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A Field of High-Producing Alfalfa

by

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Summary and Conclusions

ALFALFA experiments have been reviewed at 10 locations on Dickson and Mountview soils—five locations on each soil. These experiments were located at the Highland Rim Experiment Station, Springfield, and on private farms in Lawrence and Putnam counties; they cover the 10-year period, 1951-1960.

● Alfalfa hay yields varied widely among locations and from year to year at some locations, ranging from less than 1 ton per acre in some very dry years in Lawrence County to 4½ tons under more favorable soil moisture and fertility conditions at the Highland Rim Experiment Station.

● Selecting the highest-yielding treatment in each experiment and combining all years at all locations on both soils, alfalfa production averaged 2.53 tons of hay per acre. On the whole, yields on Dickson (2.99 tons) exceeded those on Mountview (2.06 tons). This does not mean that Dickson is better suited to alfalfa than Mountview. In fact, under similar conditions alfalfa production on Mountview would be expected to exceed that on Dickson. The explanation is that all of the experiments on Mountview were on private farms in Lawrence County where soil fertility and moisture conditions were less favorable than they were in the experiments on Dickson soil, most of which were conducted at the Highland Rim Experiment Station.

● On the basis of these data, alfalfa might well be grown on Dickson and Mountview soils where the need exists for a highly palatable, nutritious forage and when soils better suited to this crop are not available. The results indicate that stands can be maintained for 3 or 4 years by adequate liming and fertilization at seeding, followed by liberal annual topdressings of phosphate and potash—particularly potash. Under these conditions, alfalfa has a higher yield potential than the alternative legume hay crops, annual lespedeza and red clover.

● Stands are just as easy to establish on Dickson and Mountview soils as they are on soils better suited to this crop; however, the life of the stand appears to be somewhat shorter. Also fewer cuttings can be expected on these soils, averaging three per year, or one less than is usually obtained on soils better adapted to alfalfa. In very dry years only two cuttings may be obtained. Often, most, (60% or more) of the total yearly production is obtained in the first cutting.

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Alfalfa Production on Dickson and Mountview Soils

by

O. H. Long and L. M. Safley [1]

Introduction

Based on early experiments and farmer experience alfalfa at one time was not recommended on the Dickson and Mountview soils in Tennessee. But, as more experiments were conducted, particularly some at higher lime and fertilizer rates, it was felt that this position needed to be reconsidered.

The Dickson and Mountview soils have developed from a thin mantle of loess over cherty limestone. They are common in the Highland Rim section of Tennessee and occupy a considerable acreage. Typically the surface layer of both soils is brown and the subsoil yellowish brown. There is no great change in clay content with depth; the soils are silt loam in texture to a depth of 30 inches or more. Varying amounts of chert occur throughout the entire solum. Drainage through the soil profile in the Mountview is good; the Dickson is moderately well drained. The chief difference between the Dickson and Mountview is a compact layer (fragipan) at a depth of about 2 feet in the Dickson; the Mountview has no such well-defined layer. This fragipan hinders downward movement of water, which results in a wet soil in the spring and a "droughty" soil in the summer. This alternate wet-dry condition makes for a shallow root system and is one of the reasons why alfalfa yields vary so widely on the Dickson soil.

The purpose in this publication is to bring together in one place all recent alfalfa experiments, both published and unpublished, on these two soils. Several experiments were conducted on these two soils over the 10-year period, 1951-1960. These experiments were located on private farms in Lawrence and Putnam counties and at the Highland Rim Experiment Station, Springfield.

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[1] Professor of Agronomy, Knoxville, and Superintendent of Highland Rim Experiment Station, Springfield, respectively.

Experiments Previously Reported

Alfalfa Yields in Crop Rotations on Dickson and Mountview Soils in Lawrence County

Alfalfa was one of the crops in a 4-year rotation at one location on Dickson silt loam and in a 6-year rotation at two locations on Mountview silt loam in Lawrence County in the period 1951-1959. Corn, cotton, and wheat were the other crops.[2] Alfalfa was seeded in the fall following the wheat crop and remained on the Mountview for 3 years and on the Dickson soil for 2 years. The experimental areas were limed at rates up to 3 tons per acre where the soil test indicated a need for lime. Initial fertilization was 30 pounds of N, 120 to 240 pounds of P_2O_5, and 150 pounds of K_2O, and 20 pounds of borax per acre at seeding. At the beginning of the third production year the alfalfa received a topdressing of 75 pounds of K_2O.

