Grazing and Clipping Experiments With Small-Grain Pastures In South Central Oklahoma

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Several studies designed to obtain information on the profitable utilization of winter small-grain pastures in south central Oklahoma were conducted during the period 1953 through 1958 on farms maintained by The Samuel Roberts Noble Foundation, Inc., in the vicinity of Ardmore, Oklahoma. This publication reports the results of those studies.

Grazing Experiments

In the grazing experiments, forage production of small-grain pastures was measured by weight gains of yearling beef cattle grazing on them.

The rate of stocking was varied as necessary to utilize the forage available. One yearling to two acres was a common stocking rate in late fall and winter. In March and April, a common rate was one head per acre on the low fertility soils, and one and one-half to two head per acre on the more productive soils. The stocking rate in March and April was about twice that maintained in December through February.

The protein content of the small-grain forage varied from 16 to 25 percent on a dry-matter basis, with the highest values occurring early

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in the season. In general, the protein content remained high until March, and then declined through March and April.

At the beginning of each grazing season, a non-legume hay was placed in feed bunks in each pasture to supply energy needed to balance the high protein content of the small-grain forage. Sudan, Johnsongrass, and prairie hays were used, as available.

Cross Timbers Soil (Stephenville Sandy Loam)

Two different trials were conducted on Stephenville sandy loam on the Foundation's Lone Grove Farm. One tested the grazing value of a mixture of Abruzzi rye and vetch. The other compared the grazing values of two varieties of rye: Abruzzi and Elbon.

This soil had been used primarily for row crops for about sixty years, and the natural productivity was very low. During these trials, cowpeas were grown for summer grazing, and the cowpea residue was disked into the soil in early September.

Abruzzi Rye and Vetch

A mixture of Abruzzi rye and hairy vetch was grown annually on a 13 acre pasture. Table 1 reports animal gains by years, and shows planting dates and rates, fertilizer treatment, and grazing period.

The 4-12-4 fertilizer applied in 1953 did not supply enough nitrogen to produce much rye, but a good stand of vetch was available for grazing in April and May.

Abruzzi Rye vs. Elbon Rye

The relative grazing values of Abruzzi rye and Elbon rye were compared on this soil in 1956-57 and 1957-58. Results are shown in Table 1. In 1956, it was necessary to replant these plots. Poor stands resulted from the first planting when the seed was drilled into moist soil that had been packed by a heavy rain. A top-dressing of ammonium nitrate was applied on February 11, 1957, which was too late to be of maximum benefit to the Elbon rye. This variety develops earlier than Abruzzi; and, as a result, the Elbon pasture was overgrazed in February and early March. The total animal gain made on it was low. The following year, animal gain on the Elbon rye pasture was higher than on the Abruzzi pasture.

Table 1.—Gains of Yearling Beef Cattle* on Winter Small-grain Pastures on Two Soil Types and with Various Fertilizer Treatments; Noble Foundation's Lone Grove Farm, Carter County

	Date Planted	Seeding rate (lbs. per acre)	Fertilizer Treatment Formula	Fertilizer Treatment Rate (lbs. per acre)	Grazing Period From	Grazing Period To	No. of Days Grazed	Animal Gain (lbs. per acre)
Stephenville Sandy Loam								
Abruzzi rye and vetch								
1952-53	Oct. 6	20**	4-12-4	200	not grazed		none	none
1953-54	Oct. 14	40	4-12-4	200	Mar. 2	Apr. 26	55	93
1954-55	Sept. 24	40	0-20-0	200	Dec. 10	Feb. 15; Mar. 9 Apr. 23	112	161
1955-56	Oct. 8	40	0-20-0	190	Feb. 23	Apr. 23	60	191
1956-57	Sept. 6	40	0-20-0	150	Dec. 26	May 22	147	216
1957-58	Sept. 20	50**	0-20-0	160	Nov. 25	May 1	157	158
Elbon rye								
1956-57	Sept. 7	43	16-20-0	100††				
	Oct. 23†	37			Dec. 26	May 10	135	150***
1957-58	Sept. 25	77	16-10-0	150	Nov. 25	May 1	157	192
Abruzzi rye								
1956-57	Sept. 7	43	16-20-0	100††				
	Oct. 23†	36			Dec. 26	May 10	135	226
1957-58	Sept. 25	64	16-10-0	150	Nov. 25	May 1	157	128
Renfrow Fine Sandy Loam								
Arkwin oats								
1956-57	Sept. 4	88	8-32-0	100	Dec. 26	Apr. 26	121	191
1957-58	Sept. 10	72	16-10-0	125	Nov. 25	May 1	157	277
Mixture†††								
1956-57****	Sept. 4	--	----	---	----	---	---	---
1957-58	Sept. 10	60	16-10-0	125	Nov. 25	May 1	157	284

