Tennessee Valley Authority) was evaluated in 1983-84. Urea phosphate increased yields slightly more than urea plus phosphorus at seven of nine sites, but TVA decided it was uneconomical to manufacture, so no further evaluations were made in 1984-85.

Response to P Fertilizer.

Phosphorus (P) soil tests were not reliable in predicting grain yield responses to P fertilizer. Three sites recorded responses to P, Br83 (13 ppm P), Gt83 (6 ppm P), and F85 (14 ppm P). A P soil test value of 10 ppm has been used as the critical soil test level for P fertilizer recommendations. Of 12 sites with soil P levels of 6 to 10 ppm, only one recorded a yield response to P fertilizer. Of 15 sites with soil test P ranging from 11 to 20 ppm P, two sites recorded grain yield responses to P fertilizer. From this and other research (Rasmussen, 1981), P responses appear to be more closely related to high yield potentials, cold soils, and/or late fall planting dates (early planting if planting spring grain) than to soil P test values.

Response to S Fertilizer.

Sulfur responses were somewhate more predictive than P responses. An S response was observed at 3 of 18 sites which had S levels below 2 ppm in the 0-30 cm soil depth, while no response to S was observed at sites with greater than 2 ppm S in the 0-30 cm soil depth. With the relatively low cost of S, an S application of 20 kg ha^{-1} whenever soil test levels drop below 2 ppm in the 0-30 cm depth should be considered.

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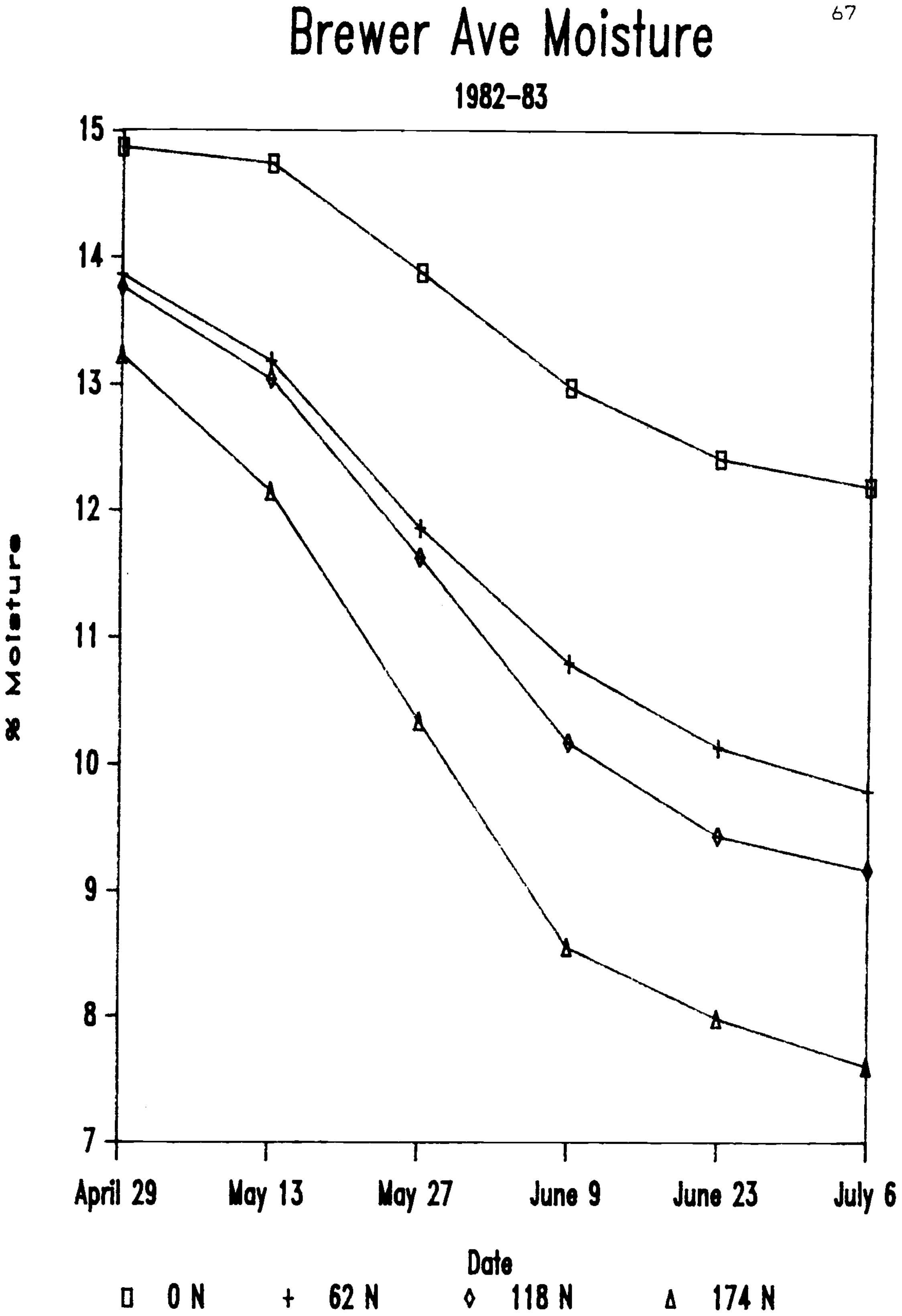
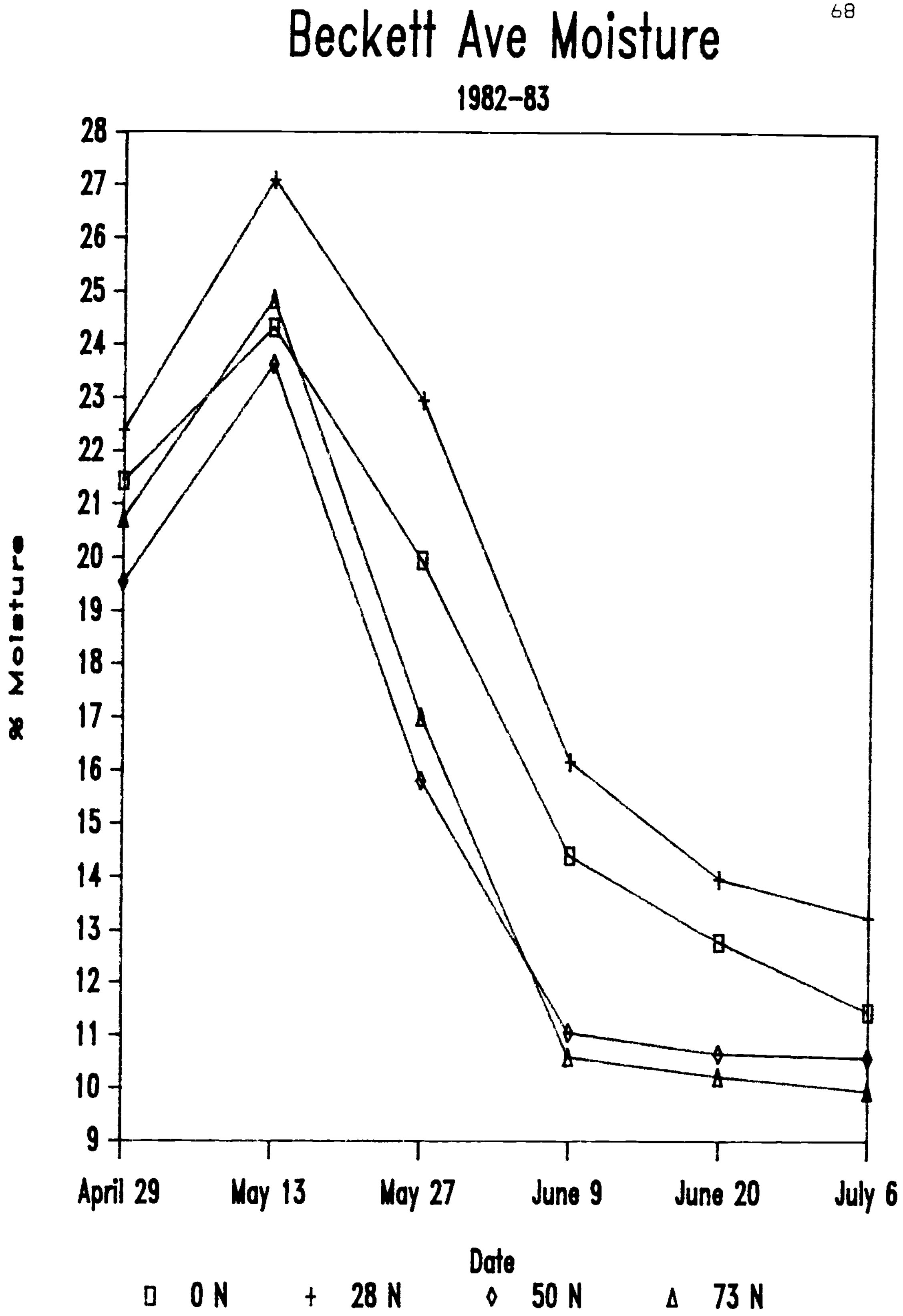
APPENDICES

APPENDIX A

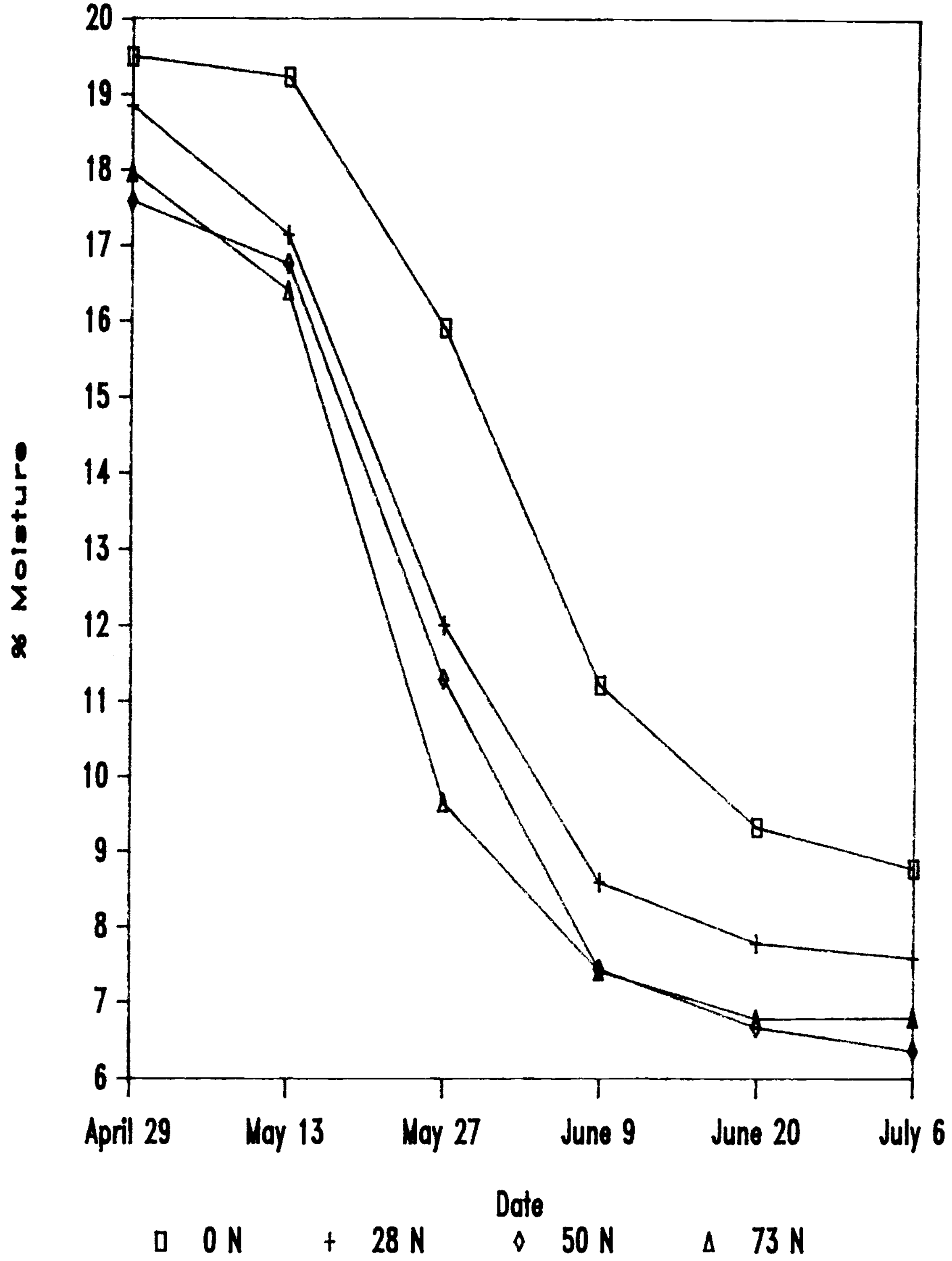
Average Moisture Figures


Brewer Ave Moisture
1982-83
15
14
13
12
11
10
9
8
7
% Moisture
April 29
May 13
May 27
June 9
June 23
July 6
Date
□ 0 N
+ 62 N
◇ 118 N
△ 174 N


Beckett Ave Moisture
1982-83
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
% Moisture
April 29
May 13
May 27
June 9
June 20
July 6
Date
□ 0 N
+ 28 N
◊ 50 N
Δ 73 N

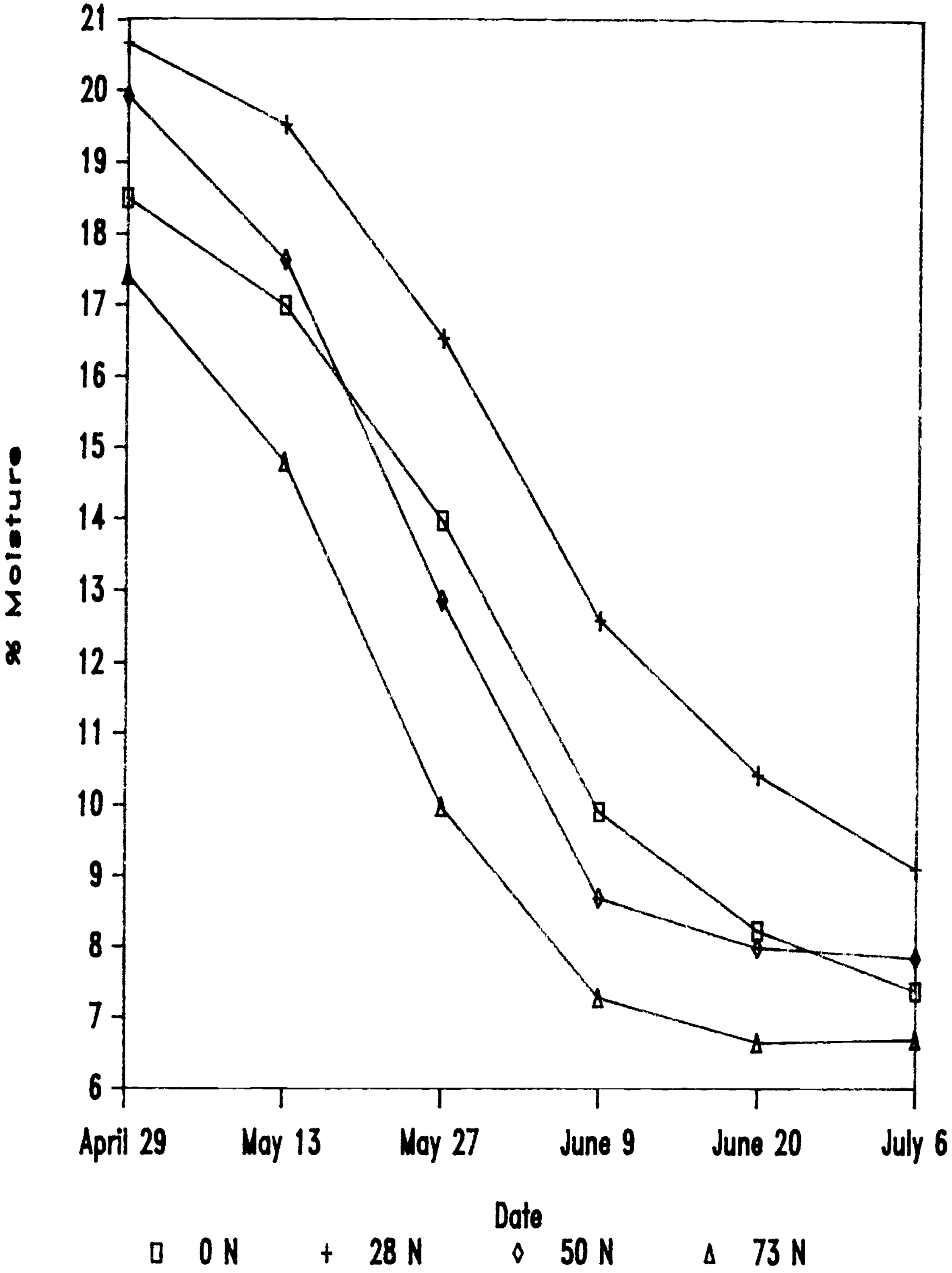
Martin Ave Moisture

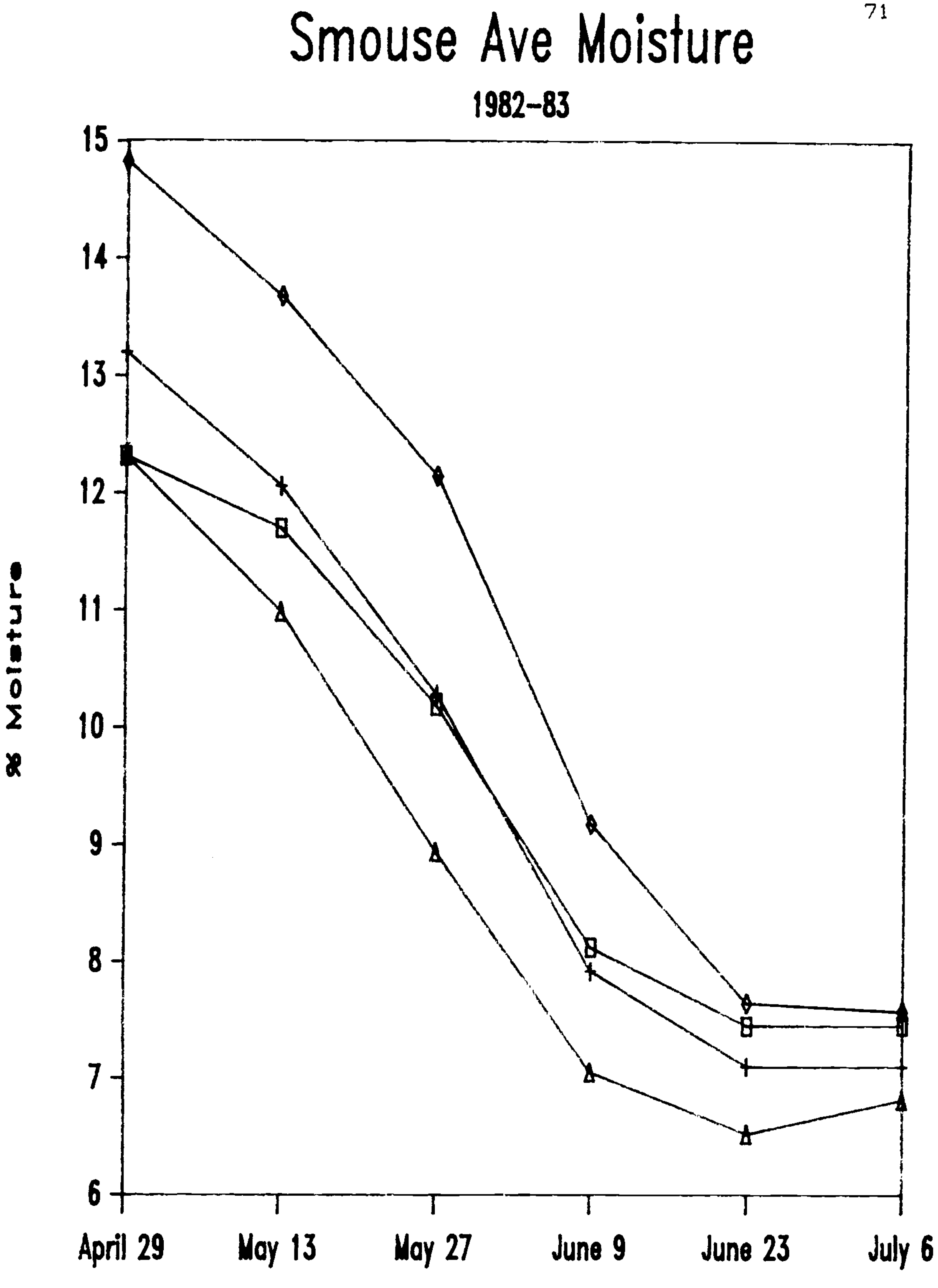
1982-83



Simontell Ave Moisture

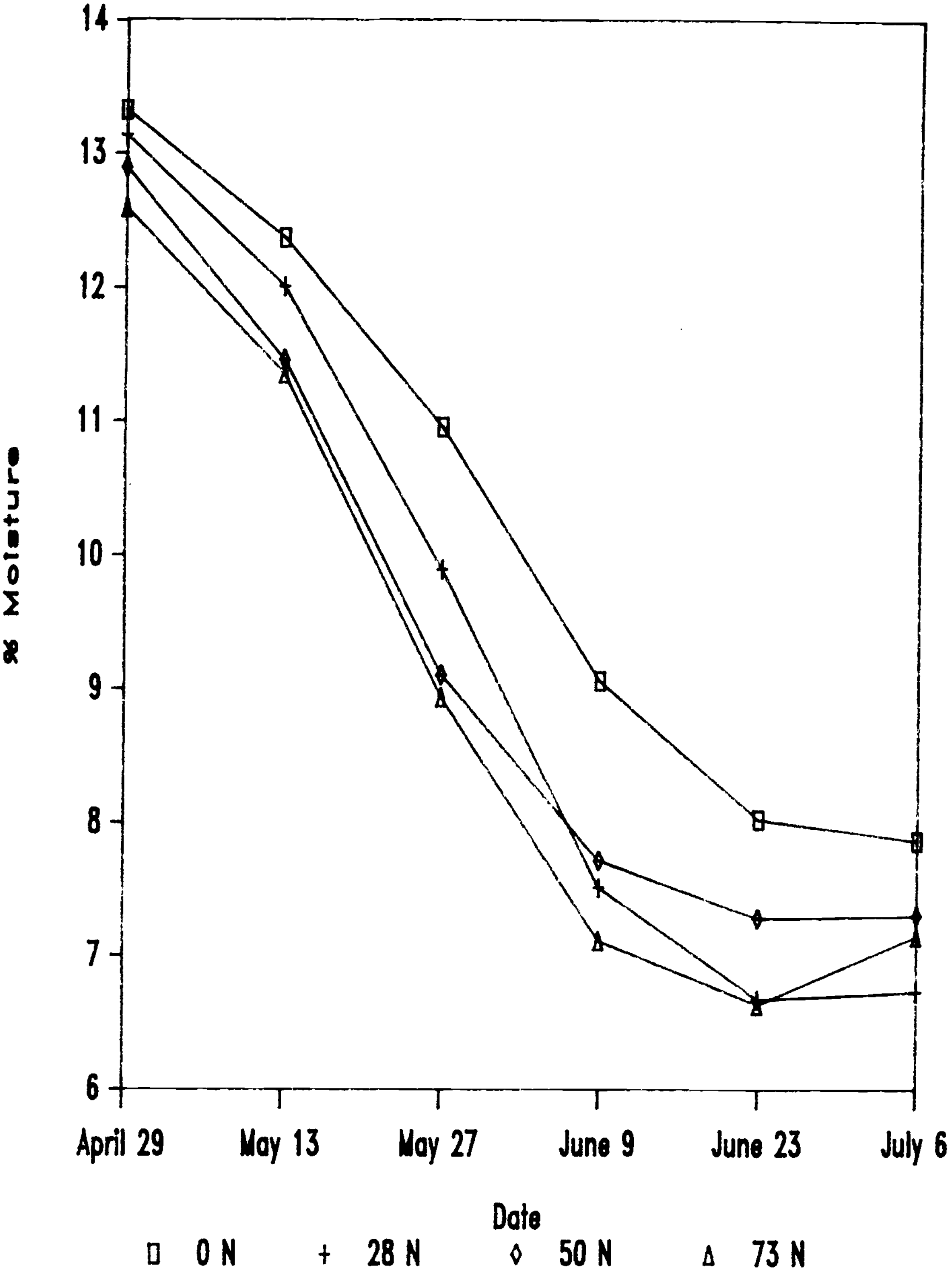
1982-83

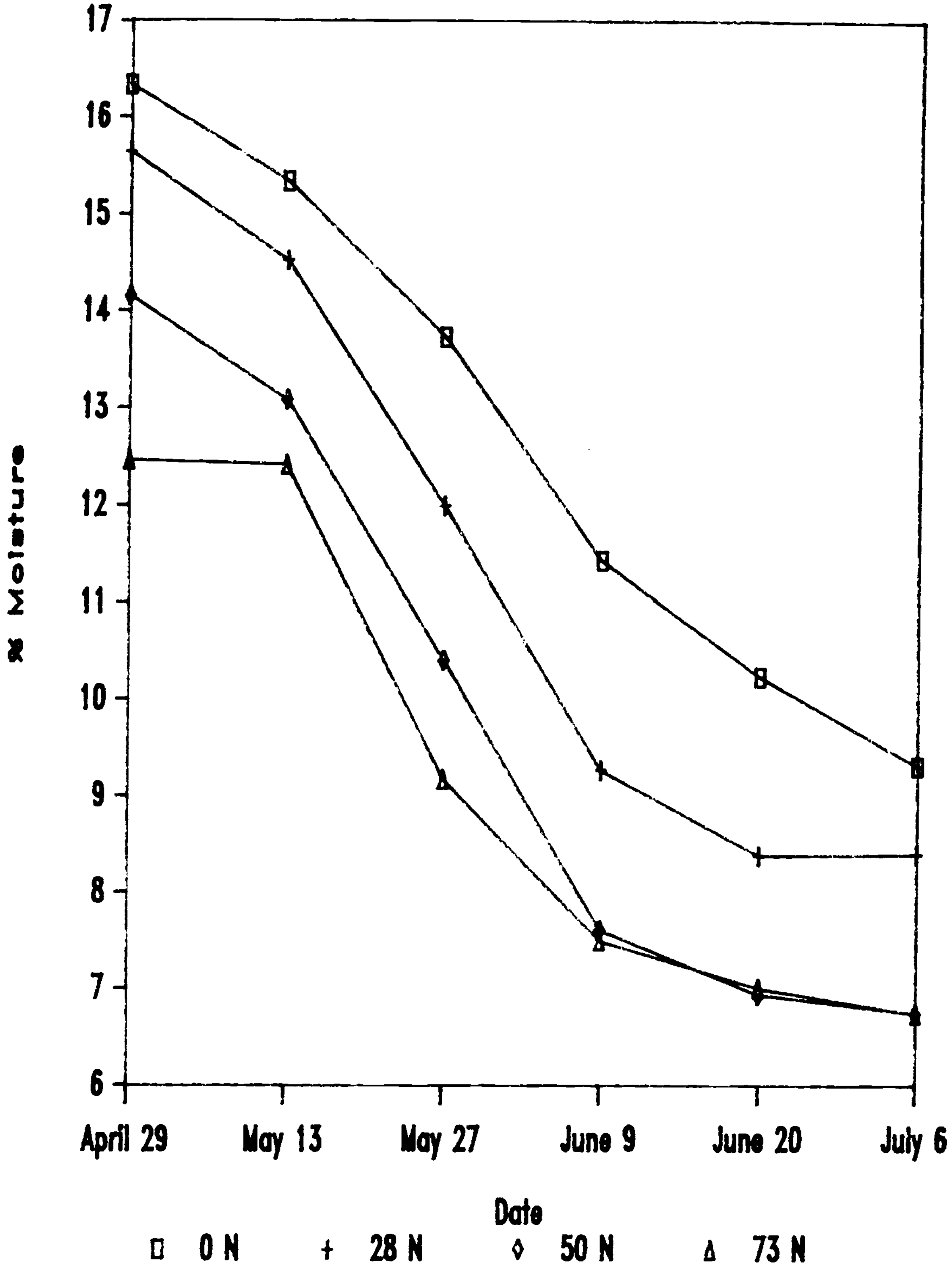



Smouse Ave Moisture
1982-83
% Moisture
15
14
13
12
11
10
9
8
7
6
April 29
May 13
May 27
June 9
June 23
July 6
Date
□ 0 N
+ 28 N
◊ 50 N
Δ 73 N