Alfalfa hay yields for the 7- to 9-year periods are shown in Table 1. Production was very low during the first 2 or 3 years but greatly improved in later years, particularly in 1959. Summer rainfall largely accounts for these wide variations in yield. In the earlier years of these experiments both total and summer rainfall were much less than normal, and hay yields of less than 1 ton were common. Summer rainfall was much more plentiful in 1959, and hay yields ranged from about 2½ to 3½ tons per acre. Average hay yields for the entire period were 1.51, 2.05, and 1.67 tons per acre at the three locations.

Alfalfa Response to Phosphate-Potash Topdressings on Dickson Silt Loam at Highland Rim Experiment Station, Springfield

In a rates of phosphate and potash topdressing experiment on alfalfa on a Dickson silt loam at the Highland Rim Experiment Station, this was found: near maximum yields of hay over the 4-year period, 1955-1958, were obtained with annual topdressings of phosphate and potash at rates of 60 pounds of P_2O_5 and 200 pounds of K_2O per acre. This was in addition to the fertilization at seeding which was 32-95-160 (N-P_2O_5-K_2O) plus borax. With this treatment yields averaged about 4 tons of hay per acre for the 4-year period.[3]

Alfalfa Variety Test on Dickson Silt Loam, Highland Rim Experiment Station, Springfield

An alfalfa variety test containing eight varieties was seeded September 11, 1956, on a Dickson silt loam at the Highland Rim Experiment

[2] A more complete report on these rotation experiments is contained in Tenn. Agric. Expt. Sta. Bul. 328, *Phosphates in Crop Rotations in Lawrence County*, published in 1961.

[3] W. L. Parks and L. M. Safley, *Alfalfa Fertilization on a Dickson Soil*, Tenn. Agric. Expt. Sta. Bul. 330, 1961.

Table 1. Alfalfa Yields in a Rotation with Corn, Cotton and Wheat on Three Farms in Lawrence County, 1951-1959. (All yields are averages of 1-, 2- and 3-year-old stands, each replicated three times.)

Year	Dickson silt loam	Mountview silt loam	
		Freemon farm	Gower farm
	Tons of hay per acre		
1951	0.46	0.73	....
1952	0.70	1.31	....
1953	1.73	2.82	0.96
1954	1.53	2.13	0.78
1955	1.31	1.99	1.46
1956	1.47	1.80	1.48
1957	1.51	1.63	2.13
1958	1.67	2.38	2.43
1959	3.21	3.63	2.46
Av.	1.51	2.05	1.67

Station. Yield data were obtained for a 4-year period, 1957-1960.[4] Alfalfa hay yields by years of each of these eight varieties are shown in Table 2. As a 4-year average all varieties produced about the same yield, except for Narragansett, Vernal, and Nomad. Nomad had declined in stand and vigor appreciably the fourth production year. This is illustrated in Figure 1, which is a photograph of the Nomad and DuPuits varieties made on July 8, 1960. Eliminating these three lowest-yielding varieties,

Table 2. Yields of Alfalfa Varieties for a 4-Year Period on Dickson Silt Loam, Highland Rim Experiment Station, Springfield, 1957-1960.

Variety	Year				4-yr. av.
	1957	1958	1959	1960	
	Tons of hay per acre				
DuPuits	2.72	4.45	4.38	4.31	3.97
Atlantic	2.76	4.34	3.93	3.80	3.71
Williamsburg	2.51	3.97	3.83	4.02	3.58
Narragansett	2.23	3.79	3.83	3.68	3.38
Kansas Common	2.81	4.52	4.26	4.45	4.01
Buffalo	2.62	4.36	4.16	4.36	3.88
Vernal	2.50	3.82	3.61	3.64	3.39
Nomad	2.31	3.16	2.66	1.71	2.46
L. S. D. (5%)	N.S.	0.55	0.41	0.55	....

