Discussion

Precipitation - the total amount, the distribution and the relative intensities of each rain, has a great effect on soil erosion and water runoff - and also materially affects subsequent corn yields on the two different methods of seedbed preparation. The heavier than normal rainfall of 1959 was more effectively controlled and conserved by deep tillage rather than by the plowing, and this method of soil preparation reduced both soil and water losses and also resulted in a 122 bushel yield of ear corn per acre. The plowed plots (all plots of the experiment are worked on the contour) had a greater runoff and soil loss under the heavy rains of that summer, and yielded 118 bushels of corn per acre.

The growing seasons of 1960, 1961 and 1962 were drier than normal, and although there were some rains resulting in runoff water in 1959, no measured soil loss occurred in any one of these three later years. The drier soil conditions apparently lowered corn yields substantially in comparison to those produced in 1959, and the deeply cultivated plots were less productive where the seed-bed was prepared by plowing. A yield difference of either 14 18 or 11 bushels per acre would be of primary concern to a farmer following such conservation practices. In addition, the corn population on the deeply cultivated plots was generally unsatisfactory, although this effect was largely corrected when the corn yields er acre were calculated.

Conclusion

While nothing definite can be concluded from the results from four years data, it is evident that there was better control of soil moisture under higher rainfall where deep cultivation was used rather than plowing. This better moisture control may have been improved by increasing the water infiltration into the subsoil by working at deeper levels than by normal plowing. Under dry conditions, this may have been detrimental in allowing greater losses of soil moisture to the air under prolonged periods of drier soil conditions. It is possible that cubbing the corn stalks in a field chopper rather than with a stalk cutter will allow preparation of a suitable seed-bed by cultivation to a maximum depth of six inches. This may allow a greater retention of subsoil moisture, which is apparently a critical factor in drier growing seasons.

Comparison of fertilizer materials on spring wheat

A. C. Caldwell and H. W. Kramer

Comparisons of fertilizer materials on wheat were made on three experimental fields in the spring of 1962. All 3 fields were on Fargo-Bearden type soils in the Minnesota Red River Valley. Farms were located near Crookston and East Grand Forks. Fertilizer materials tried included 0-46-0, 27-14-0, and 30-10-0. They were applied on the basis of 30 pounds of P_2O_5 per acre with the wheat at planting time through a fertilizer attachment on the drill. Yields of wheat were secured.

The effects of the different materials are shown in the table. On field 3 there were essentially no effects from fertilizers. The small positive and negative effects are probably not significant. On the other two fields there were yield increases brought about by fertilizer usage, particularly the nitrogen-phosphorus combinations. 30-10-0 might appear to be a bushel or so better than 27-14-0, but this is likely due to the extra nitrogen in 30-10-0, 90 pounds vs. 58. (Fertilizers were applied on the basis of 30 pounds P_2O_5 per acre).

Effect of fertilizer materials on yields of spring wheat (1962).

Treatment[1]	Field 1	Field 2	Field 3
		Yield of wheat, bu/ac	
None	18.7	23.9	28.4
0-46-0	19.1	27.4	26.7
27-14-0	27.6	28.3	29.4
30-10-0	29.4	31.9	26.4

[1]Fertilizers applied on the basis of 30 lbs. P_2O_5 per acre.

CLAY COUNTY BARLEY DEMONSTRATIONS - 1961

O. A. Dællenbach, Curtis Johnson and Merle Halverson

Soil Type: Fargo silty clay loam
pH: 6.8
%).M.: 6.7
Avail. P: 33 (Very High)
Exch. K: 600+ (Very High)

Variety: Traill
Sample size: 12' x 181.5' = 0.05A
(Combine harvested)

	Early	Late
Seeded	4-21-61	5-4-61
Swathed	7-23-61	7-29-61
Combined	8-1-61	8-1-61

(Each measurement is an average of 3 separately harvested samples)

Fertilizer Treatment	Yield, Bu./A.		% Plump Kernels		% Thin Kernels		Bu.Wt.,Lbs./Bu.	
	Early	Late	Early	Late	Early	Late	Early	Late
0+0+0	56.0	55.0	67.7	71.0	2.0	1.3	46.2	46.7
0+30+0	66.5	61.8	39.0	69.3	6.7	2.7	44.7	47.0
0+30+15	56.3	61.8	81.3	75.7	1.0	2.0	47.2	47.0
30+30+0	72.0	77.0	44.6	63.3	4.7	2.0	45.5	47.5
30+30+15	72.8	73.6	71.0	69.3	1.0	2.0	46.8	47.2

The apparent effect of phosphorus was to drastically reduce kernel plumpness on an early seeding, but not on a later seeding. Potassium applied with the phosphorus apparently increased kernel plumpness to its original high level on the early seeding, but showed no substantial effect on the later seeding. These effects are noted both in the absence and presence of fertilizer nitrogen.

These data suggest a possibility that soil conditions peculiar to time of seeding may influence quality responses of barley to row-placed potassium fertilizers, irrespective of soil potassium status.

KITTSON COUNTY BARLEY DEMONSTRATIONS - 1962

Winton Fuglie and Merle Halverson

Soil Type: Fargo clay
% O.M.: 5.5
Avail. P: 19 (Medium)
Exch. K: 600+ (Very High)
Cropping history: 1960 Durum, 50 Bu./A.
1961 Durum, 15 Bu./A.

Variety: Parkland
Seeded: May 27, soil wet and cold
Sample size: 12' x 503' = 0.138A
(Combine harvested)

(Each measurement is an average of 2 separately harvested samples)

Fertilizer Treatment	Yield Bu./A.	% Plump Kernels	% Thin Kernels	Bu. Wt. Lb./Bu.	% Protein in Grain
0+0+0	49.0	41	13.5	42	9.5
0+30+0	45.1	38	13.5	42	10.8
0+30+15	49.6	47	10.5	42	9.9
30+30+0	64.8	49	8.5	44	10.3
30+30+15	57.5	61	6.5	44	10.0

Nitrogen treatments advanced maturity 4 days to one week, apparently increased yield, kernel weight and kernel plumpness, and reduced percentage of thin kernels without affecting bushel weight.

The apparent effect of potassium treatment was to increase percent plump kernels and decrease percent thin kernels without affecting kernel weight. The real effect of potassium upon yield is not clear in this work.

These data are consistent with those obtained in previous demonstration work with respect to effect of potassium on kernel plumpness when barley is seeded early on cold, wet soils. They are indicative only, and constitute no basis for generally recommending the use of potassium on soils testing high in this mineral nutrient. Under many conditions on such soils, however, the addition of 15 lb. K_2O may provide sufficient increases in yield and/or kernel plumpness to more than pay for the relatively small investment .