Weatherford Ave Moisture

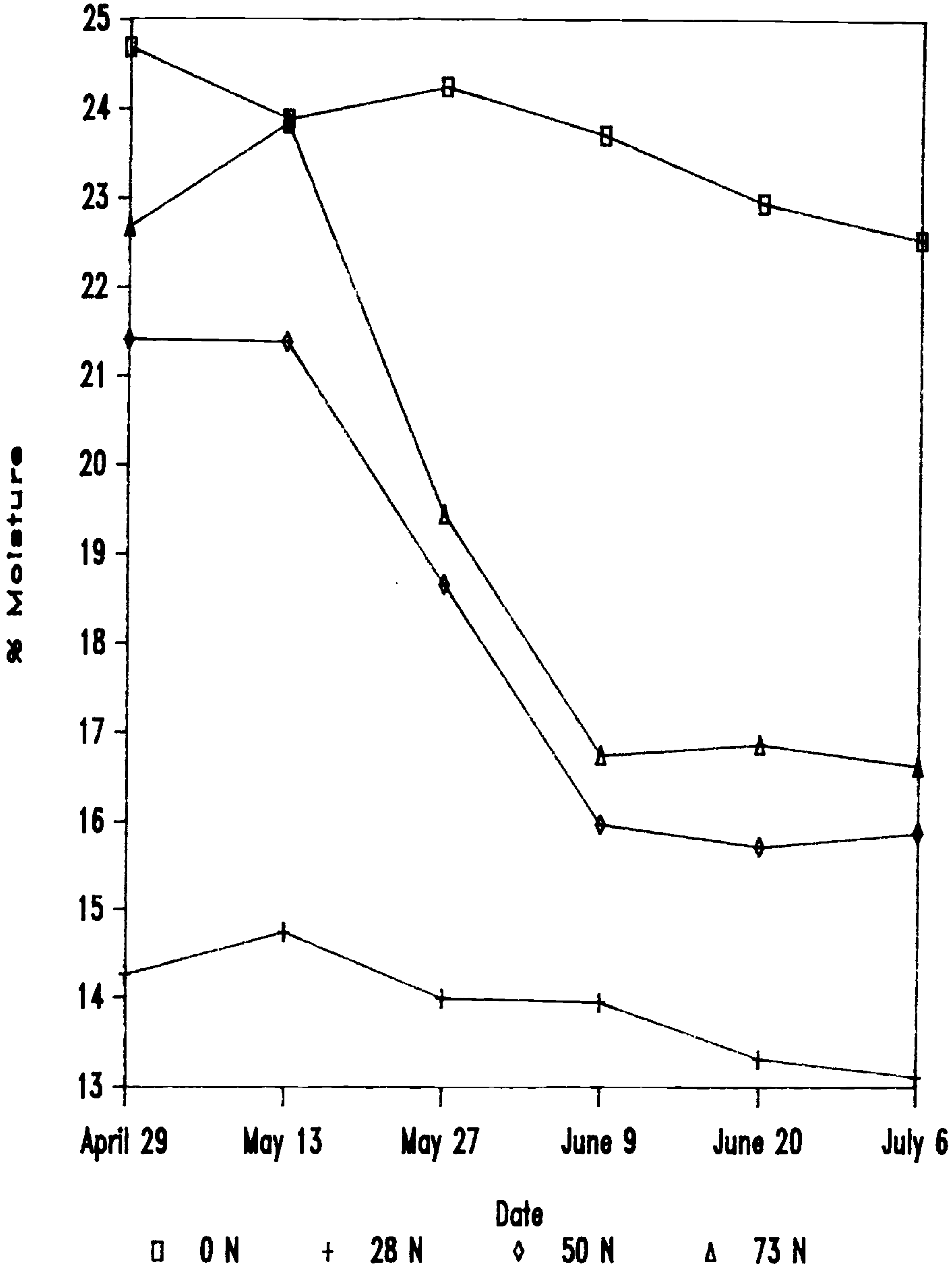
1982-83





Borstall Ave Moisture

1982-83

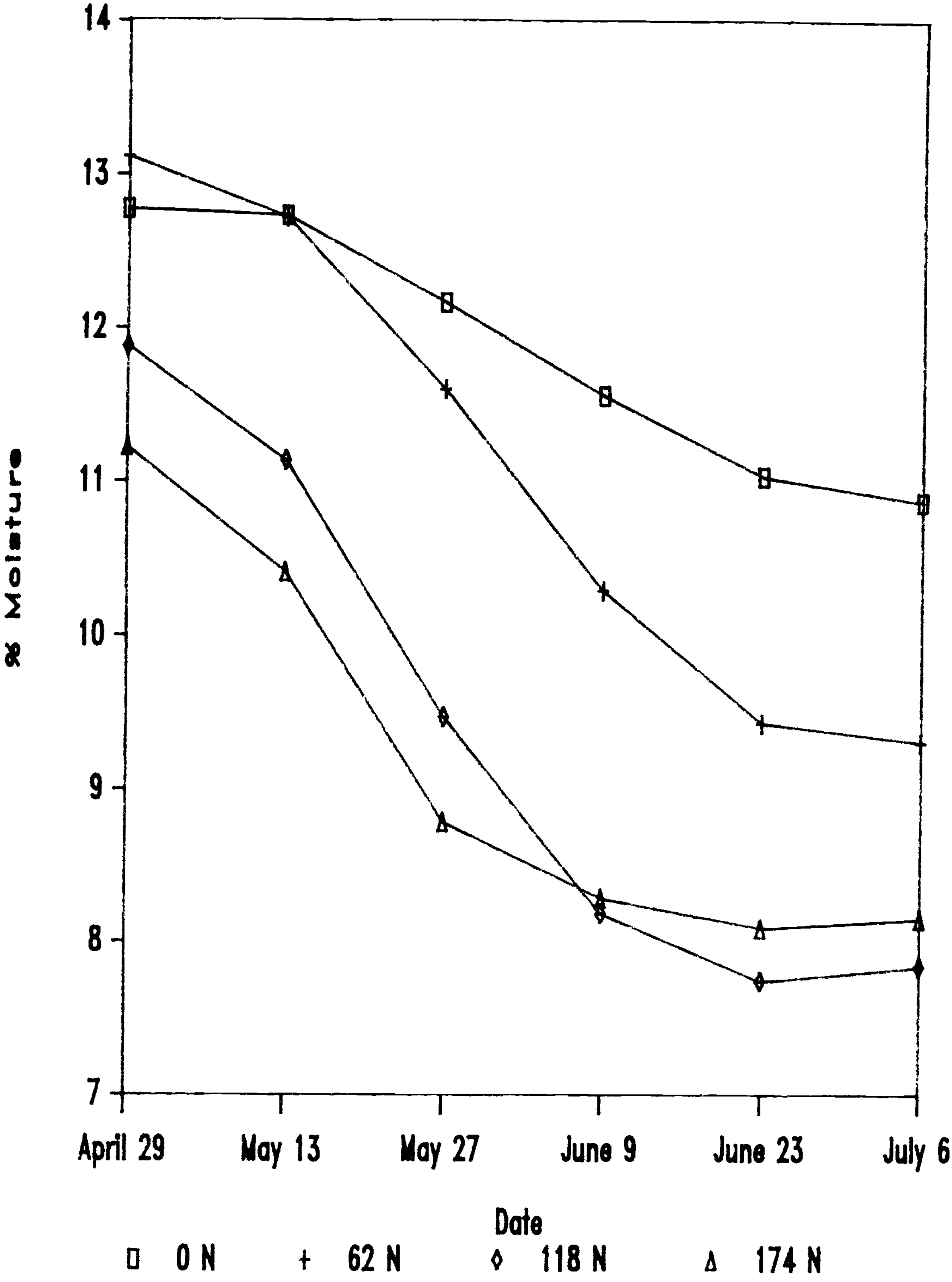


Gilbert Ave Moisture

1982-83

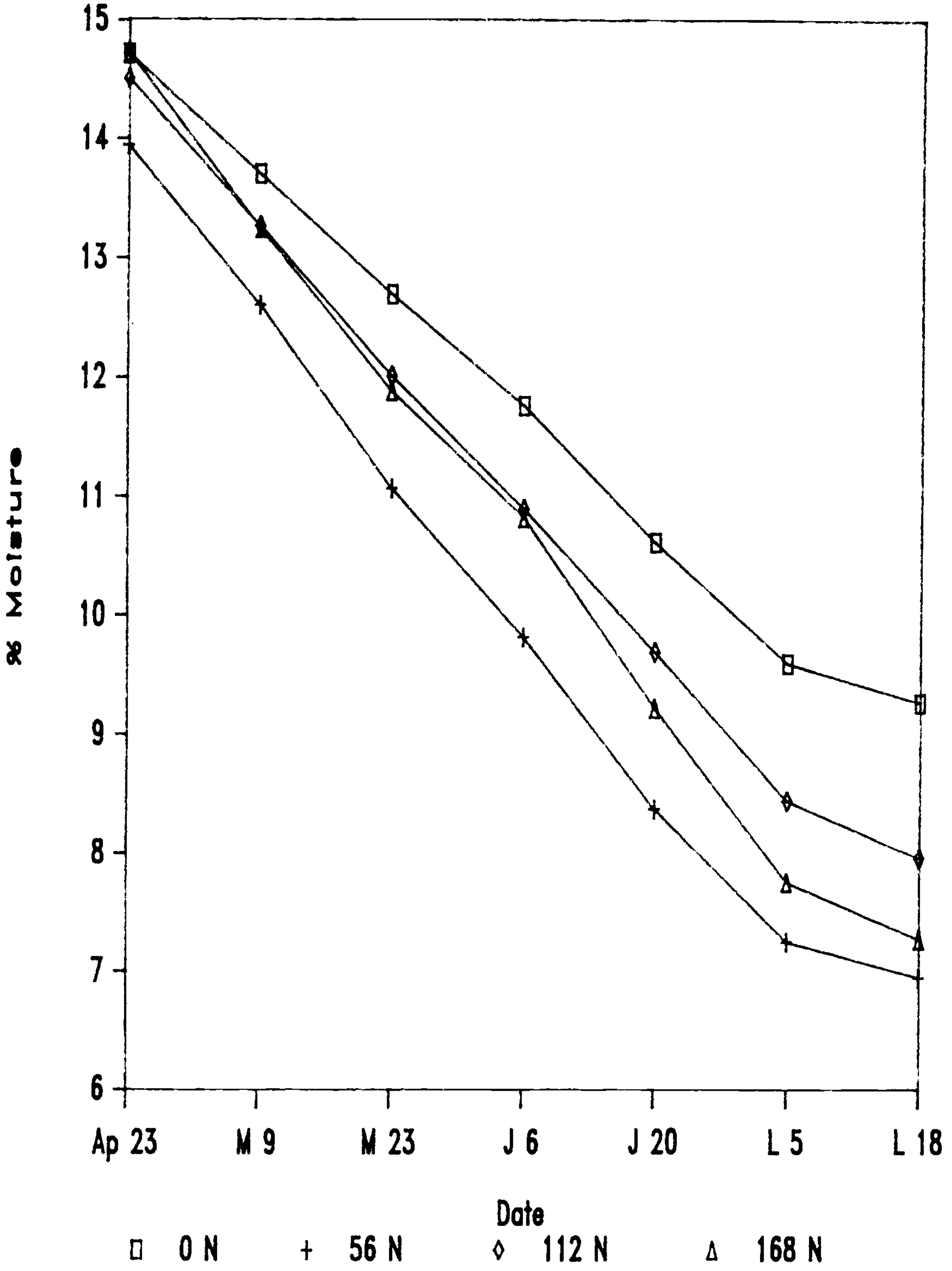
Reeder Ave Moisture

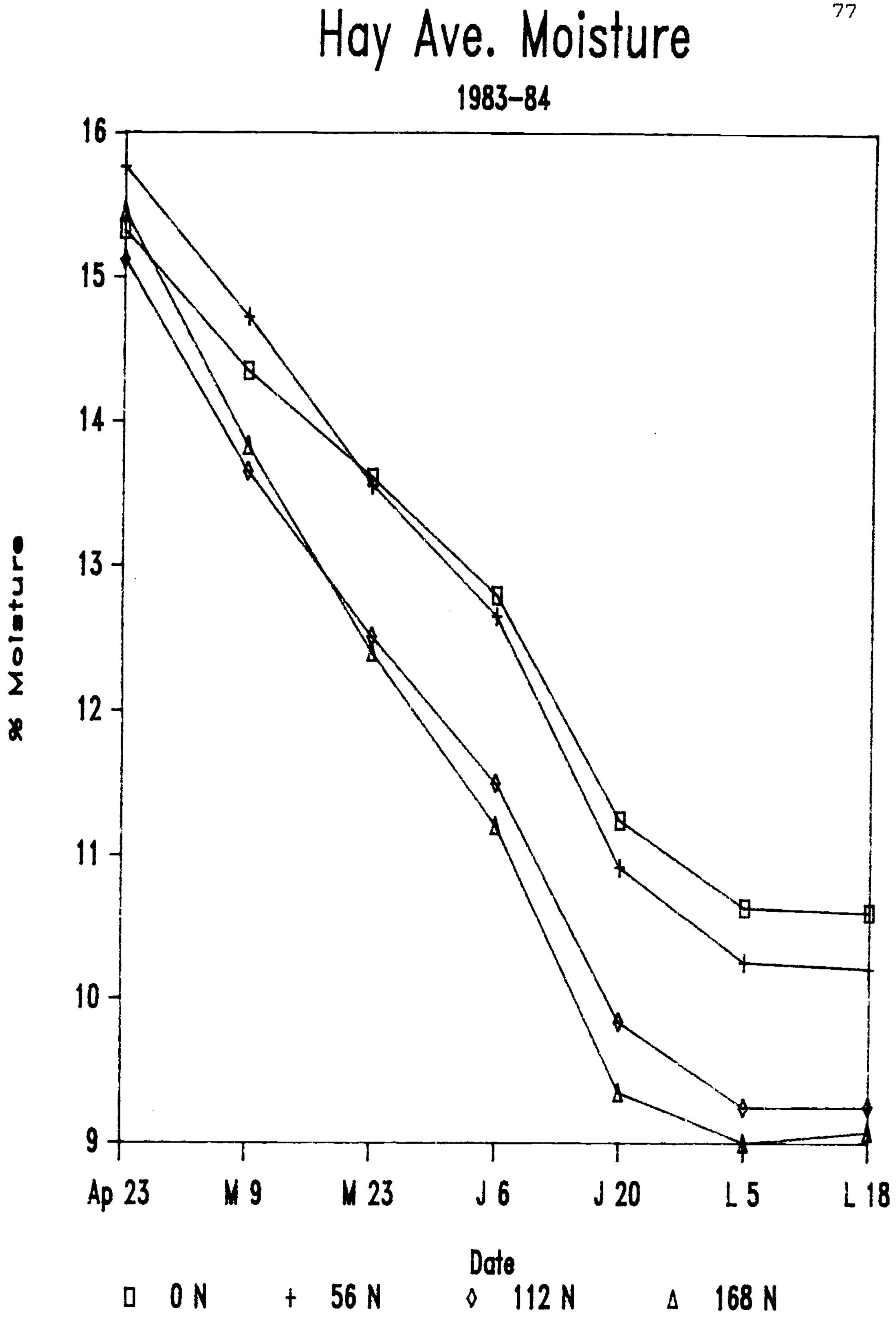
1982-83



Harper Ave. Moisture

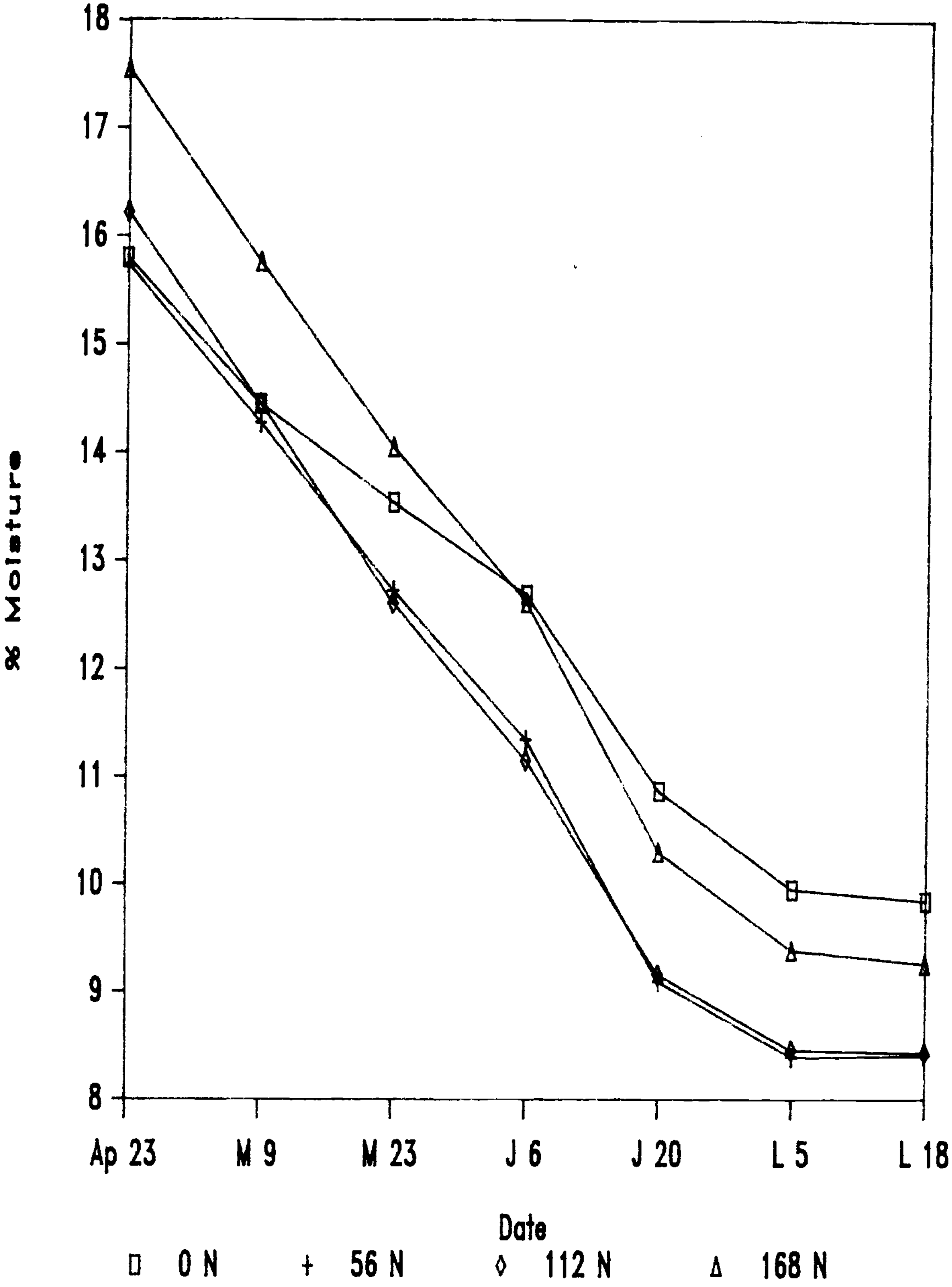
1983-84

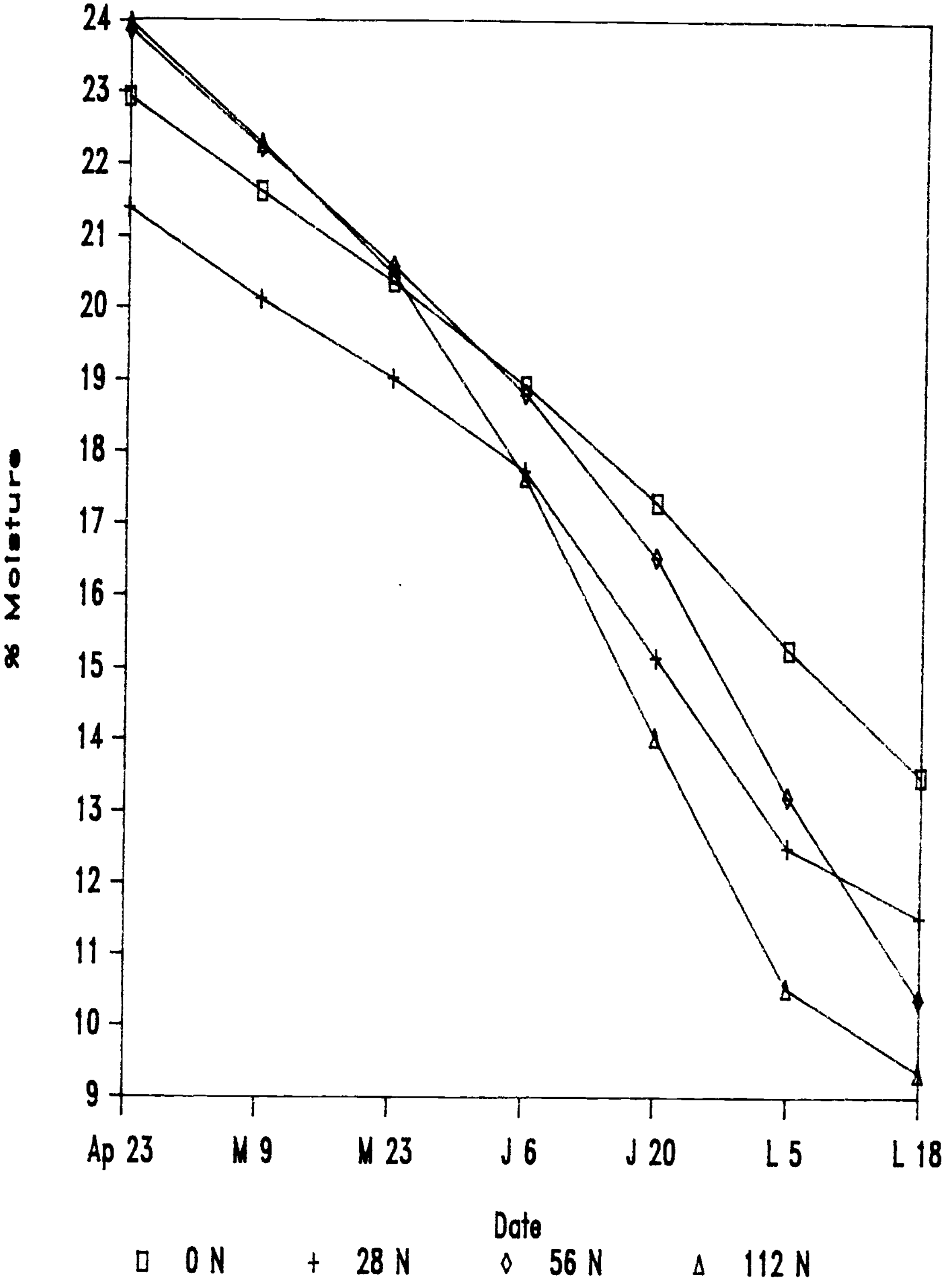



Hay Ave. Moisture
1983-84
% Moisture
16
15
14
13
12
11
10
9
Ap 23
M 9
M 23
J 6
J 20
L 5
L 18
Date
□ 0 N
+ 56 N
◇ 112 N
△ 168 N

Kaseberg Ave. Moisture

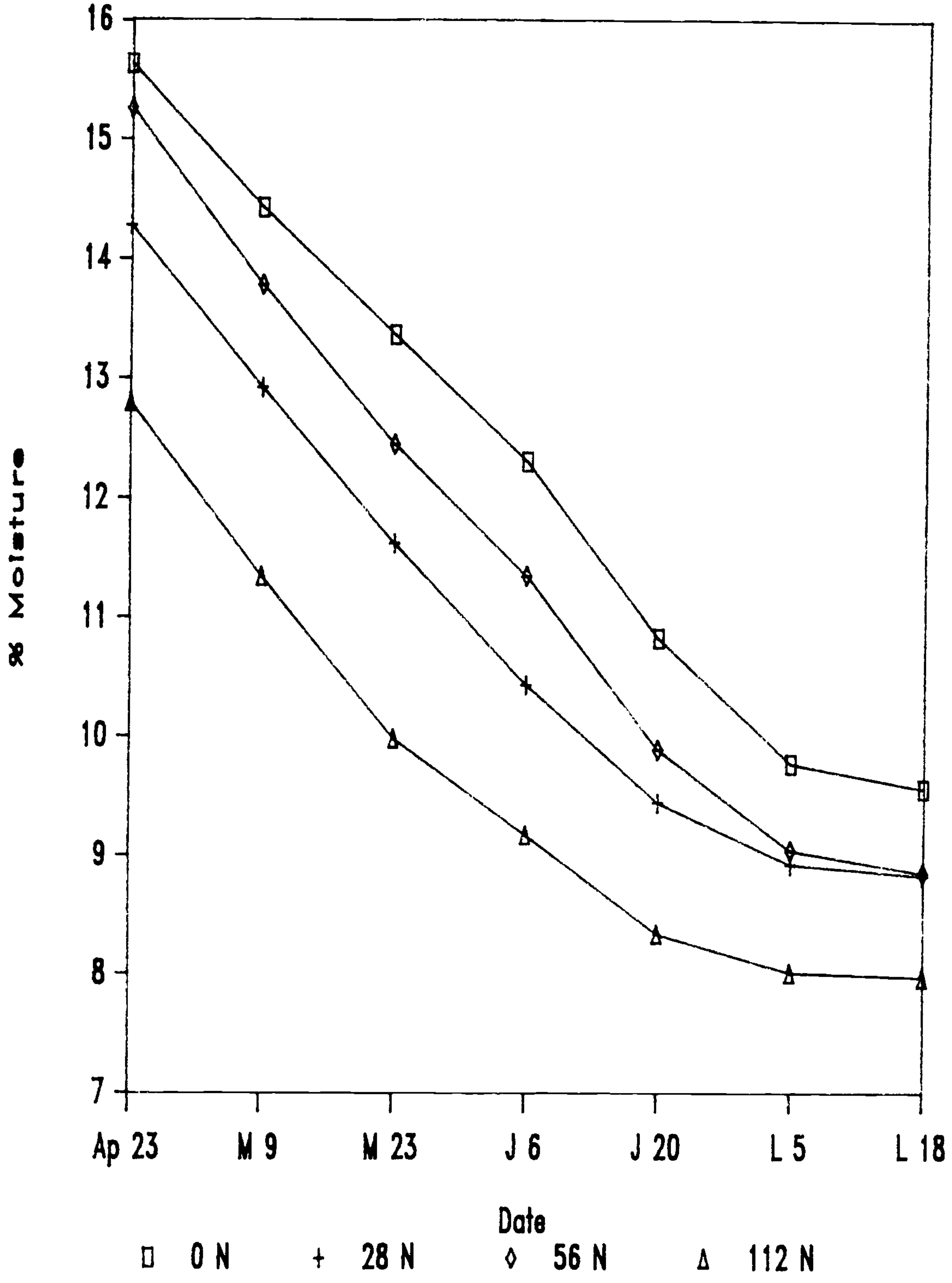
1983-84





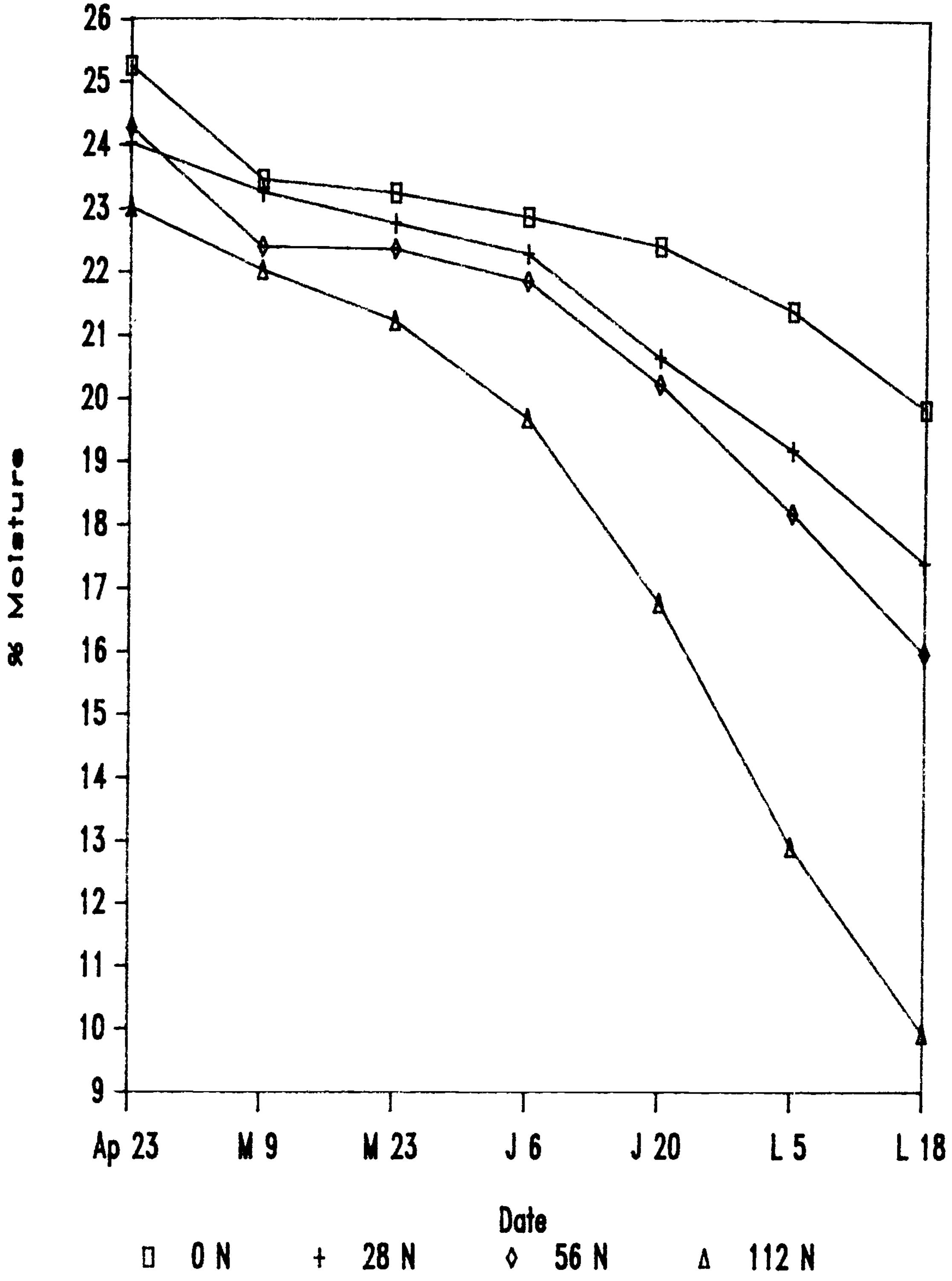
Bergstrom Ave. Moisture

1983-84



Smouse Ave. Moisture

1983-84

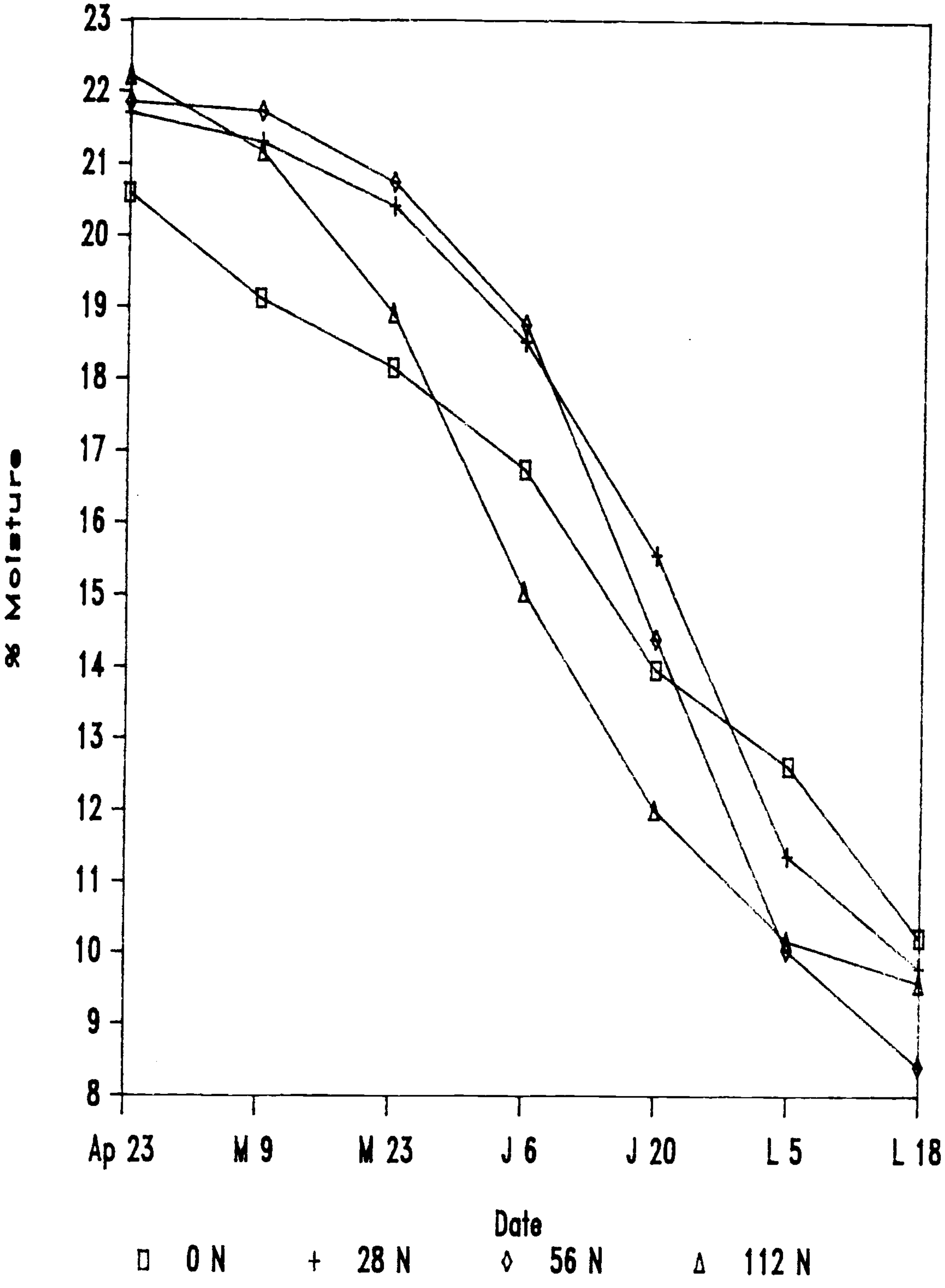


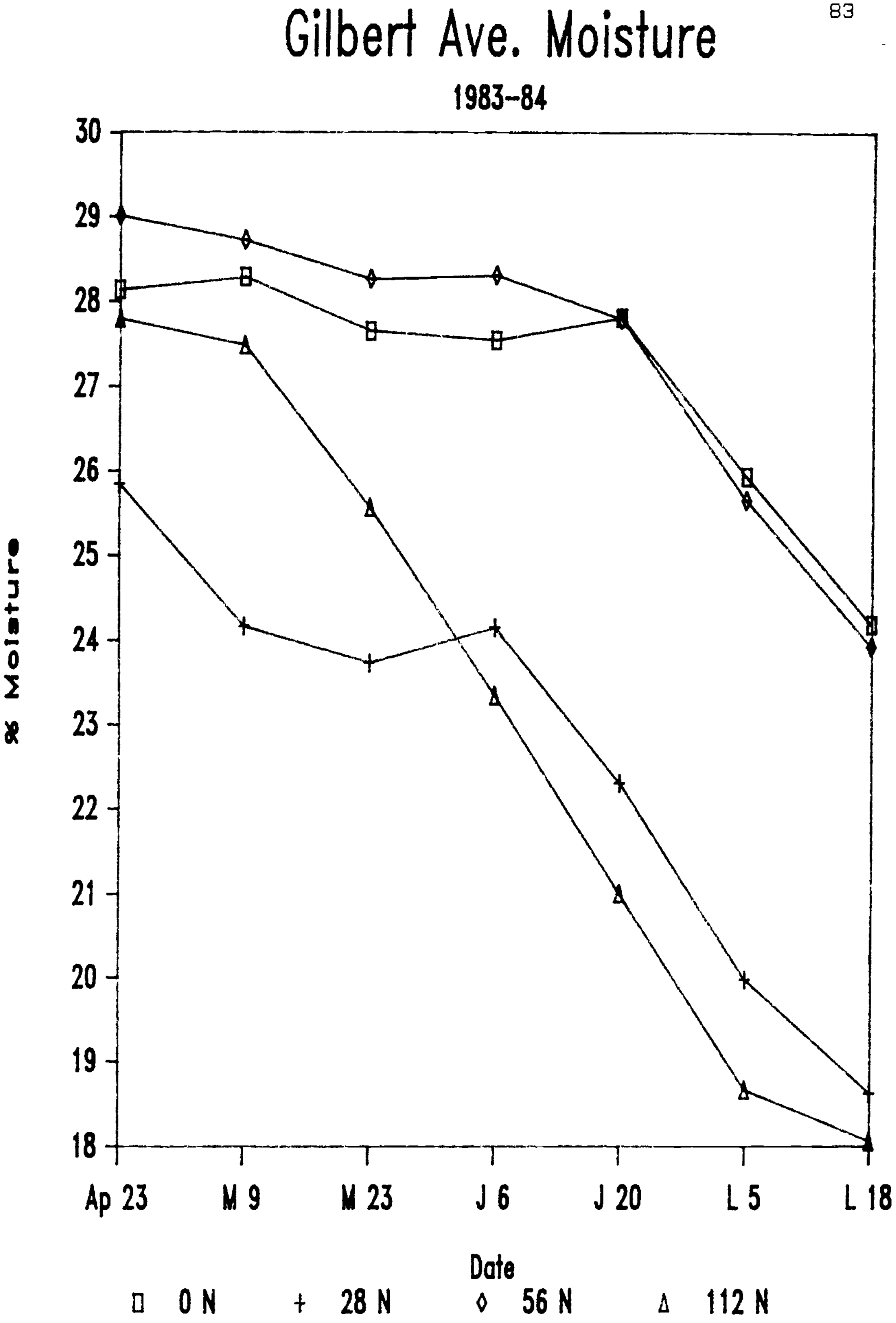
Anderson Ave. Moisture

1983-84

Campbell Ave. Moisture

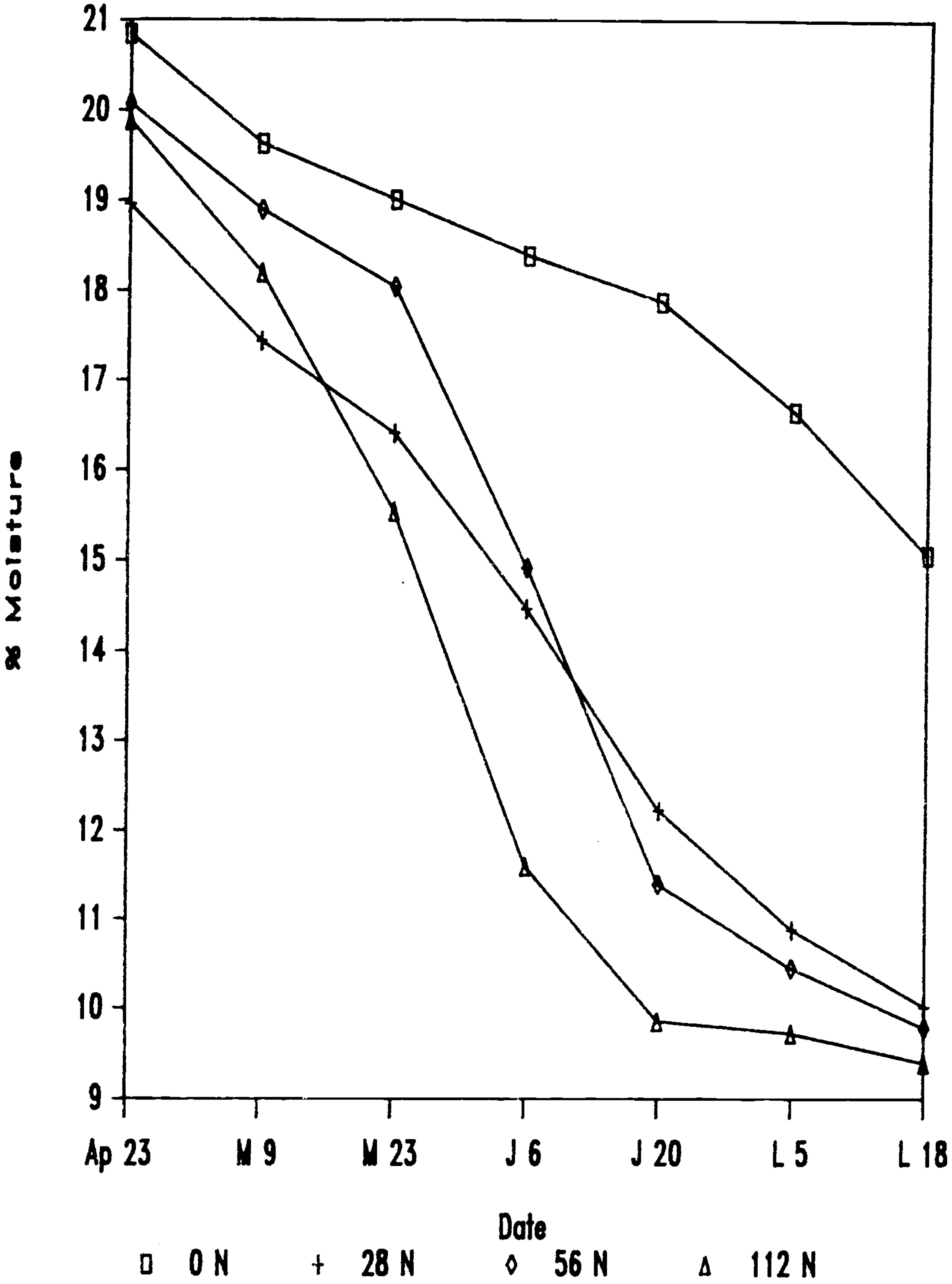
1983-84




Gilbert Ave. Moisture
1983-84
% Moisture
30
29
28
27
26
25
24
23
22
21
20
19
18
Ap 23
M 9
M 23
J 6
J 20
L 5
L 18
Date
□ 0 N
+ 28 N
◊ 56 N
△ 112 N