[4] These yields are reported separately in Tenn. Agric. Expt. Sta. Bulletins 278, 293, 308, and 322: *Performance Trials of Field Crop Varieties.*

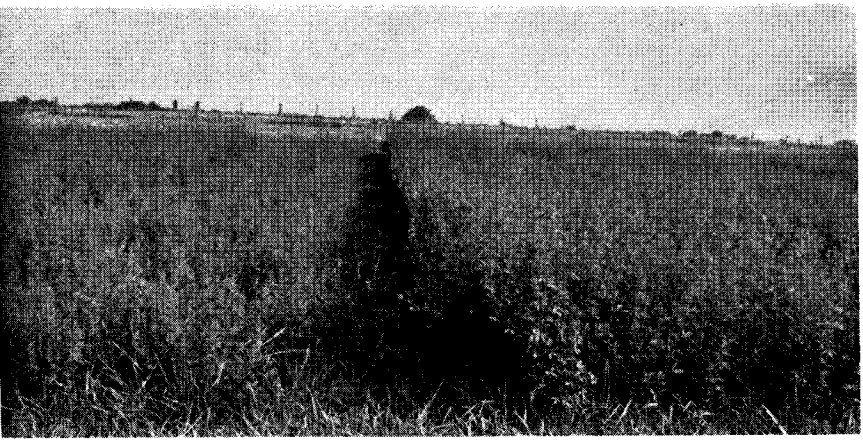

Figure 1. Alfalfa in its fourth production year on Dickson silt loam, Highland Rim Experiment Station, Springfield: Nomad variety on left, DuPuits variety on right.

the other five varieties—DuPuits, Atlantic, Williamsburg, Kansas Common and Buffalo—produced 3.83 tons of hay per acre as a 4-year average.

In 1956, before the experiment was started, a collected soil sample tested as follows:

pH = 5.8
P = 20 lb./acre (medium)
K = 112 lb./acre (low)

Before seeding, the area was treated with ground limestone at the rate of 2½ tons per acre and ammonium nitrate, concentrated superphosphate and muriate of potash at rates of 100, 150, and 300 pounds per acre respectively (equivalent to 33-72-180). Maintenance applications averaging about 50 pounds of P_2O_5 and 90 pounds of K_2O per acre were made each spring beginning in 1958.

Alfalfa Production on Mountview Soils in Putnam County

Studies were made of alfalfa production on Mountview soil at 16 locations in Putnam County in 1957.[5] These were on 1-year-old stands established by farmers. Acre yields were determined by counting the number of bales of hay, multiplying by the average bale weight and dividing by the number of acres. Yields under "better than average management" averaged 2.24 tons of hay per acre; under "average management" they averaged 1.55 tons. Inadequate fertilization appeared to be the main reason for the low production on some fields.

[5] Joseph H. Vaden, "Relationships of Soils and Management to Establishment and Yield of Alfalfa in Putnam County Tennessee" (unpublished Master's thesis, The University of Tennessee, 1958).

Experiments Not Previously Reported

Alfalfa Response to Time and Rate of Phosphate Application on Mountview Silt Loam, Lawrence County

An alfalfa experiment was conducted for the 3-year period, 1954-1956, on Mountview silt loam on a private farm in Lawrence County to compare a single application of phosphate made at time of seeding with annual applications of phosphate, but where the total amount applied was the same.

Crop response to phosphate had already been demonstrated on this area with wheat as a test crop, where in 1953 unphosphated wheat (60-0-30) produced 29.8 bushels per acre and phosphated wheat (60-80-30), 36.9 bushels. Soil tests made before wheat was seeded indicated a pH of 5.6, a low level of phosphorus (10 lb. P per acre) and a medium level of potassium (150 lb. K per acre). The land was prepared, limed, and seeded to alfalfa in the fall of that same year.

In the alfalfa experiment phosphate was applied at three rates—90, 180 and 360 pounds of P_2O_5 per acre, either all at time of seeding or part at seeding followed by topdressings in February 1954 and 1955. At each rate the total amount applied was the same. There was also an unphosphated treatment which was a continuation of the unphosphated treatment on wheat. All treatments received 30 pounds of nitrogen (N), 200 pounds of potash (K_2O), and 20 pounds of borax per acre at time of seeding.

Yield data for the unphosphated and for the 180- and 360-pound P_2O_5 treatments are presented in Table 3. These two phosphated treatments had received the same amount of phosphate (80 pounds of P_2O_5) on the previous wheat crop. No yields are shown for the 90-pound P_2O_5 rate because in this treatment the wheat crop had received a lesser amount of phosphate.