65
+9
16 bu
30# N

Residual Effect of Fertilizer on First Year Yield of Vernal Alfalfa Following a Decade of Fertilized Alfalfa Production

J. M. MacGregor and R. G. Hanson

Ranger alfalfa was seeded in the spring of 1950 on the Port Byron silt loam of the Soils Unit of the Rosemount Experiment Station, with fertilizer treatments commencing in the fall of 1949. The initial object of the study was to determine the optimum kind, rate, and time of fertilization most effective on the yield, composition and longevity of alfalfa.

Three crops of hay (commencing in 1951) were removed annually from the differentially fertilized plots. In the eleventh year, with thinning alfalfa stands and increasing invasion of grasses and of weeds, after the first cutting of hay was removed, the plots were worked to about an eight inch depth with a spring harrow to kill all vegetation. They were reworked in late August, packed and seeded to Vernal alfalfa (August, 1961) with additional fertilizer.

Two cuttings of alfalfa were removed in 1962 with the residual effect of the ten year fertilizer program being evident on the alfalfa growth during the entire growing season. The following table shows the initial 1951 yields of Ranger alfalfa, the 1962 yields of Vernal alfalfa, and the total hay yields over the twelve year period consisting of 33 cuttings.

The most effective fertilizer treatment (48, 48 tons of hay per acre)over the twelve year cropping period was with initial phosphorus-potassium followed by annual applications. The highest yield of 1962 alfalfa (3.31 tons per acre) occurred where phosphorus alone had been applied and this treatment yielded some ten tons of hay less than the most effective treatment. The greater 1962 yield was the result of more limited alfalfa production over the 1951-61 period due to lack of stand, but when the stand was restored in 1962, the residual effect of the fertilizer phosphorus was evident. The three highest yielding fertilizer treatments over the twelve year period yielded considerably less alfalfa in 1962 than the more productive plots of the previous years.

It is evident that the higher yields obtained over the initial eleven year period was at least partially the result of a better maintenance of the initial Ranger alfalfa stand. As the alfalfa stand became depleted on some treatments over the years, yields decreased. With the establishment of a new alfalfa stand late in 1961, the residual fertility of some of these lower yielding plots resulted in a much greater hay production.

Total Yields - Rosemount Alfalfa - 1951-62

Average of Seven Replications

12 year yield rank	Treatment	(Tons/acre at 15% moisture) 1951	1962	12 year total yield	Increase
29	Check	3.10	2.12	32.31	----
1	300# 0-20-20 SBS + 200# AS	3.96	2.95	48.48	16.17
2	300# 0-20-20 FBS + 200# AF	3.89	2.96	47.71	15.40
3	300# 5-20-20 SBS + 200# AS	4.03	2.92	47.42	15.10
4	1000# 0-20-20 SBS + 200# AS	4.42	3.09	47.10	14.79
5	1000# 0-20-0 SBS + 100# KCl AFC	4.26	3.10	46.82	14.51
6	200# 0-20-20 AS	3.25	3.29	46.59	14.28
7	1000# 0-20-20 SBS + 200# 5-20-20 BS	4.34	2.78	46.20	13.89
8	1000# 0-20-0 SBS + 200# 0-20-20 AS	4.14	2.96	45.52	13.21
9	300# 0-20-20 FBS + 200# BF	3.51	3.28	44.51	12.20
10	200# 0-20-20 AF	3.60	3.06	44.29	11.98
11	1000# 0-20-20 SBS + 200# BS	4.30	2.59	41.64	9.33
12	300# 0-20-20 SBS + 200# BS	3.79	2.81	41.31	9.00
13	1000# 0-20-0 SBS + 200# 0-20-20 BS	3.95	2.58	39.70	7.39
14	300# 0-20-0 SBS + 200# AS	3.77	2.44	39.01	6.70
15	300# 0-20-20 SBS	3.90	2.47	38.11	5.80
16	1000# 0-20-0 SBS + 200# AS	4.04	3.31	38.02	5.71
17	200# 0-20-0 AF	3.83	3.18	37.62	5.31
18	1000# 0-20-20 SBS	4.09	2.37	37.59	5.28
19	200# 0-20-0 AS	3.64	2.86	37.55	5.24
20	300# 0-20-0 FBS + 200# BF	3.68	2.96	36.82	4.51
21	300# 0-20-0 FBS + 200# AF	3.77	2.92	36.59	4.28
22	300# 0-20-20 + Trace elements SBS	3.88	2.52	35.85	3.54
23	300# 5-20-20 SBS + 20# N AS	3.75	2.34	34.96	2.65
24	300# 0-20-0 SBS + 200# BS	3.64	2.05	34.69	2.38
25	300# 0-20-0 FBS	3.61	2.24	34.26	1.95
26	300# 0-20-20 + 20# Boron SBS	3.84	2.41	33.48	1.17
27	1000# 0-20-0 SBS	4.01	2.37	33.05	0.74
28	300# 0-20-20 FBS	3.78	2.34	32.49	0.18
30	300# 5-20-20 SBS	3.82	2.17	32.30	-0.01
31	300# 0-20-0 SBS	3.59	1.81	31.23	-1.08

SBS - Spring before seeding
FBS - Fall before seeding
AFC - Annual first cutting
AS - Annual spring
BS - Biennial spring
AF - Annual fall
BF - Biennial fall

Trace elements - $CuSO_4$ 25#/A; $ZnSO_4$ 25#/A; $MnSO_4$; $FeSO_4$ 25#/A
Borax 20#/A.

1. Only 1 cutting taken in 1961, reseeded to Vernal alfalfa in August of 1961.
2. 2 Cuttings taken in 1962.
3. 3 Cuttings taken in all years 1951-60.

Residual effects of fertilizer on soybeans grown continuously

A. C. Caldwell

An experiment was set up in 1957 to study the effects of P, K and barnyard manure on the yields and plant composition of soybeans. Fifteen treatments were applied with 4 replications. In 1958 through 1962 no fertilizer was applied in order to study the residual effects of the fertilizer applied in 1957.

Yield results are shown in the accompanying table. All treatments with the exception of P and K applied alone at the minimum rate, gave small to moderate increases in yield. Statistical analyses have not been run on these data yet, but at this yield level it is doubtful if a yield difference of less than 2 bushels per acre would be significant.

Yields are lower than in past years. There was evidence of some disease (unidentified), that may be partly responsible for this.

Effect of residual fertilizer on yield of continuous soybeans (Rosemount, 1962).