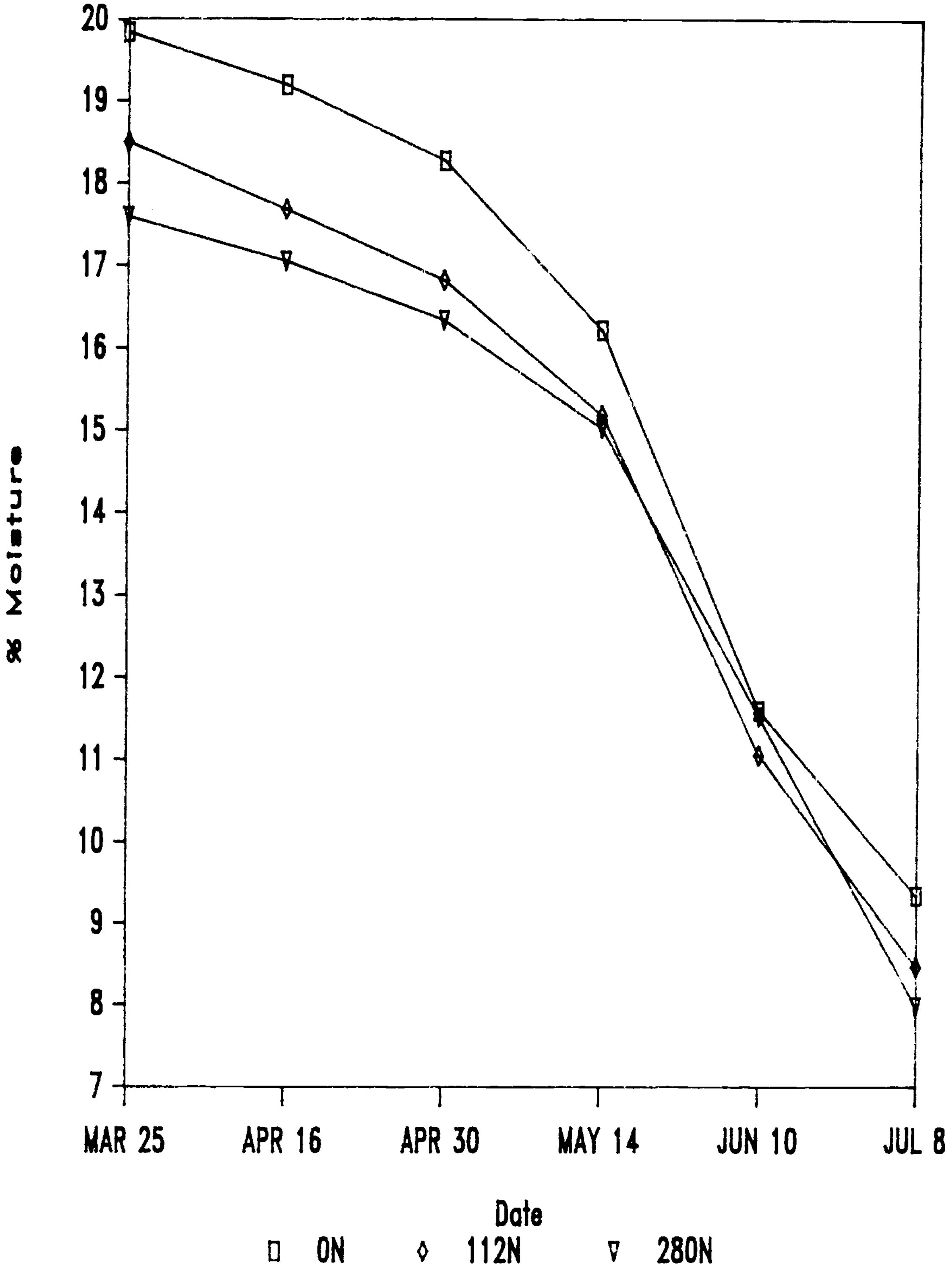
Martin Ave. Moisture

1983-84

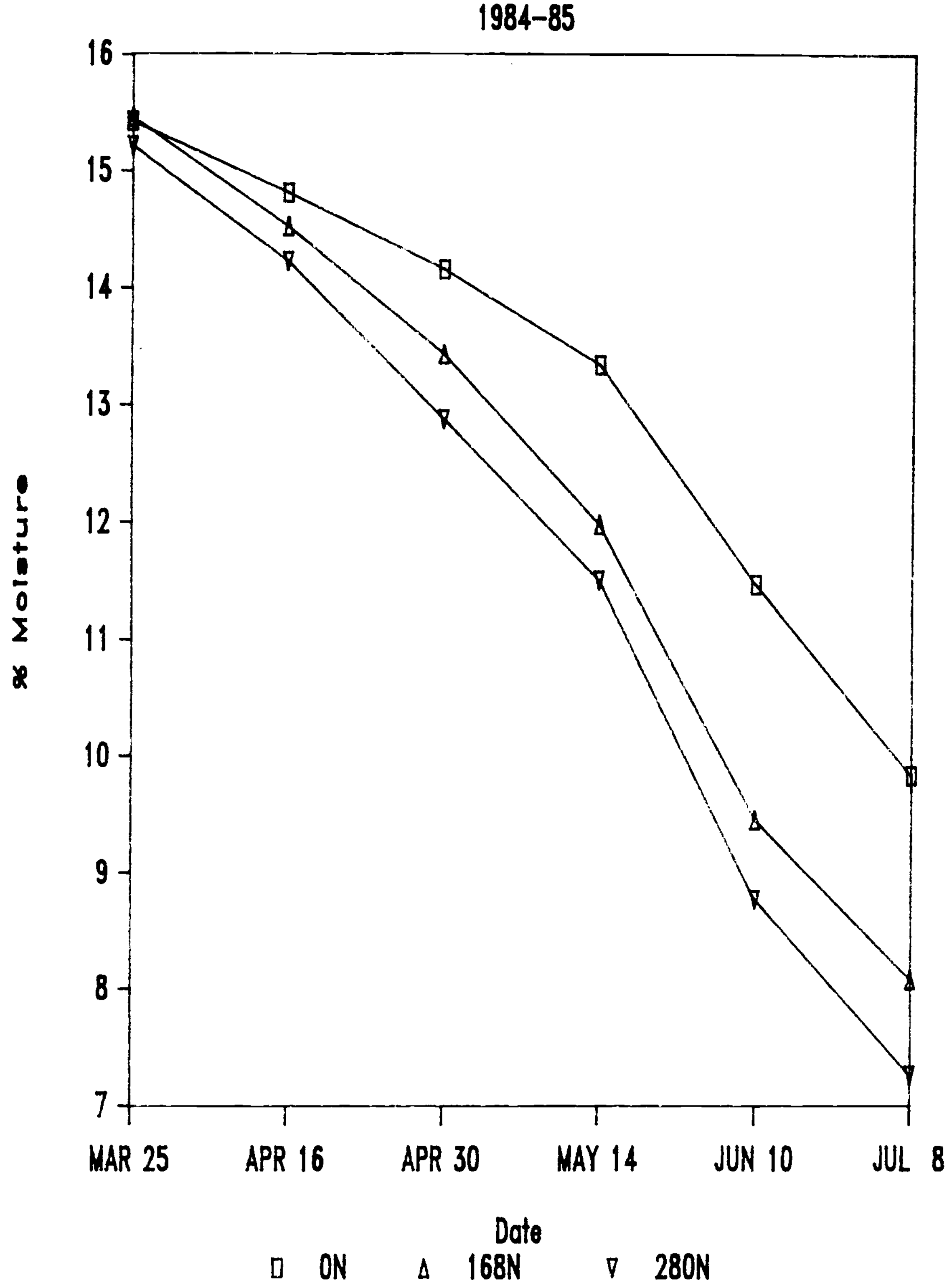


Feist Ave Moisture

1984-85

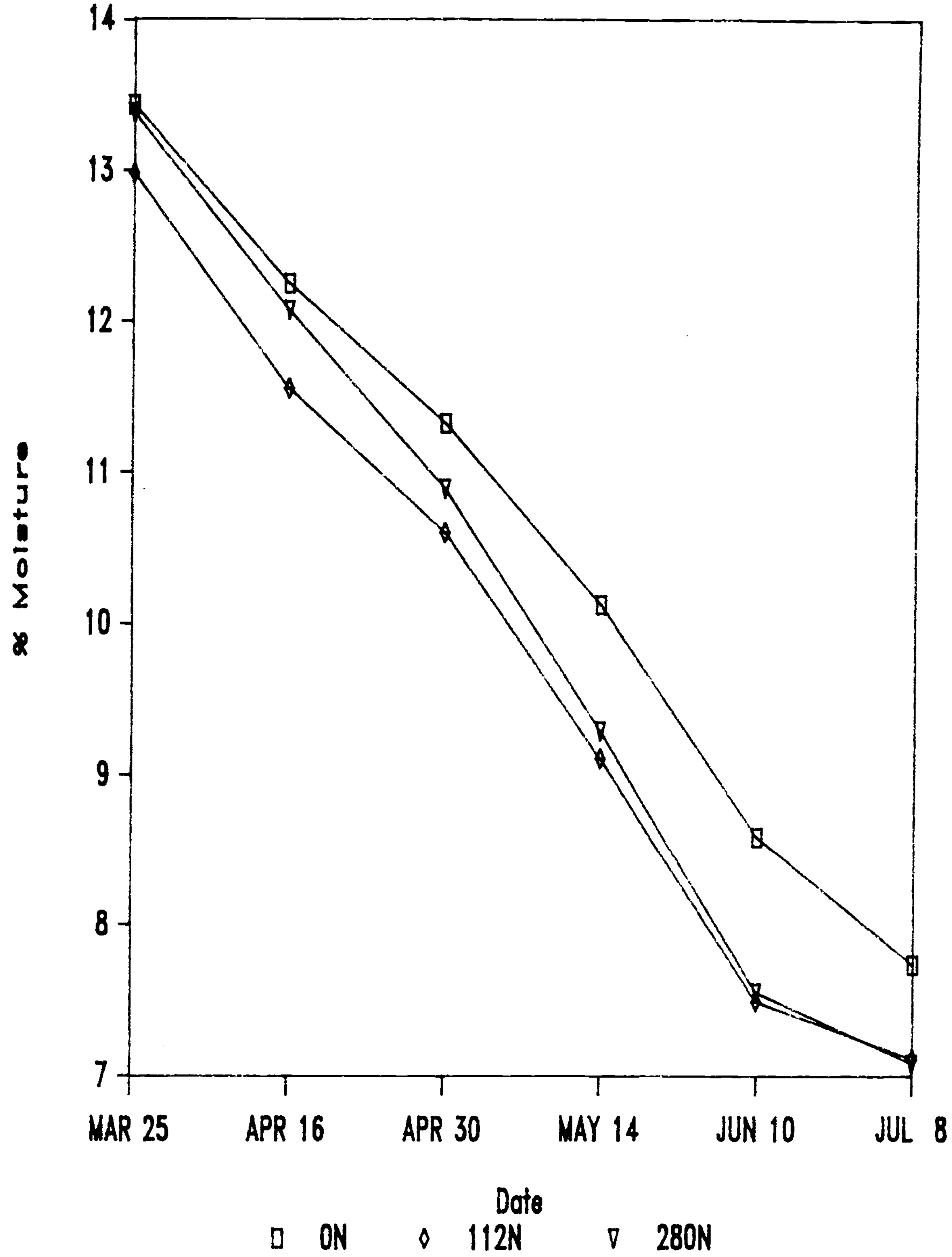


Goodwin Ave Moisture



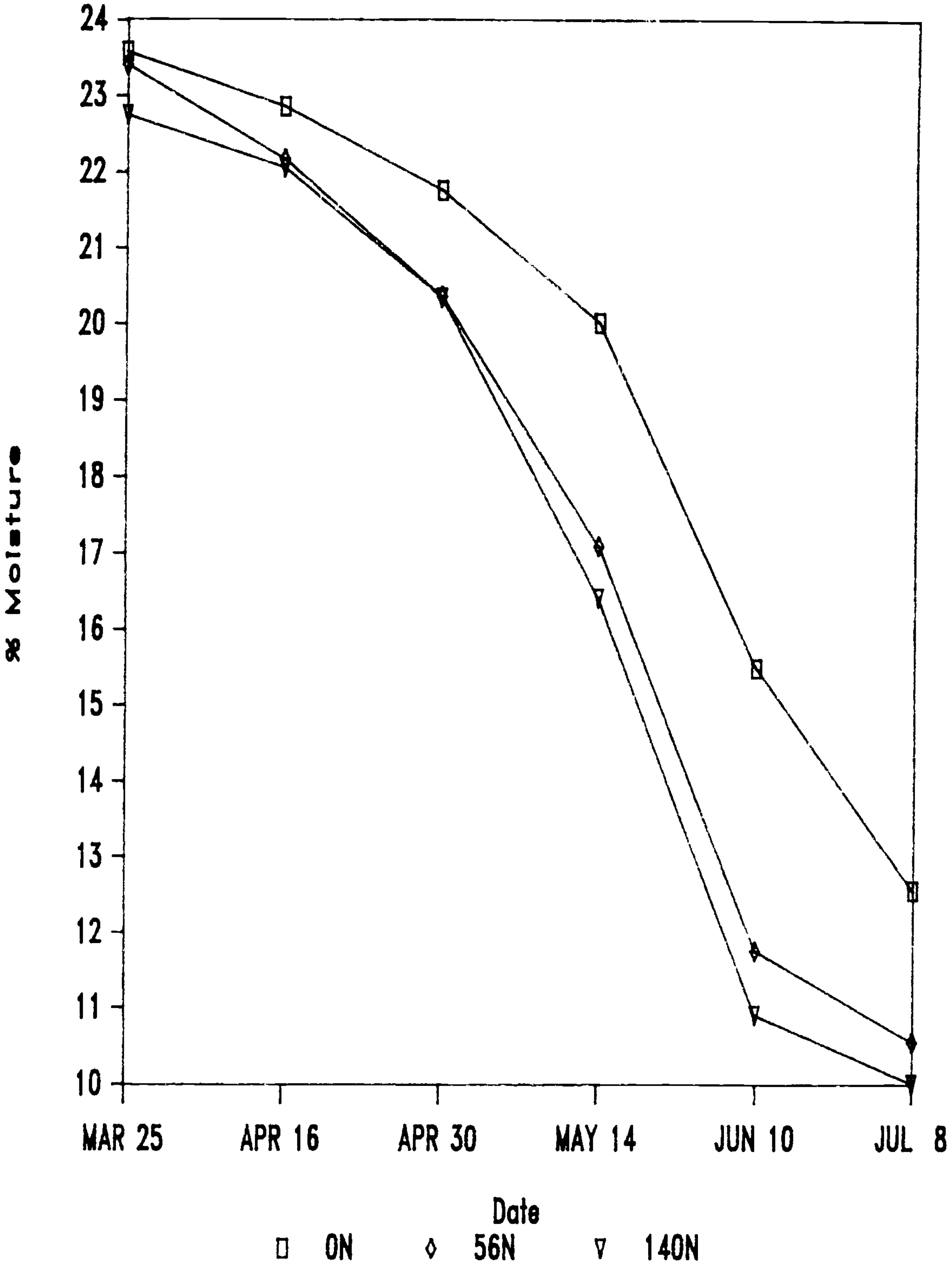
Kaseberg Ave Moisture

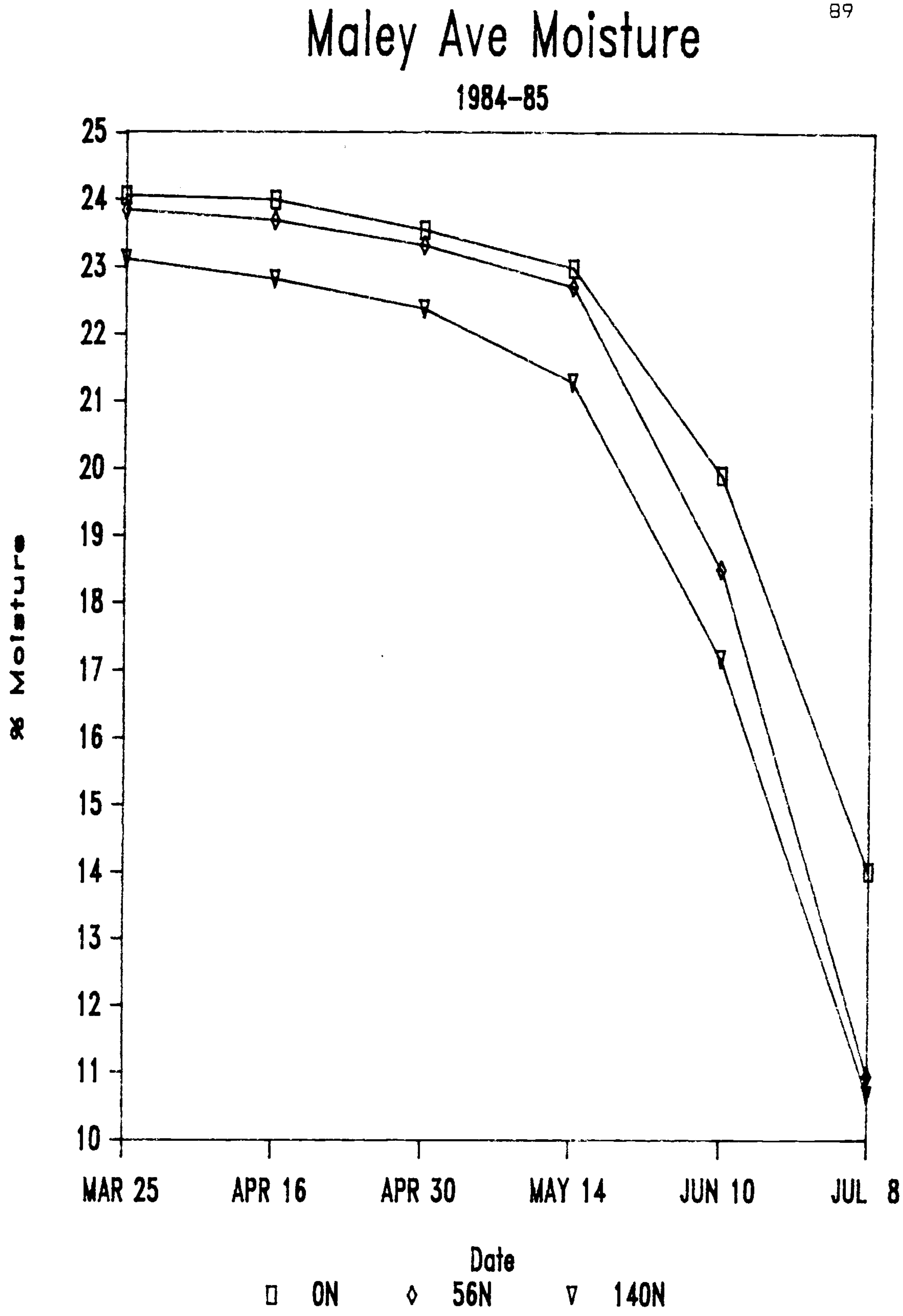
1984-85

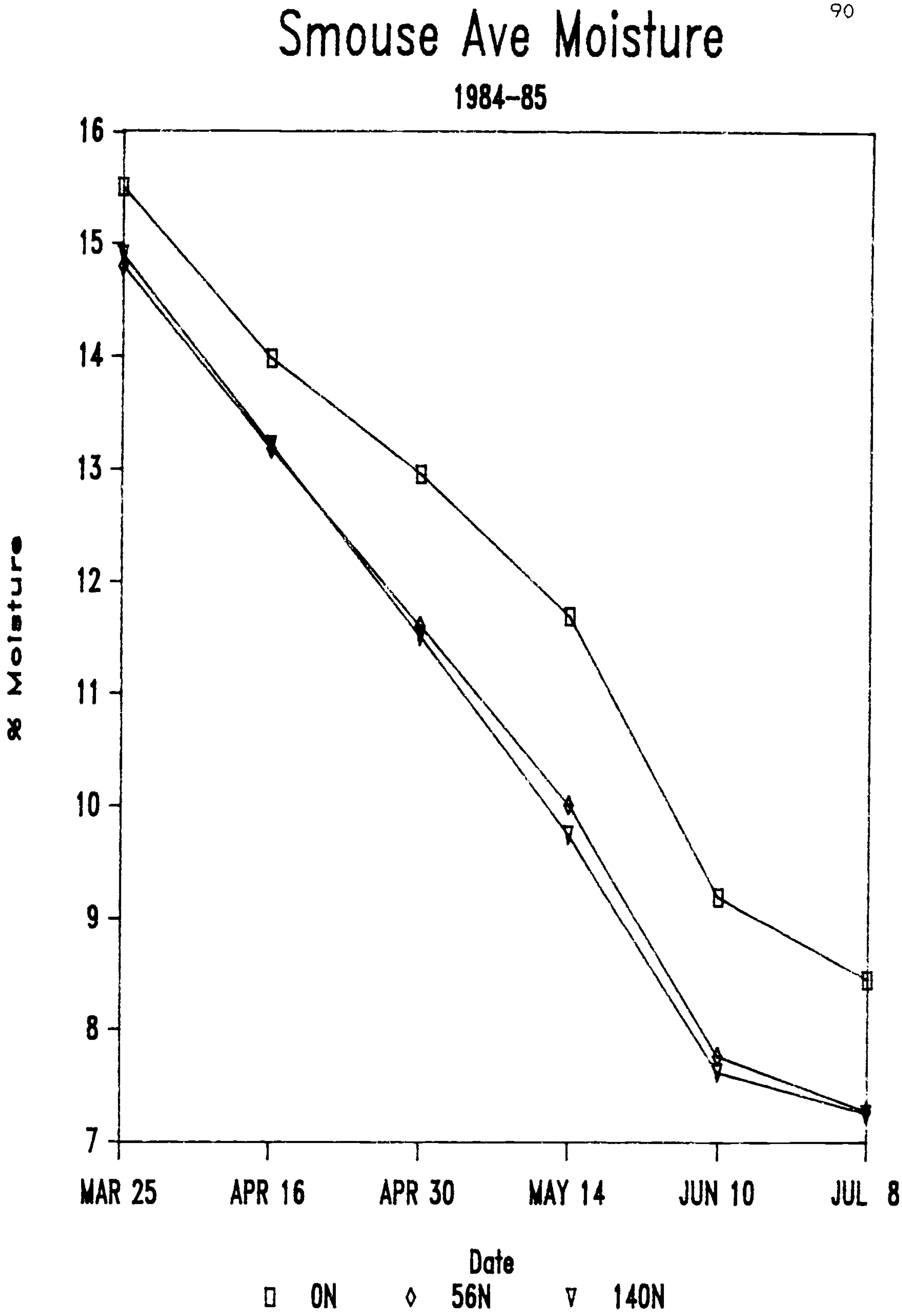


Anderson (SF) Ave Moisture

1984-85

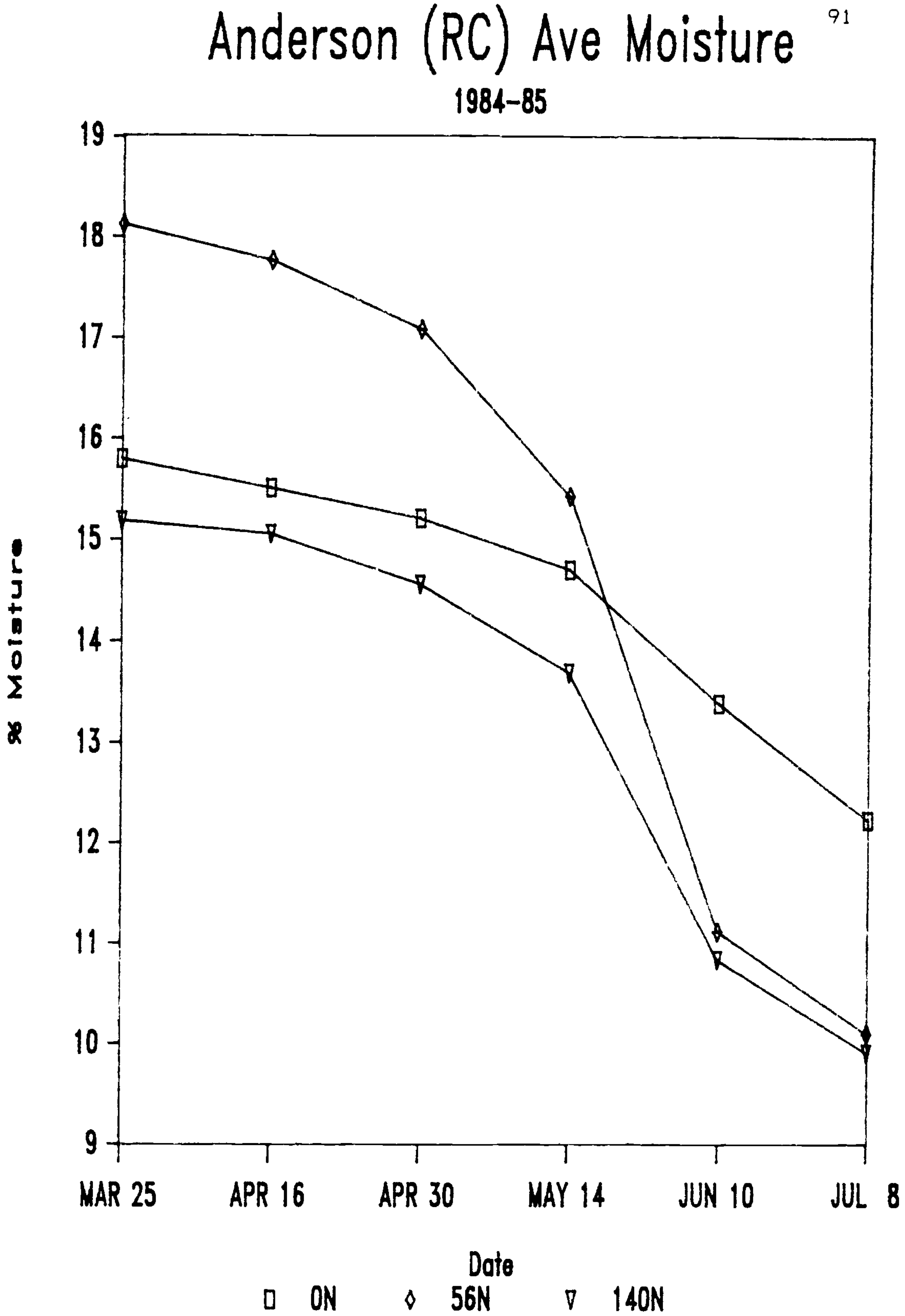



Maley Ave Moisture
1984-85
% Moisture
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
MAR 25
APR 16
APR 30
MAY 14
JUN 10
JUL 8
Date
□ 0N
◊ 56N
▽ 140N



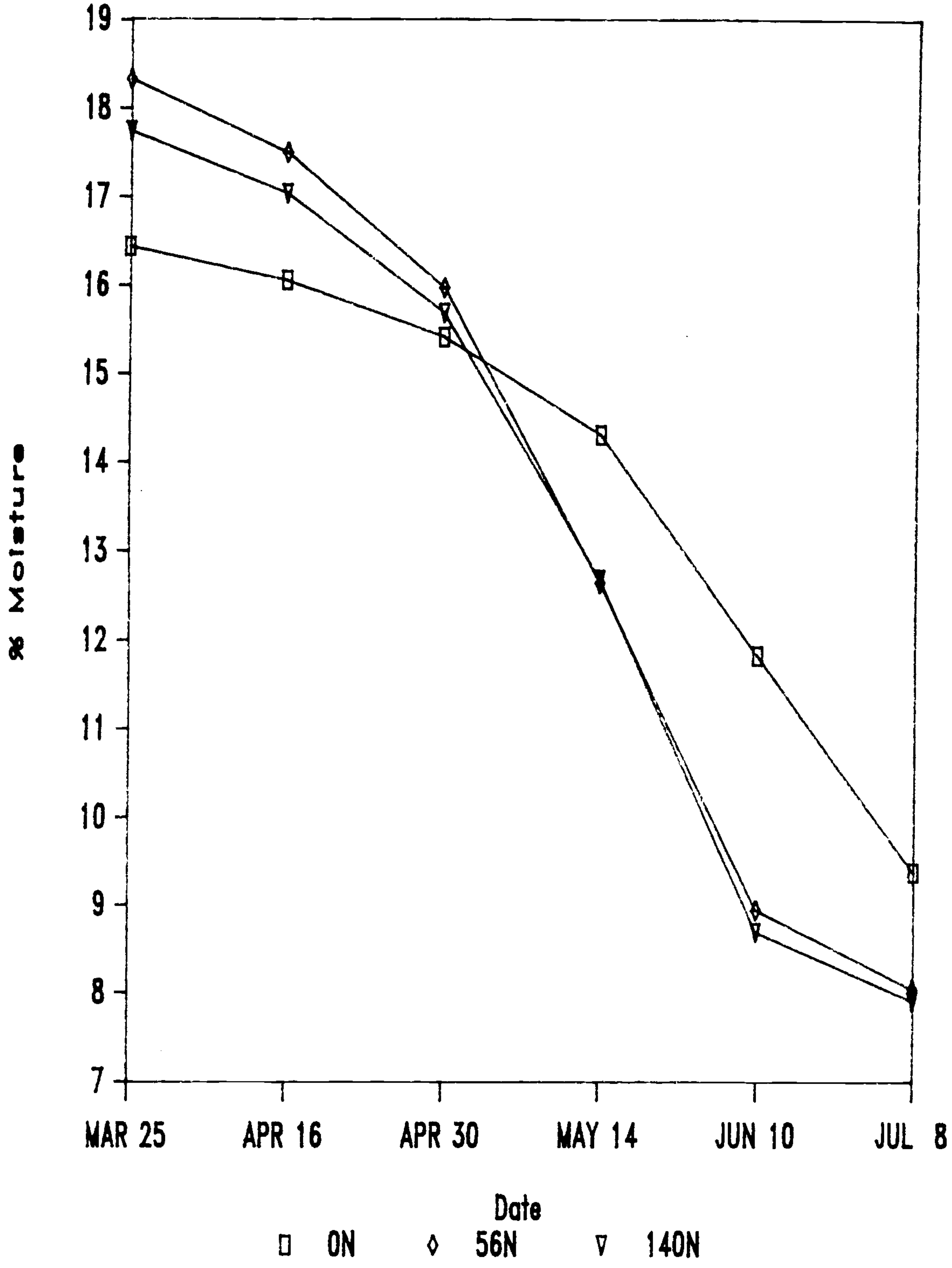
Smouse Ave Moisture

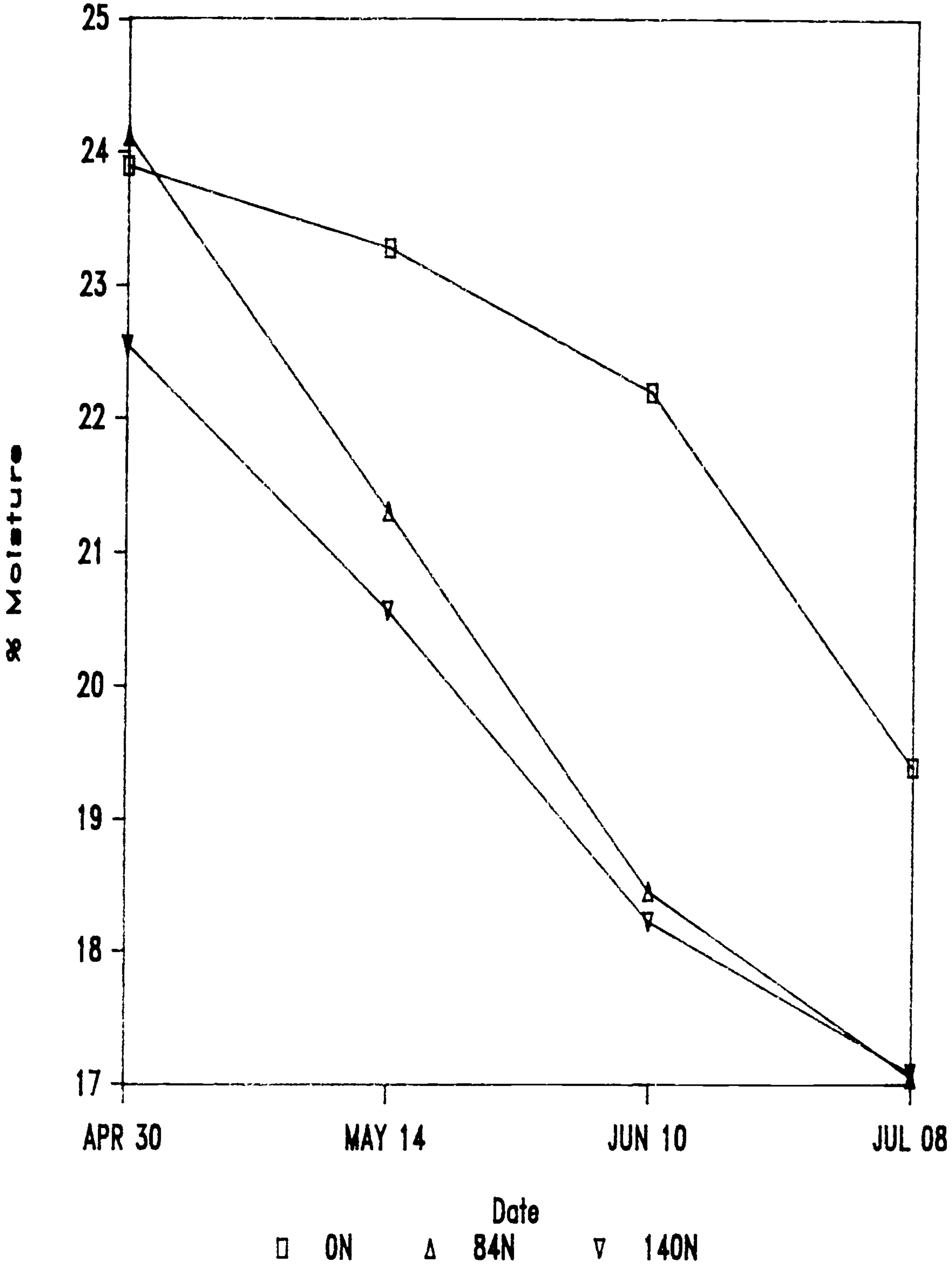
1984-85


Anderson (RC) Ave Moisture
1984-85
19
18
17
16
15
14
13
12
11
10
9
% Moisture
MAR 25
APR 16
APR 30
MAY 14
JUN 10
JUL 8
Date
□ 0N
◊ 56N
▽ 140N

Martin Ave Moisture

1984-85





Newtson Ave Moisture

1984-85

APPENDIX B

% Soil Moisture (by Weight)

APPENDIX B

% SOIL MOISTURE (BY WEIGHT)

Brewer (Br83)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		April 29	May 13	May 27	June 9	June 23	July 6
		% Moisture Content					
0	30	13.3	12.1	10.4	8.9	8.4	8.2
	60	15.1	15.2	14.2	12.8	12.4	12.3
	90	15.0	15.4	14.1	13.5	12.5	12.6
	120	14.5	14.4	14.1	13.0	12.8	12.3
	150	17.3	17.4	16.9	16.6	16.0	15.9
	180	14.0	14.1	13.6	13.2	12.5	12.0
	Col Ave	14.9	14.7	13.9	13.0	12.4	12.2
62	30	11.2	9.0	7.4	6.8	6.5	6.5
	60	12.8	11.7	9.5	7.9	7.5	7.2
	90	14.5	14.1	12.4	10.6	9.7	9.3
	120	14.6	14.3	13.3	11.9	10.9	10.8
	150	15.1	14.8	14.1	13.6	12.9	12.4
	180	15.0	15.3	14.5	14.1	13.3	12.7
	Col Ave	13.9	13.2	11.9	10.8	10.1	9.8
118	30	12.0	9.8	7.7	7.3	6.9	7.0
	60	13.9	13.1	10.6	8.7	8.0	7.8
	90	13.8	12.9	11.0	8.2	7.2	7.2
	120	13.7	13.5	12.6	10.7	9.7	9.3
	150	15.1	15.1	14.3	13.7	12.8	12.3
	180	14.1	13.9	13.7	12.6	12.1	11.5
	Col Ave	13.8	13.0	11.6	10.2	9.4	9.2
174	30	10.6	8.4	6.7	6.0	5.8	5.7
	60	12.5	10.3	7.6	6.3	6.3	6.1
	90	13.5	12.5	9.8	7.2	6.7	6.4
	120	14.1	13.2	11.1	7.7	6.7	6.4
	150	14.9	14.9	13.9	12.4	11.3	10.6
	180	13.8	13.7	13.1	11.8	11.2	10.5
	Col Ave	13.2	12.2	10.4	8.6	8.0	7.6

APPENDIX B continued

Beckett (Bt83)

Nitrogen Rate kg ha^{-1}	Depth cm	April 29	May 13	May 27	June 9	June 20	July 6
		% Moisture Content					
0	30	21.13	25.74	20.54	14.43	13.37	12.66
	60	21.77	22.93	19.41	14.42	12.20	10.25
	Col Ave	21.45	24.34	19.98	14.43	12.79	11.46
28	30	21.39	27.75	22.81	16.79	14.97	14.57
	60	23.43	26.45	23.13	15.58	12.99	11.95
	Col Ave	22.41	27.10	22.97	16.19	13.98	13.26
50	30	18.60	23.47	15.73	11.36	10.84	10.69
	60	20.52	23.81	15.91	10.75	10.46	10.48
	Col Ave	19.56	23.64	15.82	11.06	10.65	10.59
73	30	18.96	25.64	16.66	10.34	10.48	10.13
	60	22.52	24.11	17.40	10.86	9.98	9.76
	Col Ave	20.74	24.88	17.03	10.60	10.23	9.95

APPENDIX B continued

Martin (Mn83)

Nitrogen Rate kg ha^{-1}	Depth cm	April 29	May 13	May 27	June 9	June 20	July 6
		% Moisture Content					
0	30	20.0	19.5	15.8	11.5	9.8	9.2
	60	19.1	19.0	16.0	10.9	8.9	8.4
	Col Ave	19.5	19.2	15.9	11.2	9.3	8.8
28	30	18.7	17.3	12.1	8.5	7.9	7.6
	60	19.0	17.0	12.0	8.7	7.7	7.6
	Col Ave	18.9	17.2	12.0	8.6	7.8	7.6
50	30	16.8	17.1	11.2	7.3	7.0	6.2
	60	18.4	16.4	11.4	7.6	6.4	6.5
	Col Ave	17.6	16.8	11.3	7.5	6.7	6.4
73	30	17.6	16.1	9.5	7.2	6.5	6.6
	60	18.4	16.7	9.9	7.6	7.0	7.0
	Col Ave	18.0	16.4	9.7	7.4	6.8	6.8

APPENDIX B continued

Simontel (Si83)

Nitrogen Rate kg ha^{-1}	Depth cm	Date April 29	May 13	May 27	June 9	June 20	July 6
		% Moisture Content					
0	30	18.1	16.8	13.5	9.3	8.0	7.1
	60	18.9	17.3	14.4	10.6	8.4	7.6
	Col Ave	18.5	17.0	14.0	9.9	8.2	7.4
28	30	20.9	19.8	16.7	12.2	10.2	9.2
	60	20.4	19.2	16.4	13.0	10.7	9.0
	Col Ave	20.7	19.5	16.6	12.6	10.4	9.1
50	30	19.3	16.6	10.9	7.5	6.9	7.0
	60	20.6	18.7	14.8	9.9	9.1	8.7
	Col Ave	19.9	17.6	12.9	8.7	8.0	7.8
73	30	16.9	14.2	9.1	6.9	6.4	6.5
	60	18.0	15.4	10.9	7.6	6.9	6.9
	Col Ave	17.4	14.8	10.0	7.3	6.6	6.7

APPENDIX B continued

Smouse (Sm83)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		April 29	May 13	May 27	June 9	June 23	July 6
		% Moisture Content					
0	30	10.1	9.5	7.7	6.6	6.3	6.6
	60	13.6	12.6	10.7	8.2	7.3	7.4
	90	13.0	12.0	10.3	7.0	6.2	5.7
	120	12.4	11.8	10.3	7.8	6.8	7.0
	150	12.5	12.6	12.0	11.1	10.7	10.7
	Col Ave	12.3	11.7	10.2	8.1	7.5	7.5
28	30	9.8	8.8	7.5	6.7	6.5	6.7
	60	13.1	12.3	10.5	8.4	7.9	7.6
	90	14.1	12.8	10.3	7.9	7.0	6.9
	120	14.5	12.9	10.9	6.8	5.7	5.6
	150	14.7	13.5	12.3	9.9	8.5	8.8
	Col Ave	13.2	12.1	10.3	7.9	7.1	7.1
50	30	9.3	8.3	6.6	6.2	5.6	5.9
	60	13.7	12.4	10.2	7.6	6.7	6.8
	90	17.0	15.7	13.9	9.3	7.7	7.4
	120	17.4	16.0	14.9	10.3	7.7	7.2
	150	16.7	16.0	15.2	12.6	10.6	10.6
	Col Ave	14.8	13.7	12.1	9.2	7.7	7.6
73	30	8.3	7.7	6.3	5.4	5.4	5.9
	60	11.7	10.2	7.6	6.0	5.5	5.6
	90	14.4	12.2	8.8	5.7	5.3	5.5
	120	13.5	12.0	9.6	6.6	5.5	6.0
	150	13.7	13.0	12.4	11.7	10.9	11.2
	Col Ave	12.3	11.0	8.9	7.1	6.5	6.8

APPENDIX B continued

Weatherford (W83)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		April 29	May 13	May 27	June 9	June 23	July 6
		% Moisture Content					
0	30	11.9	11.0	9.3	7.9	7.2	7.2
	60	13.1	12.3	11.1	9.2	8.1	8.0
	90	14.4	13.2	11.4	8.7	7.5	7.1
	120	14.0	12.9	11.4	8.9	7.6	7.5
	150	13.3	12.6	11.7	10.7	9.8	9.5
	Col Ave	13.3	12.4	11.0	9.1	8.0	7.9
28	30	10.2	9.3	7.8	7.2	6.6	6.8
	60	13.8	12.5	10.5	8.5	7.6	7.6
	90	13.6	11.9	9.4	6.7	6.2	6.2
	120	14.5	13.3	10.1	6.7	5.9	5.9
	150	13.6	13.1	11.7	8.6	7.1	7.2
	Col Ave	13.1	12.0	9.9	7.5	6.7	6.7
50	30	10.7	9.6	8.2	7.0	6.9	6.7
	60	12.7	10.7	8.6	7.1	6.8	6.7
	90	12.6	10.3	6.9	5.4	5.3	5.4
	120	14.0	12.7	8.8	6.9	6.3	6.6
	150	14.6	14.1	13.1	12.2	11.2	11.2
	Col Ave	12.9	11.5	9.1	7.7	7.3	7.3
73	30	9.8	8.9	7.5	6.7	6.4	6.9
	60	13.0	11.5	9.4	7.5	7.1	7.3
	90	13.9	12.2	8.8	6.6	6.3	6.3
	120	13.1	11.8	8.4	6.4	5.9	6.5
	150	13.2	12.4	10.6	8.3	7.6	8.9
	Col Ave	12.6	11.4	8.9	7.1	6.6	7.2