As was the case with wheat, alfalfa yields were increased significantly by applications of phosphate. The average annual yield was 1.61 tons of hay per acre on the unphosphated check and 2.58 tons as an average of the six phosphated treatments. There was essentially no difference in the yields of alfalfa following single and split applications of phosphate. Also it appears that the 180-pound P_2O_5 rate was just as effective as the 360-pound rate.

Soil reaction (pH) probably was too low in this experiment and potassium fertilization may not have been adequate for maximum yields. Only two cuttings were made in 1954 and 1956, but three were made in 1955. The average dates of the first and second cuttings were May 25 and July 5, respectively. As an average, approximately 60% of the total yearly production was obtained in the first cutting.

Table 3. Three-Year Production of Alfalfa on Mountview Silt Loam as Affected by Time of Application of Phosphate, Farm of Paul Dixon, Lawrence County, 1954-1956. (Average of four replications)

Time of application and P_2O_5 rate.*			Year			
At seeding (1953)	Topdressing Feb. 1954	Topdressing Feb. 1955	1954 (2 cuts)	1955 (3 cuts)	1956 (2 cuts)	3-year average
			Tons of hay per acre			
No phosphate			1.22	1.79	1.81	1.61
180	0	0	2.89	2.47	2.17	2.51
120	30	30	3.14	2.53	2.21	2.63
60	60	60	2.62	2.55	2.29	2.49
360	0	0	2.78	2.57	2.32	2.56
240	60	60	2.82	2.54	2.40	2.59
120	120	120	2.63	2.91	2.46	2.67
L. S. D. (5%)			0.57	0.43	0.24	....

* Nitrogen (N), potash (K_2O), and borax were applied to all treatments at seeding at rates of 30, 200, and 20 pounds per acre, respectively.

Alfalfa Response to 2 Liming Materials; Rates and Methods of Application of Lime

An experiment involving two liming materials, three rates and two methods of incorporation, was conducted on a Mountview silt loam on another private farm in Lawrence County in 1958-1959. Limestone (calcium carbonate) and dolomitic limestone (calcium-magnesium carbonate) were the two materials and they were applied at rates of 1, 2, 3, and 4 tons per acre. The dolomitic limestone was applied by two different methods: 1) one-half of the material before turning and one-half after turning, and 2) all of the material after turning. In each case, after turning, the fertilizers were applied and disked in, followed by seeding (September 12, 1957). The fertilization was 0-170-170 plus 10 pounds of borax per acre at seeding, followed by a like amount applied as a top-dressing about 1 month later.

A special effort was made to obtain liming materials that were equal in fineness and neutralizing value, but this was not possible. The data in Table 4 show that both limestone materials had about the same neutralizing value, but the dolomite contained more fine material. However, considering the lower solubility of dolomite, the two materials were fairly comparable.

Some chemical determinations made on the surface soil before the experiment was started are presented in Table 5.

Table 4. Mechanical Analysis and Chemical Composition of the Two Liming Materials Used in Lime Source-Rate Study on Mountview Silt Loam, Lawrence County.

Liming material*	Percent through:			
	20 mesh	40 mesh	60 mesh	100 mesh
Calcium carbonate	84.3	47.5	27.5	15.6
Dolomite	87.0	57.0	49.0	42.4

* Calcium carbonate contained 98.2% $CaCO_3$ and 0.5% $MgCO_3$ and had a neutralizing value of 98.8%. Dolomite contained 58.5% $CaCO_3$ and 35.7% $MgCO_3$ and had a neutralizing value of 100.8%.

Table 5. Some Chemical Properties of Mountview Silt Loam in Lime Source-Rate Study, Lawrence County.

pH	Organic matter (%)	Milliequivalents per 100 grams of soil:				Base saturation (%)
		K	Ca	Mg	C. E. C.*	
5.4	1.25	0.16	2.53	0.38	7.20	42.6

* Cation exchange capacity.

Table 6. The Effect of Rate and Placement of Two Liming Materials on pH of Surface Soil and on Alfalfa Yields on Mountview Silt Loam, Lawrence County, 1958-1959.