Treatment $N-P_2O_5-K_2O$ lbs/A	Yield Bu/A	Diff.
0-0-0	12.4	
0-0-20	11.9	-0.5
0-0-80	15.4	3.0
0-0-400	16.7	4.3
0-20-20	18.8	6.4
0-40-40	14.3	1.9
0-60-60	14.3	1.9
0-80-80	16.4	4.0
0-400-400	19.5	7.1
0-400-400 + 6 T* Man.	15.3	2.9
0-20-0	10.7	-1.7
0-80-0	15.9	3.5
0-400-0	14.2	1.8
0-20-0 + 6 T* Man.	13.2	0.8
6 T* Man.	14.8	2.4

*6 T = 6 tons manure/A.

THE EFFECT OF PASTURE FERTILITY AND MANAGEMENT ON BEEF PRODUCTION
Rosemount 1962

P. M. Burson, Soils; A. R. Schmid, Agronomy;
A. L. Harvey and O. E. Kolari, Animal Husbandry

On May 22, 1962, "medium" to "good" grade steers were lotted and turned onto pasture. Prior to 1962 one-half of each pasture was fertilized and the other one-half unfertilized. Beginning in 1962 all of the pasture area was fertilized except for a one rod strip adjacent to the center fence in the original unfertilized area. On this area a basic treatment of 500 lbs. per acre of 0-20-20 is applied at the time of renovation. No other treatment of phosphate and potash will be made until again renovated. On the original fertilized area the usual annual application of 200 lbs. per acre of 0-20-20- was made. Since pastures B and C have not been renovated for several years no treatments of phosphate and potash were made on the old unfertilized areas. On the areas only 120 lbs. of actual N were applied in 1962. On the original fertilized areas the regular 200 lbs. of 0-20-20 was applied with the nitrogen. In all cases the nitrogen was applied as a topdressing at two different times as follows: (1) all in early spring, (2) all in early June, (3) 1/2 early spring and 1/2 in July, and (4) 1/2 early June and 1/2 in July.

The total production of beef per acre ranged from 271 lbs. on the pastures B and C (south) to 301 lbs. on pastures B and C (north) to the maximum on pasture E (renovated) where 396 lbs. of beef was produced per acre.

The carrying capacity as shown by steer-days per acre ranged from 153 on the B and C (north) pasture to 190 on the renovated E pasture. It should be noted that there is a big difference in pastures B and C (north) and B and C (south) in fertility levels, type of soil, the need for lime, the steepness of slopes, the extent to which erosion has previously occurred and the depth of topsoil. On the basis of these soil characteristics pasture B and C (north) could be classes as "fair to good", pasture B and C (south) "poor to fair" while pasture E could be classed as "good to very good".

The production of beef per acre for 1962 seems to reflect these soil differences even though the grazing-management practices were the same on all pastures. Pasture B and C (south) with 120 lbs. of N per acre, produced 271 lbs. of beef per acre as compared to pasture B and C (north) with only 60 lbs. of N produced 301 lbs. of beef to 396 lbs. of beef per acre on pasture E.

These data seem to bear out the principle that more beef per acre, the same as any other agricultural crop, can be produced on those soils that are higher in fertility, even though they are too steep and erosive to use in the production of tillable agricultural crops.

Table 1. Beef produced with yearling steers on fertilized pastures grazed in rotation May 22 to September 5, 1962 (106 days).

Pasture	B & C south 120 # N	B & C north 60# N	E
No. acres	7.2	7.4	7.8
No. steers - started[a]	12	12	16
Ave. initial wt., lbs.	598	604	598
No. steers - finish[b]	4	4	8
Ave. final wt., lbs.	844	812	819
Ave. daily gain, lbs.	1.71	1.97	2.08
Steer-days/acre	159	153	190
Beef produced/acre	271	301	396
Value of beef produced per acre @$23.50 cwt.	$63.69	$70.74	$93.06
Tillage and seed cost/acre			$6.64
Fertilizer and lime cost/acre	$11.05	$6.01	$5.25
Return over lime, fertilizer, seed and tillage costs	$52.64	$64.73	$81.17

[a]All steers implanted with 24 mg. stilbesterol May 22, 1962.
[b]Steers were removed as carrying capacity decreased.
Grade: "medium" to "good" yearling steers.
Fertilizer and lime treatments: 0-40-40 (P, $.09/lb., 20% carry-over; K, $.07/lb., 50% carry-over), nitrogen, 30% carry-over; Lime, all pastures @ 3 tons per acre, cost $.97 per acre per year over a 10 year period.
E pasture: Renovated in 1960-61.

Acknowledgement is due Ed Bonnell, Earl Stevermer and David Kill for field assistance on the project.

Fertilizer Experiments on Park Kentucky Bluegrass Seed Production in Roseau County

P. M. Burson, J. M. MacGregor, & H. W. Kramer

Park Kentucky Bluegrass seed is produced on both organic and mineral soils of Roseau County. The effect of fertilizer on seed production on such soils has now been studied for three years.

A. Fertilization of organic (peat) soils.

Two experimental fields were selected during the summer of 1959, and the first fertilizer treatments were made in that autumn and comparable treatments were applied in the spring of 1960. No later treatments were made with the seed yields being taken for 1960, 1961 and 1962. These and the total yield on each treatment for the three year period 1960-62 are shown in the two following tables.

Table 1. The effect of different fertilizer treatments on the 1960-62 yields of Park Kentucky Bluegrass seed on two peat soils of Roseau County.

Charles Habstritt Farm-Roseau
(deep peat - seeded 1959)

Nutrients applied (lbs/A.)

	1960	1961	1962	Total '60-'62	1960	1961	1962	Total '60-'62
	Pounds of harvested grass seed per acre							
None	54	133	141	328	54	113	141	308
	Fertilized-fall of 1959				Fertilized-spring of 1960			
0+80+0	167	327	164	658	237**	371	262	870
0+80+80	196*	255	200	651	242**	259	313	814
30+80+0	164	247	329	740	218*	272	306	796
30+80+80	197*	265	364	826	146	370	279	795
60+80+80	128	268	305	701	255**	257	249	761
90+80+80	250**	248	350	848	221*	247	261	729
40+20+80	186*	220	354	760	179	220	191	590
33+33+33 (winter)	173	203	---	---	173	203	---	---

The last treatment was a farm operator application of 12+12+12 at the rate of 275#/A.

* L.S.D. (5%) = 128#/A.
** " (1%) = 170#/A.

Table 2. The effect of different fertilizer treatments on the 1960-62 yields of Park Kentucky Bluegrass seed on two peat soils of Roseau County.