APPENDIX B continued

Borstal (B183)

Nitrogen Rate kg ha^{-1}	Depth cm	April 29	May 13	May 27	June 9	June 20	July 6
		% Moisture Content					
0	30	16.0	15.5	13.8	11.2	10.4	9.2
	60	16.7	15.2	13.7	11.7	10.1	9.5
	Col Ave	16.3	15.4	13.7	11.4	10.3	9.3
28	30	13.9	13.3	10.9	8.4	7.7	7.7
	60	17.4	15.8	13.1	10.2	9.1	9.2
	Col Ave	15.7	14.5	12.0	9.3	8.4	8.4
50	30	12.4	11.8	9.8	7.6	6.9	6.5
	60	15.9	14.4	11.1	7.7	7.0	7.0
	Col Ave	14.2	13.1	10.4	7.6	6.9	6.7
73	30	11.6	12.6	8.8	7.0	6.6	6.5
	60	13.3	12.2	9.6	8.0	7.4	7.0
	Col Ave	12.5	12.4	9.2	7.5	7.0	6.7

APPENDIX B continued

Gilbert (Gt83)

Nitrogen kg ha^{-1}	Depth cm	April 29	May 13	May 27	June 9	June 20	July 6
		% Moisture Content					
0	30	24.7	23.9	24.3	23.7	23.0	22.6
28	30	14.3	14.8	14.0	14.0	13.3	13.1
50	30	21.4	21.4	18.7	16.0	15.7	15.9
73	30	22.7	23.9	19.5	16.8	16.9	16.6

APPENDIX B continued

Reeder (R83)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		April 29	May 13	May 27	June 9	June 23	July 6
		% Moisture Content					
0	30	15.24	14.87	13.39	11.56	10.71	10.73
	60	15.30	15.04	13.91	12.67	12.08	11.72
	90	14.05	13.69	13.19	12.44	11.23	11.10
	120	10.92	11.55	11.38	11.15	10.70	10.50
	150	10.14	10.42	10.47	10.73	10.65	10.55
	180	11.03	10.89	10.70	10.86	10.89	10.67
	Col Ave	12.78	12.74	12.17	11.57	11.04	10.88
62	30	11.86	11.21	8.92	8.05	7.87	8.13
	60	14.17	13.18	11.23	9.40	8.42	8.33
	90	15.53	14.68	13.46	10.77	9.59	9.34
	120	14.32	14.07	13.04	11.38	10.38	9.92
	150	11.46	11.57	11.25	10.72	9.69	9.62
	180	11.40	11.66	11.76	11.48	10.68	10.53
	Col Ave	13.12	12.73	11.61	10.30	9.44	9.31
118	30	11.74	10.69	8.58	8.02	7.92	8.57
	60	12.86	11.14	8.68	7.63	7.27	7.49
	90	14.30	13.01	9.77	7.88	7.75	7.76
	120	12.73	12.18	10.18	7.72	7.42	7.48
	150	9.44	9.52	9.37	8.57	7.46	7.35
	180	10.27	10.31	10.26	9.31	8.63	8.40
	Col Ave	11.89	11.14	9.47	8.19	7.74	7.84
174	30	10.42	9.32	7.65	7.32	7.00	7.58
	60	12.44	10.36	7.81	7.37	7.46	7.29
	90	13.80	12.23	8.65	7.89	7.92	7.85
	120	10.60	10.29	8.58	7.55	7.08	7.18
	150	9.12	9.48	9.23	8.84	8.45	8.47
	180	11.02	10.82	10.85	10.76	10.65	10.56
	Col Ave	11.23	10.42	8.80	8.29	8.09	8.16

APPENDIX B continued

Hay Hy84

Nitrogen Rate kg ha^{-1}	Depth cm	Date						
		April 23	May 9	May 23	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	13.2	10.8	9.3	8.4	7.9	7.7	7.5
	60	13.4	12.5	11.2	9.8	7.9	7.5	7.5
	90	15.1	14.1	13.4	12.6	10.3	9.5	9.7
	120	16.0	15.3	15.0	14.1	12.4	11.6	11.5
	150	16.1	15.5	15.2	14.5	13.5	12.8	12.8
	180	18.3	18.0	17.7	17.4	15.4	14.8	14.7
	Col Ave	15.3	14.4	13.6	12.8	11.3	10.6	10.6
56	30	12.9	10.7	8.9	8.3	7.8	7.5	7.6
	60	14.5	13.9	11.5	10.1	8.4	8.3	8.3
	90	16.2	15.0	13.8	12.1	9.8	9.3	9.2
	120	16.8	15.9	14.9	14.1	11.7	10.9	10.5
	150	17.0	16.0	15.7	15.2	12.8	11.4	11.5
	180	17.2	16.9	16.6	16.3	15.0	14.1	14.2
	Col Ave	15.8	14.7	13.6	12.7	10.9	10.3	10.2
112	30	11.3	8.6	8.0	7.6	7.2	7.2	7.1
	60	13.8	11.2	9.1	8.3	7.6	7.6	7.5
	90	14.8	13.5	11.5	9.9	8.4	7.9	8.0
	120	16.3	15.3	13.9	12.3	9.4	8.7	8.9
	150	17.1	16.3	15.6	14.8	12.2	10.8	10.6
	180	17.4	17.1	16.9	16.3	14.3	13.3	13.4
	Col Ave	15.1	13.7	12.5	11.5	9.8	9.2	9.2
168	30	11.6	9.0	8.0	7.7	7.6	7.3	7.4
	60	13.0	9.7	8.1	7.6	7.2	7.2	7.3
	90	15.2	13.1	10.2	8.5	7.8	7.7	7.5
	120	15.7	14.4	12.6	10.2	8.1	7.9	7.8
	150	17.4	17.0	16.2	14.4	9.7	9.1	9.2
	180	19.9	19.8	19.4	18.9	15.8	14.9	15.3
	Col Ave	15.5	13.8	12.4	11.2	9.4	9.0	9.1

APPENDIX B continued

Martin (Mn84)

Nitrogen Rate kg ha^{-1}	Depth cm	Date						
		April 23	May 9	May 23	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	20.6	18.8	18.2	17.7	17.1	15.9	14.5
	60	21.1	20.4	19.8	19.1	18.7	17.5	15.6
	Col Ave	20.8	19.6	19.0	18.4	17.9	16.7	15.1
28	30	19.6	17.3	16.1	13.7	12.2	10.5	9.6
	60	18.4	17.6	16.7	15.3	12.2	11.2	10.5
	Col Ave	19.0	17.4	16.4	14.5	12.2	10.9	10.0
56	30	20.4	19.0	17.7	13.9	11.0	9.8	9.1
	60	19.7	18.8	18.4	16.0	11.8	11.1	10.5
	Col Ave	20.1	18.9	18.1	14.9	11.4	10.5	9.8
112	30	20.1	18.1	14.7	10.9	9.6	9.1	8.8
	60	19.7	18.3	16.4	12.3	10.1	10.3	10.0
	Col Ave	19.9	18.2	15.5	11.6	9.9	9.7	9.4

APPENDIX B continued

Kaseberg (K84)

Nitrogen Rate kg ha^{-1}	Depth cm	April 23	May 9	May 23	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	14.2	11.7	9.8	8.8	8.2	7.7	7.7
	60	14.6	13.5	12.2	10.9	8.8	8.1	8.1
	90	15.1	13.9	13.0	11.7	9.9	9.0	8.7
	120	15.9	14.2	13.6	12.7	10.7	9.3	8.9
	150	15.6	14.5	14.2	13.8	11.6	10.1	10.3
	180	19.3	18.9	18.5	18.2	16.0	15.5	15.4
	Col Ave	15.8	14.4	13.5	12.7	10.9	10.0	9.8
56	30	13.2	11.0	9.0	8.3	7.5	7.1	7.1
	60	14.6	12.3	9.6	8.3	7.8	7.3	7.2
	90	15.1	13.6	11.2	8.9	8.0	7.4	7.4
	120	15.9	14.4	13.0	9.9	7.9	7.4	7.2
	150	15.6	14.6	14.1	13.4	8.9	7.8	7.8
	180	20.0	19.8	19.4	19.2	14.6	13.3	13.8
	Col Ave	15.7	14.3	12.7	11.3	9.1	8.4	8.4
112	30	13.9	10.2	8.5	8.0	7.8	7.5	7.2
	60	15.2	12.4	9.3	8.4	7.7	7.3	7.4
	90	15.8	14.3	10.9	8.7	8.0	7.6	7.7
	120	16.8	15.5	13.6	10.2	8.1	7.6	7.5
	150	15.8	14.7	14.1	13.0	8.8	7.9	7.9
	180	19.8	19.6	19.4	18.7	14.7	12.9	12.
	Col Ave	16.2	14.5	12.6	11.2	9.2	8.5	8.4
168	30	14.9	11.3	8.7	8.1	7.8	7.6	7.3
	60	15.3	13.3	9.9	8.7	7.9	7.5	7.4
	90	15.7	14.0	11.7	9.0	8.2	7.9	7.8
	120	16.0	14.8	13.6	11.0	8.4	7.7	7.7
	150	20.2	19.6	19.2	18.3	10.7	9.5	9.4
	180	23.3	21.6	21.3	20.7	18.8	16.2	15.9
	Col Ave	17.6	15.8	14.1	12.6	10.3	9.4	9.3

APPENDIX B continued

Campbell (C84)

Nitrogen Rate kg ha^{-1}	Depth cm	April 23	May 9	May 20	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	20.1	18.1	17.3	15.8	12.8	10.8	9.5
	60	21.1	20.2	19.1	17.7	15.2	14.5	11.0
	Col Ave	20.6	19.1	18.2	16.8	14.0	12.6	10.2
28	30	20.8	19.6	18.9	16.9	13.8	11.2	10.0
	60	22.6	23.0	22.0	20.2	17.3	11.6	9.6
	Col Ave	21.7	21.3	20.4	18.5	15.6	11.4	9.8
56	30	20.3	20.1	19.0	17.1	11.6	9.4	8.4
	60	23.4	23.4	22.5	20.5	17.2	10.7	8.4
	Col Ave	21.9	21.7	20.8	18.8	14.4	10.1	8.4
112	30	21.1	20.1	17.9	14.1	11.4	10.0	9.4
	60	23.4	22.3	20.0	16.1	12.7	10.4	9.8
	Col Ave	22.2	21.2	18.9	15.1	12.0	10.2	9.6

APPENDIX B continued

Bergstrom (Bm84)

Nitrogen Rate kg ha^{-1}	Depth cm	Date						
		April 23	May 9	May 23	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	21.5	20.4	19.0	17.6	15.2	11.9	10.7
	60	23.4	22.2	20.8	19.5	17.6	15.8	13.5
	90	24.0	22.2	21.3	19.7	19.2	18.1	16.3
	Col Ave	22.9	21.6	20.4	18.9	17.3	15.3	13.5
28	30	20.9	19.1	17.0	14.5	12.3	10.1	9.6
	60	22.0	20.2	19.6	18.9	14.2	11.1	9.9
	90	21.4	21.1	20.5	19.8	19.0	16.3	15.1
	Col Ave	21.4	20.1	19.0	17.7	15.2	12.5	11.5
56	30	22.0	20.0	18.2	16.2	13.5	10.0	8.8
	60	24.3	23.4	22.1	20.2	17.1	13.5	9.8
	90	25.3	23.3	21.5	20.1	19.1	16.2	12.5
	Col Ave	23.9	22.2	20.6	18.8	16.6	13.2	10.4
112	30	22.4	20.7	18.0	14.6	11.0	9.1	8.4
	60	24.4	23.2	21.7	19.0	13.9	9.5	8.3
	90	25.1	23.0	21.8	19.4	17.2	13.0	11.3
	Col Ave	24.0	22.3	20.5	17.7	14.1	10.5	9.3

APPENDIX B continued

Anderson (A84)

Nitrogen Rate kg ha^{-1}	Depth cm	Date						
		April 23	May 9	May 23	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	26.8	23.6	23.4	22.9	23.6	21.8	20.3
	60	23.6	23.2	22.9	22.6	21.0	20.1	18.3
	90	25.5	23.6	23.5	23.1	22.7	22.4	21.0
	Col Ave	25.3	23.5	23.3	22.9	22.4	21.4	19.9
28	30	21.9	20.7	20.0	19.5	17.9	15.8	13.6
	60	24.0	23.5	23.2	22.8	19.9	18.8	17.2
	90	26.2	25.6	25.2	24.6	24.2	23.1	21.5
	Col Ave	24.0	23.3	22.8	22.3	20.7	19.2	17.4
56	30	25.6	22.7	21.5	20.2	17.6	13.9	11.8
	60	23.5	22.0	21.8	21.8	19.8	18.2	15.2
	90	23.8	22.5	23.8	23.6	23.4	22.6	21.0
	Col Ave	24.3	22.4	22.4	21.9	20.3	18.2	16.0
112	30	22.2	20.9	19.6	17.1	12.5	10.3	9.5
	60	22.4	21.3	20.9	19.5	16.7	11.1	9.0
	90	24.5	23.9	23.3	22.5	21.2	17.4	11.3
	Col Ave	23.0	22.0	21.3	19.7	16.8	12.9	9.9

APPENDIX B continued

Smouse (Sm84)

Nitrogen Rate kg ha^{-1}	Depth cm	Date April 23	May 9	May 23	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	12.7	11.9	10.0	8.6	7.2	6.5	6.4
	60	15.1	12.8	11.3	9.6	8.1	7.1	7.0
	90	13.0	11.4	10.6	9.4	8.0	6.8	6.6
	120	13.3	12.8	12.2	11.6	9.2	7.7	7.7
	150	24.0	23.3	22.6	22.3	21.7	20.8	20.2
	Col Ave	15.6	14.4	13.4	12.3	10.8	9.8	9.6
28	30	10.1	9.3	8.3	7.6	6.5	6.0	5.9
	60	12.5	10.5	9.1	7.7	7.2	6.6	6.6
	90	13.3	11.1	9.0	7.5	7.0	6.4	6.4
	120	13.1	11.6	10.1	8.4	6.4	6.0	5.9
	150	22.4	22.2	21.7	21.0	20.2	19.7	19.5
	Col Ave	14.3	12.9	11.6	10.4	9.5	8.9	8.8
56	30	12.4	10.9	8.9	7.7	6.8	6.4	6.3
	60	13.8	11.9	10.4	8.5	7.4	6.6	6.5
	90	13.9	12.6	10.9	9.2	7.2	6.4	6.2
	120	13.6	12.0	11.2	10.5	8.2	6.9	6.6
	150	22.7	21.5	20.9	20.8	19.9	19.0	18.6
	Col Ave	15.3	13.8	12.5	11.4	9.9	9.1	8.9
112	30	9.1	8.1	7.3	6.8	6.3	6.0	5.9
	60	11.4	9.1	7.4	6.8	6.6	6.5	6.5
	90	12.0	9.5	7.1	6.2	6.0	5.9	5.8
	120	12.4	10.9	9.6	8.2	5.8	5.5	5.6
	150	19.1	19.1	18.7	18.0	17.0	16.2	16.1
	Col Ave	12.8	11.3	10.0	9.2	8.3	8.0	8.0

APPENDIX B continued

Harper (Hr84)

Nitrogen Rate kg ha^{-1}	Depth cm	Date						
		April 23	May 9	May 23	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	13.3	12.0	9.8	8.9	8.4	8.0	8.0
	60	14.5	14.1	12.8	11.3	8.8	8.0	8.0
	90	16.2	14.9	14.0	12.9	11.2	9.6	9.2
	120	14.1	12.6	12.0	11.1	10.8	9.6	9.0
	150	14.1	13.3	12.7	12.2	10.8	9.7	9.2
	180	16.0	15.3	14.9	14.3	13.7	12.9	12.3
	Col Ave	14.7	13.7	12.7	11.8	10.6	9.6	9.3
56	30	12.2	10.4	8.6	8.0	7.9	7.4	7.4
	60	13.3	12.3	9.5	8.4	7.5	7.1	7.0
	90	15.0	12.7	10.8	8.8	7.9	7.4	7.2
	120	13.5	12.4	11.1	9.4	7.4	6.7	6.6
	150	14.5	13.4	12.6	11.4	8.0	6.7	6.4
	180	15.2	14.4	13.8	12.9	11.4	8.2	7.2
	Col Ave	14.0	12.6	11.1	9.8	8.4	7.3	7.0
112	30	13.3	11.3	8.9	7.9	8.2	7.8	7.8
	60	14.3	13.1	11.0	9.1	7.7	7.4	7.3
	90	15.1	13.6	12.6	11.0	8.7	7.8	7.6
	120	14.4	13.1	12.2	11.2	9.8	7.7	7.2
	150	15.0	13.9	13.2	12.6	10.9	8.6	7.3
	180	14.9	14.7	14.1	13.6	12.9	11.4	10.5
	Col Ave	14.5	13.3	12.0	10.9	9.7	8.4	8.0
168	30	12.5	10.0	8.3	8.1	8.1	7.8	7.5
	60	14.2	12.6	9.9	8.7	7.8	7.5	7.1
	90	14.3	12.2	10.6	8.9	8.0	7.2	6.9
	120	14.2	12.7	11.7	10.4	8.2	6.7	6.5
	150	15.2	14.8	14.1	13.2	9.2	6.9	6.4
	180	18.0	17.2	16.7	15.7	14.1	10.4	9.3
	Col Ave	14.7	13.3	11.9	10.8	9.2	7.8	7.3

APPENDIX B continued

Gilbert (Gt84)

Nitrogen Rate kg ha^{-1}	Depth cm	April 23	May 9	May 23	June 6	June 20	July 5	July 18
		% Moisture Content						
0	30	28.1	28.3	27.7	27.6	27.8	26.0	24.2
28	30	25.9	24.2	23.7	24.2	22.3	20.0	18.6
56	30	29.0	28.7	28.3	28.3	27.8	25.7	23.9
112	30	27.8	27.5	25.6	23.4	21.0	18.7	18.1

APPENDIX B continued

Feist (F85)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
0 N	30	18.5	17.0	15.9	13.8	11.4	9.2
	60	19.3	19.0	17.9	15.8	10.3	8.5
	90	21.8	21.7	21.1	19.1	13.2	10.3
	120	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	19.8	19.2	18.3	16.2	11.6	9.3
56 N	30	18.6	16.6	14.8	12.4	11.0	8.7
	60	19.4	19.5	18.8	16.1	10.4	8.6
	90	19.5	19.3	18.7	16.7	9.7	7.8
	120	21.7	21.4	20.7	19.1	12.6	9.9
	Col Ave	19.8	19.2	18.2	16.1	10.9	8.7
112 N	30	16.7	14.6	13.3	11.3	10.1	8.2
	60	18.9	18.7	17.8	15.1	10.0	8.3
	90	18.8	18.2	17.6	16.2	10.2	7.5
	120	19.7	19.2	18.7	18.2	13.9	9.9
	Col Ave	18.5	17.7	16.8	15.2	11.1	8.5
168 N	30	17.5	16.0	14.5	11.8	9.8	8.2
	60	18.9	19.0	18.1	15.7	9.5	7.8
	90	20.3	20.1	19.8	17.9	10.8	8.2
	120	20.9	20.8	20.1	19.1	13.7	9.6
	Col Ave	19.4	19.0	18.1	16.1	11.0	8.5
224 N	30	17.3	15.8	14.2	11.3	9.4	8.2
	60	18.6	18.4	17.8	16.3	10.3	8.0
	90	19.7	19.6	19.0	18.0	14.2	8.6
	120	18.4	18.5	17.9	17.3	14.9	11.6
	Col Ave	18.5	18.1	17.2	15.7	12.2	9.1
280 N	30	16.4	14.4	13.3	11.1	9.8	7.9
	60	17.7	17.6	16.8	15.2	9.8	7.4
	90	18.5	18.5	18.0	17.1	12.2	7.7
	120	17.8	17.7	17.4	16.8	14.4	8.9
	Col Ave	17.6	17.1	16.4	15.0	11.5	8.0

APPENDIX B continued

Goodwin (Gn85)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
0 N	30	15.7	13.7	12.5	10.6	8.0	7.2
	60	15.5	14.7	13.7	12.8	10.2	8.2
	90	16.2	15.9	15.4	14.4	12.1	9.9
	120	14.9	14.9	14.3	13.7	12.2	9.8
	150	15.3	15.1	14.6	14.0	12.9	11.3
	180	14.9	14.7	14.6	14.5	13.4	12.7
	Col Ave	15.4	14.8	14.2	13.4	11.5	9.8
56 N	30	16.1	11.5	8.7	7.4	6.7	6.5
	60	14.6	12.9	11.5	9.0	7.1	6.7
	90	16.2	15.4	14.5	13.0	8.7	7.6
	120	13.8	13.6	12.9	12.0	9.6	7.0
	150	15.5	15.7	14.8	14.5	12.5	8.9
	180	14.9	14.9	14.6	14.0	13.1	11.1
	Col Ave	15.2	14.0	12.8	11.7	9.6	8.0
112 N	30	16.7	12.6	9.2	7.9	7.0	6.8
	60	15.1	13.9	11.4	8.8	7.1	6.4
	90	15.9	15.2	14.5	12.3	8.2	7.2
	120	15.1	14.7	14.2	13.1	8.5	6.5
	150	16.2	16.1	15.5	15.2	12.0	7.7
	180	16.1	15.7	15.5	15.0	13.8	11.4
	Col Ave	15.8	14.7	13.4	12.1	9.4	7.7
168 N	30	17.3	13.5	9.7	7.7	7.2	6.8
	60	14.5	13.3	11.6	8.7	6.6	6.2
	90	16.6	16.3	15.8	13.9	8.5	7.6
	120	15.2	15.0	14.7	14.0	9.8	7.3
	150	15.1	15.3	15.0	14.3	12.4	9.7
	180	14.0	13.9	13.8	13.3	12.3	10.9
	Col Ave	15.5	14.5	13.4	12.0	9.5	8.1

APPENDIX B continued

Goodwin (Gn85) continued

Nitrogen Rate kg ha^{-1}	Depth cm	March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
224 N	30	16.4	12.8	9.3	7.9	7.3	7.0
	60	15.2	14.2	12.2	8.8	7.1	6.7
	90	16.9	16.1	15.3	12.9	8.4	7.6
	120	15.5	15.5	14.7	13.4	8.5	6.7
	150	15.1	15.1	14.7	14.1	10.7	7.6
	180	15.0	15.4	14.8	14.5	13.0	11.0
	Col Ave	15.7	14.8	13.5	11.9	9.2	7.8
280 N	30	16.8	12.4	9.1	8.0	7.3	6.8
	60	14.6	13.4	10.8	8.0	6.6	6.2
	90	15.2	15.0	14.3	11.4	7.5	6.8
	120	14.3	14.2	13.7	12.5	7.7	6.2
	150	15.2	15.1	14.5	14.4	10.7	7.1
	180	15.2	15.3	14.9	14.8	13.0	10.4
	Col Ave	15.2	14.2	12.9	11.5	8.8	7.3

APPENDIX B continued

Kaseberg (K85)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
0 N	30	14.6	10.4	9.0	8.1	7.8	7.5
	60	14.5	12.9	11.3	9.4	8.1	7.6
	90	12.4	11.6	10.5	8.8	7.0	6.4
	120	12.2	11.6	11.0	9.2	6.9	6.1
	150	12.3	12.3	11.9	11.2	9.0	7.5
	180	14.6	14.8	14.4	14.1	12.8	11.4
Col Ave		13.4	12.3	11.3	10.1	8.6	7.7
56 N	30	13.5	8.6	7.7	7.5	7.1	6.9
	60	13.4	10.7	8.5	7.3	6.8	6.5
	90	13.0	12.2	10.2	7.7	6.3	6.2
	120	12.4	12.2	11.3	8.8	6.4	5.8
	150	12.4	12.2	11.8	10.8	7.1	6.0
	180	13.1	13.0	13.0	12.4	10.2	8.2
Col Ave		13.0	11.5	10.4	9.1	7.3	6.6
112 N	30	13.2	8.2	7.7	7.3	7.0	6.5
	60	12.9	10.2	8.5	7.4	6.4	6.2
	90	12.6	11.8	9.7	7.4	6.1	6.0
	120	12.5	12.1	11.0	8.3	6.6	6.1
	150	12.6	12.6	12.5	10.9	7.3	6.9
	180	14.0	14.4	14.3	13.4	11.6	11.0
Col Ave		13.0	11.6	10.6	9.1	7.5	7.1
168 N	30	14.2	9.3	8.2	7.5	7.2	7.0
	60	14.3	11.9	9.5	8.1	7.1	6.6
	90	13.1	12.6	10.8	8.3	6.7	6.1
	120	13.8	13.6	12.4	9.6	6.8	6.4
	150	13.0	12.8	12.1	11.3	7.1	6.6
	180	12.3	12.2	11.9	11.6	9.5	8.5
Col Ave		13.4	12.0	10.8	9.4	7.4	6.9

APPENDIX B continued

Kaseberg (K85) continued

Nitrogen Rate kg ha^{-1}	Depth cm	March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
224 N	30	14.9	9.6	8.3	7.8	7.2	6.9
	60	14.4	12.6	10.2	8.3	7.0	6.7
	90	12.5	12.2	10.8	8.5	6.3	5.7
	120	12.8	12.7	12.1	10.6	7.0	6.5
	150	12.5	12.6	12.2	11.5	8.3	7.0
	180	11.5	11.9	11.8	11.3	10.2	9.2
	Col Ave	13.1	11.9	10.9	9.7	7.7	7.0
280 N	30	14.2	9.3	8.1	7.6	7.3	6.9
	60	13.4	11.4	8.8	7.4	6.6	6.6
	90	12.9	12.2	10.5	7.4	6.2	5.8
	120	13.1	12.8	11.6	9.0	6.4	5.9
	150	12.8	12.7	12.4	11.2	7.4	6.6
	180	13.8	14.0	13.9	13.3	11.5	10.7
	Col Ave	13.4	12.1	10.9	9.3	7.6	7.1

APPENDIX B continued

Anderson (A85RC)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
REP 1							
0 N	30	15.8	14.8	14.5	13.6	12.9	12.5
	60	12.6	12.5	12.7	12.6	12.6	12.4
	Col Ave	14.2	13.7	13.6	13.1	12.8	12.5
28 N	30	14.9	14.4	14.2	13.2	12.1	11.4
	60	10.4	10.5	10.6	10.7	10.8	10.5
	Col Ave	12.7	12.4	12.4	11.9	11.4	10.9
56 N	30	22.2	21.6	20.8	19.4	12.1	10.1
	60	22.5	22.0	21.6	19.8	11.2	9.7
	Col Ave	22.4	21.8	21.2	19.6	11.7	9.9
84 N	30	16.9	16.9	16.0	14.5	11.9	11.3
	60	11.7	11.9	11.8	12.0	10.9	10.4
	Col Ave	14.3	14.4	13.9	13.2	11.4	10.9
112 N	30	14.2	13.8	13.5	12.6	11.2	10.4
	60	11.3	11.5	11.7	11.4	11.1	10.4
	Col Ave	12.7	12.7	12.6	12.0	11.2	10.4
140 N	30	16.2	15.9	15.0	13.3	10.2	9.2
	60	9.7	9.9	10.0	10.0	10.0	10.0
	Col Ave	12.9	12.9	12.5	11.7	10.1	9.6
REP 2							
0 N	30	18.8	18.0	17.4	16.5	14.4	12.4
	60	20.2	20.0	19.4	18.8	16.1	13.7
	Col Ave	19.5	19.0	18.4	17.6	15.2	13.0
28 N	30	18.6	17.6	16.3	13.7	10.7	9.6
	60	17.5	17.9	17.1	15.0	11.0	10.4
	Col Ave	18.1	17.7	16.7	14.4	10.8	10.0

APPENDIX B continued

Anderson (A85RC) continued

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
56 N	30	16.8	16.2	14.9	12.7	9.7	9.0
	60	14.7	15.1	14.9	13.4	10.0	9.1
	Col Ave	15.8	15.6	14.9	13.1	9.9	9.1
84 N	30	19.2	18.6	17.3	14.6	10.3	9.6
	60	20.0	20.1	19.4	17.6	11.0	10.1
	Col Ave	19.6	19.3	18.3	16.1	10.7	9.9
112 N	30	14.8	14.4	13.8	12.7	9.9	9.2
	60	10.3	10.5	10.2	10.4	10.4	10.2
	Col Ave	12.5	12.5	12.0	11.6	10.1	9.7
140 N	30	16.9	16.6	15.7	14.1	10.2	8.9
	60	17.2	17.4	17.2	16.5	11.5	9.3
	Col Ave	17.0	17.0	16.5	15.3	10.8	9.1
REP 3							
0 N	30	17.0	16.5	15.9	15.0	13.4	11.7
	60	12.0	12.4	13.2	13.5	12.2	11.1
	Col Ave	14.5	14.5	14.6	14.3	12.8	11.4
28 N	30	17.5	16.8	15.5	13.7	10.7	9.6
	60	17.5	17.4	16.9	15.4	11.3	9.7
	Col Ave	17.5	17.1	16.2	14.6	11.0	9.7
56 N	30	17.3	16.5	15.7	14.2	10.1	8.9
	60	20.6	20.3	19.7	17.8	12.0	11.0
	Col Ave	18.9	18.4	17.7	16.0	11.0	9.9
84 N	30	18.3	17.6	16.7	14.9	10.4	9.6
	60	19.0	18.6	18.1	16.6	11.0	9.9
	Col Ave	18.7	18.1	17.4	15.8	10.7	9.8

APPENDIX B continued

Anderson (A85RC) continued

Nitrogen Rate kg ha^{-1}	Depth cm	Date March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
112 N	30	18.3	17.1	16.1	13.8	10.5	9.7
	60	17.2	16.7	15.8	13.8	10.5	9.7
	Col Ave	17.8	16.9	16.0	13.8	10.5	9.7
140 N	30	19.6	18.7	17.7	16.6	11.4	10.1
	60	14.2	14.7	14.8	14.7	11.7	10.5
	Col Ave	16.9	16.7	16.3	15.6	11.5	10.3
REP 4							
0 N	30	15.3	15.2	14.5	14.0	12.8	11.9
	60	14.7	14.7	14.2	13.8	12.7	12.2
	Col Ave	15.0	14.9	14.3	13.9	12.7	12.1
28 N	30	18.4	17.4	15.6	13.0	10.2	10.1
	60	12.4	12.5	12.3	11.8	10.9	10.7
	Col Ave	15.4	14.9	13.9	12.4	10.6	10.4
56 N	30	18.1	17.5	16.3	13.8	12.0	11.3
	60	12.8	12.9	12.8	12.4	11.9	11.7
	Col Ave	15.4	15.2	14.6	13.1	12.0	11.5
84 N	30	17.0	16.1	15.3	13.4	10.0	9.1
	60	15.8	16.0	15.7	14.1	10.4	9.5
	Col Ave	16.4	16.0	15.5	13.8	10.2	9.3
112 N	30	20.3	18.9	17.8	14.8	10.2	9.5
	60	16.1	16.6	16.7	15.6	12.3	11.5
	Col Ave	18.2	17.8	17.2	15.2	11.3	10.5
140 N	30	16.9	16.5	15.2	13.4	11.2	10.6
	60	10.8	10.9	10.9	11.0	10.6	10.8
	Col Ave	13.8	13.7	13.1	12.2	10.9	10.7

APPENDIX B continued

Maley (My85)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
FEP 1							
0 N	30	21.1	20.5	19.6	18.3	12.6	9.2
	60	23.7	23.7	23.3	22.8	18.0	10.5
	90	26.2	26.6	25.7	25.0	20.4	12.0
	Col Ave	23.7	23.6	22.9	22.0	17.0	10.6
28 N	30	21.6	20.7	20.3	17.9	12.1	9.2
	60	23.8	23.6	23.7	22.8	16.5	10.4
	90	25.8	25.9	25.3	24.6	18.7	11.6
	Col Ave	23.7	23.4	23.1	21.7	15.8	10.4
56 N	30	21.6	20.8	20.3	19.0	12.4	9.0
	60	25.5	25.6	25.4	25.4	20.6	10.3
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	23.5	23.2	22.8	22.2	16.5	9.6
84 N	30	20.8	20.2	19.4	16.7	10.6	8.4
	60	24.0	24.0	23.8	23.2	12.9	9.7
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.4	22.1	21.6	19.9	11.8	9.0
112 N	30	21.8	21.4	21.2	20.0	14.6	10.7
	60	23.8	24.1	23.7	23.6	20.0	11.5
	90	25.0	25.4	25.2	25.0	21.8	13.4
	Col Ave	23.5	23.6	23.4	22.9	18.8	11.9
140 N	30	21.5	19.4	17.9	14.2	11.0	9.2
	60	23.8	24.3	24.1	24.1	20.5	14.8
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.7	21.8	21.0	19.1	15.8	12.0
REP 2							
0 N	30	21.3	20.0	19.7	18.4	14.6	11.4
	60	23.1	23.5	22.9	22.5	19.8	11.8
	90	27.0	27.3	26.8	26.5	24.8	17.1
	Col Ave	23.8	23.6	23.1	22.5	19.8	13.4

APPENDIX B continued

Maley (My85) continued

Nitrogen Rate $_{-1}$ kg ha	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
28 N	30	21.7	20.5	19.6	17.5	13.2	10.9
	60	24.0	24.2	24.1	23.8	21.5	12.1
	90	24.1	26.9	26.9	26.8	24.2	16.0
	Col Ave	23.3	23.9	23.5	22.7	19.6	13.0
56 N	30	21.5	21.4	20.7	19.2	12.5	9.4
	60	23.4	23.4	23.0	22.7	19.1	9.3
	90	27.3	27.4	26.8	26.7	24.3	11.0
	Col Ave	24.0	24.1	23.5	22.9	18.7	9.9
84 N	30	20.7	19.4	19.0	16.4	12.3	9.5
	60	24.8	25.1	24.7	24.4	19.7	9.9
	90	28.2	28.1	27.8	27.4	23.5	11.1
	Col Ave	24.6	24.2	23.8	22.7	18.5	10.2
112 N	30	22.8	22.1	21.6	20.1	13.6	9.6
	60	25.2	24.9	24.8	24.6	20.1	9.3
	90	29.7	29.2	29.1	28.5	24.0	10.8
	Col Ave	25.9	25.4	25.2	24.4	19.2	9.9
140 N	30	21.5	20.9	20.6	18.8	11.5	8.9
	60	23.1	23.3	22.8	22.5	16.3	8.7
	90	26.6	26.9	26.2	25.8	21.7	9.4
	Col Ave	23.7	23.7	23.2	22.4	16.5	9.0
REP 3							
0 N	30	20.7	20.5	20.1	19.5	16.5	10.4
	60	24.8	24.7	24.6	24.5	23.1	16.5
	90	27.7	27.5	26.6	26.5	23.4	17.6
	Col Ave	24.4	24.2	23.7	23.5	21.0	14.8
28 N	30	23.0	22.6	22.0	20.6	16.1	10.1
	60	25.4	25.6	25.6	25.6	24.1	16.4
	90	27.1	26.8	26.9	26.4	24.1	18.2
	Col Ave	25.2	25.0	24.8	24.2	21.4	14.9

APPENDIX B continued

Maley (My85) continued

Nitrogen Rate $kg\ ha^{-1}$	Depth cm	March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
56 N	30	21.7	20.9	20.3	18.5	12.5	10.1
	60	22.0	22.4	22.2	22.0	19.6	10.4
	90	27.7	28.0	28.1	27.7	25.9	15.6
	Col Ave	23.8	23.8	23.5	22.7	19.3	12.0
84 N	30	21.8	21.0	20.2	18.0	12.1	8.9
	60	23.0	23.0	22.5	22.5	19.2	9.3
	90	27.6	27.0	27.0	27.0	24.6	11.5
	Col Ave	24.1	23.7	23.2	22.5	18.6	9.9
112 N	30	20.5	20.0	19.7	18.5	12.1	9.8
	60	22.3	22.6	23.0	22.8	20.8	13.5
	90	25.4	24.5	24.3	23.6	22.3	18.7
	Col Ave	22.7	22.3	22.3	21.6	18.4	14.0
140 N	30	20.6	19.9	19.5	16.7	11.4	9.4
	60	21.8	21.9	21.6	21.1	16.4	10.2
	90	24.0	24.1	23.6	23.3	22.5	15.3
	Col Ave	22.1	22.0	21.6	20.4	16.8	11.6
REP 4							
0 N	30	22.2	22.2	21.9	21.2	17.2	12.3
	60	23.0	23.1	23.2	22.7	21.7	16.2
	90	28.1	28.5	28.4	28.1	26.9	23.5
	Col Ave	24.4	24.6	24.5	24.0	21.9	17.3
28 N	30	21.8	21.2	21.0	19.7	13.2	10.5
	60	21.3	21.9	21.5	21.1	17.4	10.6
	90	30.2	30.1	30.2	29.9	28.9	23.0
	Col Ave	24.4	24.4	24.2	23.5	19.9	14.7
56 N	30	22.0	21.5	20.9	19.8	13.9	10.2
	60	23.0	23.0	23.2	23.4	21.3	11.1
	90	27.0	26.8	26.4	26.1	23.6	15.4
	Col Ave	24.0	23.8	23.5	23.1	19.6	12.2