Liming material			pH values of Surface Soil in:			Alfalfa Yields		
						Year		2-year
Kind	Rate	Placement*	Fall of 1958	Fall of 1959	Fall of 1960	1958	1959	average
	Tons/acre					Tons hay per acre		
....	0	....	....	5.3	5.2	1.06	0.43	0.75
$CaCO_3$	1	Surface	....	5.7	5.7	2.52	2.12	2.32
Dol.	1	Surface	....	5.7	5.5	2.35	2.13	2.24
"	1	Mixed	....	5.7	...	2.43	2.50	2.47
$CaCO_3$	2	Surface	....	6.0	5.9	2.56	2.16	2.36
Dol.	2	Surface	....	6.1	5.6	2.54	2.25	2.40
"	2	Mixed	....	6.0	...	2.50	2.45	2.48
$CaCO_3$	3	Surface	5.9	6.3	6.4	2.71	2.51	2.61
Dol.	3	Surface	6.0	6.2	6.1	2.61	2.54	2.58
"	3	Mixed	6.1	6.4	...	2.83	2.85	2.84
$CaCO_3$	4	Surface	....	6.4	6.1	2.43	2.75	2.59
Dol.	4	Surface	....	6.3	6.7	2.55	2.79	2.67
"	4	Mixed	....	6.5	...	2.53	3.06	2.80
L. S. D. (5%)						0.38	0.37	...

* "Surface" means all of liming material was applied after turning. "Mixed" means one-half of liming material was applied before turning and one-half after turning. The lime was mixed with the soil by disking in both placement methods.

Alfalfa yields for the 2-year period (1958 and 1959) are shown in Table 6, along with some pH determinations made over time on the surface soil. The crop was cut twice in 1958 (June 4 and July 30—with 68% of the total yield being in the first cutting) and three times in 1959 (May 21, June 7 and August 11). Yields were not determined in 1960; however, the pH of the soil was measured in the fall of that year, or 3 years after liming.

Combining the two liming materials and the two methods of incorporation, the yields of alfalfa hay for the 2-year period were 0.75, 2.34, 2.41, 2.68 and 2.69 tons per acre at liming rates of 0, 1, 2, 3 and 4 tons, respectively. There was a response to each increment of lime in the second production year.

Soil pH increased with rate of liming, ranging from a low of 5.2 on the unlimed treatment to as high as 6.7 on the 4-ton lime treatment. There was no marked change in pH from 1959 to 1960.

From these data it is concluded that both liming materials were equally effective. The evidence is slightly in favor of the split application of lime, i.e., one-half prior to turning followed by the other half after turning.

Alfalfa and lespedeza yields compared.—In 1959 Korean lespedeza was in a fertilizer experiment adjacent to the lime experiment on alfalfa already described. This experiment also was on Mountview silt loam. Both areas had received the same management before the experiments were started. Wheat, fertilized at a rate of 60-80-80 and limed at a rate of 2 tons per acre, had preceded the lespedeza crop, the lespedeza being seeded in the wheat in the spring of 1958. The lespedeza made such poor growth following wheat harvest that it was not cut that year. It did produce enough seed, however, to re-seed the area. In 1959 the lespedeza produced 2 tons of hay per acre. This may be compared with the alfalfa yield of 2.16 tons obtained on the 2-ton calcium carbonate treatment in 1959. The point needing emphasis here is that alfalfa has a higher lime requirement than lespedeza. The 2-ton lime rate probably was sufficient for lespedeza, while alfalfa continued to show a response up to the 4-ton rate.

Alfalfa Response to Phosphate and Potash Topdressings on Dickson Silt Loam

Table 7 shows 4 years' alfalfa production on a Dickson silt loam at the Highland Rim Experiment Station in an experiment designed to determine the effect of maintenance applications of phosphate and potash on yield.

Before liming, this soil had a pH of 4.8. Agricultural limestone was applied at a rate of 3 tons per acre in August 1951; later that month, con-

Table 7. Four-year Production of Alfalfa as Influenced by Fertilization at Seeding and by Annual Topdressings of Phosphate and Potash at Various Rates on Dickson Silt Loam, Highland Rim Experiment Station, Springfield, 1953-1956.