Nutrients applied (lbs./A.)	Stanley Roadfeldt Farm-Badger (shallow peat - 1957 seeding)							
	1960	1961	1962	Total '60-'62	1960	1961	1962	Total '60-'62
	Pounds of harvested grass seed per acre							
None	205	113	212	530	205	113	212	530
	Fertilized-fall of 1959				Fertilized-spring 1960			
0+80+0	382**	192	383	957	300	195	291	786
0+80+80	349**	229	207	785	334*	229	170	733
30+80+0	327*	202	417	946	387**	179	266	832
30+80+80	306	140	375	821	372**	216	450	1038
60+80+80	377**	177	184	738	409**	173	583	1165
90+80+80	331*	223	330	884	365**	144	292	801

It is evident that all of the fertilizer treatments have increased grass seed yields in each year, resulting in a substantial increase for the three year period. The comparative of the fall and of the spring treatments are variable.

* L.S.D. (5%) = 128#/A.
** L.S.D. (1%) = 170#/A.

It was desirable to determine the effect of fall and spring fertilization on a comparatively older stand of Park Kentucky Bluegrass on peat soil which had a sod-bound condition. The experiment was simplified, nitrogen alone and a complete fertilizer being applied in the fall of 1961 and in the spring of 1962 on the same peat field as that reported in the preceding table (Stanley Roadfeldt of Badger).

The 1962 grass seed yield was the fourth harvest and the brief results are shown in Table 3.

Table 3. Yield of Park Kentucky Bluegrass Seed in 1962 on a fourth year harvest on peat soil fertilized after three harvesting years - Stanley Roadfeldt-Badger.

Nutrients applied (lbs./A.)	1962 Grass seed yield in pounds per acre	
None	314	314
	Fertilized-fall 1961	Fertilized-spring 1962
60+0+0	654	447
60+80+80	714	616

The fall fertilization of this fourth year stand on peat readily doubled the grass seed yields, with complete fertilzation being more effective than nitrogen alone. Spring fertilization was not so effective, especially where nitrogen alone was applied.

B. Fertilization of Park Kentucky Bluegrass on Mineral Soils

Several mineral soils were fertilized with different treatments in different years.

A Park Kentucky bluegrass stand on mineral soil was fertilized at the end of the second year - in the fall of 1961 and in the spring of 1962- on the Clifford Foss farm of Badger. The 1962 seed yields are shown in the following table.

Table 4. The effect of fall or of spring fertilization (1961-62) of Park Kentucky Bluegrass on a mineral soil on the 1962 grass seed yield. (Clifford Foss farm - Badger)

Nutrients applied (lbs./A.)	Pounds of grass seed harvested per acre.	
	Fertilized-fall 1961	Fertilized-spring 1962
None	130	
0 +80+ 0	154	207
0 +80+80	176	178
30+80+ 0	323**	299**
30+80+80	368**	256**
60+80+80	429**	344**
90+80+80	377**	412**
90+ 0+ 0	301**	315**
surrounding farm field	265	

L.S.D. (5%) = 95
" (1%) = 114

Nitrogen is the most effective nutrient element, but the inclusion of the two minerals produced additional yield increases. There is little or no yield difference between the fall or the spring fertilization treatments.

A second mineral soil at Pine Creek was fertilied in May of 1962 on the Ray Rice farm with the results shown in table 5.

Table 5. The 1962 first year yield of Park Kentucky bluegrass seed on a mineral soil fertilized in May, 1962. (Roy Rice farm-Pine Creek)

Nutrients applied (lbs./A.)	Pounds of grass seed per acre
None	180
30+ 0+ 0	148
30+40+ 0	400**
30+40+40	409**
30+80+ 0	223
30+80+80	300*
30+80+40	354*
60+ 0+ 0	208
60+40+ 0	433**
60+40+40	502**
60+80+ 0	547**
60+80+80	507**
60+80+40	247
farm field	376**

* L.S.D. (5%) = 115
** " (1%) = 155

Phosphorus and nitrogen were the two effective elements for increasing grass seed on this farm-with potassium having very little response.

Winter Versus Spring Fertilization on Park Bluegrass-Mineral Soil

Nitrogen fertilizer alone and a complete fertilizer were spread on the snow lying on two Park Kentucky bluegrass mineral soil fields in February and in April of 1961. Yields were obtained on both fields in 1961, after which one was plowed up. The 1962 yield of grass seed was then obtained on the Magnuson field. Results of both years are shown in table 6.

Table 6. The effect of winter versus spring fertilization of Park Kentucky bluegrass seed on two mineral soils.

Nutrients applied (lbs./A.)	Fertilized in Feb., 1961				Fertilized in April, 1962			
	Wold. 1961	Magnuson 1961	Magnuson 1962	Total 1961&62	Wold 1961	Magnuson 1961	Magnuson 1962	Total 1961&62
	Grass seed yield in pounds per acre							
None	53	39	135	174	53	39	176	215
60+ 0+ 0	60	43	363	406	115	66	310	376
60+80+80	77	97	300	407	113	52	318	370

In the first growing season after fertilization, the grass seed yield on both fields was substantially better on the April fertilization, indicating a probable loss of fertility in the February fertilizer application. However, when the two years yield (of 1961 and 1962) are totalled, the fertilizer applied

on the surface of the deep snow in February of 1961 produced a two year grass seed yield at least equivalent to the fertilization applied on bare soil some forty days later. This suggests that over a period of two years or more, fertilizer application on snow can produce satisfactory yield increases.

The Effect of Fertilizer on Yield of Climax Timothy Seed on Mineral Soils in Roseau County

1960-62

Paul M. Burson, J. M. MacGregor, & H.W. Kramer

Roseau County is fast becoming a grass seed producing area which includes both Park bluegrass and Climax timothy. This northern area of Minnesota is well adapted for the production of these graas seed crops. Grass such as timothy is is a basic part of a permanent agriculture for this area. Timothy fits into a forage program. It is an excellent grass crop in mixtures with alfalfa, medium red clover and alsike clover for hay or for pasture. It has a wide range of soil and fertility adaptation and is vegy palatable for livestock as either hay or pasture. About 5,000 acres of timothy are now being grown in Roseau County for seed production.

In the Fall of 1959 three fields were selected to study the effect of fertilizer on timothy seed production. The two fields selected in Roseau County were on the Clifford Foss and the B.J. Borgen farms while the third was the Andrew Skaar farm in Pennington County. The fertilizer treatments included 80 lbs. of P_2O_5 alone and in combination with 80 lbs. of K_2O with 30, 60 and 90 lbs. of actual nitrogen per acre. On the Borgen and Skaar fields the treatments were applied in the spring of 1960. On the Foss fields the same treatments were applied in the fall of 1959 and on adjacent plots in the spring of 1960. The purpose here was to determine if there was any difference between fall and spring application. The Skaat field was plowed up in 1961, half of the plots on the Foss field were refertilized in the fall of 1961, and a new experiment was applied on the same field in 1961.