APPENDIX B continued

Maley (My85) continued

Nitrogen Rate kg ha^{-1}	Depth cm	March 25	April 16	April 30	May 14	June 10	July 8
		Date					
		% Moisture Content					
84 N	30	22.2	21.3	21.1	19.5	12.9	10.5
	60	23.6	24.3	24.4	24.9	22.5	12.6
	90	29.8	30.0	29.4	29.5	27.6	18.5
	Col Ave	25.2	25.2	25.0	24.6	21.0	13.9
112 N	30	22.1	21.7	21.3	20.0	14.6	10.2
	60	22.6	22.6	22.3	22.1	19.0	8.8
	90	28.4	28.4	28.2	27.9	24.9	9.7
	Col Ave	24.4	24.2	23.9	23.4	19.5	9.6
140 N	30	21.5	21.1	20.9	19.7	14.2	9.9
	60	23.1	23.2	23.1	22.9	20.8	9.7
	90	27.3	27.3	27.4	27.4	24.2	10.4
	Col Ave	24.0	23.9	23.8	23.3	19.7	10.0

APPENDIX B continued

Smouse (Sm85)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
0 N	30	14.2	10.7	8.9	8.0	6.6	6.5
	60	14.7	13.1	12.0	10.6	8.2	7.3
	90	16.9	15.3	14.0	12.4	8.7	7.5
	120	15.9	15.1	14.1	12.5	8.8	8.1
	150	15.8	15.8	15.7	15.1	13.7	12.9
	Col Ave	15.5	14.0	13.0	11.7	9.2	8.5
28 N	30	14.2	9.8	8.4	7.3	6.5	6.4
	60	14.3	12.7	11.2	9.2	6.8	6.4
	90	16.5	15.4	13.4	10.5	6.3	6.0
	120	15.2	14.5	12.8	10.8	6.6	6.2
	150	12.9	12.5	12.3	11.3	9.5	9.4
	Col Ave	14.6	13.0	11.6	9.8	7.2	6.9
56 N	30	14.5	9.4	7.6	7.0	6.4	6.1
	60	15.1	13.1	10.6	8.4	6.4	6.1
	90	17.0	16.2	14.4	11.1	6.7	6.1
	120	14.6	14.1	12.8	11.3	8.2	7.4
	150	12.8	13.2	12.7	12.3	11.0	10.6
	Col Ave	14.8	13.2	11.6	10.0	7.8	7.3
84 N	30	14.0	9.4	7.6	7.0	6.2	6.2
	60	14.7	12.5	10.1	8.0	6.3	5.9
	90	15.8	14.7	13.1	10.1	5.8	5.7
	120	14.1	13.6	12.2	10.7	7.0	6.9
	150	13.8	13.8	13.4	12.6	11.0	10.7
	Col Ave	14.5	12.8	11.3	9.7	7.3	7.1
112 N	30	15.4	9.9	7.8	7.2	6.5	6.2
	60	15.4	12.9	10.7	8.1	6.2	6.2
	90	16.5	15.1	13.3	10.2	5.9	5.4
	120	14.9	14.0	12.7	11.1	6.9	6.3
	150	15.5	15.2	14.4	13.6	11.9	11.0
	Col Ave	15.5	13.4	11.8	10.0	7.5	7.0

APPENDIX B continued

Smouse (Sm85) continued

Nitrogen Rate kg ha^{-1}	Depth cm	March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
140 N	30	14.7	9.7	7.4	6.8	6.2	5.9
	60	14.8	12.8	10.3	7.6	6.1	5.9
	90	16.0	15.0	13.1	9.9	5.7	5.7
	120	15.1	14.4	13.3	11.6	8.5	7.7
	150	13.9	14.2	13.5	12.8	11.6	11.1
	Col Ave	14.9	13.2	11.5	9.8	7.6	7.3

APPENDIX B continued

ANDERSON (A85SF)

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
REP 1							
0 N	30	23.5	22.7	22.2	20.9	18.2	15.5
	60	24.8	24.5	23.6	22.4	18.5	13.6
	90	27.8	27.9	27.8	26.7	23.7	19.3
	Col Ave	25.4	25.1	24.5	23.3	20.1	16.1
28 N	30	24.2	22.4	21.5	19.3	16.2	14.6
	60	25.3	25.3	24.7	23.4	17.6	10.4
	90	28.4	29.2	28.6	27.3	21.2	14.5
	Col Ave	26.0	25.7	24.9	23.3	18.4	13.2
56 N	30	21.7	20.1	18.5	15.7	11.5	10.1
	60	23.5	23.0	21.8	19.4	12.0	9.9
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.6	21.5	20.2	17.6	11.8	10.0
84 N	30	22.4	20.8	18.7	15.4	12.6	11.2
	60	25.2	25.2	24.4	22.6	12.1	9.9
	90	26.5	25.9	25.3	23.7	14.1	11.0
	Col Ave	24.7	24.0	22.8	20.6	12.9	10.7
112 N	30	21.7	20.9	19.2	15.1	10.5	9.4
	60	22.8	22.1	21.1	18.8	11.4	9.4
	90	23.2	23.1	21.9	20.1	13.1	10.6
	Col Ave	22.6	22.0	20.7	18.0	11.6	9.8
140 N	30	22.4	21.5	19.8	15.4	10.3	9.2
	60	21.0	20.1	19.1	16.7	9.7	8.4
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	21.7	20.8	19.4	16.1	10.0	8.8
REP 2							
0 N	30	22.6	21.6	20.3	18.3	13.6	11.3
	60	23.2	22.3	21.4	19.8	15.3	11.2
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.9	21.9	20.9	19.0	14.4	11.3

APPENDIX B continued

ANDERSON (A85SF) continued

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
28 N	30	22.5	20.9	19.4	15.9	11.7	10.5
	60	24.8	23.9	21.9	17.9	10.8	9.8
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	23.6	22.4	20.6	16.9	11.2	10.1
56 N	30	22.7	20.8	18.4	14.6	10.8	9.9
	60	25.7	25.0	22.4	17.9	11.0	10.1
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	24.2	22.9	20.4	16.2	10.9	10.0
84 N	30	22.0	19.8	17.0	13.1	10.2	9.6
	60	24.0	23.3	21.5	16.2	11.1	10.4
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	23.0	21.6	19.2	14.6	10.7	10.0
112 N	30	21.6	19.5	16.9	13.0	10.0	9.2
	60	23.1	22.5	21.1	17.2	10.9	10.2
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.3	21.0	19.0	15.1	10.4	9.7
140 N	30	23.0	22.0	19.4	14.2	10.3	9.7
	60	26.0	25.3	23.8	18.8	10.6	10.1
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	24.5	23.6	21.6	16.5	10.4	9.9
REP 3							
0 N	30	23.0	22.0	20.3	18.1	14.1	12.5
	60	24.3	23.9	22.5	20.4	13.6	11.4
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	23.6	23.0	21.4	19.2	13.9	12.0
28 N	30	25.0	24.1	22.4	19.3	14.9	13.5
	60	25.3	25.3	24.5	22.9	14.1	11.6
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	25.2	24.7	23.5	21.1	14.5	12.6

APPENDIX B continued

ANDERSON (A85SF) continued

Nitrogen Rate kg ha^{-1}	Depth cm	Date					
		March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
56 N	30	22.3	18.9	16.4	13.6	11.4	10.8
	60	23.1	22.8	21.5	17.7	12.2	11.5
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.7	20.8	18.9	15.7	11.8	11.1
84 N	30	22.9	20.9	18.2	13.8	11.2	10.3
	60	23.8	23.0	20.7	14.4	10.3	9.7
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	23.4	22.0	19.4	14.1	10.8	10.0
112 N	30	23.1	22.1	20.7	16.3	11.8	11.0
	60	25.1	24.6	22.9	18.3	11.2	10.5
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	24.1	23.3	21.8	17.3	11.5	10.7
140 N	30	21.2	19.2	17.5	14.6	11.2	10.2
	60	22.6	22.1	21.3	19.0	11.6	10.1
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	21.9	20.6	19.4	16.8	11.4	10.2
REP 4							
0 N	30	22.5	21.1	20.0	18.3	13.4	10.9
	60	22.3	21.9	20.6	18.9	13.7	11.0
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.4	21.5	20.3	18.6	13.6	10.9
28 N	30	22.3	20.5	18.9	15.9	11.9	10.1
	60	23.7	22.8	21.5	18.7	12.0	10.4
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	23.0	21.6	20.2	17.3	11.9	10.3
56 N	30	23.1	22.0	20.2	16.8	12.6	11.3
	60	25.1	24.8	23.8	21.1	12.5	10.8
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	24.1	23.4	22.0	19.0	12.6	11.1

APPENDIX B continued

ANDERSON (A85SF) continued

Nitrogen Rate kg ha^{-1}	Depth cm	March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
84 N	30	22.2	20.8	18.0	13.9	11.3	10.5
	60	23.6	22.1	19.4	14.6	11.6	10.8
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.9	21.5	18.7	14.2	11.4	10.7
112 N	30	23.6	22.7	21.0	16.9	12.2	11.8
	60	24.3	24.6	23.6	20.5	12.6	11.9
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	23.9	23.7	22.3	18.7	12.4	11.9
140 N	30	23.0	22.6	19.9	14.8	11.6	11.0
	60	22.8	23.9	22.1	17.8	12.1	11.4
	90	0.0	0.0	0.0	0.0	0.0	0.0
	Col Ave	22.9	23.2	21.0	16.3	11.8	11.2

APPENDIX B continued

Martin (Mn85)

Nitrogen Rate kg ha^{-1}	Depth cm	Date March 25	 April 16	 April 30	 May 14	 June 10	 July 8
		% Moisture Content					
REP 1							
0 N	30	17.7	16.7	15.9	14.3	11.5	9.5
	60	16.3	16.3	15.8	14.5	11.1	9.7
	Col Ave	17.0	16.5	15.9	14.4	11.3	9.6
28 N	30	16.4	14.5	12.4	10.2	8.6	8.2
	60	15.5	15.8	15.3	12.9	10.7	9.9
	Col Ave	15.9	15.2	13.9	11.6	9.7	9.1
56 N	30	17.4	15.7	13.4	9.8	7.9	7.1
	60	18.8	18.3	17.4	13.3	9.3	8.8
	Col Ave	18.1	17.0	15.4	11.5	8.6	8.0
84 N	30	16.4	15.1	13.3	10.2	8.2	7.9
	60	15.2	15.3	14.7	11.9	9.5	8.9
	Col Ave	15.8	15.2	14.0	11.1	8.9	8.4
112 N	30	17.6	15.7	13.6	10.8	8.6	7.7
	60	19.3	19.4	18.4	14.6	9.5	9.0
	Col Ave	18.4	17.6	16.0	12.7	9.0	8.3
140 N	30	17.8	16.5	15.1	12.3	8.7	7.5
	60	19.7	19.6	18.7	16.3	10.1	9.3
	Col Ave	18.8	18.0	16.9	14.3	9.4	8.4
REP 2							
0 N	30	18.3	17.5	16.9	15.9	13.8	10.3
	60	18.6	18.3	17.8	16.9	14.1	10.2
	Col Ave	18.5	17.9	17.4	16.4	14.0	10.3
28 N	30	17.9	16.1	14.2	11.8	9.4	7.7
	60	19.5	19.1	18.2	14.5	9.4	8.8
	Col Ave	18.7	17.6	16.2	13.2	9.4	8.3

APPENDIX B continued

Martin (Mn85) continued

Nitrogen		Date					
Rate	Depth	March 25	April 16	April 30	May 14	June 10	July 8
kg ha^{-1}	cm	% Moisture Content					
56 N	30	18.5	16.4	14.3	12.0	9.1	8.0
	60	19.2	19.1	17.8	14.2	9.3	8.6
	Col Ave	18.8	17.7	16.1	13.1	9.2	8.3
84 N	30	17.7	16.1	13.5	10.2	8.9	7.8
	60	19.0	19.0	17.9	12.7	10.0	9.1
	Col Ave	18.4	17.5	15.7	11.5	9.5	8.5
112 N	30	17.3	15.8	13.6	10.7	8.4	7.7
	60	19.2	19.6	18.6	15.4	10.1	9.4
	Col Ave	18.2	17.7	16.1	13.0	9.2	8.5
140 N	30	18.2	16.3	14.0	11.6	9.0	8.1
	60	20.3	19.9	18.6	14.1	9.3	9.0
	Col Ave	19.3	18.1	16.3	12.9	9.2	8.5
REP 3							
0 N	30	15.1	13.9	12.7	10.9	9.0	7.5
	60	10.3	11.0	10.6	10.1	9.2	8.7
	Col Ave	12.7	12.5	11.7	10.5	9.1	8.1
28 N	30	14.9	13.8	12.3	10.0	7.9	7.1
	60	14.9	15.4	15.2	12.6	9.3	8.8
	Col Ave	14.9	14.6	13.8	11.3	8.6	7.9
56 N	30	16.9	15.8	13.8	10.9	8.3	7.7
	60	19.1	19.6	18.7	15.0	10.3	9.6
	Col Ave	18.0	17.7	16.3	13.0	9.3	8.6
84 N	30	18.1	16.7	14.2	10.7	8.4	7.3
	60	19.7	19.5	18.5	14.2	8.7	8.2
	Col Ave	18.9	18.1	16.3	12.4	8.5	7.7

APPENDIX B continued

Martin (Mn85) continued

Nitrogen Rate kg ha^{-1}	Depth cm	Date March 25	April 16	April 30	May 14	June 10	July 8
		% Moisture Content					
112 N	30	15.5	13.2	11.1	9.1	7.8	7.1
	60	16.3	16.3	15.3	12.0	8.5	7.8
	Col Ave	15.9	14.8	13.2	10.6	8.1	7.4
140 N	30	15.6	14.4	12.7	10.2	7.8	7.1
	60	16.1	16.1	15.4	12.6	8.3	7.6
	Col Ave	15.9	15.2	14.1	11.4	8.1	7.3
REP 4							
0 N	30	17.4	17.2	16.2	15.2	12.1	9.6
	60	17.8	17.8	17.6	16.9	13.9	9.7
	Col Ave	17.6	17.5	16.9	16.0	13.0	9.7
28 N	30	17.2	15.2	13.8	11.7	9.2	8.0
	60	17.3	17.1	16.4	14.3	9.8	8.6
	Col Ave	17.3	16.1	15.1	13.0	9.5	8.3
56 N	30	17.2	16.0	14.0	10.9	8.4	7.1
	60	19.6	19.3	18.3	15.2	9.0	7.6
	Col Ave	18.4	17.7	16.2	13.1	8.7	7.3
84 N	30	16.4	14.9	12.5	9.8	7.6	6.8
	60	18.4	18.1	17.3	12.7	8.6	7.6
	Col Ave	17.4	16.5	14.9	11.3	8.1	7.2
112 N	30	16.0	14.3	11.9	9.8	8.4	7.9
	60	12.1	12.8	12.7	10.6	8.4	8.1
	Col Ave	14.1	13.5	12.3	10.2	8.4	8.0
140 N	30	16.1	15.4	14.1	11.1	8.2	7.4
	60	18.2	18.3	17.0	13.3	8.3	7.4
	Col Ave	17.1	16.8	15.5	12.2	8.2	7.4

APPENDIX B continued

Newtson (N85)

Nitrogen Rate kg ha^{-1}	Depth cm	Date			
		April 30	May 14	June 10	July 8
		% Moisture Content			
0 N	30	23.4	22.5	21.3	19.1
	60	24.4	24.1	23.1	19.7
	Col Ave	23.9	23.3	22.2	19.4
28 N	30	26.8	26.2	23.5	18.8
	60	22.3	22.6	21.9	18.3
	Col Ave	24.5	24.4	22.7	18.6
56 N	30	22.5	20.2	18.4	18.0
84 N	30	24.1	21.3	18.5	17.0
112 N	30	23.5	23.0	21.2	18.1
	60	22.3	22.9	24.1	20.7
	Col Ave	22.9	22.9	22.6	19.4
140 N	30	22.6	20.6	18.2	17.1

APPENDIX C

Soil Nitrogen vs Check Plot Yields

APPENDIX C

SOIL NITROGEN VERSUS CHECK PLOT YIELDS

Fall sampled, soil nitrogen regression models[*]

SF sites (17 sites)	Total Degrees of Freedom	T[+] Value	Probability Value	R^2
$Y = 1222 + 39.19(T) - 0.1256(T)^2$	61	-1.723	0.09	0.40
$Y = 1701 + 40.52(U)$	61	3.919	0.00	0.20
$Y = 1758 + 13.74(S)$	61	4.792	0.00	0.28
$Y = 2143 + 13.96(V)$	61	1.389	0.07	0.05
RC sites (10 sites)				
$Y = 634 + 0.7245(T)^2$	36	7.918	0.00	0.64
$Y = 502 + 32.83(U)$	36	7.540	0.00	0.62
$Y = 390 + 0.2856(S)^2$	36	3.499	0.00	0.26
$Y = 81 + 24.51(V)$	36	3.765	0.00	0.29
All sites (27 sites)				
$Y = 134 + 64.45(T) - 0.2469(T)^2$	98	-6.068	0.00	0.70
$Y = -35 + 121.64(U) - 0.9766(U)^2$	98	-2.321	0.02	0.55
$Y = -1165 + 65.93(S) - 0.207(S)^2$	98	-4.142	0.00	0.59
$Y = -2476 + 140.44(V) - 0.8386(V)^2$	98	-3.497	0.00	0.45

---

[*] Y = check plot grain yield, kg ha^{-1}; T = total soil NO_3-N from 0 to 180 cm or bedrock; U = soil $NO-_3$ times 1, 1/2, 1/4, 1/8, 1/16 or 1/32 for each 30 cm segment down to 180 cm or bedrock; S = total soil NO_3-N + NH_4-N in top 60 cm of soil; V = NO_3-N + NH_4-N times 1, 1/2, 1/4, 1/8, 1/16 or 1/32 for each 30 cm segment down to 180 cm or bedrock.

[+] T and Probability values are for last variable to enter model.

APPENDIX C continued

SOIL NITROGEN VERSUS CHECK PLOT YIELDS

Spring sampled, soil nitrogen regression models*

SF sites (17 sites)	Total Degrees of Freedom	T+ Value	Probability Value	R^2
$Y = 3190 - 14.73(T) \pm 0.1274(T)^2$	61	-1.317	0.19	0.07
$Y = 3098 - 0.1238(U)^2$	61	-1.345	0.28	0.03
$Y = 3549 - 21.53(S) + 0.1415(S)^2$	61	-2.001	0.05	0.09
$Y = 3107 - 0.0470\ (V)^2$	61	-0.953	0.35	0.01
RC sites (9 sites)				
$Y = 794 + 0.180(T)^2$	32	4.566	0.00	0.40
$Y = 797 + 0.5249(U)^2$	32	4.514	0.00	0.40
$Y = 2369 - 60.76(S) + 0.5759(S)^2$	32	3.479	0.00	0.48
$Y = 3067 - 125.07(V) + 1.6510(V)^2$	32	-4.720	0.00	0.54
All sites (26 sites)				
$Y = 1502 + 15.59(T)$	94	5.230	0.00	0.23
$Y = 1301 + 71.46(U) - 0.8181(U)^2$	94	-2.188	0.03	0.11
$Y = 1765 + 0.0802(S)^2$	94	4.302	0.00	0.17
$Y = 1647 + 13.54(V)$	94	2.206	0.03	0.05

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* Y = check plot grain yield, kg ha^{-1}; T = total soil NO_3-N from 0 to 180 cm or bedrock; U = soil NO-$_3$ times 1, 1/2, 1/4, 1/8, 1/16 or 1/32 for each 30 cm segment down to 180 cm or bedrock; S = total soil NO_3-N + NH_4-N in top 60 cm of soil; V = NO_3-N + NH_4-N times 1, 1/2, 1/4, 1/8, 1/16 or 1/32 for each 30 cm segment down to 180 cm or bedrock.

+ T and Probability values are for last variable to enter model.

APPENDIX D

Soil Test Data

APPENDIX D

1982-83 Soil Test Data from Samples Taken in Mid-September

Soil Depth (cm)	Br83	Bl83	Mn83	Si83	W83	Bt83	Sm83	R83	Gt83
pH									
0-30	6.8	6.9	7.3	6.8	6.6	7.5	6.8	6.2	6.7
P ppm									
0-30	13	20	10	10	12	6	9	16	6
K ppm									
0-30	378	413	293	117	484	250	488	456	359
SO_4-S ppm									
0-30	0.8	0.8	1.3	0.1	0.3	1.2	0.9	1.9	1.0
30-60	0.2	0.7	8.1	0.1	0.3	1.0	0.4	0.6	3.6
60-120	0.5	0.7		1.2	0.9		1.2	0.2	
120-150	0.3	1.6			1.0		2.2	0.3	
150-180	0.3				1.5		17.9	0.1	
NO_3-N ppm									
0-30	4.1	1.5	3.0	4.3	4.1	4.1	2.7	2.1	5.8
30-60	1.1	1.6	2.5	2.2	1.9	2.5	2.2	0.7	0.9
60-120	0.8	1.3		2.7	1.9		2.0	0.4	
120-150	0.5	1.3			2.2		2.0	0.9	
150-180	1.3				2.4		2.5	0.4	
NH_4-N ppm									
0-30	1.9	2.5	3.0	3.9	1.4	1.9	3.5	5.0	4.4
30-60	2.4	3.5	3.9	2.5	1.9	1.5	3.5	1.5	3.9
60-120	5.4	3.0		3.0	1.9		3.9	1.5	
120-150	1.4	3.5			1.4		3.0	4.4	
150-180	1.4				1.9		3.0	3.9	

APPENDIX D continued

1983-84 Soil Test Data from Samples Taken in Mid-September

Soil Depth (cm)	Hy84	Mn84	K84	C84	Bm84	A84	Sm84	Gt84	Hr84
					pH				
0-30	6.2	7.0	6.7	7.0	8.5	7.9	8.5	7.6	7.1
					P ppm				
0-30	16	10	15	16	7	7	8	9	12
					K ppm				
0-30	406	312	538	339	328	343	449	316	488
					SO_4-S ppm				
0-30	2.2	2.2	1.4	0.9	2.5	4.9	2.6	1.9	0.6
30-60	1.1	0.7	1.3	1.2	11.9	4.7	1.6	16.5	0.6
60-120	1.1		1.0		12.3	55.0	1.7		0.3
120-150	1.9		0.7				12.3		1.0
150-180	4.3		0.9				63.2		1.4
180-210	7.1		1.6						2.1
					NO_3-N ppm				
0-30	6.3	1.1	4.2	5.1	5.5	0.9	6.4	5.3	3.5
30-60	2.0	0.4	1.3	3.1	2.6	0.6	3.5	1.3	6.5
60-120	1.5		1.1		1.5	0.4	4.7		1.5
120-150	1.3		0.6				9.8		0.8
150-180	1.3		0.6				10.5		0.8
180-210	2.9		1.7						2.2
					NH_4-N ppm				
0-30	2.2	2.5	2.9	1.5	2.5	3.2	2.5	2.5	4.3
30-60	2.2	1.8	2.2	1.1	2.5	3.8	1.8	1.8	5.0
60-120	2.2		2.9		1.8	2.5	1.8		3.6
120-150	2.2		2.2				1.8		2.9
150-180	2.2		2.2				1.8		3.6
180-210	1.5		2.2						2.2

APPENDIX D continued

1984-85 Soil Test Data from Samples Taken in Mid-September

Soil Depth (cm)	F85	Mn85	K85	My85	A85SM	A85RC	Sm85	Gn85	N85
pH									
0-30	6.8	6.9	6.4	7.0	7.4	6.9	7.3	6.5	8.4
P ppm									
0-30	14	13	19	16	11	--	7	16	7
K ppm									
0-30	398	378	413	328	293	285	394	445	406
SO_4-S ppm									
0-30	1.4	0.9	2.2	1.0	2.4	--	0.5	0.7	4.4
30-60	1.2	1.3	0.8	0.5	15.8	--	1.7	0.3	18.7
60-120	1.6	1.1	3.0	1.1	0.7		1.0	0.5	
120-150	0.9		1.7	6.8			2.4	0.2	
150-180			0.7				1.9	0.7	
180-210			0.7					1.4	
NO_3-N ppm									
0-30	7.4	0.7	9.0	6.8	3.5	1.1	4.0	2.9	1.8
30-60	2.7	0.5	2.2	2.7	1.8	0.7	2.4	0.9	2.7
60-120	2.2	0.5	3.1	2.7	2.0		2.2	1.1	
120-150	2.0		4.6	2.0			1.8	0.7	
150-180			3.5				1.6	0.5	
180-210			4.4					0.5	
NH_4-N ppm									
0-30	4.1	3.2	5.8	5.8	4.1	3.5	3.6	4.1	4.3
30-60	4.1	4.1	4.1	4.1	4.5	3.5	3.6	4.1	2.8
60-120	4.1	3.2	4.9	3.2	4.1		3.6	3.6	
120-150	1.7		4.5	2.3			2.8	3.6	
150-180			3.2				2.8	3.2	
180-210			2.3					2.8	

APPENDIX D continued

1982-83 Spring Soil N Levels Taken in April

Soil Depth (cm)	Br83	Bl83	W83	Si83	Bt83	Mn83	Sm83	Gt83	R83
NO_3-N ppm									
0-30	1.1	0.9	1.1	1.4	2.2	1.4	0.6	0.7	0.9
30-60	0.6	0.9	0.7	1.4	2.2	1.1	1.1	0.9	1.1
60-120	0.4	0.7	0.5				1.1		1.4
120-150	0.3		0.3				1.1		1.3
150-180	0.3		0.7				5.6		1.1
180-210									0.8
NH_4-N ppm									
0-30	3.7	1.9	0.8	1.6	1.6	2.5	1.6	2.9	2.0
30-60	6.1	5.6	1.2	2.0	2.5	2.5	1.2	1.5	1.1
60-120	3.3	1.9	0.8				2.9		1.1
120-150	1.2		0.8				1.1		1.1
150-180	0.8		0.8				0.6		1.1
180-210									

APPENDIX D continued

1983-84 Spring Soil N Levels Taken in April

Soil Depth (cm)	Hr84	Gt84	Mn84	C84	Bm84	K84	A84	Sm84	Hy84
NO_3-N ppm									
0-30	1.8	2.2	0.7	5.1	4.4	3.6	2.7	3.5	2.5
30-60	1.3	2.4	1.3	5.1	4.2	3.4	1.9	3.7	2.3
60-120	1.5			5.1	3.7	2.5	1.4	3.7	1.4
120-150	1.8					1.7		5.6	1.1
150-180	1.3					1.4		13.2	1.1
180-210	1.3					2.3			1.4
NH_4-N ppm									
0-30	3.4	3.4	2.9	3.1	2.6	2.8	4.2	2.4	4.1
30-60	2.4	3.4	2.9	2.2	2.6	2.8	2.8	2.8	5.0
60-120	3.4			3.1	2.2	3.2	2.8	2.8	5.0
120-150	3.4					1.8		1.9	5.0
150-180	3.4					1.4		2.4	5.0
180-210	3.4					2.3			4.6

APPENDIX D continued

1984-85 Spring Soil N Levels Taken in April

Soil Depth (cm)	Gn85	Sm85	My85	K85	F85	A85SF	A85RC	Mn85	N85
NO_3-N ppm									
0-30	3.8	1.8	10.1	6.8	4.9	5.7	1.1	1.3	
30-60	2.3	2.6	7.8	8.8	5.7	4.0	0.7	2.1	
60-120	2.6	1.6	5.0	5.0	4.1	5.7		2.6	
120-150	2.6	3.5	1.9	4.1	3.3				
150-180	3.0	2.8		3.4					
180-210	0.9	4.9		2.9					
NH_4-N ppm									
0-30	2.7	2.3	3.0	4.0	3.5	3.5	3.5	3.5	
30-60	2.3	1.7	3.0	3.0	3.5	3.5	3.5	3.5	
60-120	2.7	1.2	1.9	4.0	3.5	3.5		3.0	
120-150	2.3	1.2	1.6	3.0	3.5				
150-180	2.7	2.7		3.0					
180-210	1.2	2.3		3.0					

APPENDIX E

Effect of Nitrogen Rate on Grain Quality

APPENDIX E

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

High Potential Yield Summer Fallow Sites

Grower: Brewer (Br83)

Treatment						
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	5.2	15.8	737.0
2	62	8.3	67	6.3	15.5	750.3
3	118	8.3	134	7.9	15.0	773.5
4	174	8.3	202	9.5	14.7	790.6
LSD$_{95}$				0.6	0.5	9.0
LSD$_{99}$				0.9	0.8	12.6

Grower: Harper (Hr84)

Treatment						
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	8.6	14.2	779.0
2	56	10	22	9.6	14.0	784.1
3	112	10	22	10.4	13.1	770.1
4	168	10	22	11.0	12.7	772.0
LSD$_{95}$				0.8	0.7	NSD
LSD$_{99}$				1.1	1.0	NSD

Grower: Hay (Hy84)

Treatment						
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	6.7	16.2	757.9
2	56	10	22	7.9	15.6	766.3
3	112	10	22	8.4	15.3	772.6
4	168	10	22	10.0	14.4	774.4
LSD$_{95}$				0.8	0.9	12.5
LSD$_{99}$				1.1	1.1	16.8

* 300 kernel weight

APPENDIX E continued

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

Grower: Kaseberg (K84)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	7.0	16.6	761.2
2	56	10	22	7.9	16.5	769.2
3	112	10	22	8.7	15.5	778.2
4	168	10	22	10.0	14.0	776.9
LSD$_{95}$				0.8	1.0	10.5
LSD$_{99}$				1.1	1.4	14.1

Grower: Feist (F85)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	7.2	13.5	736.0
2	56	10	22	8.8	13.4	744.8
3	112	10	22	9.8	11.9	744.2
4	168	10	22	11.0	11.3	738.8
5	224	10	22	11.8	11.3	733.9
6	280	10	22	12.4	12.0	709.5
LSD$_{95}$				0.5	1.1	15.4
LSD$_{99}$				0.7	1.5	20.5

Grower: Kaseberg (K85)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	11.4	14.2	777.2
2	56	10	22	11.6	13.5	774.5
3	112	10	22	12.7	12.6	764.1
4	168	10	22	13.2	12.4	748.8
5	224	10	22	13.5	12.2	734.8
6	280	10	22	13.6	12.5	743.6
LSD$_{95}$				1.0	1.0	16.8
LSD$_{99}$				1.3	1.4	22.5

* 300 kernel weight

APPENDIX E continued

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

Grower: Goodwin (Gn85)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	6.6	13.6	739.9
2	56	10	22	7.5	13.1	749.3
3	112	10	22	9.7	11.8	745.8
4	168	10	22	11.4	11.1	729.2
5	196	10	22	12.0	11.2	728.2
6	280	10	22	12.8	10.9	720.3
LSD_{95}				0.3	0.4	10.4
LSD_{99}				0.5	0.6	13.9

Low Potential Yield Summer Fallow Sites

Grower: Martin (Mn83)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	5.1	13.9	722.9
2	28	8.3	27	5.2	12.3	724.6
3	50	8.3	54	6.9	10.7	725.9
4	73	8.3	81	9.0	9.7	699.7
LSD_{95}				1.2	1.2	16.4
LSD_{99}				1.7	1.7	23.0

Grower: Beckett (Bt83)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	4.7	14.6	720.7
2	28	8.3	27	5.0	13.3	729.3
3	50	8.3	54	6.2	12.3	734.9
4	73	8.3	81	8.5	10.4	724.6
LSD_{95}				1.0	0.9	11.1
LSD_{99}				1.4	1.2	15.5

* 300 kernel weight

APPENDIX E continued

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

Grower: Simontel (Si83)

Treatment						
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	5.4	16.0	750.8
2	28	8.3	27	5.9	15.1	762.8
3	50	8.3	54	6.8	13.7	768.3
4	73	8.3	81	8.2	12.5	760.6
LSD$_{95}$				0.9	1.3	13.5
LSD$_{99}$				1.3	1.8	18.9

Grower: Weatherford (W83)

Treatment						
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	6.9	16.9	760.2
2	28	8.3	27	7.2	16.8	770.9
3	50	8.3	54	8.4	15.3	773.9
4	73	8.3	81	8.5	14.9	779.1
LSD$_{95}$				1.0	1.1	11.7
LSD$_{99}$				1.5	1.5	16.4

Grower: Smouse (Sm83)

Treatment						
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	6.7	17.4	760.6
2	28	8.3	27	7.4	17.0	776.1
3	50	8.3	54	7.8	16.5	777.3
4	73	8.3	81	9.0	15.3	791.9
LSD$_{95}$				0.9	0.6	12.2
LSD$_{99}$				1.2	0.8	17.1

* 300 kernel weight

APPENDIX E continued

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

Grower: Bergstrom (Bm84)

	Treatment					
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	7.0	16.1	710.0
2	28	10	22	7.1	15.8	699.1
3	56	10	22	7.5	15.7	710.9
4	112	10	22	9.3	14.8	717.2
LSD_{95}				0.7	0.5	11.9
LSD_{99}				1.0	0.7	15.9

Grower: Smouse (Sm84)

	Treatment					
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	9.1	16.9	792.4
2	28	10	22	9.0	16.3	797.5
3	56	10	22	9.9	15.5	786.6
4	112	10	22	11.6	13.7	781.2
LSD_{95}				0.7	0.7	12.5
LSD_{99}				0.9	1.0	16.7

Grower: Smouse (Sm85)

	Treatment					
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	7.2	15.4	763.7
2	28	10	22	8.0	14.6	771.0
3	56	10	22	8.9	14.1	772.8
4	84	10	22	10.3	12.9	767.7
5	112	10	22	10.7	12.9	763.8
6	140	10	22	11.6	12.3	750.4
LSD_{95}				0.5	0.4	8.3
LSD_{99}				0.6	0.6	11.1

* 300 kernel weight

APPENDIX E continued

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

Grower: Anderson (A85SF)

Treatment						
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	5.9	13.2	722.0
2	28	10	22	6.7	11.8	723.5
3	56	10	22	8.1	10.9	721.1
4	84	10	22	9.4	10.2	709.0
5	112	10	22	11.6	8.7	667.7
6	140	10	22	12.6	8.2	641.7
LSD$_{95}$				0.7	0.9	9.5
LSD$_{99}$				0.9	1.1	12.8

Grower: Maley (My85)

Treatment						
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	7.8	14.0	722.5
2	28	10	22	8.4	13.9	729.4
3	56	10	22	9.5	12.6	709.3
4	84	10	22	11.1	11.9	685.9
5	112	10	22	11.9	11.0	669.4
6	140	10	22	12.5	11.0	661.4
LSD$_{95}$				0.9	1.1	24.6
LSD$_{99}$				1.2	1.5	32.8

Recrop Sites

Grower: Borstal (B183)

Treatment						
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	5.0	12.5	744.0
2	28	8.3	27	4.9	12.2	740.0
3	50	8.3	54	6.1	12.0	747.7
4	73	8.3	81	7.0	11.5	768.3
LSD$_{95}$				1.1	0.9	15.2
LSD$_{99}$				1.5	1.3	21.4

* 300 kernel weight

APPENDIX E continued

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

Grower: Gilbert (Gt83)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	6.6	15.8	767.9
2	28	8.3	27	7.0	15.8	764.5
3	50	8.3	54	7.5	14.7	780.4
4	73	8.3	81	9.7	13.9	796.7
LSD$_{95}$				1.2	0.6	14.3
LSD$_{99}$				1.6	0.9	20.0

Grower: Reeder (R83)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	6	8.3	27	6.6	14.1	740.9
2	62	8.3	67	7.6	12.4	751.2
3	118	8.3	134	12.6	11.0	734.0
4	174	8.3	202	16.8	10.8	719.4
LSD$_{95}$				1.8	1.2	NSD
LSD$_{99}$				2.6	1.7	NSD

Grower: Campbell (C84)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	7.6	16.6	751.2
2	28	10	22	7.5	16.3	747.1
3	56	10	22	8.1	15.7	745.2
4	112	10	22	9.7	12.9	715.5
LSD$_{95}$				0.8	1.2	19.8
LSD$_{99}$				1.1	1.6	26.6

* 300 kernel weight

APPENDIX E continued

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

Grower: Gilbert (Gt84)

	Treatment					
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	7.4	17.0	768.9
2	28	10	22	7.5	16.4	748.6
3	56	10	22	7.5	16.6	754.6
4	112	10	22	8.2	16.0	755.7
LSD$_{95}$				0.6	0.6	NSD
LSD$_{99}$				0.8	0.8	NSD

Grower: Martin (Mn84)

	Treatment					
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	7.3	15.6	759.2
2	28	10	22	7.1	14.8	760.3
3	56	10	22	8.1	13.7	766.7
4	112	10	22	11.1	10.9	734.5
LSD$_{95}$				0.7	0.9	11.5
LSD$_{99}$				0.9	1.2	15.4

Grower: Anderson (A84)

	Treatment					
#	N ka ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
7	0	10	22	9.1	15.7	755.1
2	28	10	22	7.8	16.1	747.6
3	56	10	22	7.8	15.9	746.7
4	112	10	22	8.6	14.7	741.7
LSD$_{95}$				0.4	0.6	10.7
LSD$_{99}$				0.6	0.9	14.4

* 300 kernel weight

APPENDIX E continued

EFFECT OF NITROGEN RATE ON GRAIN QUALITY

Grower: Anderson (A85RC)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	7.1	12.3	717.6
2	28	10	22	9.5	10.1	723.8
3	56	10	22	11.9	9.6	689.3
4	84	10	22	14.5	9.0	652.3
5	112	10	22	14.8	8.0	647.9
6	140	10	22	14.9	7.9	631.3
LSD$_{95}$				1.0	1.2	19.6
LSD$_{99}$				1.4	1.6	26.3

Grower: Martin (Mn85)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	7.4	13.8	745.2
2	28	10	22	8.4	11.8	749.0
3	56	10	22	10.8	10.5	733.2
4	84	10	22	13.6	9.0	706.8
5	112	10	22	14.9	8.8	691.2
6	140	10	22	15.8	8.4	677.7
LSD$_{95}$				0.9	0.5	13.5
LSD$_{99}$				1.2	0.7	18.1

