

# Effect of Fertilization on Native Grass Pastures in Oklahoma

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Attempts to improve native grass areas by fertilization have rarely been successful in Oklahoma. Studies by Elder and Murphy (1958) and Murphy (n.d.) have shown that weeds were increased in native grassland by repeated applications of fertilizer.

To obtain additional data on the effect of fertilizers on native grass pastures, studies were conducted in 1957 and 1958 in the central cross-timber section of Oklahoma in an area formerly occupied by the Red Plains Conservation Experiment Station (1956). Botanical composition was determined both years on two fertilized and two unfertilized native grass pastures that had been grazed. The land on which these pastures were developed was described and designated by Daniel et al. (1943) as two types: 1. virgin, in the sense that it had never been plowed; it had been cleared of timber and scrub brush; 2. eroded and abandoned crop land which had been allowed to return to native grass over a period of 20 years or more. One pasture of each type was fertilized and one was left unfertilized. The unplowed and cleared area had been covered with native grasses and scrubby oaks (*Quercus* spp.) originally. The oaks were removed in 1935 and 1936 and in 1939 grazing was begun on both areas as a single unit.

The fertilized pastures received 300 pounds of superphosphate 0-20-0 per acre in 1952 and again in 1955, and an annual application of 33 pounds of actual nitrogen from ammonium ni-

trate 33-0-0 per acre applied in late May of each year until the grazing study was terminated at the end of the 1956 season.

The four native grass pastures investigated in this study were not grazed in 1957 and 1958. (The pastures will hereafter be referred to by fertility treatment and by land condition on which they were developed.) In August of 1957 and July, 1958, ten samples of vegetation selected at random were obtained from each pasture. The samples collected in 1957 were from plots 30 square feet in size clipped at a height of two inches above the soil surface. The same height of clip was used in 1958, but the plot size was reduced to 18 square feet. Each sample was hand separated into three categories; weeds, grasses and legumes. The composition of each pasture expressed in pounds of oven dry matter per acre is shown in Table 1. Previous treatment of these pastures and experimental grazing results as reported from the Red Plains Conservation Experiment Station (1956) from 1952 through 1956 are given in Tables 2 and 3.

## Plant Species Present

The predominant grasses in

the pastures at the time of this study were big and little bluestem (*Andropogon gerardi* and *A. scoparius*), switch (*Panicum virgatum*), Indian (*Sorghastrum nutans*), side-oats and blue grama (*Bouteloua curtipendula* and *B. gracilis*), splitbeard bluestem and silver beardgrass (*Andropogon ternarius* and *A. saccharoides*). A wide range of weeds were present, but the most commonly found were annual plantain (*Plantago* spp.), black-eyed susan (*Rudbeckia hirta*), maretail (*Erigeron canadensis*), annual broomweed (*Amblychyrus dracunculoides*), and western ragweed (*Ambrosia psilostachya*). Legumes present were catclaw sensitivebrier (*Schrankia uncinata*), lead plant (*Amorpha canescens*) and *Cassia* species.

## Pasture Differences in Grass Species

The predominant grass species in the pastures developed on eroded land were silver beardgrass and splitbeard bluestem; however, these grasses were noticeably absent on the deeper soils in the fertilized pasture of this group. In the non-fertilized eroded pasture the grasses were smaller in stature but more dense than those in the fertilized area.

In the unplowed-cleared pastures the desirable tall grasses predominated, with very little silver beardgrass or splitbeard bluestem present. In the fertilized pasture, many areas of solid switch grass stands resisted weeds and made a dense cover.

**Table 1. Botanical Composition of Four Native Grass Pastures on the Red Plains Conservation Experiment Station.**

Pasture—(Initial Land Condition & Treatment)	Pounds of Oven-Dry Matter Per Acre <sup>1</sup>					
	Grass		Weeds		Legumes	
	1957	1958	1957	1958	1957	1958
Eroded (No Fertilization)	754	847	229	89	13	3
Eroded (Fertilized)	714	504	821	476	45	39
Unplowed-cleared (No Fertilization)	1230	1311	541	185	23	0
Unplowed-cleared (Fertilized)	982	1408	1294	423	1	5

<sup>1</sup> Average of ten samples from each pasture.