The following tables gives the seed yields from the various fertilizer treatment combinations for the years 1960,1961 and 1962. The year 1961 should not be considered as a representative year because of the severe drought from April to September, with the rainfall being 5.75 inches below normal during this period. Timothy is not a productive crop during extreme dry periods, and is better adapted to cool moist conditions typical of the usual growing conditions of northern Minnesota. The yield results for 1960 might be considered as quite representative of what could be expected from the fertilization of timothy for seed production. The growing season of 1962 was one of ample precipitation.

In 1960 the seed yields ranged from 159 lbs. on the unfertilized soil to almost 900 lbs. with a 90 + 80 + 80 treatment. Spring fertilizer applications gave the greater increase in seed production with an average yield of 531 lbs. in comparison to 431 pounds when fertilized in the fall.

Timothy is not subject to as much lodging as some other grasses or grain crops. Some lodging did occur on the 90 lbs. rate of nitrogen plots, however.

On the basis of the present information 60 lbs. of N appears to be adequate in seed production with little or no danger of lodging. For phosphate and potash needs, the soil test should be the basis for this determination, the same as for any other crop.

Table 1. Climax Timothy Seed Yields in 1960-61-62 on Three Mineral Soild in Roseau County.

Nutrients applied (lbs/A.)	Seed yield in pounds per acre						
	1960		1961			1962	
	Skaar[1]	Foss[2]	Skaar[1]	Foss[2]	Borgen[1]	Foss[2]	Borgen[1]
None	225	159	63	56	76	195	173
0+80+ 0	235	177	141	102	119	180	187
0+80+80	226	173	111	105	104	166	176
30+80+ 0	568	494	134	70	139	442	415
30+80+80	634	505	121	68	113	410	438
60+80+80	815	710	100	80	144	537	470
90+80+80	892	823	103	62	145	522	526
Average fall yield	--	431	--	80	--	368	--
Average spring yield	--	531	--	88	--	401	--

1. Fertilized spring of 1960
2. Fertilized fall of 1959 or spring of 1960 (average yields of spring or fall treatments). 1961 very dry.

It is evident from the results shown on Table 1 that the most substantial increases in timothy seed yields were where NP or NPK fertilizers were applied to these mineral soils. The 1960 increases were somewhat better when fall fertilized, but this was not true in the two following years.

The results shown in Table 2 comprise the total of the two or the three year yields of the fields reported in the preceding table.

Table 2. Cumulative two-or three-year yields of Climax timothy seed in the years 1960-'61-'62 on three Roseau County mineral fields with one fertilization.

Nutrients applied (lbs/A.)	Skaar 1960+'61 (Fert. spring of '60)	Borgen 1961+'62 (Fert. spring of '60)	Foss 1960+'61+'62 (FERT. fall and spring '59 or '60)
	Total pounds of timothy seed per acre over 2 or 3 yrs.		
None	288	249	410
0+80+ 0	376	306	459
0+80+80	337	280	444
30+80+ 0	702	554	1006
30+80+80	755	551	983
60+80+80	915	614	1327
90+80+80	995	671	1407
Total average-fall	---	---	879
Total average-spring	---	---	1014

The cumulative timothy seed yields of the three fields shown in Table 2 indicate what results a grower might expect for fertilization over a two year or longer period. Increasing amounts of nitrogen were increasingly effective with the inclusion of the two mineral elements. The grower can reasonable expect fertilizer effect for two years or more.

The three year averages on the Foss field indicate that spring fertilization on this mineral soil produced more effective results.

The Foss experimental timothy field of the two previous tables was first fertilized in the fall of 1959 and in the spring of 1960. The 1960 and 1961 seed harvests were removed fromlthese treatments, and it was then decided to refertilize half of these treatments in the fall of 1961 to determine if periodic fertilization would be profitable compared to the initial fertilization alone. The effect of this additional fertilization treatment of late 1961 in comparison to the initial treatment results obtained with the 1959-1960 fertilization only in the 1962 seed yield are shown in Table 3.

Table 3. The 1962 Yield of Climax Timothy Seed Fertilized in 1959-60 in Comparison to Yields Fertilized in 1959-60 and Refertilized in the Fall of 1961-Mineral Soil.

(Clifford Foss Farm-Badger)

Nutrients(lbs/A.) in 1959-60		1962 Yield (lbs/A.)	Additional nutrients (lbs/A) Fall, 1961	1962 Yields (lbs/A.)	Increase for 1961, Fert. (lbs/A.)
None		195	None	262	67
0+80+0	fall '59	193	40+0 +0	230	37
"	spring '60	166	80+0 +0	454	288
0+80+80	fall '59	174	40+40+0	635	461
"	spring '60	157	80+40+0	596	439
30+80+0	fall '59	385	40+40+40	585	200
"	spring '60	498	40+ 0+40	458	-40
30+80+80	fall '59	397	40+40+20	422	25
"	spring '60	423	80+40+40	589	166
60+80+80	fall '59	436	80+ 0+40	330	-106
"	spring '60	638	30+ 0+0	351	-287
90+80+80	fall '59	521	60+ 0+0	359	0162
"	spring '60	523	90+ 0+0	429	-94

The results shown on Table 3 are important, since the second fertilization late in 1961 emphasizes the value of phosphorus fertilization. Good yield increases were obtained where this element was included with nitrogen on this mineral soil. Nitrogen or nitrogen-potash resulted in decreased 1962 seed yields.

Effect of Fertilizers on Timothy Seed Yields in Clearwater County

Harley Shurson, Arnold Heikkala, Curtis Klint and Merle Halverson

A demonstration was laid out on an established stand of timothy growing on an organic soil of low phosphorus and potassium status. The pu pose was to measure the effects of time and rate-of-application of nitrogen, phosphorus, and potassium fertilizers on seed yield. A complete factorial design including two application times (fall vs. spring), two rates of nitrogen (0 and 33 lbs/A as ammonium nitrate), three rates of phosphorus,(35, 70 and 105 lb. P_2O_5 as triple superphosphate) and two rates of potassium (23 and 92 lbs. K_2O/acre as muriate of potash)was used. The design was repliated 3 times. Individual plot dimension was 15' x 15'.

Seed yields were harvested in the fall of 1961, yields per acre calculated and the data subjected to statistical analysis.