Grower: Newton (N85)

	Treatment					
#	N kg ha^{-1}	P kg ha^{-1}	S kg ha^{-1}	Prot. %	Ker. wt.*	test wt. kg m^{-3}
1	0	10	22	9.3	12.4	744.3
2	28	10	22	10.1	12.2	744.2
3	56	10	22	10.3	11.8	730.6
4	84	10	22	11.1	11.5	733.6
5	112	10	22	10.9	12.5	719.8
6	140	10	22	11.6	12.0	709.9
LSD$_{95}$				1.5	1.1	15.7
LSD$_{99}$				2.1	1.5	21.1

* 300 kernel weight

APPENDIX F

Effect of Nitrogen Timing on Grain Quality

APPENDIX F

EFFECT OF NITROGEN TIMING ON GRAIN QUALITY

High Potential Yield Summer Fallow Sites

Grower: Harper (Hr84)

Treatment								
Treatment No.	Nitrogen Timing SS	S	SC	P kg/ha	Sulfur kg/ha	Prot. %	Ker. wt.*	test wt kg m^{-3}
3	0	112	0	10	22	10.4	13.1	770.1
8	56	0	56	10	22	9.8	14.0	791.5
9	112	0	0	10	22	9.3	14.3	794.9
10	0	0	112	10	22	10.3	13.5	775.0
11	0	28	84	10	22	10.0	14.2	787.7
LSD95						0.8	0.7	NSD
LSD99						1.1	1.0	NSD

Grower: Hay (Hy84)

Treatment								
Treatment No.	Nitrogen Timing SS	S	SC	P kg/ha	Sulfur kg/ha	Prot. %	Ker. wt.*	test wt kg m^{-3}
3	0	112	0	10	22	8.4	15.3	772.6
8	56	0	56	10	22	7.4	16.6	761.9
9	112	0	0	10	22	7.1	16.0	759.4
10	0	0	112	10	22	8.1	15.7	773.3
11	0	28	84	10	22	8.5	15.5	774.3
LSD95						0.8	0.9	12.5
LSD99						1.1	1.1	16.8

* 300 kernel weight

APPENDIX F continued

EFFECT OF NITROGEN TIMING ON GRAIN QUALITY

Grower: Kaseberg (K84)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	112	0	10	22	8.7	15.5	778.2
8	56	0	56	10	22	8.1	16.7	778.2
9	112	0	0	10	22	8.2	16.3	771.1
10	0	0	112	10	22	8.2	16.8	780.4
11	0	28	84	10	22	8.3	16.8	783.6
LSD95						0.8	1.0	10.5
LSD99						1.1	1.4	14.1

Grower: Feist (F85)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	112	0	10	22	9.8	11.9	744.2
7	0	0	112	10	22	8.9	14.1	754.7
8	56	0	56	10	22	9.7	13.7	750.2
9	112	0	0	10	22	9.7	12.7	743.7
10	0	56	56	10	22	9.1	13.3	754.9
LSD95						0.5	1.1	15.4
LSD99						0.7	1.5	20.5

* 300 kernel weight

APPENDIX F continued

EFFECT OF NITROGEN TIMING ON GRAIN QUALITY

Grower: Kaseberg (K85)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	112	0	10	22	12.7	12.6	764.1
7	0	0	112	10	22	12.9	14.0	774.9
8	56	0	56	10	22	12.3	13.0	761.6
9	112	0	0	10	22	12.8	12.9	758.4
10	0	56	56	10	22	12.7	13.3	761.9
LSD95						1.0	1.0	16.8
LSD99						1.3	1.4	22.5

Grower: Goodwin (Gn85)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
4	0	168	0	10	22	11.4	11.1	729.2
7	0	0	168	10	22	10.0	12.6	756.8
8	84	0	84	10	22	11.6	11.3	733.8
9	168	0	0	10	22	12.1	11.1	728.3
10	0	84	84	10	22	10.7	11.4	745.3
LSD95						0.3	0.4	10.4
LSD99						0.5	0.6	13.9

* 300 kernel weight

APPENDIX F continued

EFFECT OF NITROGEN TIMING ON GRAIN QUALITY

LOW POTENITAL YIELD SUMMER FALLOW SITES

Grower: Bergstrom (Bm84)

Treatment								
Treatment No.	Nitrogen Timing SS	S	SC	P kg/ha	Sulfur kg/ha	Prot. %	Ker. wt.*	test wt kg m^{-3}
3	0	56	0	10	22	7.5	15.7	710.9
8	28	0	28	10	22	7.5	15.9	720.0
9	56	0	0	10	22	7.4	16.1	711.1
10	0	0	56	10	22	7.9	16.0	733.1
11	0	28	28	10	22	7.7	15.9	718.5
LSD95						0.7	0.5	11.9
LSD99						1.0	0.7	15.9

Grower: Smouse (Sm84)

Treatment								
Treatment No.	Nitrogen Timing SS	S	SC	P kg/ha	Sulfur kg/ha	Prot. %	Ker. wt.*	test wt kg m^{-3}
3	0	56	0	10	22	9.9	15.5	786.6
8	28	0	28	10	22	9.2	16.4	799.9
9	56	0	0	10	22	9.2	16.2	791.7
10	0	0	56	10	22	9.8	16.4	802.6
11	0	28	28	10	22	9.9	16.1	799.1
LSD95						0.7	0.7	12.5
LSD99						0.9	1.0	16.7

* 300 kernel weight

APPENDIX F continued

EFFECT OF NITROGEN TIMING ON GRAIN QUALITY

Grower: Smouse (Sm85)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	56	0	10	22	8.9	14.1	772.8
7	0	0	56	10	22	7.3	15.3	766.9
8	28	0	28	10	22	8.1	14.7	777.2
9	56	0	0	10	22	8.5	14.2	778.0
10	0	28	28	10	22	8.2	14.5	779.3
LSD95						0.5	0.4	8.3
LSD99						0.6	0.6	11.1

Grower: Anderson (A85SF)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	56	0	10	22	8.1	10.9	721.1
7	0	0	56	10	22	6.8	12.7	733.0
8	28	0	28	10	22	7.3	12.0	733.8
9	56	0	0	10	22	7.4	11.2	723.5
10	0	28	28	10	22	7.0	12.3	728.5
LSD95						0.7	0.9	9.5
LSD99						0.9	1.1	12.8

Grower: Maley (My85)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	56	0	10	22	9.5	12.6	709.3
7	0	0	56	10	22	9.3	13.1	725.5
8	28	0	28	10	22	8.7	13.2	724.3
9	56	0	0	10	22	10.4	12.1	703.6
10	0	28	28	10	22	9.3	13.2	724.9
LSD95						0.9	1.1	24.6
LSD99						1.2	1.5	32.8

* 300 kernel weight

APPENDIX F continued

EFFECT OF NITROGEN TIMING ON GRAIN QUALITY

Recrop Sites

Grower: Campbell (C84)

----------------Treatment------------------								
Treatment No.	Nitrogen Timing SS	S	SC	P kg/ha	Sulfur kg/ha	Prot. %	Ker. wt.*	test wt $kg\ m^{-3}$
3	0	56	0	10	22	8.1	15.7	745.2
10	0	0	56	10	22	8.2	15.5	740.4
11	0	28	28	10	22	7.6	13.9	747.0
LSD95						0.8	1.2	19.8
LSD99						1.1	1.6	26.6

Grower: Gilbert (Gt84)

----------------Treatment------------------								
Treatment No.	Nitrogen Timing SS	S	SC	P kg/ha	Sulfur kg/ha	Prot. %	Ker. wt.*	test wt $kg\ m^{-3}$
3	0	56	0	10	22	7.5	16.6	754.6
10	0	0	56	10	22	7.2	16.5	756.6
11	0	28	28	10	22	7.1	16.4	759.3
LSD95						0.6	0.6	NSD
LSD99						0.8	0.8	NSD

Grower: Martin (Mn84)

----------------Treatment------------------								
Treatment No.	Nitrogen Timing SS	S	SC	P kg/ha	Sulfur kg/ha	Prot. %	Ker. wt.*	test wt $kg\ m^{-3}$
3	0	56	0	10	22	8.1	13.7	766.7
10	0	0	56	10	22	7.1	14.5	758.0
11	0	28	28	10	22	7.3	14.1	766.3
LSD95						0.7	0.9	11.5
LSD99						0.9	1.2	15.4

* 300 kernel weight

APPENDIX F continued

EFFECT OF NITROGEN TIMING ON GRAIN QUALITY

Grower: Anderson (A84)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	56	0	10	22	7.8	15.9	746.7
10	0	0	56	10	22	7.9	15.7	752.0
11	0	28	28	10	22	7.6	15.8	747.1
LSD95						0.4	0.6	10.7
LSD99						0.6	0.9	14.4

Grower: Anderson (A85RC)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	56	0	10	22	11.9	9.6	689.3
7	0	0	56	10	22	9.1	11.7	734.7
10	0	28	28	10	22	11.1	10.3	719.1
LSD95						1.0	1.2	19.6
LSD99						1.4	1.6	26.3

Grower: Martin (Mn85)

Treatment								
Treatment	Nitrogen Timing			P	Sulfur	Prot.	Ker.	test wt
No.	SS	S	SC	kg/ha	kg/ha	%	wt.*	kg m^{-3}
3	0	56	0	10	22	10.8	10.5	733.2
7	0	0	56	10	22	8.7	14.0	760.6
10	0	28	28	10	22	9.4	11.5	757.1
LSD95						0.9	0.5	13.5
LSD99						1.2	0.7	18.1

* 300 kernel weight

APPENDIX F continued

EFFECT OF NITROGEN TIMING ON GRAIN QUALITY

Grower: Newton (N85)

Treatment	Treatment							
Treatment No.	Nitrogen Timing SS	S	SC	P kg/ha	Sulfur kg/ha	Prot. %	Ker. wt.*	test wt kg m^{-3}
3	0	56	0	10	22	10.3	11.8	730.6
7	0	0	56	10	22	10.6	13.3	747.6
10	0	28	28	10	22	9.6	13.1	743.9
LSD95						1.5	1.1	15.7
LSD99						2.1	1.5	21.1

* 300 kernel weight

APPENDIX G

Effect of Nitrogen Source on Grain Quality

APPENDIX G

EFFECT OF N SOURCE ON GRAIN QUALITY

High Potential Yield Summer Fallow Sites

Grower: Harper (Hr84)

Treatment	Treatment	Treatment	Treatment	Treatment	Treatment			
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
11	28	84	U	10	22	10.0	14.2	787.7
12	28	84	AC	10	22	10.2	15.0	777.5
13	28	84	AS	10	22	9.9	13.6	780.2
14	168	0	UP	24	22	11.4	12.5	764.4
15	168	0	U	24	22	11.0	13.0	758.1
LSD$_{95}$						0.8	0.7	NSD
LSD$_{99}$						1.1	1.0	NSD

Grower: Hay (Hy84)

Treatment	Treatment	Treatment	Treatment	Treatment	Treatment			
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
11	28	84	U	10	22	8.5	15.5	774.3
12	28	84	AC	10	22	7.8	16.6	777.0
13	28	84	AS	10	22	8.1	15.3	767.7
14	168	0	UP	24	22	9.7	14.5	772.9
15	168	0	U	24	22	10.0	14.0	769.5
LSD$_{95}$					0.8	0.9	12.5	
LSD$_{99}$					1.1	1.1	16.8	

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* 300 kernel weight

APPENDIX G continued

EFFECT OF N SOURCE ON GRAIN QUALITY

Grower: Kaseberg (K84)

Treatment No.	N Timing S	N Timing SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
11	28	84	U	10	22	8.3	16.8	783.6
12	28	84	AC	10	22	8.5	16.9	783.4
13	28	84	AS	10	22	8.2	16.3	778.0
14	168	0	UP	24	22	9.6	14.7	780.0
15	168	0	U	24	22	10.2	14.2	774.9
LSD_{95}						0.8	1.0	10.5
LSD_{99}						1.1	1.4	14.1

Grower: Feist (F85)

Treatment No.	N Timing S	N Timing SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
10	56	56	U	10	22	9.1	13.3	754.9
13	56	56	AC	10	22	9.2	13.1	745.9
14	56	56	AS	10	22	9.1	12.6	745.9
LSD_{95}						0.5	1.1	15.4
LSD_{99}						0.7	1.5	20.5

Grower: Kaseberg (K85)

Treatment No.	N Timing S	N Timing SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
10	56	56	U	10	22	12.7	13.3	761.9
13	56	56	AC	10	22	12.2	13.6	763.6
14	56	56	AS	10	22	11.9	13.5	772.9
LSD_{95}						1.0	1.0	16.8
LSD_{99}						1.3	1.4	22.5

* 300 kernel weight

APPENDIX G continued

EFFECT OF N SOURCE ON GRAIN QUALITY

Grower: Goodwin (Gn85)

Treatment	Treatment	Treatment	Treatment	Treatment	Treatment			
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
10	84	84	U	10	22	10.7	11.4	745.3
13	84	84	AC	10	22	10.0	12.6	750.5
14	84	84	AS	10	22	10.4	11.1	736.5
LSD$_{95}$						0.3	0.4	10.4
LSD$_{99}$						0.5	0.6	13.9

Low Potential Yield Summer Fallow Sites

Grower: Bergstrom (Bm84)

Treatment	Treatment	Treatment	Treatment	Treatment	Treatment			
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
11	28	28	U	10	22	7.7	15.9	718.5
12	28	28	AC	10	22	7.3	15.7	706.0
13	28	28	AS	10	22	7.9	16.4	733.1
14	112	0	UP	16	22	8.5	15.2	718.6
15	112	0	U	16	22	9.4	14.3	711.8
LSD$_{95}$						0.7	0.5	11.9
LSD$_{99}$						1.0	0.7	15.9

Grower: Smouse (Sm84)

Treatment	Treatment	Treatment	Treatment	Treatment	Treatment			
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
11	28	28	U	10	22	9.9	16.1	799.1
12	28	28	AC	10	22	9.6	16.5	801.4
13	28	28	AS	10	22	9.9	15.6	800.2
14	112	0	UP	16	22	10.8	14.1	794.0
15	112	0	U	16	22	11.1	13.6	781.9
LSD$_{95}$						0.7	0.7	12.5
LSD$_{99}$						0.9	1.0	16.7

* 300 kernel weight

APPENDIX G continued

EFFECT OF N SOURCE ON GRAIN QUALITY

Grower: Smouse (Sm85)

			Treatment					
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
10	28	28	U	10	22	8.2	14.5	779.3
13	28	28	AS	10	22	7.9	15.1	779.9
14	28	28	AC	10	22	8.0	14.5	769.7
LSD$_{95}$						0.5	0.4	8.3
LSD$_{99}$						0.6	0.6	11.1

Grower: Anderson (A85SF)

			Treatment					
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
10	28	28	U	10	22	7.0	12.3	728.5
13	28	28	AC	10	22	6.6	13.2	730.0
14	28	28	AS	10	22	7.0	11.9	733.3
LSD$_{95}$						0.7	0.9	9.5
LSD$_{99}$						0.9	1.1	12.8

Grower: Maley (My85)

			Treatment					
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m 1
10	28	28	U	10	22	9.3	13.2	724.9
13	28	28	AC	10	22	9.2	13.8	735.4
14	28	28	AS	10	22	9.4	12.7	727.5
LSD$_{95}$						0.9	1.1	24.6
LSD$_{99}$						1.2	1.5	32.8

* 300 kernel weight

APPENDIX G continued

EFFECT OF N SOURCE ON GRAIN QUALITY

Recrop Sites

Grower: Campbell (C84)

Treatment								
Treatment	N Timing		N	P	Sulfur	Prot	Ker.	test wt
No.	S	SC	Source	kg ha^{-1}	kg ha^{-1}	%	wt.*	kg m^{-3}
11	28	28	U	10	22	7.6	13.9	747.0
12	28	28	AC	10	22	7.8	16.2	741.9
13	28	28	AS	10	22	7.7	15.6	741.6
14	112	0	UP	16	22	9.8	13.0	723.9
15	112	0	U	16	22	9.7	12.5	713.1
LSD$_{95}$						0.8	1.2	19.8
LSD$_{99}$						1.1	1.6	26.6

Grower: Gilbert (Gt84)

Treatment								
Treatment	N Timing		N	P	Sulfur	Prot	Ker.	test wt
No.	S	SC	Source	kg ha^{-1}	kg ha^{-1}	%	wt.*	kg m^{-3}
11	28	28	U	10	22	7.1	16.4	759.3
12	28	28	AC	10	22	7.2	16.4	743.2
13	28	28	AS	10	22	7.6	16.6	760.1
14	112	0	UP	16	22	8.2	15.9	759.3
15	112	0	U	16	22	8.0	16.2	765.9
LSD$_{95}$						0.6	0.6	NSD
LSD$_{99}$						0.8	0.8	NSD

Grower: Martin (Mn84)

Treatment								
Treatment	N Timing		N	P	Sulfur	Prot	Ker.	test wt
No.	S	SC	Source	kg ha^{-1}	kg ha^{-1}	%	wt.*	kg m^{-3}
11	28	28	U	10	22	7.3	14.1	766.3
12	28	28	AC	10	22	7.2	15.7	755.3
13	28	28	AS	10	22	7.4	14.2	760.3
14	112	0	UP	16	22	11.6	10.9	738.7
15	112	0	U	16	22	12.1	11.0	724.9
LSD$_{95}$						0.7	0.9	11.5
LSD$_{99}$						0.9	1.2	15.4

* 300 kernel weight

APPENDIX G continued

EFFECT OF N SOURCE ON GRAIN QUALITY

Grower: Anderson (A84)

Treatment								
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
11	28	28	U	10	22	7.6	15.8	747.1
12	28	28	AC	10	22	7.5	16.0	733.7
13	28	28	AS	10	22	7.7	15.5	745.4
14	112	0	UP	16	22	8.1	15.5	743.7
15	112	0	U	16	22	8.5	15.4	748.3
LSD$_{95}$						0.4	0.6	10.7
LSD$_{99}$						0.6	0.9	14.4

Grower: Anderson (A85RC)

Treatment								
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
10	28	28	U	10	22	11.1	10.3	719.1
13	28	28	AC	10	22	8.9	11.7	726.5
14	28	28	AS	10	22	9.5	11.0	704.4
LSD$_{95}$						1.0	1.2	19.6
LSD$_{99}$						1.4	1.6	26.3

Grower: Martin (Mn85)

Treatment								
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
10	28	28	U	10	22	9.4	11.5	757.1
13	28	28	AC	10	22	8.2	12.4	754.6
14	28	28	AS	10	22	9.2	11.8	754.5
LSD$_{95}$						0.9	0.5	13.5
LSD$_{99}$						1.2	0.7	18.1

* 300 kernel weight

APPENDIX G continued

EFFECT OF N SOURCE ON GRAIN QUALITY

Grower: Newtson (N85)

Treatment								
Treatment No.	N Timing S	SC	N Source	P kg ha^{-1}	Sulfur kg ha^{-1}	Prot %	Ker. wt.*	test wt kg m^{-3}
10	28	28	U	10	22	9.6	13.1	743.9
13	28	28	AC	10	22	9.3	13.0	749.8
14	28	28	AS	10	22	10.2	13.1	746.0
LSD$_{95}$						1.5	1.1	15.7
LSD$_{99}$						2.1	1.5	21.1

* 300 kernel weight

APPENDIX H

Yield and Yield Quality Data

APPENDIX H

YIELD AND YIELD QUALITY DATA

BREWER (Br83)

Trt	Rep	N	P	S	Yield	Prot.	300 ker. wt	Test wt
		--------kg	ha-1	----------		%	g	kg m^{-3}
1	1	0	0	0	1912	5.0	15.8	738.7
1	2	0	0	0	2353	5.3	15.9	737.5
1	3	0	0	0	2289	5.5	16.0	746.5
2	1	62	8.3	67	4440	6.2	15.5	754.2
2	2	62	8.3	67	4853	6.1	15.6	750.3
2	3	62	8.3	67	4343	6.5	15.2	746.5
3	1	118	8.3	134	6705	7.4	15.2	769.6
3	2	118	8.3	134	6736	8.1	15.2	776.1
3	3	118	8.3	134	6773	8.3	14.7	774.8
4	1	174	8.3	202	7065	9.2	14.4	783.8
4	2	174	8.3	202	7579	9.3	14.9	788.9
4	3	174	8.3	202	7919	10.0	14.7	799.2
5	1	118	0	134	6117	7.0	14.7	772.2
5	2	118	0	134	5465	7.7	15.2	772.2
5	3	118	0	134	6070	8.2	14.2	777.3
6	1	118	8.3	0	3795	8.8	15.5	785.1
6	2	118	8.3	0	4080	9.5	16.0	777.3
6	3	118	8.3	0	4685	8.4	15.9	772.2
7	1	6	8.3	27	2343	5.1	15.4	736.2
7	2	6	8.3	27	2232	5.4	15.8	736.2
7	3	6	8.3	27	2786	5.2	16.3	738.7

APPENDIX H continued

BECKETT (Be83)

		N	P	S	Yield	Prot.	300 ker. wt	Test wt
Trt	Rep	--------kg ha-1----------				%	g	kg m-^{3}
1	1	0	0	0	2887	4.7	14.3	723.3
1	2	0	0	0	3378	4.9	13.9	702.7
1	3	0	0	0	2793	4.5	14.1	698.8
2	1	28	8.3	27	4131	5.4	12.6	737.5
2	2	28	8.3	27	4054	4.9	13.8	727.2
2	3	28	8.3	27	3606	4.8	13.4	723.3
3	1	50	8.3	54	4057	6.9	11.6	737.5
3	2	50	8.3	54	4201	6.2	12.5	737.5
3	3	50	8.3	54	4564	5.5	12.8	729.7
4	1	73	8.3	81	4410	7.7	10.7	729.7
4	2	73	8.3	81	4121	9.2	10.1	731.0
4	3	73	8.3	81	3771	8.6	10.6	713.0
5	1	50	0	54	3865	7	11.4	743.9
5	2	50	0	54	3606	7.9	11.3	732.3
5	3	50	0	54	4551	6.1	12.2	728.4
6	1	50	8.3	0	4285	6.3	13.7	740.0
6	2	50	8.3	0	4175	5.5	13.5	736.2
6	3	50	8.3	0	4319	6.1	12.6	745.2
7	1	6	8.3	27	2766	4.8	14.6	722.0
7	2	6	8.3	27	2504	4.6	14.6	725.9
7	3	6	8.3	27	2128	4.6	14.4	714.3

APPENDIX H continued

MARTIN (Mn83)

Trt	Rep	N	P	S	Yield	Prot.	300 ker. wt	Test wt
		--------kg ha-1----------				%	g	kg m^{-3}
1	1	0	0	0	2423	4.4	13.6	709.1
1	2	0	0	0	2242	4.4	14.2	715.6
1	3	0	0	0	2464	4.5	13.5	696.3
2	1	28	8.3	27	3307	5.5	11.9	723.3
2	2	28	8.3	27	3623	4.8	12.8	724.6
2	3	28	8.3	27	2958	5.2	12.2	725.9
3	1	50	8.3	54	3176	6.7	11.3	731.0
3	2	50	8.3	54	3553	7.0	11.1	727.2
3	3	50	8.3	54	3378	7.0	9.8	719.4
4	1	73	8.3	81	2971	8.5	10.4	711.7
4	2	73	8.3	81	3173	9.9	8.9	679.5
4	3	73	8.3	81	3546	8.6	9.7	707.9
5	1	50	0	54	3200	8.7	9.2	715.6
5	2	50	0	54	3633	7.0	11.0	710.4
5	3	50	0	54	3233	6.8	10.7	719.4
6	1	50	8.3	0	3721	6.5	11.7	741.3
6	2	50	8.3	0	3627	6.6	11.1	732.3
6	3	50	8.3	0	3109	7.5	10.1	725.9
7	1	6	8.3	27	2370	6.2	14.1	737.5
7	2	6	8.3	27	2689	4.5	13.8	711.7
7	3	6	8.3	27	2319	4.5	13.8	719.4

APPENDIX H continued

SIMONTEL (Si83)

		N	P	S	Yield	Prot.	300 ker. wt	Test wt
Trt	Rep	--------kg ha-1----------				%	g	kg m^{-3}
1	1	0	0	0	2101	5	16.2	755.5
1	2	0	0	0	2413	5.8	15.1	754.2
1	3	0	0	0	2484	5.2	16.4	760.6
2	1	28	8.3	27	2978	5.5	14.8	759.3
2	2	28	8.3	27	3183	6.2	14.6	761.9
2	3	28	8.3	27	4652	5.9	15.9	767.1
3	1	50	8.3	54	3415	7	13.2	778.6
3	2	50	8.3	54	3613	7.4	13.0	764.5
3	3	50	8.3	54	4285	6.1	15.0	761.9
4	1	73	8.3	81	3065	9	11.3	770.9
4	2	73	8.3	81	3479	8.9	11.3	743.9
4	3	73	8.3	81	4319	6.7	14.8	767.1
5	1	50	0	54	3220	6.4	13.4	764.5
5	2	50	0	54	3630	6	14.7	754.2
5	3	50	0	54	4420	6.1	15.6	756.8
6	1	50	8.3	0	3489	6.7	13.3	788.9
6	2	50	8.3	0	3207	7.1	13.1	763.2
6	3	50	8.3	0	4504	6.3	15.9	761.9
7	1	6	8.3	27	2272	5.7	15.7	758.0
7	2	6	8.3	27	2205	5.2	16.0	742.6
7	3	6	8.3	27	3028	5.2	16.3	751.6

APPENDIX H continued

SMOUSE (Sm83)

Trt	Rep	N	P	S	Yield	Prot.	300 ker. wt	Test wt
		--------kg ha-1----------				%	g	kg m^{-3}
1	1	0	0	0	3055	6.8	16.8	760.6
1	2	0	0	0	3462	7.7	17.0	769.6
1	3	0	0	0	2897	6.5	17.0	765.8
2	1	28	8.3	27	4178	7.2	17.0	782.5
2	2	28	8.3	27	3707	8.1	16.9	785.1
2	3	28	8.3	27	4390	6.9	17.0	760.6
3	1	50	8.3	54	5132	7.4	16.8	774.8
3	2	50	8.3	54	4722	7.9	16.4	774.8
3	3	50	8.3	54	5348	8.2	16.3	782.5
4	1	73	8.3	81	5075	8.8	15.2	791.5
4	2	73	8.3	81	5781	8.9	15.9	788.9
4	3	73	8.3	81	5949	9.3	14.9	795.4
5	1	50	0	54	5869	7.7	16.5	781.2
5	2	50	0	54	4924	8.5	15.5	785.1
5	3	50	0	54	5593	9.3	15.2	788.9
6	1	50	8.3	0	4763	7.9	16.7	787.6
6	2	50	8.3	0	4507	8.4	16.4	782.5
6	3	50	8.3	0	5348	7.8	16.3	779.9
7	1	6	8.3	27	3418	7.0	17.6	767.1
7	2	6	8.3	27	2696	6.9	17.3	758.0
7	3	6	8.3	27	3210	6.3	17.3	756.8

APPENDIX H continued

WEATHERFORD (W83)

Trt	Rep	N	P	S	Yield	Prot.	300 ker. wt	Test wt
		--------kg ha-1----------				%	g	kg m^{-3}
1	1	0	0	0	4450	8.0	17.6	776.1
1	2	0	0	0	3512	6.5	16.9	754.2
1	3	0	0	0	3462	6.5	16.6	761.9
2	1	28	8.3	27	4265	7.9	17.4	769.6
2	2	28	8.3	27	4296	7.0	15.8	769.6
2	3	28	8.3	27	4215	6.7	17.0	773.5
3	1	50	8.3	54	4927	10.4	14.4	768.3
3	2	50	8.3	54	4833	7.2	15.5	779.9
3	3	50	8.3	54	4722	7.6	15.9	773.5
4	1	73	8.3	81	5811	9.7	14.3	781.2
4	2	73	8.3	81	4706	7.9	15.4	774.8
4	3	73	8.3	81	5257	7.8	15.2	781.2
5	1	50	0	54	5089	8.4	15.6	772.2
5	2	50	0	54	4037	6.7	16.1	764.5
5	3	50	0	54	4013	6.6	16.3	761.9
6	1	50	8.3	0	5001	7.2	16.9	763.2
6	2	50	8.3	0	4628	7.5	16.4	763.2
6	3	50	8.3	0	4998	7.4	16.3	769.6
7	1	6	8.3	27	4470	8.3	17.3	770.9
7	2	6	8.3	27	3422	6.4	16.8	758.0
7	3	6	8.3	27	2642	6.1	16.5	751.6

APPENDIX H continued

BORSTAL (B183)

Trt	Rep	N	P	S	Yield	Prot.	300 ker. wt	Test wt
		--------kg ha-1----------				%	g	kg m^{-3}
1	1	0	0	0	632	5.1	13.0	755.5
1	2	0	0	0	921	5.4	12.8	742.6
1	3	0	0	0	992	5.7	13.1	756.8
2	1	28	8.3	27	2111	5.1	11.9	733.6
2	2	28	8.3	27	2353	4.6	12.4	745.2
2	3	28	8.3	27	2121	5.1	12.2	741.3
3	1	50	8.3	54	3008	6.8	10.7	740.0
3	2	50	8.3	54	4094	5.9	12.9	754.2
3	3	50	8.3	54	3580	5.5	12.3	749.0
4	1	73	8.3	81	3015	8.4	11.0	776.1
4	2	73	8.3	81	4144	6.1	11.6	758.0
4	3	73	8.3	81	3825	6.6	12.0	770.9
5	1	50	0	54	2844	5.8	10.9	750.3
5	2	50	0	54	3122	5.9	12.1	750.3
5	3	50	0	54	3522	5.2	12.5	743.9
6	1	50	8.3	0	2625	7.0	11.1	768.3
6	2	50	8.3	0	3522	5.1	13.1	741.3
6	3	50	8.3	0	3916	5.6	12.4	746.5
7	1	6	8.3	27	968	4.8	12.5	741.3
7	2	6	8.3	27	1086	4.9	12.2	747.7
7	3	6	8.3	27	965	5.4	12.8	743.9

APPENDIX H continued

GILBERT (Gt83)

Trt	Rep	N	P	S	Yield	Prot.	300 ker. wt	Test wt
		--------kg ha-1----------				%	g	kg m^{-3}
1	1	0	0	0	1284	7.4	15.3	778.6
1	2	0	0	0	1472	6.6	15.5	764.5
1	3	0	0	0	1183	6.2	14.7	763.2
2	1	28	8.3	27	1482	7.8	15.8	774.8
2	2	28	8.3	27	2524	6.0	15.8	745.2
2	3	28	8.3	27	2396	7.3	15.6	773.5
3	1	50	8.3	54	3237	8.0	14.5	776.1
3	2	50	8.3	54	3526	7.6	14.7	783.8
3	3	50	8.3	54	3889	6.9	14.9	781.2
4	1	73	8.3	81	2672	10.7	14.1	800.5
4	2	73	8.3	81	3559	9.4	13.5	794.1
4	3	73	8.3	81	3627	9.0	14.1	795.4
5	1	50	0	54	2783	6.7	15.0	773.5
5	2	50	0	54	3270	6.9	14.3	773.5
5	3	50	0	54	2565	8.5	15.5	785.1
6	1	50	8.3	0	2612	8.0	16.3	782.5
6	2	50	8.3	0	2729	7.5	15.9	778.6
6	3	50	8.3	0	2622	7.9	16.5	786.4
7	1	6	8.3	27	1328	7.2	16.1	779.9
7	2	6	8.3	27	1422	5.9	15.5	755.5
7	3	6	8.3	27	1405	6.6	15.7	768.3

APPENDIX H continued

REEDER (R83)

Trt	Rep	N	P	S	Yield	Prot.	300 ker. wt	Test wt
		--------kg ha^{-1}----------				%	g	kg m^{-3}
1	1	0	0	0	612	6.5	14.3	737.5
1	2	0	0	0	834	6.7	14.5	752.9
1	3	0	0	0	776	6.6	14.6	747.7
2	1	62	8.3	67	2696	7.0	13.0	741.3
2	2	62	8.3	67	2591	6.8	12.8	742.6
2	3	62	8.3	67	2070	9.0	11.3	769.6
3	1	118	8.3	134	2329	13.0	11.8	755.5
3	2	118	8.3	134	2020	11.4	10.7	737.5
3	3	118	8.3	134	2531	13.5	10.4	709.1
4	1	174	8.3	202	1260	17.5	11.1	720.7
4	2	174	8.3	202	1418	17.5	11.1	725.9
4	3	174	8.3	202	2272	15.5	10.1	711.7
5	1	118	0	134	2202	13.3	10.9	715.6
5	2	118	0	134	2289	14.0	11.1	732.3
5	3	118	0	134	3156	11.1	10.5	733.6
6	1	118	8.3	0	2477	10.3	12.0	746.5
6	2	118	8.3	0	2037	10.7	11.4	718.1
6	3	118	8.3	0	2407	10.9	13.2	759.3
7	1	6	8.3	27	1415	6.5	14.2	737.5
7	2	6	8.3	27	602	6.5	13.6	732.3
7	3	6	8.3	27	763	6.8	14.6	752.9

APPENDIX H continued

HARPER (Hr84)

Trt	Rep	---N Timing--- SS	SD	SC	N Source	P	S	Yield	Prot.	300 Ker. wt	Test wt
		---kg	ha^{-1}	----		---kg	ha^{-1}	----	%	g	kg m^{-3}
1	1	0	0	0	-	0	0	4554	7.4	15.6	791.9
1	2	0	0	0	-	0	0	3980	7.6	15.6	775.7
1	3	0	0	0	-	0	0	4860	8.1	15.4	795.7
1	4	0	0	0	-	0	0	5791	10.5	12.9	764.3
2	1	0	56	0	U	10	22	5085	8.9	15.7	784.1
2	2	0	56	0	U	10	22	5791	8.7	14.6	805.0
2	3	0	56	0	U	10	22	5912	9.6	13.4	797.2
2	4	0	56	0	U	10	22	5536	11.4	12.2	749.8
3	1	0	112	0	U	10	22	5771	10.1	14.1	789.2
3	2	0	112	0	U	10	22	5724	9.9	13.5	791.0
3	3	0	112	0	U	10	22	6047	9.6	13.8	794.5
3	4	0	112	0	U	10	22	4450	12.2	10.9	705.5
4	1	0	168	0	U	10	22	5704	10.6	13.2	788.6
4	2	0	168	0	U	10	22	5257	9.5	13.5	781.6
4	3	0	168	0	U	10	22	5590	11.5	12.6	785.6
4	4	0	168	0	U	10	22	4538	12.4	11.4	732.2
5	1	0	112	0	U	0	22	5781	9.7	14.1	777.4
5	2	0	112	0	U	0	22	5613	10.2	13.9	779.7
5	3	0	112	0	U	0	22	5290	9.9	13.6	789.7
5	4	0	112	0	U	0	22	5203	10.9	12.0	749.1
6	1	0	112	0	U	10	0	5714	9.9	14.1	797.9
6	2	0	112	0	U	10	0	5526	8.8	14.4	794.8
6	3	0	112	0	U	10	0	5707	10.1	13.9	793.5
6	4	0	112	0	U	10	0	5153	12.4	11.6	730.7
7	1	0	0	0	-	10	22	4736	8.1	15.4	789.4
7	2	0	0	0	-	10	22	4417	8.3	14.6	781.7
7	3	0	0	0	-	10	22	5001	8.1	15.1	788.5
7	4	0	0	0	-	10	22	5522	10.1	11.9	756.1
8	1	56	0	56	U	10	22	5721	9.4	14.7	790.6
8	2	56	0	56	U	10	22	5912	9.6	14.0	802.8
8	3	56	0	56	U	10	22	5630	9.2	14.9	803.0
8	4	56	0	56	U	10	22	4638	10.9	12.6	769.2
9	1	112	0	0	U	10	22	5304	8.7	14.8	787.5
9	2	112	0	0	U	10	22	5895	9.5	14.6	797.0
9	3	112	0	0	U	10	22	5573	8.3	15.2	796.4
9	4	112	0	0	U	10	22	5721	10.7	12.7	798.4
10	1	0	0	112	U	10	22	5764	9.6	14.1	795.7
10	2	0	0	112	U	10	22	6094	9.0	15.1	798.4
10	3	0	0	112	U	10	22	5428	10.6	13.8	797.2
10	4	0	0	112	U	10	22	3748	11.9	11.2	708.6

APPENDIX H continued

HARPER (Hr84) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	28	84	U	10	22	5748	9.0	14.9	795.9
11	2	0	28	84	U	10	22	5038	9.7	14.7	788.3
11	3	0	28	84	U	10	22	5633	9.9	13.9	795.9
11	4	0	28	84	U	10	22	4437	11.6	13.2	770.7
12	1	0	28	84	AC	10	22	5835	10.4	15.6	791.7
12	2	0	28	84	AC	10	22	4961	8.9	16.0	756.1
12	3	0	28	84	AC	10	22	5331	9.3	16.0	804.1
12	4	0	28	84	AC	10	22	4890	12.1	12.5	757.8
13	1	0	28	84	AS	10	22	5741	8.8	14.5	787.7
13	2	0	28	84	AS	10	22	4440	10.0	14.3	766.1
13	3	0	28	84	AS	10	22	4931	10.2	13.4	785.0
13	4	0	28	84	AS	10	22	4652	10.6	12.1	781.6
14	1	0	168	0	UP	24	22	6242	11.0	12.8	773.6
14	2	0	168	0	UP	24	22	5798	10.3	13.0	796.3
14	3	0	168	0	UP	24	22	5368	11.1	13.2	779.9
14	4	0	168	0	UP	24	22	4161	13.2	11.0	707.5
15	1	0	168	0	U	24	22	4874	9.9	14.3	790.3
15	2	0	168	0	U	24	22	5724	11.2	13.0	762.3
15	3	0	168	0	U	24	22	6322	9.6	14.1	793.5
15	4	0	168	0	U	24	22	4319	13.3	10.5	686.0