Rate of fertilization (pounds per acre):				Year				
At seeding		As topdressing		1953 (3 cuts)	1954 (2 cuts)	1955 (4 cuts)	1956 (3 cuts)	4-year average
P_2O_5	K_2O	P_2O_5	K_2O					
					Tons of hay per acre			
0	150	0	0	2.90	2.27	2.81	1.25	2.31
40	150	0	0	3.24	2.47	3.00	1.49	2.55
80	150	0	0	3.48	2.35	2.76	1.40	2.50
160	150	0	0	3.38	2.46	2.84	1.45	2.53
160	0	0	0	3.19	2.31	2.71	1.37	2.40
160	150	20	37½	3.40	2.77	3.46	2.35	3.00
160	150	40	75	4.17	3.35	4.52	3.59	3.91
160	150	80	150	3.38	2.95	3.97	3.62	3.48
160	150	0	75	3.87	2.94	3.80	2.62	3.31
160	150	40	0	4.02	2.67	3.10	1.71	2.88
L. S. D. (5%)				N.S.	0.61	0.79	0.76	....

centrated superphosphate (CSP) and fused tricalcium phosphate, -40 mesh (FTP), were applied at rates of 40, 80, and 160 pounds of P_2O_5 per acre, along with muriate of potash at a rate of 150 pounds of K_2O per acre. A no-phosphate and a no-potash treatment were also included. A set of five treatments, fertilized at seeding at the rate of 0-160-150, was also included, on which topdressings of phosphate and/or potash were made annually at the rates specified in the table. CSP was the material used in this set.

The first seeding, made on August 23, 1951, failed, but the re-seeding (no additional fertilization) made about 1 year later was a success. The variety was Buffalo.

Topdressings were started in February 1953, the first production year, and were repeated annually for the duration of the experiment. Borax was applied at the rate of 15 pounds per acre at seeding and annually thereafter as a topdressing over the entire experiment.

Where no phosphate was applied, alfalfa averaged 2.31 tons of hay per acre over the 4-year period, and where no potash was applied it averaged 2.40 tons. Where both phosphate and potash were applied at seeding, but with no maintenance applications, the yields were only slightly higher than those on the no-phosphate and no-potash treatments, averaging 2.53 tons for the 40-, 80-, and 160-pound P_2O_5 rates. The

yields obtained with the two phosphates (CSP and FTP) were so similar that their yields have been combined and averaged.

Yields were markedly increased by the topdressings of phosphate and potash, the latter appearing to be more effective than the former. (See last two treatments in the table.) A topdressing maintenance application of 40 pounds of P_2O_5 and 75 pounds of K_2O appeared to be ample under the conditions of this experiment. This treatment resulted in a 4-year average yield of 3.91 tons of hay per acre. A maintenance application of one-half these amounts produced 3.00 tons and an application of twice these amounts produced 3.48 tons. A photograph of a part of this experiment in its first production year is shown in Figure 2.

An excavation of the root system in 1956 on one of the plots in this experiment showed that the maximum depth of root penetration was only 27 inches.[6] Apparently the fragipan (restrictive layer) in this soil limited root penetration.

The alfalfa crop was cut from 2 to 4 times a year in this experiment; the average number of cuttings was three. The average date of the first cutting was May 16, at which time—excepting 1955, when four cuttings were made—about 60% of the total hay production for the year was obtained. The average dates of the second and third cuttings were June 22 and August 3, respectively. June 23 was the date of the second and final cutting in 1954, while September 1 was the date of the final cutting in 1955, the only year in which four cuttings were made.

The stand of alfalfa had become spotty by the fourth production year; when observed in early spring of 1956, two species of weeds had begun to invade the stand—mouse-ear chickweed (*Cerastium viscosum*) and annual bluegrass (*Poa annua*), the bluegrass being the more prominent of the two. Crabgrass had become a problem by mid-summer.

Soil samples collected in the summer of 1953 (2 years after liming) tested mostly in the range pH 6.2 to 6.6.

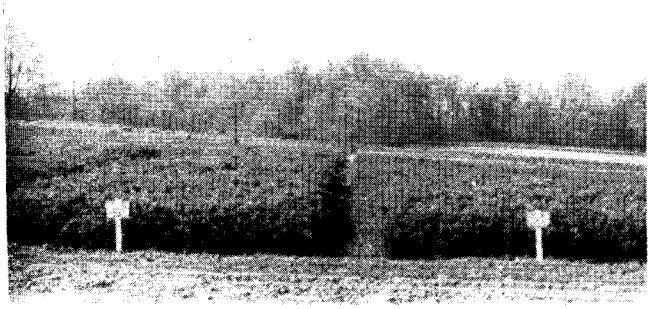

Figure 2. Alfalfa on Dickson silt loam, Highland Rim Experiment Station, Springfield, 1953.

[6] O. H. Long, *Root Studies on Some Farm Crops in Tennessee*, Tenn. Agric. Exp. Sta. Bul. 301, 1959.