Results

Table 1. Effect of time of application and rate of nitrogen on yield of timothy seed. (each yield is the average of 18 plots receiving the indicated treatment)

N rate, lb/A	Seed yields, lb/A: N applied fall, 1960	N applied spring 1961
0	248	248
33	327	407

A highly significant interaction between application time and nitrogen response was found. Yield increases due to 33lb/A spring applied nitrogen were essentially double those obtained with fall application of the identical nitrogen rate.

Though high in total nitrogen, raw sedge peats of this type may decompose slowly and provide little nitrogen in a form available to plants. This is because their wide carbon: nitrogen ratio is unsuited to the dietary needs of soil microorganisms. In the present case, it is possible that the small amount of added fertilizer nitrogen may have hastened decomposition with an increase in production of available nitrogen from the soil source.

Table 2. Effect of phosphorus and potassium on yield of timothy seed (each yield is an average of 12 plots receiving the indicated treatment).

K_2O rate lb/A	Seed yield, lb/A: P_2O_5 rate lb/A 35	70	140
23	334	268	299
92	283	341	324

A highly significant interaction between phosphorus rates and potassium rates was noted. Increasing the potassium rate from 23 to 92 lbs/A at the 35 lb/A P_2O_5 rate produced a significant yield decrease. At the 70 and 140 lbs/A P_2O_5 rates, however, significant yield increases occurred when the K_2O rate was increased from 23 to 92 lb/A. These findings serve to emphasize that phosphorus and potassium were both in critical short supply on this soil in terms of the needs of the timothy crop for seed production.

The following additional findings are of interest.

- Phosphorus and potasssium were as effective in fall as in spring application.

- The effects of phosphorus and potassium upon yield occurred both in the presence and absence of added nitrogen.

Woodchip (sawdust)- Nitrogen Experiment on Potatoes
Grand Rapids Experiment Station

W. P. Martin, A. C. Caldwell, M. V. Halverson

Yield Results - 1962

Object: To determine how woodchips or sawdust used as a soil conditioner will influence potato yields with and without supplementary nitrogen and also to measure residual effects.

Soil type: Unnamed fine sandy loam soil related to the Nebish gray-wooded soils.

Crops: Potatoes first year: small-grain second without furthur treatment to check on residuals.

Woodchips (or sawdust): W_0 = none: W_1 = 5 tons/ac.; and W_2 = 15 tons/Ac. placed on surface and disked in.

Fertilization:

250 lbs 0-0-60 applied preplant and plowed down throughout.
335 lbs 12-24-12 band placed at planting time throughout.
N_0 = no additional nitrogen; N_1 = 360 lbs/ac. 33.3-0-0 applied preplant and plowed down; and N_2 = 540 lbs/ac. 33.3-0-0 plowed down and 540 lbs./ac. also applied side-dress 3 wks. after emergence.

There are nine combination treatments and five replications (45 plots) in the experiment.

	N_0	N_1	N_2	Ave.
W_0	214 bu.	188 bu.	178 bu.	193 bu.
W_1	211	151	158	173
W_2	176	148	163	162
Ave.:	200	162	166	176

FERTILITY STUDIES ON ORGANIC SOILS AT HOLLANDALE, 1962

R. S. Farnham

The fertility studies on organic soils in the Hollandale area commenced in 1960 were continued in 1962 with emphasis on placement of straight materials.

The pH of this partly decomposed organic soil was 7.0 to 7.2; extractable P (Bray's No. 1) was very high; and extractable K was very high. The plot area was tiled and is located about ½ mile west of the 1961 site on the same type of organic soil.

The plot design was a randomized block using 12 treatments replicated four times. All fertilizer was applied below and to the side (row placed) of the potato tubers at planting time. Plots were harvested October 18 and total yield of potatoes and specific gravity data are shown in Table 1.

Table 1. Yield and specific gravity of cobbler potatoes, 1962.

Number		Treatment N P K	Total Yield Cwt./Acre	Yield Increase Cwt./Acre	Specific Gravity	Total Solids %
1	CHECK	0-0-0	273	--	1.062	16.0
2		0-50-0	288	15	1.064	16.5
3		0-100-0	280	7	1.064	16.5
4		0-200-0	286	13	1.065	16.6
5		0-0-100	262	-11	1.062	16.0
6		0-50-100	314	41	1.064	16.5
7		0-100-100	319	46	1.065	16.6
8		0-200-100	306	33	1.066	16.8
9		0-0-300	304	31	1.065	16.6
10		0-50-300	316	43	1.060	15.7
11		0-100-300	259	-14	1.062	16.0
12		0-200-300	299	26	1.065	16.6

Yield increases from 40 to 46 hundred weight were obtained where phosphorus and potassium were applied in the proper combinations. Potassium alone at the 300 lb. K_2O rate was more effective than phosphorus alone. Apparently there is a PK interaction effect.

Specific gravity does not appear to be affected by any of the treatments, although a slight increase was noted where the P and K were in the best combinations.

This is the second year in succession that highly significant yield increases have been obtained despite very high soil test values before fertilizing. Also the high yield increases were obtained this year despite unfavorable weather conditions - high rainfall and very cool growing season. This is probably due to the placement of fertilizer instead of broadcasting.

Fertilizer Experiments with Cucumbers - 1962

R. S. Farnham and John Grava

Location: M. A. Gedney Co's. Research Farm, Silver Lake (McLeod Co) Minnesota

Materials and Methods:

Soil Type: Lester loam
Percent O.M.: 6.4 (very high)
pH: 7.0 (neutral)
Extractable phosphorus: 16 lbs/A (medium)
Exchangeable potassium: 170 lbs/A (medium)

Variety: SMR 15

Plot Design:

Two separate experiments, one a nitrogen placement study and the other a phosphorus and potassium study to determine the most economical fertilizer application for pickling cucumbers.

Spacing between hill planted cucumbers was 42" x 42". Each plot contained 9 hills and there were 4 replications.

It was calculated that 5,762 plants (hills) constitute an acre and these figures were used to determine fertilizer needs per hill. Fertilizer was hill placed in a 6 inch circle around the germinating plants at a depth of about 2 inches below seed. This was approximately one week after planting.

Some nitrogen was hill placed at time of planting and the remainder side dressed after appearance of first female bloom (approximately July 10th).

All plots were harvested by hand at least every three days and pickles were sorted and sized into the 5 pickle grades - 1A, 1B, 2, 3, 4.

Rainfall Data:

	1962	1961
July	2.8"	.7"
August	5.5	2.4
Sept. 15	3.5	3.4
	11.8"	6.5"

Temperature:

Ave. High for 1962 growing season 76.7° F.
Ave. Low for 1962 growing season 57.3° F.