**Table 2. Stocking rate, animal gains and hay produced during five seasons on fertilized and unfertilized native grass pastures developed on eroded land at the Red Plains Conservation Experiment Station**

Item	Season <sup>1</sup>				
	1952	1953	1954	1955	1956
30 acres—Fertilized:					
Acres per animal	3.75	3.75	3.00	3.00	3.75
Lbs. gain/head, season	316	276	178	138	211
Lbs. gain/head, day	2.61	2.12	1.71	2.55	1.94
Lbs. gain/head, acre	85	75	59	46	56
Lbs. hay/acre (oven dry) <sup>2</sup>	1,362	1,905	525	861	1,229
30 acres—Unfertilized:					
Acres per animal	5.00	5.00	4.29	4.29	5.00
Lbs. gain/head, season	285	240	104	186	151
Lbs. gain/head, day	2.36	1.85	1.00	1.65	1.39
Lbs. gain/head, acre	57	48	24	43	30
Lbs. hay/acre (oven dry) <sup>2</sup>	1,180	1,217	203	618	910

<sup>1</sup> Grazing period in 1952 was May 1 to August 29 (121 days); in 1953, April 24 to August 31 (130 days); in 1954, May 6 to August 18 (105 days); and in 1955, the fertilized pasture was grazed from May 5 to June 26 (53 days) and the unfertilized pasture was grazed from May 3 to August 25 (115 days).

<sup>2</sup> Yields from three meadows in each pasture.

As was found in the eroded area, the grasses were taller where fertilizer was used, but the unfertilized-unplowed pasture had the most dense stand of grass.

### Weed Growth

Most of the weeds found in these pastures were annuals. This was probably the result of a 2,4-D spraying program in previous years which practically eliminated the perennials. In the non-fertilized eroded pasture 23 percent of the total yield was weeds in 1957 which is not considered excessive in this type of grassland. Weeds will usually comprise about 20 percent or more of the total yield of most hay meadows in Oklahoma that are cut only once a year. Very few native grass pastures, properly grazed, will have less than about 30 percent of their total yield in the form of weeds.

The production of 2 to 5 times more weeds by weight in the fertilized pastures than the unfertilized, clearly demonstrates that many weeds will respond to fertilizer much better than these native grasses.

A greater proportion of weeds was found each year in the pas-

tures developed on the unplowed and cleared land than on that which was eroded. In 1957 the non-fertilized unplowed pasture had 30 percent of its total yield in the form of weeds, while 57 percent of the total yield was weeds in a similar pasture that was fertilized. Then in 1958 weeds produced twice as much vegetation on the fertilized unplowed pasture as on the non-

fertilized. These results not only indicate that fertilizers will increase weed production considerably, but in addition, along with animal gains per acre as shown in Tables 2 and 3, suggest these pastures on the unplowed and cleared land had been grazed heavier in the past than those developed on the eroded land.

One application of 2,4-D in 1958 to a portion of the fertilized unplowed pasture reduced the yield of weeds more than 90 percent as compared to the unsprayed area.

### Total Production

Total production of grass for this two year period was slightly in favor of the non-fertilized pastures regardless of land condition where they were developed. The greatest yield of oven-dry material per acre each year was higher where fertilizers were used. This primarily resulted from greater weed production, as there was very little, if any, increase in legume yield and only in 1958 was there an increase in grass production and this was less than 100 pounds per acre. These data are in close agreement with those obtained by Elder and Murphy (1958). The

**Table 3. Stocking rate, animal gains and hay produced during 5 seasons on fertilized and unfertilized native grass pastures developed on unplowed and cleared (virgin) land at the Red Plains Conservation Experiment Station**