Alfalfa Response to Phosphate and Potash on Mountview and Dickson Soils

Two experiments on alfalfa concerned with particle size of the fertilizer and the water solubility of the potassium in it were seeded in the fall of 1957—one on Mountview silt loam in Lawrence County and one on Dickson silt loam at the Highland Rim Experiment Station. The fertilizer materials were potassium-calcium pyrophosphate, potassium metaphosphate, and postassium chloride. Each material was applied in two sizes: 1) that passing through a 6-mesh screen but retained on a 14-mesh screen, and 2) that passing through a 35-mesh screen. The potassium component varied in water solubility from about 28% to 48% in the case of the first two materials to 100% in the case of potassium chloride.[7] Also included were a no-phosphate and a no-potash treatment. The rate of fertilization at seeding was 30-240-120 plus 20 pounds of borax per acre. Ground limestone had been applied in both experiments at a rate of 3 tons per acre before seeding.

Yields for the 2-year period, 1958-1959, are shown in Table 8. Since there was no significant difference in the yields obtained with the various P-K materials, they have been combined and averaged.

Table 8. Response of Alfalfa to Phosphate and Potash Fertilization on Mountview and Dickson soils, 1958-1959.

Fertilizer treatment	Mountview silt loam		Dickson silt loam	
	1958	1959	1958*	1959
	Tons of hay per acre			
No phosphate (30-0-120)	0	0	....	3.98
No potash (30-240-0)	1.94	1.50	....	4.35
Phos. and potash (30-240-120)	2.31	1.93	....	4.53
L. S. D. between no-potash and phosphate-potash treatment (5%)	N.S.	0.34	....	N.S.

* Cut twice in 1958, but yields not reported because of ryegrass infestation in first cutting.

Where unphosphated, the stand failed completely on the Mountview soil in the winter following seeding. There was some response to potash in both years, but the increase was statistically significant only in the second production year.

Alfalfa production was much better on the Dickson soil at the Highland Rim Experiment Station than on the Mountview soil in Lawrence County, but the response to both phosphate and potash was short of statistical significance. In the second year of production at the Highland Rim Experiment Station, yields of about 4½ tons of hay were

[7] These materials were provided by Tennessee Valley Authority, Division of Chemical Development.

obtained in four cuttings on the phosphate-potash treatment. First-year production was not recorded because of a heavy ryegrass infestation in the first cut.

Influence of lime and potash topdressings on alfalfa.—The experiment on Dickson silt loam, the results of which were presented in Table 8, was modified after the second production year by applying lime and potash at different rates as a topdressing on the various treatments. Rates of liming were 0, 1, 2, and 3 tons, and rates of potash were 100 and 200 pounds of K_2O per acre. In addition, the entire experiment was topdressed with 50 pounds of P_2O_5 and 30 pounds of borax per acre.

The alfalfa was cut four times in 1960. The yields obtained on the various treatments are shown in Table 9.

Table 9. Influence of Lime and Potash Topdressings on Yields of Alfalfa on Dickson Silt Loam, Highland Rim Experiment Station, Springfield, 1960.

Topdressing treatment* (rate per acre)	Acre yield of hay
No limestone topdressing, 100 lb. K_2O	3.56
No limestone topdressing, 200 lb. K_2O	3.92
1-ton lime rate, 100 lb. K_2O	3.73
1-ton lime rate, 200 lb. K_2O	4.03
2-ton lime rate, 100 lb. K_2O	3.67
2-ton lime rate, 200 lb. K_2O	3.95
3-ton lime rate, 100 lb. K_2O	3.74
3-ton lime rate, 200 lb. K_2O	3.98
SUMMARY	
Rates of lime	
No lime	3.88
1-ton rate	3.81
2-ton rate	3.86
3-ton rate	3.74
L. S. D. (5%)	N.S.
Rates of K_2O	
100 lb. K_2O	3.68
200 lb. K_2O	3.97
L. S. D. (5%)	0.13

* All treatments topdressed with phosphate (50 pounds of P_2O_5) and borax (30 pounds).

No yield response was obtained from lime topdressings, but the higher rate of potash resulted in yields significantly greater than those obtained from the lower rate.

Crabgrass began to invade the experiment in late summer of 1960. Phosphate, potash and borax topdressings were repeated in the spring of 1961, but the crabgrass infestation had become so pronounced that the experiment was abandoned after the first cutting that year.

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