Results and Discussion:

Table 1 shows the results of the fertilizer trials on cucumbers in 1962 at Silver Lake, Minnesota.

The nitrogen placement studies show that hill applied nitrogen shortly after planting gave the best results. Side dress applications alone after the first bloom were not as effective as the hill applied and even caused a decrease in yield in one case.

Nitrogen, phosphorus and potassium in combination gave the biggest yield increases varying from 254 to 321 bushels above the 30-0-0 treatment. The 30-120-120 application produced the biggest yield-632 bushels.

Table 2 gives the percent and value by pickle grades (sizes) and total return in gross dollar value per acre for the various combinations of N-P-K. The treatment which produced the highest dollar value per acre was the 30-120-60 which totaled $ 903.30 gross return. This was due to the highest percent 1A and 1B grades which are worth more per pound.

No. 1A size is worth $7\frac{1}{4}$ ¢ per pound
No. 1B " " " 4.5 ¢ " "
No. 2 " " " 2.9 ¢ " "
No. 3 " " " 1.5 ¢ " "
No. 4 " " " 1.0 ¢ " "

Fertilizers producing the highest dollar value of the more expensive sizes are the most economical to use on pickling cucumbers.

Potassium alone with blanket nitrogen was more effective than phosphorus alone.

It is concluded that highly significant yield increases can be obtained on this soil with a relatively small investment in fertilizer. In fact the most profitable rate (30-60-120) produced a groww return of $ 903.30 per acre with a fertilizer investment of less than $ 25.00 per acre. This is about double the return where no P and K were applied.

1962 Cucumber Fertility Plots
Silver Lake, Minn.

Treatments

No.	Experiment I	NITROGEN PLACEMENT
1	0-60-60	All plots received 60# P_2O_5
2	30H-60-60	all 60# K_2O
3	60H-60-60	
4	30SD-60-60	SD-Side Dress N after first
5	30SD, 30H-60-60	female bloom. H-Hill
6	30SD, 60H-60-60	application of N at regular
7	60SD-60-60	fertilizer time.
8	60SD, 30H-60-60	
9	60SD, 60H-6060	

No.	Experiment II N - P - K	PHOSPHORUS AND POTASSIUM EXPERIMENT
10	30-0-0	Nitrogen applied at 30# N rate
11	30-60-0	on all plots.
12	30-120-0	
13	30-0-60	P and K variable.
14	30-60-60	
15	30-120-60	
16	30-0-120	
17	30-60-120	
18	30-120-120	

Table 1. Results of fertilizer trials on cucumbers - 1962

NITROGEN PLACEMENT

1962 Silver Lake Fertilizer Trials

Plot No.	Treatment	1A	1B	No.2	No.3	No.4	Total lbs.	Lbs. per Acre	Bushels per Acre
1	0-60-60	16.3	28.8	42.	50.	9.4	146.5	25,862	517
2	30H-60-60	18.7	27.3	48.3	52.6	11.3	158.3	28,137	563
3	60H-60-60	15.8	23.1	49.8	60.5	12.9	153.1	27,213	544
4	30SD-60-60	15.3	24.4	46.4	43.3	11.9	141.1	25,080	501
5	30SD-30H-60-60	15.6	25.6	43.	45.7	21.1	151.1	26,858	537
6	30SD, 60H-60-60	17.1	24.1	42.2	51.1	9.8	144.3	25,649	513
7	60SD-60-60	14.4	25.6	42.	56.4	12.9	151.3	26,893	537
8	60SD, 30H-60-60	18.4	29.	45.3	48.7	13.4	155.	27,551	551
9	60SD, 60H-60-60	16.1	23.6	42.3	56.	15.9	153.8	27,337	547

SD=Side Dressing
All plots received 60# P_2O_5 and 60# K_2O.
N after first female bloom. H-Hill. [2]Application of N at regular fertilizer time.

PHOSPHORUS AND POTASSIUM EXPERIMENT

Plot No.	Treatment	1A	1B	No.2	No.3	No.4	Total #	# per Acre	Bu. per Acre
10	30-0-0	7.4	15.8	30.9	25.9	7.7	87.6	15,570	311
11	30-60-0	9.5	14.8	26.3	32.3	12.7	95.6	16,992	339
12	30-120-0	10.4	19.1	26.9	32.	12.5	100.9	17,934	359
13	30-0-60	9.7	17.7	30.5	37.4	7.4	102.7	18,254	365
14	30-60-60	16.4	29.	45.6	49.9	18.	159.1	28,280	565
15	30-120-60	18.2	27.7	46.8	65.2	18.1	176.	31,284	625
16	30-0-120	12.5	16.7	32.	38.7	15.9	115.7	20,565	411
17	30-60-120	18.8	28.6	45.8	62.1	14.2	167.4	29,755	595
18	30-120-120	14.2	26.5	54.6	65.1	17.5	177.9	31,620	632

Nitrogen applied at 30# N rate on all plots.

P and K variable.

Table 2. PHOSPHORUS AND POTASSIUM EXPERIMENT - PERCENT AND VALUE BY PICKLE GRADES AND TOTAL VALUE OF PICKLING CUCUMBERS

Treatment	1 A		1 B		2		3		4		Total
	%	Value	%	Value	%	Value	%	Value	%	Value	Value
10. 30-0-0	8.45	$95.38	18.04	$126.40	35.27	$159.25	29.57	$69.06	8.79	$13.69	$463.78
11. 30-60-0	9.94	122.45	15.48	118.37	27.51	135.56	33.79	86.12	13.28	22.56	485.06
12. 30-120-0	10.31	134.05	18.93	152.77	26.66	138.65	31.71	85.30	12.39	22.22	532.99
13. 30-0-60	9.44	124.93	17.23	141.53	29.70	157.22	36.42	99.72	7.20	13.14	536.54
14. 30-60-60	10.31	211.38	18.23	231.99	28.66	235.05	31.36	133.03	11.31	31.98	843.43
15. 30-120-60	10.34	234.52	15.04	221.58	26.59	241.23	37.04	173.81	10.28	32.16	903.30
16. 30-0-120	10.80	101.02	14.43	133.54	27.66	164.96	33.45	103.18	13.74	28.26	590.96
17. 30-60-120	10.04	216.59	17.08	228.70	27.36	236.09	37.10	165.59	8.48	25.23	872.20
18. 30-120-120	7.98	182.94	14.90	212.01	30.69	281.42	36.59	173.55	9.84	31.11	881.03

Nitrogen Fertilization Studies on Turf - 1962

R. S. Farnham

Nitrogen fertilization studies on bluegrass turf were continued in 1962 and a greenhouse study on turf was added. Objectives of these studies were as follows:

1. Compare the effectiveness of several slow-release nitrogen fertilizers on yield and color of Kentucky bluegrass turf.
2. To determine the optimum nitrogen rate needed when applied as a single application in late spring.
3. To evaluate the effectiveness of several new coated nitrogen materials, slow-release chemicals, and organic nitrogen forms in supplying nitrogen to grass during the growing season.