Item	Season <sup>1</sup>				
	1952	1953	1954	1955	1956
30 acres—Fertilized:					
Acres per animal	2.50	2.30	2.00	2.00	2.00
Lbs. gain/head, season	334	304	172	252	213
Lbs. gain/head, day	2.76	2.34	1.65	2.22	1.97
Lbs. gain/head, acre	134	132	86	126	106
Lbs. hay/acre (oven dry) <sup>2</sup>	2,222	2,885	1,107	1,294	1,390
30 acres—Unfertilized:					
Acres per animal	3.33	3.33	2.73	2.73	2.00
Lbs. gain/head, season	321	242	143	202	152
Lbs. gain/head, day	2.65	1.86	1.38	1.79	1.41
Lbs. gain/head, acre	96	73	52	74	76
Lbs. hay/acre (oven dry) <sup>2</sup>	1,822	2,081	956	1,089	841

<sup>1</sup> Grazing period in 1952 was May 1 to August 29 (121 days); in 1953, April 24 to August 31 (130 days); in 1954, May 6 to August 18 (105 days); and in 1955, May 5 to August 25 (113 days).

<sup>2</sup> Yields from three meadows in each pasture.

most unexpected result from this study was the lack of, or extremely small contribution made by native legumes to the total production, even when fertilized.

### Summary

The effect of repeated application of fertilizers on native grass pastures was determined in the growing season of 1957 and 1958. These pastures were located in the central cross-timber area of Oklahoma on land formerly occupied by the Red Plains Conservation Experiment Station. The land had been described and designated as two types: 1. virgin, in the sense that it had never been plowed; it had been cleared of timber and scrub brush; 2. eroded and abandoned crop land which had been allowed to return to native grass over a period of 20 years or more. Each land type was equally divided into two pastures one of which was fertilized. The fertilized pasture of each land type received an application of 300 pounds of superphosphate 0-20-0 per acre in 1952 and again in 1955, and an annual application of 100 pounds of ammonium nitrate 33-0-0 per acre

applied in late May of each year until the grazing study was terminated at the end of the 1956 season. The four native grass pastures reported in this study were not grazed in 1957 or 1958.

In August of 1957 and July, 1958 ten samples of vegetation selected at random were obtained from each pasture. Each sample was separated into three categories: grasses, weeds, and legumes. Weed production expressed in percent of the total yield of vegetation for both years was 16 on the eroded non-fertilized pasture compared to 50 on the fertilized eroded pasture. In the non-fertilized unplowed pasture 22 percent of the total yield for both years were weeds, whereas weeds constituted 42 percent of the vegetation harvested from the fertilized unplowed pasture.

The total yield of grass for this two year period was slightly greater on the non-fertilized pastures regardless of land condition where they were developed.

The production of 2 to 5 times more weeds by weight in the fertilized pastures than the unferti-

lized, clearly demonstrates that many weeds will respond to fertilizer much better than these native grasses.

Pastures which were fertilized produced the greatest yield of oven-dry material per acre each year. This primarily resulted from greater weed production, as there was very little, if any, increase in legume yield and only in 1958 was there an increase in grass production and this was less than 100 pounds.

Native legumes contributed little, if any, to the total production even when fertilized.

### LITERATURE CITED

- DANIEL, HARLEY A., HARRY M. ELLIOTT, AND MAURICE B. COX. 1943. Investigations in erosion control and reclamation of eroded land at the Red Plains Conservation Experiment Station, Guthrie, Oklahoma 1930-40. U. S. Dept. of Agric. Tech. Bul. No. 837.
- ELDER, W. C. AND H. F. MURPHY. 1958. The effect of fertilization and over-seeding with Lespedezas on a native hay meadow. Okla. Agri. Exp. Sta. Bul. B-504.
- MURPHY, H. F. Unpublished data. Okla. Agr. Exp. Sta.
- RED PLAINS CONSERVATION EXPERIMENT STATION. 1956. Guthrie, Oklahoma Annual report of progress.