APPENDIX H continued

HAY (Hy84)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	0	0	4117	7.5	16.7	759.8
1	2	0	0	0	-	0	0	2793	6.4	16.7	754.7
1	3	0	0	0	-	0	0	3267	6.8	16.2	757.5
1	4	0	0	0	-	0	0	3304	6.2	15.9	755.6
2	1	0	56	0	U	10	22	5630	9.1	14.9	762.7
2	2	0	56	0	U	10	22	5075	7.8	15.5	764.4
2	3	0	56	0	U	10	22	4985	7.4	16.1	774.2
2	4	0	56	0	U	10	22	5351	7.2	15.9	763.8
3	1	0	112	0	U	10	22	6232	9.2	15.3	772.2
3	2	0	112	0	U	10	22	5956	7.6	15.6	769.1
3	3	0	112	0	U	10	22	6299	8.7	15.7	776.7
3	4	0	112	0	U	10	22	6820	8.1	14.6	772.3
4	1	0	168	0	U	10	22	6890	10.7	13.8	767.1
4	2	0	168	0	U	10	22	6440	9.7	14.7	771.6
4	3	0	168	0	U	10	22	7240	9.3	14.7	776.9
4	4	0	168	0	U	10	22	7411	10.4	14.4	782.0
5	1	0	112	0	U	0	22	6736	8.9	15.3	775.3
5	2	0	112	0	U	0	22	5929	8.9	15.1	770.9
5	3	0	112	0	U	0	22	5969	8.9	15.7	776.2
5	4	0	112	0	U	0	22	5788	9.8	15.8	733.7
6	1	0	112	0	U	10	0	6420	8.8	15.2	780.9
6	2	0	112	0	U	10	0	5516	8.4	15.7	766.5
6	3	0	112	0	U	10	0	6658	8.8	15.4	771.3
6	4	0	112	0	U	10	0	8010	9.7	15.5	787.1
7	1	0	0	0	-	10	22	3630	6.8	16.6	758.4
7	2	0	0	0	-	10	22	3200	6.8	16.4	760.7
7	3	0	0	0	-	10	22	3482	6.8	16.0	757.1
7	4	0	0	0	-	10	22	3361	6.5	15.6	755.5
8	1	56	0	56	U	10	22	6114	8.5	18.9	773.3
8	2	56	0	56	U	10	22	3516	7.0	15.8	755.5
8	3	56	0	56	U	10	22	3509	6.8	15.8	756.7
8	4	56	0	56	U	10	22	5206	7.3	15.8	762.0
9	1	112	0	0	U	10	22	4991	7.5	16.3	767.1
9	2	112	0	0	U	10	22	4406	7.4	15.7	760.9
9	3	112	0	0	U	10	22	2904	6.6	15.7	748.6
9	4	112	0	0	U	10	22	4104	7.0	16.1	760.9
10	1	0	0	112	U	10	22	6285	8.7	15.2	773.4
10	2	0	0	112	U	10	22	5213	7.9	16.2	771.3
10	3	0	0	112	U	10	22	6262	7.8	16.1	773.1
10	4	0	0	112	U	10	22	6191	8.2	15.2	775.6

APPENDIX H continued

HAY (Hy84) continued

Trt	Rep	---N Timing--- SS	SD	SC	N Source	P	S	Yield	Prot.	300 Ker. wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	28	84	U	10	22	6595	9.4	14.6	767.4
11	2	0	28	84	U	10	22	5798	8.7	16.3	776.9
11	3	0	28	84	U	10	22	6453	8.6	15.3	778.5
11	4	0	28	84	U	10	22	6544	7.4	15.9	774.3
12	1	0	28	84	AC	10	22	6500	7.8	16.6	778.7
12	2	0	28	84	AC	10	22	5922	7.9	16.8	771.4
12	3	0	28	84	AC	10	22	6094	7.7	16.5	777.6
12	4	0	28	84	AC	10	22	6793	8.0	16.3	780.2
13	1	0	28	84	AS	10	22	6860	8.2	15.4	768.5
13	2	0	28	84	AS	10	22	6107	8.1	15.3	768.7
13	3	0	28	84	AS	10	22	6006	8.4	15.2	761.6
13	4	0	28	84	AS	10	22	6265	7.8	15.1	771.8
14	1	0	168	0	UP	24	22	6833	11.0	13.6	753.8
14	2	0	168	0	UP	24	22	7021	9.1	15.2	775.3
14	3	0	168	0	UP	24	22	6800	8.6	14.8	780.3
14	4	0	168	0	UP	24	22	7431	10.0	14.4	782.3
15	1	0	168	0	U	24	22	6131	11.4	13.3	751.8
15	2	0	168	0	U	24	22	5973	10.2	14.0	771.4
15	3	0	168	0	U	24	22	7754	10.1	14.2	774.9
15	4	0	168	0	U	24	22	6944	8.5	14.7	779.8

APPENDIX H continued

KASEBERG (K84)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	0	0	3946	7.1	16.8	764.0
1	2	0	0	0	-	0	0	3116	6.8	17.1	760.4
1	3	0	0	0	-	0	0	2928	6.7	16.7	762.2
1	4	0	0	0	-	0	0	2733	6.7	17.2	762.9
2	1	0	56	0	U	10	22	5425	7.3	16.9	756.7
2	2	0	56	0	U	10	22	4937	8.7	16.3	770.9
2	3	0	56	0	U	10	22	5247	7.8	16.5	771.1
2	4	0	56	0	U	10	22	4625	7.7	16.3	778.2
3	1	0	112	0	U	10	22	6084	8.7	16.7	780.9
3	2	0	112	0	U	10	22	5653	9.4	14.0	776.3
3	3	0	112	0	U	10	22	5667	7.7	16.4	784.1
3	4	0	112	0	U	10	22	5001	9.0	14.8	771.3
4	1	0	168	0	U	10	22	6665	7.9	16.0	783.1
4	2	0	168	0	U	10	22	5499	11.2	12.2	776.3
4	3	0	168	0	U	10	22	5132	10.3	13.4	762.7
4	4	0	168	0	U	10	22	6252	10.6	14.3	785.4
5	1	0	112	0	U	0	22	5694	8.3	16.9	774.0
5	2	0	112	0	U	0	22	6349	8.2	16.5	783.1
5	3	0	112	0	U	0	22	5143	8.1	15.9	768.7
5	4	0	112	0	U	0	22	5922	9.1	15.2	789.8
6	1	0	112	0	U	10	0	6184	9.1	15.7	784.0
6	2	0	112	0	U	10	0	5522	9.3	17.0	785.2
6	3	0	112	0	U	10	0	5038	9.1	16.9	785.2
6	4	0	112	0	U	10	0	4645	9.1	17.6	780.5
7	1	0	0	0	-	10	22	3465	7.3	16.7	761.8
7	2	0	0	0	-	10	22	2672	6.5	16.3	759.6
7	3	0	0	0	-	10	22	3559	7.4	16.6	765.6
7	4	0	0	0	-	10	22	2625	6.7	16.7	757.6
8	1	56	0	56	U	10	22	5680	7.6	16.8	779.6
8	2	56	0	56	U	10	22	5055	8.6	16.4	774.0
8	3	56	0	56	U	10	22	5341	8.1	16.8	782.3
8	4	56	0	56	U	10	22	5126	8.2	16.6	776.7
9	1	112	0	0	U	10	22	5741	9.1	16.6	783.6
9	2	112	0	0	U	10	22	4773	8.2	15.7	771.1
9	3	112	0	0	U	10	22	3536	6.7	16.8	753.3
9	4	112	0	0	U	10	22	6282	8.9	16.0	776.5
10	1	0	0	112	U	10	22	6174	7.9	16.9	784.9
10	2	0	0	112	U	10	22	4927	8.5	17.1	778.7
10	3	0	0	112	U	10	22	5183	8.1	16.7	777.1
10	4	0	0	112	U	10	22	5089	8.1	16.6	781.1

APPENDIX H continued

KASEBERG (K84) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg	ha^{-1}	----		---kg	ha^{-1}	----	%	g	kg m^{-3}
11	1	0	28	84	U	10	22	5371	8.0	16.9	780.3
11	2	0	28	84	U	10	22	5815	8.4	16.9	783.6
11	3	0	28	84	U	10	22	5734	8.5	16.1	789.4
11	4	0	28	84	U	10	22	5200	8.2	17.2	780.9
12	1	0	28	84	AC	10	22	6863	8.7	16.9	777.6
12	2	0	28	84	AC	10	22	6097	8.3	17.1	785.8
12	3	0	28	84	AC	10	22	6558	8.6	16.7	785.6
12	4	0	28	84	AC	10	22	6111	8.3	17.0	784.5
13	1	0	28	84	AS	10	22	6719	8.2	16.6	774.9
13	2	0	28	84	AS	10	22	5237	8.0	16.6	770.7
13	3	0	28	84	AS	10	22	5311	8.3	16.3	779.8
13	4	0	28	84	AS	10	22	6571	8.5	15.9	786.5
14	1	0	168	0	UP	24	22	8635	9.3	15.6	791.4
14	2	0	168	0	UP	24	22	5371	10.0	13.6	767.1
14	3	0	168	0	UP	24	22	5986	9.7	14.2	783.6
14	4	0	168	0	UP	24	22	6131	9.3	15.2	781.2
15	1	0	168	0	U	24	22	6561	9.9	16.1	791.4
15	2	0	168	0	U	24	22	5028	10.4	13.4	768.2
15	3	0	168	0	U	24	22	5768	10.5	12.8	769.6
15	4	0	168	0	U	24	22	6571	10.2	14.7	770.5

APPENDIX H continued

BERGSTOM (Bm84)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	0	0	2202	6.8	16.0	700.1
1	2	0	0	0	-	0	0	2255	7.2	16.3	713.9
1	3	0	0	0	-	0	0	2528	6.7	15.9	698.3
1	4	0	0	0	-	0	0	2289	7.1	16.1	717.3
2	1	0	28	0	U	10	22	3176	7.0	15.6	698.6
2	2	0	28	0	U	10	22	3885	7.6	16.0	710.4
2	3	0	28	0	U	10	22	2793	6.6	15.5	686.8
2	4	0	28	0	U	10	22	3465	7.2	16.1	700.6
3	1	0	56	0	U	10	22	4702	7.6	15.9	712.4
3	2	0	56	0	U	10	22	4857	8.3	15.9	726.9
3	3	0	56	0	U	10	22	3986	6.9	15.6	692.6
3	4	0	56	0	U	10	22	3539	7.4	15.5	711.5
4	1	0	112	0	U	10	22	4894	7.8	15.4	718.2
4	2	0	112	0	U	10	22	5596	9.5	14.7	723.3
4	3	0	112	0	U	10	22	4911	9.9	15.1	715.3
4	4	0	112	0	U	10	22	4887	9.9	13.8	712.1
5	1	0	56	0	U	0	22	4003	7.6	16.1	710.4
5	2	0	56	0	U	0	22	4652	8.1	16.5	728.9
5	3	0	56	0	U	0	22	4285	8.3	15.9	723.3
5	4	0	56	0	U	0	22	4396	7.9	15.5	723.5
6	1	0	56	0	U	10	0	4689	7.4	16.1	709.3
6	2	0	56	0	U	10	0	4685	8.4	16.1	724.9
6	3	0	56	0	U	10	0	3919	7.3	16.2	722.9
6	4	0	56	0	U	10	0	4655	8.4	16.0	719.3
7	1	0	0	0	-	10	22	2897	7.1	16.0	714.4
7	2	0	0	0	-	10	22	2255	7.0	16.3	702.1
7	3	0	0	0	-	10	22	2743	7.3	16.2	711.9
7	4	0	0	0	-	10	22	2017	6.8	15.9	711.7
8	1	28	0	28	U	10	22	3781	6.9	15.6	702.4
8	2	28	0	28	U	10	22	4124	7.9	16.0	731.7
8	3	28	0	28	U	10	22	3593	7.4	16.0	726.8
8	4	28	0	28	U	10	22	3741	7.7	16.1	719.3
9	1	56	0	0	U	10	22	4060	7.3	16.3	713.7
9	2	56	0	0	U	10	22	3479	7.2	15.9	709.0
9	3	56	0	0	U	10	22	4114	8.0	16.3	717.5
9	4	56	0	0	U	10	22	3852	7.0	15.7	704.1
10	1	0	0	56	U	10	22	4927	8.1	16.0	737.7
10	2	0	0	56	U	10	22	3949	7.7	16.0	721.3
10	3	0	0	56	U	10	22	4383	7.6	16.0	734.8
10	4	0	0	56	U	10	22	3983	8.2	16.1	738.7

APPENDIX H continued

BERGSTOM (Bm84) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	28	28	U	10	22	4171	8.1	15.4	713.3
11	2	0	28	28	U	10	22	4393	8.1	16.7	728.8
11	3	0	28	28	U	10	22	3946	7.0	15.5	710.6
11	4	0	28	28	U	10	22	4181	7.6	16.1	721.1
12	1	0	28	28	AC	10	22	4104	7.0	15.6	696.3
12	2	0	28	28	AC	10	22	4245	7.5	15.7	710.1
12	3	0	28	28	AC	10	22	4601	7.1	15.9	703.0
12	4	0	28	28	AC	10	22	4501	7.5	15.8	714.6
13	1	0	28	28	AS	10	22	4504	7.9	16.0	721.9
13	2	0	28	28	AS	10	22	4094	7.7	16.8	732.6
13	3	0	28	28	AS	10	22	4285	8.3	16.7	746.6
13	4	0	28	28	AS	10	22	4598	7.6	15.9	731.5
14	1	0	112	0	UP	16	22	4272	7.8	15.0	713.3
14	2	0	112	0	UP	16	22	5361	8.8	15.6	728.4
14	3	0	112	0	UP	16	22	4490	8.9	14.6	716.4
14	4	0	112	0	UP	16	22	4591	8.4	15.5	716.4
15	1	0	112	0	U	16	22	5169	10.5	14.4	707.7
15	2	0	112	0	U	16	22	5042	9.6	13.7	730.2
15	3	0	112	0	U	16	22	4380	8.6	14.8	707.7
15	4	0	112	0	U	16	22	4544	8.9	14.3	701.7

APPENDIX H continued

SMOUSE (Sm84)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	0	0	4148	8.8	17.3	789.8
1	2	0	0	0	-	0	0	5337	9.3	16.3	796.7
1	3	0	0	0	-	0	0	4171	8.9	17.1	797.4
1	4	0	0	0	-	0	0	4904	9.3	17.1	795.0
2	1	0	28	0	U	10	22	4548	8.8	15.6	793.4
2	2	0	28	0	U	10	22	5600	9.5	16.4	800.1
2	3	0	28	0	U	10	22	5388	8.9	17.1	799.6
2	4	0	28	0	U	10	22	5660	8.9	16.2	796.7
3	1	0	56	0	U	10	22	5687	10.0	15.7	789.6
3	2	0	56	0	U	10	22	5421	10.0	14.7	798.1
3	3	0	56	0	U	10	22	5132	9.4	16.2	795.6
3	4	0	56	0	U	10	22	5956	10.2	15.3	763.3
4	1	0	112	0	U	10	22	5025	11.1	14.2	780.2
4	2	0	112	0	U	10	22	5284	12.6	13.1	775.3
4	3	0	112	0	U	10	22	4803	12.0	13.6	778.5
4	4	0	112	0	U	10	22	5821	10.7	14.1	790.9
5	1	0	56	0	U	0	22	5092	9.2	15.9	796.7
5	2	0	56	0	U	0	22	5882	9.2	16.3	795.8
5	3	0	56	0	U	0	22	5536	10.4	14.8	797.8
5	4	0	56	0	U	0	22	5912	8.7	16.1	790.9
6	1	0	56	0	U	10	0	6013	9.7	15.6	794.0
6	2	0	56	0	U	10	0	5949	10.1	14.7	792.5
6	3	0	56	0	U	10	0	5516	10.2	14.8	791.6
6	4	0	56	0	U	10	0	6463	9.8	15.1	791.2
7	1	0	0	0	-	10	22	4689	8.7	16.6	789.8
7	2	0	0	0	-	10	22	4914	9.0	17.4	794.7
7	3	0	0	0	-	10	22	5388	9.2	16.9	793.0
7	4	0	0	0	-	10	22	4753	9.4	16.5	792.1
8	1	28	0	28	U	10	22	4749	9.7	16.2	803.6
8	2	28	0	28	U	10	22	5058	9.4	16.6	798.7
8	3	28	0	28	U	10	22	6000	9.7	16.4	805.4
8	4	28	0	28	U	10	22	6265	8.1	16.6	792.0
9	1	56	0	0	U	10	22	5627	9.2	16.2	792.1
9	2	56	0	0	U	10	22	5499	8.9	17.0	794.3
9	3	56	0	0	U	10	22	5176	9.6	15.7	788.5
9	4	56	0	0	U	10	22	5542	9.0	15.9	792.0
10	1	0	0	56	U	10	22	5455	10.2	16.7	803.2
10	2	0	0	56	U	10	22	5748	10.0	16.2	803.2
10	3	0	0	56	U	10	22	5674	10.1	16.0	802.1
10	4	0	0	56	U	10	22	5905	8.9	16.6	801.8

APPENDIX H continued

SMOUSE (Sm84) continued

		---N Timing---			N						
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	300 Ker. wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	28	28	U	10	22	5139	10.6	15.4	799.4
11	2	0	28	28	U	10	22	5727	9.5	16.7	798.5
11	3	0	28	28	U	10	22	5516	9.7	16.4	798.3
11	4	0	28	28	U	10	22	5761	9.4	16.1	800.1
12	1	0	28	28	AC	10	22	6090	9.4	16.3	797.8
12	2	0	28	28	AC	10	22	5354	10.1	16.4	798.7
12	3	0	28	28	AC	10	22	5374	9.4	16.5	804.1
12	4	0	28	28	AC	10	22	5458	9.5	16.9	805.0
13	1	0	28	28	AS	10	22	5109	9.9	15.3	802.3
13	2	0	28	28	AS	10	22	6389	9.4	16.7	804.5
13	3	0	28	28	AS	10	22	5798	10.1	15.0	794.1
13	4	0	28	28	AS	10	22	5872	10.0	15.3	799.8
14	1	0	112	0	UP	16	22	5001	11.1	13.8	776.9
14	2	0	112	0	UP	16	22	6026	11.3	14.1	782.0
14	3	0	112	0	UP	16	22	5660	10.9	14.1	785.8
14	4	0	112	0	UP	16	22	5805	10.0	14.6	831.2
15	1	0	112	0	U	16	22	4527	11.4	13.4	770.5
15	2	0	112	0	U	16	22	5341	11.5	13.7	786.5
15	3	0	112	0	U	16	22	5559	10.9	13.5	786.7
15	4	0	112	0	U	16	22	5744	10.7	13.8	784.0

APPENDIX H continued

ANDERSON (A84)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	0	0	823	9.0	15.4	752.9
1	2	0	0	0	-	0	0	729	9.1	16.1	751.1
1	3	0	0	0	-	0	0	629	8.9	16.0	756.0
1	4	0	0	0	-	0	0	776	9.0	16.3	738.4
2	1	0	28	0	U	10	22	1371	8.0	16.0	748.9
2	2	0	28	0	U	10	22	1869	7.5	15.9	740.9
2	3	0	28	0	U	10	22	1761	7.6	16.4	753.3
2	4	0	28	0	U	10	22	1576	7.9	16.2	747.5
3	1	0	56	0	U	10	22	1929	8.3	16.1	745.1
3	2	0	56	0	U	10	22	2336	7.8	16.0	748.9
3	3	0	56	0	U	10	22	3334	7.5	16.1	742.7
3	4	0	56	0	U	10	22	1788	7.7	15.4	750.0
4	1	0	112	0	U	10	22	3990	8.2	15.7	744.7
4	2	0	112	0	U	10	22	3546	8.9	13.5	721.9
4	3	0	112	0	U	10	22	4161	8.5	14.2	747.1
4	4	0	112	0	U	10	22	4363	8.6	15.3	753.1
5	1	0	56	0	U	0	22	3267	7.7	15.8	748.0
5	2	0	56	0	U	0	22	2904	7.7	15.5	745.1
5	3	0	56	0	U	0	22	2739	7.5	15.4	726.9
5	4	0	56	0	U	0	22	2763	8.2	16.4	756.5
6	1	0	56	0	U	10	0	2696	7.7	16.5	740.9
6	2	0	56	0	U	10	0	3257	7.2	16.1	741.1
6	3	0	56	0	U	10	0	2007	7.2	16.0	745.5
6	4	0	56	0	U	10	0	2407	7.6	15.9	749.6
7	1	0	0	0	-	10	22	729	8.8	15.1	754.0
7	2	0	0	0	-	10	22	776	9.2	16.4	756.0
7	3	0	0	0	-	10	22	743	9.3	15.4	754.7
7	4	0	0	0	-	10	22	750	8.9	15.9	755.8
10	1	0	0	56	U	10	22	1496	7.8	15.7	754.4
10	2	0	0	56	U	10	22	1872	7.8	15.7	754.4
10	3	0	0	56	U	10	22	2249	7.8	15.7	746.4
10	4	0	0	56	U	10	22	2037	8.1	15.6	752.7
11	1	0	28	28	U	10	22	2054	7.4	15.8	749.6
11	2	0	28	28	U	10	22	2094	7.7	15.4	750.4
11	3	0	28	28	U	10	22	1896	8.0	16.0	753.8
11	4	0	28	28	U	10	22	2437	7.5	15.9	734.4
12	1	0	28	28	AC	10	22	2010	7.7	16.3	729.9
12	2	0	28	28	AC	10	22	2114	7.3	15.7	728.2
12	3	0	28	28	AC	10	22	1980	7.1	15.9	732.2
12	4	0	28	28	AC	10	22	2141	7.8	16.0	744.6

APPENDIX H continued

ANDERSON (A84) continued

Trt	Rep	---N Timing--- SS	SD	SC	N Source	P	S	Yield	Prot.	300 Ker. wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
13	1	0	28	28	AS	10	22	1644	7.6	14.9	738.9
13	2	0	28	28	AS	10	22	2060	7.8	15.7	753.1
13	3	0	28	28	AS	10	22	2168	7.5	15.8	742.9
13	4	0	28	28	AS	10	22	1660	7.8	15.8	746.6
14	1	0	112	0	UP	16	22	4006	8.2	16.0	738.0
14	2	0	112	0	UP	16	22	4000	8.5	14.7	744.2
14	3	0	112	0	UP	16	22	4282	7.9	15.6	745.1
14	4	0	112	0	UP	16	22	3855	7.8	15.8	747.6
15	1	0	112	0	U	16	22	4151	7.9	15.6	748.9
15	2	0	112	0	U	16	22	3556	8.2	14.9	739.8
15	3	0	112	0	U	16	22	3348	9.0	15.4	757.1
15	4	0	112	0	U	16	22	4228	8.8	15.6	747.5

APPENDIX H continued

CAMPBELL (C84)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	0	0	2185	10.2	15.7	770.3
1	2	0	0	0	-	0	0	1876	8.3	15.5	749.3
1	3	0	0	0	-	0	0	1318	7.5	17.0	765.8
1	4	0	0	0	-	0	0	1321	7.6	16.6	753.3
2	1	0	28	0	U	10	22	2309	7.9	16.3	760.2
2	2	0	28	0	U	10	22	1304	7.3	15.4	742.0
2	3	0	28	0	U	10	22	2329	7.7	16.6	741.3
2	4	0	28	0	U	10	22	1923	7.3	16.9	745.1
3	1	0	56	0	U	10	22	3230	8.7	14.0	724.8
3	2	0	56	0	U	10	22	2749	7.9	16.0	743.8
3	3	0	56	0	U	10	22	2692	8.0	16.5	764.4
3	4	0	56	0	U	10	22	3351	7.7	16.5	747.8
4	1	0	112	0	U	10	22	3516	10.2	13.9	732.2
4	2	0	112	0	U	10	22	3896	9.3	12.5	710.4
4	3	0	112	0	U	10	22	3159	9.9	12.5	712.1
4	4	0	112	0	U	10	22	4232	9.2	12.7	707.2
5	1	0	56	0	U	0	22	3173	7.6	15.5	753.5
5	2	0	56	0	U	0	22	3012	7.7	15.4	744.0
5	3	0	56	0	U	0	22	2844	7.9	15.4	758.0
5	4	0	56	0	U	0	22	2917	8.2	15.6	753.3
6	1	0	56	0	U	10	0	3321	7.9	15.9	735.5
6	2	0	56	0	U	10	0	2904	9.2	13.2	718.4
6	3	0	56	0	U	10	0	3640	7.6	16.3	742.2
6	4	0	56	0	U	10	0	2917	7.7	15.7	724.8
7	1	0	0	0	-	10	22	1637	7.4	16.6	748.2
7	2	0	0	0	-	10	22	1771	7.7	15.9	743.5
7	3	0	0	0	-	10	22	1862	7.5	17.0	760.5
7	4	0	0	0	-	10	22	1428	7.7	16.8	752.7
10	1	0	0	56	U	10	22	2195	8.8	14.0	720.4
10	2	0	0	56	U	10	22	1879	7.2	16.6	759.5
10	3	0	0	56	U	10	22	2269	8.9	16.1	746.4
10	4	0	0	56	U	10	22	1791	7.9	15.1	735.5
11	1	0	28	28	U	10	22	2823	7.4	16.3	752.2
11	2	0	28	28	U	10	22	3005	7.6	15.7	754.5
11	3	0	28	28	U	10	22	3190	7.5	16.2	753.5
11	4	0	28	28	U	10	22	3344	7.9	15.4	727.9
12	1	0	28	28	AC	10	22	3553	7.8	16.0	757.5
12	2	0	28	28	AC	10	22	2497	8.2	17.1	742.0
12	3	0	28	28	AC	10	22	2850	7.7	15.5	730.4
12	4	0	28	28	AC	10	22	3546	7.6	16.3	737.7

APPENDIX H continued

CAMPBELL (C84) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
13	1	0	28	28	AS	10	22	2165	7.6	15.4	757.6
13	2	0	28	28	AS	10	22	3260	8.2	14.6	727.1
13	3	0	28	28	AS	10	22	2857	7.3	16.8	738.2
13	4	0	28	28	AS	10	22	3489	7.5	15.5	743.5
14	1	0	112	0	UP	16	22	2995	10.7	12.4	712.8
14	2	0	112	0	UP	16	22	3936	9.0	14.1	741.8
14	3	0	112	0	UP	16	22	4064	10.2	12.2	704.8
14	4	0	112	0	UP	16	22	3680	9.5	13.2	736.4
15	1	0	112	0	U	16	22	3445	9.0	13.3	735.7
15	2	0	112	0	U	16	22	3351	10.1	12.3	733.1
15	3	0	112	0	U	16	22	3284	9.6	12.0	691.0
15	4	0	112	0	U	16	22	3583	10.1	12.2	692.8

APPENDIX H continued

GILBERT (Gt84)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	0	0	1264	9.0	16.6	781.2
1	2	0	0	0	-	0	0	1341	7.5	15.5	764.0
1	3	0	0	0	-	0	0	1217	9.5	17.5	779.4
1	4	0	0	0	-	0	0	810	7.9	16.5	765.1
2	1	0	28	0	U	10	22	1697	8.3	16.3	758.7
2	2	0	28	0	U	10	22	2161	7.1	16.9	757.3
2	3	0	28	0	U	10	22	1634	7.4	15.9	717.3
2	4	0	28	0	U	10	22	1667	7.1	16.6	760.9
3	1	0	56	0	U	10	22	2790	7.8	16.8	763.4
3	2	0	56	0	U	10	22	2198	7.6	16.3	743.3
3	3	0	56	0	U	10	22	2867	7.3	16.6	741.1
3	4	0	56	0	U	10	22	2763	7.3	16.7	770.7
4	1	0	112	0	U	10	22	4023	8.6	15.5	754.2
4	2	0	112	0	U	10	22	4067	7.5	16.2	748.0
4	3	0	112	0	U	10	22	3815	8.3	15.5	751.1
4	4	0	112	0	U	10	22	2810	8.4	16.7	769.4
5	1	0	56	0	U	0	22	1926	7.5	17.0	747.6
5	2	0	56	0	U	0	22	2833	7.7	16.9	745.8
5	3	0	56	0	U	0	22	2262	7.4	17.3	773.6
5	4	0	56	0	U	0	22	1976	6.8	16.5	766.9
6	1	0	56	0	U	10	0	3045	7.8	17.0	748.0
6	2	0	56	0	U	10	0	2591	7.3	16.1	748.6
6	3	0	56	0	U	10	0	2854	7.3	16.8	765.1
6	4	0	56	0	U	10	0	2339	7.2	16.6	766.9
7	1	0	0	0	-	10	22	1395	7.6	17.1	762.2
7	2	0	0	0	-	10	22	1482	6.9	17.2	770.2
7	3	0	0	0	-	10	22	1207	7.8	16.9	765.8
7	4	0	0	0	-	10	22	1139	7.4	16.7	777.4
10	1	0	0	56	U	10	22	2138	7.4	16.1	748.4
10	2	0	0	56	U	10	22	2729	7.9	16.1	763.3
10	3	0	0	56	U	10	22	2232	6.8	16.7	771.3
10	4	0	0	56	U	10	22	2504	7.0	17.0	743.7
11	1	0	28	28	U	10	22	1785	7.3	16.1	766.2
11	2	0	28	28	U	10	22	2864	7.0	16.5	757.3
11	3	0	28	28	U	10	22	2168	7.3	16.1	762.9
11	4	0	28	28	U	10	22	1899	7.0	16.7	750.7
12	1	0	28	28	AC	10	22	2602	7.3	16.4	741.5
12	2	0	28	28	AC	10	22	2017	7.3	16.3	723.9
12	3	0	28	28	AC	10	22	2850	7.3	16.5	755.5
12	4	0	28	28	AC	10	22	2191	6.9	16.5	752.2

APPENDIX H continued

GILBERT (Gt84) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
13	1	0	28	28	AS	10	22	1936	7.3	16.4	757.1
13	2	0	28	28	AS	10	22	2265	8.1	16.7	754.4
13	3	0	28	28	AS	10	22	2444	8.1	16.7	768.2
13	4	0	28	28	AS	10	22	2202	6.8	16.7	760.9
14	1	0	112	0	UP	16	22	3509	8.6	16.3	753.1
14	2	0	112	0	UP	16	22	4067	8.6	16.0	760.7
14	3	0	112	0	UP	16	22	3902	7.9	15.7	762.7
14	4	0	112	0	UP	16	22	3764	7.7	15.7	760.7
15	1	0	112	0	U	16	22	3583	8.8	15.9	769.4
15	2	0	112	0	U	16	22	3422	7.9	16.4	768.7
15	3	0	112	0	U	16	22	3479	7.8	16.5	761.1
15	4	0	112	0	U	16	22	2759	7.5	16.2	764.4

APPENDIX H continued

MARTIN (Mn84)

		---N Timing---			N					300	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	Ker. wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	0	0	850	7.3	15.6	758.5
1	2	0	0	0	-	0	0	944	7.3	15.9	760.9
1	3	0	0	0	-	0	0	763	7.4	15.3	766.2
1	4	0	0	0	-	0	0	847	7.2	15.9	762.0
2	1	0	28	0	U	10	22	1738	7.0	14.9	748.6
2	2	0	28	0	U	10	22	1943	7.2	15.0	761.8
2	3	0	28	0	U	10	22	1882	7.5	14.4	772.7
2	4	0	28	0	U	10	22	1741	6.7	14.9	758.2
3	1	0	56	0	U	10	22	2487	8.6	13.6	769.4
3	2	0	56	0	U	10	22	2635	8.1	13.5	773.1
3	3	0	56	0	U	10	22	2672	8.4	13.4	760.4
3	4	0	56	0	U	10	22	2672	7.2	14.3	764.0
4	1	0	112	0	U	10	22	2702	12.2	10.2	726.2
4	2	0	112	0	U	10	22	2712	10.2	11.8	750.2
4	3	0	112	0	U	10	22	3052	11.3	10.6	723.1
4	4	0	112	0	U	10	22	2642	10.8	10.9	738.6
5	1	0	56	0	U	0	22	2618	8.2	13.6	769.6
5	2	0	56	0	U	0	22	2739	8.4	12.3	758.7
5	3	0	56	0	U	0	22	2649	7.9	13.4	765.4
5	4	0	56	0	U	0	22	2094	8.3	12.9	770.3
6	1	0	56	0	U	10	0	2975	8.5	12.7	744.9
6	2	0	56	0	U	10	0	2796	8.7	12.9	752.6
6	3	0	56	0	U	10	0	2827	8.9	13.2	751.1
6	4	0	56	0	U	10	0	2602	8.9	13.5	762.4
7	1	0	0	0	-	10	22	635	7.5	15.3	756.4
7	2	0	0	0	-	10	22	750	7.0	15.7	759.5
7	3	0	0	0	-	10	22	837	7.4	16.3	762.0
7	4	0	0	0	-	10	22	823	7.4	15.2	759.1
10	1	0	0	56	U	10	22	1368	6.9	14.3	754.7
10	2	0	0	56	U	10	22	1791	6.8	15.1	759.6
10	3	0	0	56	U	10	22	1869	6.8	14.8	755.5
10	4	0	0	56	U	10	22	2487	7.9	13.6	762.4
11	1	0	28	28	U	10	22	2205	6.8	14.2	771.4
11	2	0	28	28	U	10	22	2259	7.3	14.6	764.5
11	3	0	28	28	U	10	22	2702	8.1	13.4	770.9
11	4	0	28	28	U	10	22	2188	7.2	14.2	758.2
12	1	0	28	28	AC	10	22	2336	7.2	15.8	756.2
12	2	0	28	28	AC	10	22	2521	7.2	16.0	757.6
12	3	0	28	28	AC	10	22	2346	7.2	15.8	754.4
12	4	0	28	28	AC	10	22	2390	7.2	15.2	753.1

APPENDIX H continued

MARTIN (Mn84) continued

Trt	Rep	---N Timing--- SS	SD	SC	N Source	P	S	Yield	Prot.	300 Ker. wt	Test wt
		---kg	ha^{-1}	----		---kg	ha^{-1}	----	%	g	kg m^{-3}
13	1	0	28	28	AS	10	22	2084	7.0	14.6	762.5
13	2	0	28	28	AS	10	22	2716	8.2	13.9	765.3
13	3	0	28	28	AS	10	22	2151	6.9	14.5	752.6
13	4	0	28	28	AS	10	22	2390	7.4	13.7	760.9
14	1	0	112	0	UP	16	22	2759	11.2	11.6	750.6
14	2	0	112	0	UP	16	22	2837	11.4	10.5	730.4
14	3	0	112	0	UP	16	22	2793	11.8	10.8	732.8
14	4	0	112	0	UP	16	22	2551	12.2	10.5	740.9
15	1	0	112	0	U	16	22	2944	11.9	10.6	731.1
15	2	0	112	0	U	16	22	2366	12.1	9.9	704.1
15	3	0	112	0	U	16	22	2645	11.7	10.2	722.9
15	4	0	112	0	U	16	22	3781	12.9	13.2	741.7

APPENDIX H continued

FEIST (F85)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg	ha^{-1}	----	%	g	kg m^{-3}
1	1	0	0	0	-	10	22	3018	7.7	13.1	736.2
1	2	0	0	0	-	10	22	4096	6.9	13.9	739.6
1	3	0	0	0	-	10	22	2105	7.5	13.7	735.1
1	4	0	0	0	-	10	22	3182	6.8	13.3	731.7
2	1	0	56	0	U	10	22	3698	9.6	12.3	742.3
2	2	0	56	0	U	10	22	4939	8.2	13.9	741.6
2	3	0	56	0	U	10	22	3712	9.2	14.5	753.4
2	4	0	56	0	U	10	22	4357	8.3	12.9	740.1
3	1	0	112	0	U	10	22	4220	10.5	10.2	711.8
3	2	0	112	0	U	10	22	5047	9.6	12.2	752.7
3	3	0	112	0	U	10	22	4985	9.5	12.5	765.6
3	4	0	112	0	U	10	22	4936	9.6	12.7	744.9
4	1	0	168	0	U	10	22	3311	11.9	10.3	719.2
4	2	0	168	0	U	10	22	6171	10.2	13.3	748.9
4	3	0	168	0	U	10	22	3856	10.9	11.3	739.4
4	4	0	168	0	U	10	22	3306	11.2	10.3	746.0
5	1	0	224	0	U	10	22	3824	12.1	10.9	709.2
5	2	0	224	0	U	10	22	3878	12.0	10.9	730.9
5	3	0	224	0	U	10	22	4469	11.3	12.6	753.7
5	4	0	224	0	U	10	22	5765	11.6	10.8	740.2
6	1	0	280	0	U	10	22	4117	12.8	11.5	689.1
6	2	0	280	0	U	10	22	5186	12.2	11.6	703.6
6	3	0	280	0	U	10	22	3366	11.9	13.2	736.2
6	4	0	280	0	U	10	22	3658	12.6	11.8	707.3
7	1	0	0	112	U	10	22	3592	8.7	13.4	746.4
7	2	0	0	112	U	10	22	3268	8.8	14.1	750.8
7	3	0	0	112	U	10	22	3276	9.5	14.9	762.6
7	4	0	0	112	U	10	22	3983	8.5	14.0	757.5
8	1	56	0	56	U	10	22	2822	11.0	13.7	758.3
8	2	56	0	56	U	10	22	5909	9.0	14.2	749.2
8	3	56	0	56	U	10	22	4288	9.4	13.6	752.4
8	4	56	0	56	U	10	22	4072	9.4	13.3	739.0
9	1	112	0	0	U	10	22	4808	10.3	13.0	730.6
9	2	112	0	0	U	10	22	5837	9.7	13.0	751.8
9	3	112	0	0	U	10	22	4672	9.2	13.3	740.7
9	4	112	0	0	U	10	22	5126	9.6	11.6	749.8
10	1	0	56	56	U	10	22	3957	9.4	12.3	732.2
10	2	0	56	56	U	10	22	4723	8.6	13.6	766.3
10	3	0	56	56	U	10	22	3201	9.5	13.9	759.5
10	4	0	56	56	U	10	22	4751	8.8	13.5	759.9