Materials and Methods

Nitrogen fertilizer materials included in the study were ammonium nitrate, urea, low grades of fertilizer such as 20-10-5, 16-8-8, 10-10-10, organics and several experimental products supplied by Spencer Chemical Co. The inorganic nitrogen forms were both coated and uncoated. The coated fertilizers were supplied by Archer-Daniels-Midland Co.

Nitrogen was applied at 4 and 8 pounds of N per 1000 sq. ft. rates. Phosphorus and potassium were applied on all plots in amounts equivalent to 8 lbs. of P_2O_5 and K_2O per 1000 sq. ft. All materials were applied in May on dry turf and thoroughly wet immediately after application. Notes on burning were kept for first month.

Plots were located west of the Farm Shop on the campus and the size of each was 5' x 10'. Thirty-two treatments were applied and clippings were made at two week intervals from June 1st to October 15th. Color comparisons were made periodically during the season.

Greenhouse plots were 18" x 18" cut sods obtained from a commercial sod grower. Optimum soil moisture was maintained by adding water as needed and temperature was kept relatively warm.

Results and Discussion

Total clipping yields and color ratings are shown in Table1, for the outside turf study and greenhouse results shown in Table 2.

1. Coated nitrogen materials for the third year in succession were superior to any of the other fertilizers as shown by highest yield of clippings and high color rating. Eight pounds of nitrogen/ 1000 sq. ft. in one application appears to be significant to maintain good growth and high quality for an entire season. Coated 10-10-10 and 20-10-5 were the highest yielding materials although this year milorganite was third. This is probably due to the above average rainfall which would favor the organics and slow-release types over the highly soluble and readily leached nitrogen materials.
2. Burning of grass shortly after applying was evident on several of the uncoated highly soluble materials at the 8 lbs. of N/1000 sq. ft. rate. The organics, coated fertilizers, and slow-release chemicals did not burn.

3. The coated 10-10-10 at the 4 lb. N/1000^2 rate was the highest yielder in the greenhouse tests. One of the organics developed fm m peat also produced high yields. Some of the urea and urea-form materials performed better in the greenhouse than in the field although only the lower rate (4lb. N/1000) was used in the greenhouse.

No burning was noticed in the greenhouse study which is probably due to the high organic sod used.

Table 1. 1962 Turf Plots total clipping yields and color ratings

No	Treatment	Rate lb. N/1000ft.^{2}	Total clippings Gms/1000 ft.^{2}	Rank	Ave Color rating	Early burn damage
7	10-10-10 coated (ADM)	8	62,938	1	6.5	none
9	20-10-5 coated (ADM)	8	61,144	2	8.0	"
19	Milorganite	8	57,922	3	7.0	"
6	10-10-10 uncoated	4	57,689	4	4.5	"
5	10-10-10 coated (ADM)	4	56,516	5	7.0	"
13	NH_4NO_3 coated (ADM)	8	56,478	6	8.0	"
27	16-8-8 1/2 coated 1/2 uncoated (ADM)	8	56,111	7	6.0	"
1	16-8-8 coated (ADM)	4	53,217	8	6.0	"
24	Spencer 30-10-0 coated	8	52,822	9	7.0	Slight
29	NH_4NO_3 1/2 coated 1/2 uncoated (ADM)	8	52,756	10	8.0	None
23	Spencer 34-0-0 S 4383	8	52,578	11	7.5	Slight
28	Spencer 34-0-0 1/2 30-10-0 1/2	8	52,467	12	7.5	None
10	20-10-5 uncoated	8	52,428	13	7.5	Slight
8	10-10-10 uncoated	8	52,406	14	7.0	None
18	Milorganite	4	52,322	15	6.0	"
3	16-8-8 coated	8	52,250	16	6.5	"
26	16-8-8 1/3 coated 1/3 uncoated 1/3 NH_4NO_3 (C)	8	51,878	17	6.5	"
21	Spencer 32-0-0 S 4238	8	51,562	18	6.5	Slight
11	NH_4NO_3 coated	4	51,162	19	5.5	"
2	k6-8-8 uncoated	4	49,784	20	6.0	"
32	20-10-5 1/2 coated 1/2 uncoated	8	49,484	21	6.5	Non e
12	NH_4NO_3 uncoated	4	48,712	22	7.0	None
22	Spencer 34-0-0 S 4383	4	47,001	23	7.0	Slight

Table 1. Con:t.

16	Urea heavy coated	8	44,751	24	7.0	Slight
17	Ca Anthraxillate (Belgium)	8	44,751	25	6.5	"
25	Spencer 30-10-0 coated	8	44,634	26	6.0	None
15	Urea med. coated	8	44,118	27	5.5	Slight
14	NH_4NO_3 uncoated 32-0-0	8	43,540	28	5.0	Severe
20	Spencer 32-0-0 S 4238	4	42,574	29	7.5	Slight
31	Check	0	42,435	30	5.5	None
30	Check	0	42,285	31	4.5	"
4	16-8-8 uncoated	8	42,096	32	6.5	Severe

Table 2. 1962 Greenhouse Turf Fertilization Studies

No	Treatment	Rate lbs. N/1000 $ft.^2$	Rep I gms.	Rep II gms.	Total Reps gms.	Rank
2	10-10-10 coated	4	106.88	108.18	215.16	1
9	Spencer 34-0-0 S 4383	4	96.19	96.27	192.46	2
11	Organic (85) 1/4" rate	4	97.28	94.88	192.16	3
7	Urea uncoated	4	86.11	96.06	182.17	4
6	NH_4NO_3 coated	4	81.99	99.95	181.94	5
13	Nitroform	4	102.29	76.26	178.55	6
1	10-10-10 uncoated	4	72.96	100.23	173.19	7
8	Urea medium coated	4	81.93	86.20	168.13	8
10	Milorganite	4	82.87	85.04	167.91	9
5	NH_4NO_3 uncoated	4	74.85	88.24	163.09	10
4	20-10-5 coated	4	84.36	76.09	160.45	11
3	20-10-5 uncoated	4	62.81	94.72	157.53	12
14	Check no fert.	0	71.95	73.05	145.00	13
12	Organic (81)	0	68.79	69.88	138.67	14