APPENDIX H continued

FEIST (F85) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	112	0	U	0	22	3349	10.8	12.9	741.0
11	2	0	112	0	U	0	22	3716	9.9	14.3	762.7
11	3	0	112	0	U	0	22	2363	10.8	14.1	760.5
11	4	0	112	0	U	0	22	4749	9.9	13.6	749.6
12	1	0	112	0	U	10	0	4171	10.4	11.6	721.6
12	2	0	112	0	U	10	0	6238	9.2	12.6	750.6
12	3	0	112	0	U	10	0	3977	9.8	13.9	759.7
12	4	0	112	0	U	10	0	4451	9.6	12.6	729.3
13	1	0	56	56	AC	10	22	3310	9.5	12.7	747.8
13	2	0	56	56	AC	10	22	4089	8.4	11.0	733.3
13	3	0	56	56	AC	10	22	3497	9.6	13.8	752.8
13	4	0	56	56	AC	10	22	3223	9.2	14.7	747.8
14	1	0	56	56	AS	10	22	3361	10.0	12.0	735.8
14	2	0	56	56	AS	10	22	4384	8.7	13.3	761.7
14	3	0	56	56	AS	10	22	3629	9.1	11.9	753.7
14	4	0	56	56	AS	10	22	4183	8.6	13.3	730.9
15	1	0	0	0	-	0	0	3023	7.5	13.5	741.2
15	2	0	0	0	-	0	0	3491	6.8	13.7	734.3
15	3	0	0	0	-	0	0	1853	6.9	13.8	733.0
15	4	0	0	0	-	0	0	3509	7.1	13.6	727.2

APPENDIX H continued

GOODWIN (Gn85)

Trt	Rep	---N Timing--- SS	SD	SC	N Source	P	S	Yield	Prot.	300 Ker. wt	Test wt
		---kg	ha^{-1}	----		---kg	ha^{-1}	----	%	g	kg m^{-3}
1	1	0	0	0	-	10	22	1845	6.5	13.4	738.6
1	2	0	0	0	-	10	22	1674	6.6	13.9	742.7
1	3	0	0	0	-	10	22	1771	6.9	13.6	747.2
1	4	0	0	0	-	10	22	1807	6.5	13.4	729.7
2	1	0	56	0	U	10	22	3136	7.1	12.8	733.8
2	2	0	56	0	U	10	22	3276	7.9	12.8	752.9
2	3	0	56	0	U	10	22	3557	7.7	13.5	756.0
2	4	0	56	0	U	10	22	3232	7.3	13.3	752.8
3	1	0	112	0	U	10	22	4501	9.6	12.0	743.4
3	2	0	112	0	U	10	22	4015	9.9	11.9	748.8
3	3	0	112	0	U	10	22	3953	9.9	11.4	748.3
3	4	0	112	0	U	10	22	4139	9.4	12.1	741.0
4	1	0	168	0	U	10	22	3911	11.5	11.2	730.6
4	2	0	168	0	U	10	22	4516	11.3	10.9	728.8
4	3	0	168	0	U	10	22	3737	11.4	11.2	728.2
4	4	0	168	0	U	10	22	4064	11.5	11.1	727.5
5	1	0	196	0	U	10	22	4392	12.3	11.0	725.2
5	2	0	196	0	U	10	22	4183	12.3	11.0	724.5
5	3	0	196	0	U	10	22	4155	11.7	11.6	734.1
5	4	0	196	0	U	10	22	4248	11.6	11.2	727.5
6	1	0	280	0	U	10	22	4957	12.8	10.7	718.8
6	2	0	280	0	U	10	22	3913	13.1	10.6	717.3
6	3	0	280	0	U	10	22	4081	12.6	10.9	708.9
6	4	0	280	0	U	10	22	3966	12.5	11.3	734.4
7	1	0	0	168	U	10	22	4371	10.0	12.7	757.5
7	2	0	0	168	U	10	22	4229	9.9	12.7	752.9
7	3	0	0	168	U	10	22	4667	10.1	12.4	758.5
7	4	0	0	168	U	10	22	4685	9.9	12.7	756.5
8	1	84	0	84	U	10	22	4658	11.4	11.2	723.2
8	2	84	0	84	U	10	22	4349	11.9	11.1	735.1
8	3	84	0	84	U	10	22	4238	11.7	11.3	745.1
8	4	84	0	84	U	10	22	3998	11.4	11.5	730.4
9	1	168	0	0	U	10	22	4665	12.2	11.2	718.8
9	2	168	0	0	U	10	22	4086	12.3	10.8	733.9
9	3	168	0	0	U	10	22	4770	12.3	11.2	736.2
9	4	168	0	0	U	10	22	4722	11.7	11.2	722.7
10	1	0	84	84	U	10	22	4183	10.9	11.8	744.7
10	2	0	84	84	U	10	22	4539	10.6	11.4	745.5
10	3	0	84	84	U	10	22	4087	10.9	10.9	735.7
10	4	0	84	84	U	10	22	4359	10.4	11.7	753.8

APPENDIX H continued

GOODWIN (Gn85) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	168	0	U	0	22	4390	10.9	10.9	737.3
11	2	0	168	0	U	0	22	4286	11.5	10.9	741.3
11	3	0	168	0	U	0	22	4284	11.7	11.2	726.3
11	4	0	168	0	U	0	22	3918	11.4	11.0	727.5
12	1	0	168	0	U	10	0	4155	11.6	13.5	762.7
12	2	0	168	0	U	10	0	4259	11.6	13.3	764.6
12	3	0	168	0	U	10	0	3555	11.7	13.9	768.8
12	4	0	168	0	U	10	0	3543	11.7	13.3	760.3
13	1	0	84	84	AC	10	22	4694	10.3	13.0	752.9
13	2	0	84	84	AC	10	22	4609	10.1	12.1	738.6
13	3	0	84	84	AC	10	22	4679	9.5	12.8	754.3
13	4	0	84	84	AC	10	22	4627	10.2	12.4	754.5
14	1	0	84	84	AS	10	22	4258	10.7	10.9	748.1
14	2	0	84	84	AS	10	22	4224	10.2	11.5	737.5
14	3	0	84	84	AS	10	22	4433	10.4	11.0	722.7
14	4	0	84	84	AS	10	22	4380	10.4	11.2	736.1
15	1	0	0	0	-	0	0	1538	6.8	12.6	729.4
15	2	0	0	0	-	0	0	1805	6.8	13.5	731.2
15	3	0	0	0	-	0	0	1544	6.6	13.4	734.4
15	4	0	0	0	-	0	0	1532	6.7	13.5	732.4

APPENDIX H continued

KASEBERG (K85)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	10	22	3671	12.6	13.9	771.2
1	2	0	0	0	-	10	22	3091	12.8	13.0	772.2
1	3	0	0	0	-	10	22	3779	9.7	14.5	780.8
1	4	0	0	0	-	10	22	2395	10.4	15.6	783.1
2	1	0	56	0	U	10	22	2902	13.4	12.7	766.9
2	2	0	56	0	U	10	22	3800	11.0	13.5	772.0
2	3	0	56	0	U	10	22	3936	11.2	13.7	776.5
2	4	0	56	0	U	10	22	2738	10.9	14.1	781.0
3	1	0	112	0	U	10	22	2830	14.1	12.3	757.9
3	2	0	112	0	U	10	22	3558	12.0	12.8	768.2
3	3	0	112	0	U	10	22	3898	12.1	12.5	766.4
3	4	0	112	0	U	10	22	2698	12.6	12.8	762.2
4	1	0	168	0	U	10	22	3431	13.6	13.0	745.4
4	2	0	168	0	U	10	22	3118	13.4	11.7	717.1
4	3	0	168	0	U	10	22	3418	13.2	12.4	760.3
4	4	0	168	0	U	10	22	3536	12.8	12.6	770.9
5	1	0	224	0	U	10	22	2866	13.9	11.7	715.6
5	2	0	224	0	U	10	22	3661	13.2	12.0	710.0
5	3	0	224	0	U	10	22	3410	13.2	13.0	756.3
5	4	0	224	0	U	10	22	2343	13.6	12.1	755.8
6	1	0	280	0	U	10	22	2989	13.8	12.6	746.6
6	2	0	280	0	U	10	22	3681	13.3	12.8	749.7
6	3	0	280	0	U	10	22	3780	13.6	12.3	741.0
6	4	0	280	0	U	10	22	2624	13.6	12.3	735.4
7	1	0	0	112	U	10	22	2823	13.0	11.9	746.0
7	2	0	0	112	U	10	22	3449	13.0	13.4	767.4
7	3	0	0	112	U	10	22	1743	13.2	15.6	792.2
7	4	0	0	112	U	10	22	2369	12.3	15.0	792.2
8	1	56	0	56	U	10	22	3353	12.7	12.5	744.3
8	2	56	0	56	U	10	22	3467	13.2	12.2	750.9
8	3	56	0	56	U	10	22	4148	11.6	14.0	775.7
8	4	56	0	56	U	10	22	2685	11.6	13.2	774.1
9	1	112	0	0	U	10	22	3132	13.5	12.8	767.1
9	2	112	0	0	U	10	22	3227	13.2	12.4	741.9
9	3	112	0	0	U	10	22	2640	12.0	13.7	775.8
9	4	112	0	0	U	10	22	2679	12.7	12.6	747.1
10	1	0	56	56	U	10	22	3362	13.2	12.8	749.4
10	2	0	56	56	U	10	22	3098	13.2	12.8	740.9
10	3	0	56	56	U	10	22	2451	13.2	14.0	778.3
10	4	0	56	56	U	10	22	2956	11.3	13.8	777.3

APPENDIX H continued

KASEBERG (K85) continued

		---N Timing---									
Trt	Rep	SS	SD	SC	N Source	P	S	Yield	Prot.	300 Ker. wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	112	0	U	0	22	3404	13.5	12.5	772.0
11	2	0	112	0	U	0	22	3184	13.4	12.2	750.0
11	3	0	112	0	U	0	22	4160	12.2	12.1	770.1
11	4	0	112	0	U	0	22	2859	11.7	13.2	772.5
12	1	0	112	0	U	10	0	3310	13.6	13.6	774.9
12	2	0	112	0	U	10	0	3548	13.2	13.5	770.6
12	3	0	112	0	U	10	0	4328	12.3	12.6	761.7
12	4	0	112	0	U	10	0	2519	12.6	14.0	783.8
13	1	0	56	56	AC	10	22	2884	12.8	13.9	764.0
13	2	0	56	56	AC	10	22	2859	12.6	11.2	734.4
13	3	0	56	56	AC	10	22	2809	12.3	14.9	777.0
13	4	0	56	56	AC	10	22	2727	10.9	14.4	777.0
14	1	0	56	56	AS	10	22	3103	13.7	13.0	763.0
14	2	0	56	56	AS	10	22	4289	11.2	12.7	765.9
14	3	0	56	56	AS	10	22	2800	10.9	14.1	775.1
14	4	0	56	56	AS	10	22	2997	11.6	14.1	786.0
15	1	0	0	0	-	0	0	3543	11.9	13.8	769.6
15	2	0	0	0	-	0	0	3402	12.5	13.9	776.3
15	3	0	0	0	-	0	0	2268	9.7	15.7	785.7
15	4	0	0	0	-	0	0	1611	9.6	15.8	785.0

APPENDIX H continued

ANDERSON (A85SF)

										300	
		---N Timing---			N					Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	10	22	1494	6.3	13.7	715.2
1	2	0	0	0	-	10	22	1940	5.7	13.3	712.5
1	3	0	0	0	-	10	22	1682	5.9	13.1	733.7
1	4	0	0	0	-	10	22	2022	5.9	12.8	725.0
2	1	0	28	0	U	10	22	2192	6.2	13.1	717.4
2	2	0	28	0	U	10	22	2583	6.7	11.5	723.6
2	3	0	28	0	U	10	22	2541	7.0	11.1	727.2
2	4	0	28	0	U	10	22	2705	7.0	11.6	724.1
3	1	0	56	0	U	10	22	2895	7.0	12.3	720.1
3	2	0	56	0	U	10	22	3009	7.8	11.1	729.6
3	3	0	56	0	U	10	22	2671	8.9	10.0	717.2
3	4	0	56	0	U	10	22	3027	8.5	10.0	715.9
4	1	0	84	0	U	10	22	3309	8.1	11.5	717.2
4	2	0	84	0	U	10	22	3255	8.6	11.0	708.4
4	3	0	84	0	U	10	22	2596	11.1	8.7	698.3
4	4	0	84	0	U	10	22	2920	9.9	9.5	710.5
5	1	0	112	0	U	10	22	2508	10.9	8.6	659.9
5	2	0	112	0	U	10	22	2545	11.4	8.5	663.9
5	3	0	112	0	U	10	22	2876	12.1	8.4	673.4
5	4	0	112	0	U	10	22	2270	12.1	9.2	671.9
6	1	0	125	0	U	10	22	2240	12.6	7.5	622.9
6	2	0	125	0	U	10	22	2944	12.7	8.5	648.8
6	3	0	125	0	U	10	22	2810	12.3	8.4	642.1
6	4	0	125	0	U	10	22	2212	13.0	8.4	651.4
7	1	0	0	56	U	10	22	2016	6.6	13.3	726.0
7	2	0	0	56	U	10	22	2492	7.0	12.7	738.3
7	3	0	0	56	U	10	22	2929	6.7	12.8	733.8
7	4	0	0	56	U	10	22	2661	7.1	12.1	732.1
8	1	28	0	28	U	10	22	3174	6.3	13.5	729.8
8	2	28	0	28	U	10	22	3132	7.1	12.5	731.0
8	3	28	0	28	U	10	22	2501	8.3	10.5	733.4
8	4	28	0	28	U	10	22	3044	7.6	11.5	739.3
9	1	56	0	0	U	10	22	2795	7.2	11.3	721.6
9	2	56	0	0	U	10	22	3359	7.3	11.1	729.0
9	3	56	0	0	U	10	22	3200	7.3	11.6	728.9
9	4	56	0	0	U	10	22	3321	7.7	10.8	713.0
10	1	0	28	28	U	10	22	2735	6.7	12.8	723.7
10	2	0	28	28	U	10	22	3017	6.6	12.8	720.3
10	3	0	28	28	U	10	22	2864	7.3	11.4	730.2
10	4	0	28	28	U	10	22	2877	7.5	12.1	738.0

APPENDIX H continued

ANDERSON (A85SF) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	56	0	U	0	22	2784	7.0	12.7	722.4
11	2	0	56	0	U	0	22	2452	8.5	10.5	712.4
11	3	0	56	0	U	0	22	2593	9.2	10.6	715.5
11	4	0	56	0	U	0	22	3166	8.2	11.1	721.1
12	1	0	56	0	U	10	0	3002	7.4	12.4	733.8
12	2	0	56	0	U	10	0	3071	8.0	12.4	743.6
12	3	0	56	0	U	10	0	2635	9.1	11.3	746.7
12	4	0	56	0	U	10	0	3288	8.4	11.2	739.4
13	1	0	28	28	AC	10	22	2731	6.7	13.6	728.0
13	2	0	28	28	AC	10	22	2777	6.7	12.8	731.4
13	3	0	28	28	AC	10	22	3595	6.7	13.3	734.9
13	4	0	28	28	AC	10	22	3586	6.5	13.0	724.1
14	1	0	28	28	AS	10	22	2663	6.4	12.8	731.0
14	2	0	28	28	AS	10	22	2659	7.2	11.8	737.3
14	3	0	28	28	AS	10	22	3294	7.0	11.7	725.9
14	4	0	28	28	AS	10	22	3056	7.5	11.3	737.3
15	1	0	0	0	-	0	0	1386	6.4	14.0	731.3
15	2	0	0	0	-	0	0	1800	6.0	13.8	726.5
15	3	0	0	0	-	0	0	1660	6.1	13.1	724.6
15	4	0	0	0	-	0	0	1912	6.0	13.5	731.4

APPENDIX H continued

MALEY (My85)

										300	
		---N Timing---			N					Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	10	22	2235	7.2	13.9	735.4
1	2	0	0	0	-	10	22	2126	7.4	14.1	727.6
1	3	0	0	0	-	10	22	2270	8.5	13.8	691.6
1	4	0	0	0	-	10	22	2215	8.2	14.2	733.7
2	1	0	28	0	U	10	22	2171	8.6	12.0	722.3
2	2	0	28	0	U	10	22	3014	8.4	14.6	720.8
2	3	0	28	0	U	10	22	3389	8.4	14.8	738.5
2	4	0	28	0	U	10	22	2896	8.1	14.1	734.5
3	1	0	56	0	U	10	22	2702	10.4	11.8	693.5
3	2	0	56	0	U	10	22	2687	9.7	12.9	703.1
3	3	0	56	0	U	10	22	3695	9.2	13.5	724.7
3	4	0	56	0	U	10	22	3483	8.8	12.2	714.5
4	1	0	84	0	U	10	22	2276	12.5	10.0	645.7
4	2	0	84	0	U	10	22	2833	10.6	11.1	683.6
4	3	0	84	0	U	10	22	3537	10.4	13.6	705.1
4	4	0	84	0	U	10	22	3156	10.8	12.9	707.7
5	1	0	112	0	U	10	22	2185	13.4	9.5	636.0
5	2	0	112	0	U	10	22	2294	13.3	9.6	634.3
5	3	0	112	0	U	10	22	3714	10.8	12.9	719.0
5	4	0	112	0	U	10	22	3470	10.3	12.3	686.7
6	1	0	125	0	U	10	22	2273	13.9	9.1	627.0
6	2	0	125	0	U	10	22	3165	12.6	10.6	632.8
6	3	0	125	0	U	10	22	3142	12.2	11.5	686.1
6	4	0	125	0	U	10	22	4166	11.2	12.9	698.5
7	1	0	0	56	U	10	22	2652	9.9	12.8	725.1
7	2	0	0	56	U	10	22	2539	9.8	12.6	707.1
7	3	0	0	56	U	10	22	2281	9.1	13.2	732.5
7	4	0	0	56	U	10	22	3077	8.4	13.8	735.9
8	1	28	0	28	U	10	22	2442	9.3	12.2	731.5
8	2	28	0	28	U	10	22	2821	8.8	12.9	717.9
8	3	28	0	28	U	10	22	3143	9.0	13.9	720.7
8	4	28	0	28	U	10	22	3325	7.8	13.9	725.5
9	1	56	0	0	U	10	22	2631	11.3	11.3	689.1
9	2	56	0	0	U	10	22	2869	10.0	10.2	675.7
9	3	56	0	0	U	10	22	3015	10.0	13.4	723.8
9	4	56	0	0	U	10	22	3048	10.4	13.5	724.3
10	1	0	28	28	U	10	22	2951	9.8	12.2	724.8
10	2	0	28	28	U	10	22	2367	9.9	12.3	707.0
10	3	0	28	28	U	10	22	2822	9.4	14.1	731.7
10	4	0	28	28	U	10	22	3443	8.2	14.1	734.3

APPENDIX H continued

MALEY (My85) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg	ha^{-1}	----		---kg	ha^{-1}	----	%	g	kg m^{-3}
11	1	0	56	0	U	0	22	2436	10.5	11.7	684.2
11	2	0	56	0	U	0	22	2278	11.0	11.1	669.7
11	3	0	56	0	U	0	22	3126	9.9	13.1	731.8
11	4	0	56	0	U	0	22	2831	10.1	13.2	720.9
12	1	0	56	0	U	10	0	2536	10.5	12.1	726.1
12	2	0	56	0	U	10	0	2713	10.3	12.5	704.9
12	3	0	56	0	U	10	0	3649	9.8	13.7	726.4
12	4	0	56	0	U	10	0	3516	9.7	14.6	745.4
13	1	0	28	28	AC	10	22	2633	9.0	13.6	740.5
13	2	0	28	28	AC	10	22	2633	9.4	12.9	710.0
13	3	0	28	28	AC	10	22	2873	9.3	14.1	742.3
13	4	0	28	28	AC	10	22	2762	9.2	14.6	747.3
14	1	0	28	28	AS	10	22	2618	9.5	12.0	722.0
14	2	0	28	28	AS	10	22	2851	9.1	13.1	727.4
14	3	0	28	28	AS	10	22	2388	9.6	12.4	720.7
14	4	0	28	28	AS	10	22	2800	9.4	13.5	738.3
15	1	0	0	0	-	0	0	2007	7.6	14.0	738.3
15	2	0	0	0	-	0	0	2110	7.5	14.5	737.4
15	3	0	0	0	-	0	0	2556	8.5	14.2	739.0
15	4	0	0	0	-	0	0	2047	7.5	14.0	728.5

APPENDIX H continued

SMOUSE (Sm85)

Trt	Rep	---N Timing--- SS	SD	SC	N Source	P	S	Yield	Prot.	300 Ker. wt	Test wt
		---kg	ha^{-1}	----		---kg	ha-^{1}	----	%	g	kg m-^{3}
1	1	0	0	0	-	10	22	3120	7.8	15.0	760.6
1	2	0	0	0	-	10	22	2627	7.3	15.4	766.1
1	3	0	0	0	-	10	22	2755	6.8	15.6	765.0
1	4	0	0	0	-	10	22	2965	6.8	15.5	761.6
2	1	0	28	0	U	10	22	3529	8.8	14.0	783.5
2	2	0	28	0	U	10	22	3398	7.9	15.0	764.9
2	3	0	28	0	U	10	22	3235	7.6	14.9	768.3
2	4	0	28	0	U	10	22	3551	7.6	14.3	765.6
3	1	0	56	0	U	10	22	4029	9.1	14.0	773.5
3	2	0	56	0	U	10	22	4046	9.1	14.0	775.4
3	3	0	56	0	U	10	22	3547	8.5	13.8	771.4
3	4	0	56	0	U	10	22	3812	8.7	14.4	769.3
4	1	0	84	0	U	10	22	3644	10.6	12.4	762.7
4	2	0	84	0	U	10	22	4189	9.8	13.3	771.3
4	3	0	84	0	U	10	22	4323	10.5	12.7	766.4
4	4	0	84	0	U	10	22	3921	10.2	13.1	768.7
5	1	0	112	0	U	10	22	3955	10.8	12.8	765.5
5	2	0	112	0	U	10	22	3860	10.9	12.9	761.5
5	3	0	112	0	U	10	22	3574	11.0	12.9	761.4
5	4	0	112	0	U	10	22	4207	10.2	13.1	765.0
6	1	0	125	0	U	10	22	4107	11.8	11.9	748.4
6	2	0	125	0	U	10	22	4204	11.6	12.2	748.1
6	3	0	125	0	U	10	22	3969	11.3	12.9	757.7
6	4	0	125	0	U	10	22	3979	11.6	12.3	745.7
7	1	0	0	56	U	10	22	3585	7.6	15.2	764.7
7	2	0	0	56	U	10	22	3384	7.3	15.4	769.4
7	3	0	0	56	U	10	22	2965	6.9	15.5	770.6
7	4	0	0	56	U	10	22	3307	7.3	15.1	761.1
8	1	28	0	28	U	10	22	3859	8.6	14.2	776.8
8	2	28	0	28	U	10	22	3820	8.3	14.9	779.4
8	3	28	0	28	U	10	22	3836	7.7	14.7	781.8
8	4	28	0	28	U	10	22	3130	7.7	15.2	769.1
9	1	56	0	0	U	10	22	3996	8.6	14.2	785.2
9	2	56	0	0	U	10	22	3845	8.6	14.4	772.2
9	3	56	0	0	U	10	22	3731	8.5	14.5	776.2
9	4	56	0	0	U	10	22	3609	8.5	13.7	776.7
10	1	0	28	28	U	10	22	3851	9.2	14.1	784.7
10	2	0	28	28	U	10	22	3714	7.7	14.9	780.7
10	3	0	28	28	U	10	22	3778	8.2	14.5	772.2
10	4	0	28	28	U	10	22	3649	7.8	14.7	777.9

APPENDIX H continued

SMOUSE (Sm85) continued

										300	
		---N Timing---			N					Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
11	1	0	56	0	U	0	22	3944	8.9	14.8	779.0
11	2	0	56	0	U	0	22	3571	9.3	14.1	780.2
11	3	0	56	0	U	0	22	3664	8.9	14.3	791.3
11	4	0	56	0	U	0	22	3478	9.2	14.6	777.3
12	1	0	56	0	U	10	0	3892	8.7	14.5	781.0
12	2	0	56	0	U	10	0	3935	9.1	14.1	780.9
12	3	0	56	0	U	10	0	3702	9.4	14.0	779.6
12	4	0	56	0	U	10	0	3952	8.9	14.0	782.0
13	1	0	28	28	AC	10	22	3569	8.5	15.0	790.3
13	2	0	28	28	AC	10	22	3702	7.9	15.1	777.5
13	3	0	28	28	AC	10	22	3202	7.5	15.1	766.2
13	4	0	28	28	AC	10	22	3593	7.8	15.2	783.9
14	1	0	28	28	AS	10	22	3614	8.9	14.0	777.5
14	2	0	28	28	AS	10	22	3515	7.9	14.7	770.9
14	3	0	28	28	AS	10	22	3529	7.7	14.2	762.9
14	4	0	28	28	AS	10	22	3470	7.8	15.1	765.9
15	1	0	0	0	-	0	0	1712	7.1	15.1	756.3
15	2	0	0	0	-	0	0	2992	7.9	15.2	776.3
15	3	0	0	0	-	0	0	2019	6.8	15.3	761.5
15	4	0	0	0	-	0	0	2762	7.2	15.4	754.3

APPENDIX H continued

ANDERSON (A85RC)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	10	22	397	7.1	12.7	716.7
1	2	0	0	0	-	10	22	410	7.1	11.7	722.2
1	3	0	0	0	-	10	22	480	7.1	12.5	712.1
1	4	0	0	0	-	10	22	563	7.1	12.4	718.0
2	1	0	28	0	U	10	22	1127	8.9	10.2	721.1
2	2	0	28	0	U	10	22	841	9.5	11.4	726.7
2	3	0	28	0	U	10	22	1208	9.3	10.8	729.8
2	4	0	28	0	U	10	22	1114	10.1	8.1	716.0
3	1	0	56	0	U	10	22	1101	11.7	10.3	702.9
3	2	0	56	0	U	10	22	1056	11.6	9.8	699.0
3	3	0	56	0	U	10	22	1102	12.3	8.9	676.1
3	4	0	56	0	U	10	22	1081	12.2	9.3	677.6
4	1	0	84	0	U	10	22	1009	14.6	8.5	651.4
4	2	0	84	0	U	10	22	1190	13.5	10.7	637.0
4	3	0	84	0	U	10	22	691	15.2	9.2	679.3
4	4	0	84	0	U	10	22	1362	14.6	7.6	640.0
5	1	0	112	0	U	10	22	661	14.4	9.0	660.7
5	2	0	112	0	U	10	22	881	15.3	8.2	657.5
5	3	0	112	0	U	10	22	1069	15.1	7.7	645.8
5	4	0	112	0	U	10	22	1503	14.2	7.3	626.0
6	1	0	125	0	U	10	22	627	15.0	8.7	654.1
6	2	0	125	0	U	10	22	1059	14.9	7.8	633.7
6	3	0	125	0	U	10	22	1335	14.6	7.4	610.3
6	4	0	125	0	U	10	22	1073	15.3	7.6	625.7
7	1	0	0	56	U	10	22	413	9.7	11.1	739.4
7	2	0	0	56	U	10	22	649	9.4	12.0	741.9
7	3	0	0	56	U	10	22	960	8.0	12.5	736.5
7	4	0	0	56	U	10	22	926	9.1	11.1	719.6
10	1	0	28	28	U	10	22	973	10.7	10.4	711.5
10	2	0	28	28	U	10	22	764	12.4	10.4	714.9
10	3	0	28	28	U	10	22	1154	9.3	10.8	723.8
10	4	0	28	28	U	10	22	905	11.8	9.9	724.8
11	1	0	56	0	U	0	22	716	13.0	9.4	685.3
11	2	0	56	0	U	0	22	967	13.0	8.4	649.0
11	3	0	56	0	U	0	22	1149	12.7	8.9	681.8
11	4	0	56	0	U	0	22	1386	11.7	9.3	675.0
12	1	0	56	0	U	10	0	566	11.5	11.1	714.7
12	2	0	56	0	U	10	0	753	12.5	11.6	719.7
12	3	0	56	0	U	10	0	698	12.3	11.5	718.0
12	4	0	56	0	U	10	0	829	11.7	12.9	718.9

APPENDIX H continued

ANDERSON (A85RC) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg	ha^{-1}	----		---kg	ha-^{1}	----	%	g	kg m-^{3}
13	1	0	28	28	AC	10	22	1127	8.8	11.3	722.8
13	2	0	28	28	AC	10	22	972	10.6	10.6	706.8
13	3	0	28	28	AC	10	22	1542	7.9	12.2	731.4
13	4	0	28	28	AC	10	22	1590	8.2	12.5	743.6
14	1	0	28	28	AS	10	22	856	10.3	10.2	702.0
14	2	0	28	28	AS	10	22	1081	9.7	10.4	722.3
14	3	0	28	28	AS	10	22	1635	8.0	11.8	714.1
14	4	0	28	28	AS	10	22	962	10.1	11.4	677.6
15	1	0	0	0	-	0	0	324	7.1	11.2	735.8
15	2	0	0	0	-	0	0	327	7.3	12.3	729.5
15	3	0	0	0	-	0	0	407	7.4	12.7	700.4
15	4	0	0	0	-	0	0	528	7.2	11.4	713.7

APPENDIX H continued

MARTIN (Mn85)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
1	1	0	0	0	-	10	22	543	7.4	13.9	739.2
1	2	0	0	0	-	10	22	603	7.3	13.8	746.6
1	3	0	0	0	-	10	22	595	7.3	13.9	741.7
1	4	0	0	0	-	10	22	511	7.8	13.8	751.6
2	1	0	28	0	U	10	22	1203	9.2	11.8	750.8
2	2	0	28	0	U	10	22	1213	8.0	12.1	744.9
2	3	0	28	0	U	10	22	1288	8.2	11.5	745.1
2	4	0	28	0	U	10	22	1096	8.3	11.8	753.4
3	1	0	56	0	U	10	22	1610	11.6	10.5	730.3
3	2	0	56	0	U	10	22	1276	11.0	10.2	734.1
3	3	0	56	0	U	10	22	1775	9.7	10.8	735.4
3	4	0	56	0	U	10	22	1557	10.7	10.4	731.4
4	1	0	84	0	U	10	22	1389	13.9	8.9	712.1
4	2	0	84	0	U	10	22	1223	14.8	9.2	718.2
4	3	0	84	0	U	10	22	1456	12.5	9.2	708.8
4	4	0	84	0	U	10	22	1311	13.2	8.9	686.4
5	1	0	112	0	U	10	22	1426	15.0	8.6	680.0
5	2	0	112	0	U	10	22	1293	15.9	8.5	690.4
5	3	0	112	0	U	10	22	1319	13.8	9.1	691.8
5	4	0	112	0	U	10	22	1356	14.9	9.1	701.2
6	1	0	125	0	U	10	22	1186	16.7	8.2	672.9
6	2	0	125	0	U	10	22	1267	16.0	8.1	686.9
6	3	0	125	0	U	10	22	1251	14.8	8.7	675.1
6	4	0	125	0	U	10	22	1295	15.5	8.5	674.6
7	1	0	0	56	U	10	22	958	8.9	13.5	750.4
7	2	0	0	56	U	10	22	744	8.7	14.0	754.7
7	3	0	0	56	U	10	22	672	8.7	14.1	765.2
7	4	0	0	56	U	10	22	770	8.6	14.4	770.5
10	1	0	28	28	U	10	22	1490	8.8	11.9	759.3
10	2	0	28	28	U	10	22	1235	9.7	11.1	759.0
10	3	0	28	28	U	10	22	1343	9.5	11.6	755.5
10	4	0	28	28	U	10	22	1301	9.5	11.5	753.0
11	1	0	56	0	U	0	22	1578	9.8	10.7	723.0
11	2	0	56	0	U	0	22	1400	13.0	9.1	686.6
11	3	0	56	0	U	0	22	1214	11.0	10.4	717.5
11	4	0	56	0	U	0	22	1466	11.2	9.4	697.5
12	1	0	56	0	U	10	0	1340	13.7	8.8	643.2
12	2	0	56	0	U	10	0	1321	12.1	9.8	673.6
12	3	0	56	0	U	10	0	1429	11.6	9.6	662.0
12	4	0	56	0	U	10	0	1361	12.4	9.7	677.0

APPENDIX H continued

MARTIN (Mn85) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg	ha^{-1}	----		---kg	ha^{-1}	----	%	g	kg m^{-3}
13	1	0	28	28	AC	10	22	1181	8.2	12.5	749.5
13	2	0	28	28	AC	10	22	1526	8.2	12.3	756.1
13	3	0	28	28	AC	10	22	1329	8.2	12.6	757.4
13	4	0	28	28	AC	10	22	1172	8.4	12.1	754.2
14	1	0	28	28	AS	10	22	989	9.4	11.6	759.5
14	2	0	28	28	AS	10	22	1469	9.9	11.4	756.6
14	3	0	28	28	AS	10	22	1285	8.8	11.9	750.9
14	4	0	28	28	AS	10	22	996	8.6	12.3	749.5
15	1	0	0	0	-	0	0	662	7.3	13.7	733.5
15	2	0	0	0	-	0	0	606	7.4	13.3	737.5
15	3	0	0	0	-	0	0	452	7.8	14.0	749.0
15	4	0	0	0	-	0	0	569	7.9	14.0	753.5

APPENDIX H continued

NEWTSON (N85)

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg	ha^{-1}	----		---kg	ha^{-1}	----	%	g	kg m^{-3}
1	1	0	0	0	-	10	22	769	8.2	12.4	730.8
1	2	0	0	0	-	10	22	968	8.2	13.1	748.7
1	3	0	0	0	-	10	22	1382	10.5	11.8	742.4
1	4	0	0	0	-	10	22	1304	10.2	12.1	753.6
2	1	0	28	0	U	10	22	1792	8.1	13.3	748.4
2	2	0	28	0	U	10	22	1323	10.1	11.8	734.6
2	3	0	28	0	U	10	22	1867	11.8	11.5	731.6
2	4	0	28	0	U	10	22	1683	10.6	12.1	760.5
3	1	0	56	0	U	10	22	1633	11.1	11.4	727.2
3	2	0	56	0	U	10	22	2019	9.6	12.5	734.1
3	3	0	56	0	U	10	22	1287	11.9	10.7	717.9
3	4	0	56	0	U	10	22	1970	8.7	12.6	741.8
4	1	0	84	0	U	10	22	2657	11.1	11.6	735.5
4	2	0	84	0	U	10	22	2440	10.0	12.5	759.3
4	3	0	84	0	U	10	22	1580	11.9	10.6	707.7
4	4	0	84	0	U	10	22	1730	11.6	11.4	730.4
5	1	0	112	0	U	10	22	3097	10.8	12.7	727.7
5	2	0	112	0	U	10	22	2110	12.0	12.2	715.9
5	3	0	112	0	U	10	22	2015	10.8	12.3	715.9
5	4	0	112	0	U	10	22	3756	10.0	12.9	718.0
6	1	0	125	0	U	10	22	2606	12.3	10.4	691.1
6	2	0	125	0	U	10	22	2761	12.0	12.8	721.1
6	3	0	125	0	U	10	22	2588	10.6	13.0	722.3
6	4	0	125	0	U	10	22	2753	11.5	11.8	703.7
7	1	0	0	56	U	10	22	1326	10.6	12.8	730.9
7	2	0	0	56	U	10	22	1831	10.2	13.3	765.8
7	3	0	0	56	U	10	22	1303	10.8	13.2	734.9
7	4	0	0	56	U	10	22	1847	10.8	13.8	757.1
10	1	0	28	28	U	10	22	1538	10.9	12.4	739.1
10	2	0	28	28	U	10	22	2746	9.7	14.6	752.9
10	3	0	28	28	U	10	22	1882	8.7	11.9	739.7
10	4	0	28	28	U	10	22	2053	9.0	13.4	742.3
11	1	0	56	0	U	0	22	1492	10.1	11.7	712.9
11	2	0	56	0	U	0	22	2131	9.1	13.0	738.2
11	3	0	56	0	U	0	22	1502	11.8	12.5	737.2
11	4	0	56	0	U	0	22	1548	11.2	12.0	732.8
12	1	0	56	0	U	10	0	1778	9.7	12.6	720.4
12	2	0	56	0	U	10	0	2451	9.5	14.1	751.0
12	3	0	56	0	U	10	0	1462	12.4	11.4	711.3
12	4	0	56	0	U	10	0	1842	10.1	12.8	750.9

APPENDIX H continued

NEWTSON (N85) continued

		---N Timing---			N					300 Ker.	
Trt	Rep	SS	SD	SC	Source	P	S	Yield	Prot.	wt	Test wt
		---kg ha^{-1}----				---kg ha^{-1}----			%	g	kg m^{-3}
13	1	0	28	28	AC	10	22	2569	8.2	13.8	752.6
13	2	0	28	28	AC	10	22	1965	11.0	12.8	745.3
13	3	0	28	28	AC	10	22	2247	9.4	11.3	740.4
13	4	0	28	28	AC	10	22	2305	8.8	14.2	759.3
14	1	0	28	28	AS	10	22	1647	10.2	12.8	743.2
14	2	0	28	28	AS	10	22	1859	11.1	12.8	745.5
14	3	0	28	28	AS	10	22	2072	8.8	13.9	744.2
14	4	0	28	28	AS	10	22	1644	10.6	13.0	749.2
15	1	0	0	0	-	0	0	1085	8.2	13.8	736.2
15	2	0	0	0	-	0	0	702	7.8	13.3	740.4
15	3	0	0	0	-	0	0	1282	9.2	13.3	742.6
15	4	0	0	0	-	0	0	800	9.2	12.7	744.7