*All animals were yearlings. Steers were used in 1953-54, 1954-55, and 1955-56; heifers in 1956-57; and half steers and half heifers in 1957-58.
**Rate shown is for small grain. Vetch was seeded with the grain at the rate of 15 pounds per acre in 1952; 10 pounds per acre in 1956-57.
†Replanted and no fertilier applied.
††Topdressed with 90 pounds per acre of ammonium nitrate Feb. 11, 1957; too late to be of maximum benefit to the Elbon rye.
***Overgrazed in February and early March and beef gain was low.
†††40 percent Elbon rye, 10 percent Abruzzi rye, and 50 percent Arkwin oats, by weight.
****Much of the rye did not survive due to hot, dry weather following seeding. Plots were grazed but data is not shown in table.

Reddish Prairie Soil (Renfrow Fine Sandy Loam)

A grazing study comparing Arkwin oats with a small-grain mixture was started on the Lone Grove Farm in the fall of 1956. It was planted on Renfrow fine sandy loam, a moderately productive, medium-textured Reddish Prairie soil. In 1956, a poor stand of the small-grain mixture resulted from the effects of two weeks of hot, dry weather following planting. Grazing data for oats in 1956-57 and 1957-58, and for the mixture in 1957-58, are shown in Table 1.

Black Grassland Soil (Denton Clay)

Abruzzi and Elbon ryes, Arkwin oats, and mixtures of these three were compared in grazing trials at the Foundation's Blackland Farm in Marshall County from 1955-56 through 1957-58. The pastures were planted on slightly eroded Denton clay, a black grassland soil. Button clover and sweet clover had been grown on the land previously to increase the available nitrogen supply. The button clover reseeded annually and produced some grazing in early spring. The land was plowed in July, after the button clover plants were mature.

Table 2.—Gains of Yearling Beef Cattle on Winter Small-grain Pastures on Denton Clay Soil,* Noble Foundation's Blackland Farm, Marshall County

	Date Planted	Seeding Rate (lbs. per acre)	Grazing Period		No. of Days Grazed	Animal Gain (lbs. per acre)
			From	To		
1955-56 (Steers)						
Abruzzi rye	Oct. 7	40	Feb. 23	May 5	72	104
Elbon rye	Oct. 7	40	Feb. 23	Apr. 10	47	101
1956-57 (Steers)						
Abruzzi rye	Sept. 14	50	Dec. 27	May 8	131	189
Elbon rye	Sept. 14	50	Dec. 27	May 8	131	227
Arkwin oats	Sept. 16	96	Dec. 27	May 8	131	261
Mixture**	Sept. 20	70	Dec. 27	May 8	131	260
1957-58 (Half steers; half heifers)						
Abruzzi rye	Sept. 20	60	Dec. 5	May 28	174	180
Elbon rye	Sept. 20	70	Dec. 5	May 28	174	195
Arkwin oats	Oct. 1	96	Dec. 5	May 28	174	261
Mixture†	Oct. 2	70	Dec. 5	May 28	174	229

*Fertilized with 150 pounds of 0-20-0 per acre annually, except 180 pounds per acre were applied on the two rye varieties in 1956-57.
**One-third each Elbon rye, Abruzzi rye, and Arkwin oats, by volume.
†Elbon rye 40 percent, Abruzzi rye 10 percent, and Arkwin oats 50 percent, by weight.

Table 2 reports animal gains, and shows planting dates and rates, fertilizer treatment, and grazing periods. In 1955-56, planting was delayed, and fall and winter rainfall was far below average. In the other two years it was possible to plant at the intended time, and the fall and winter rainfall was average.

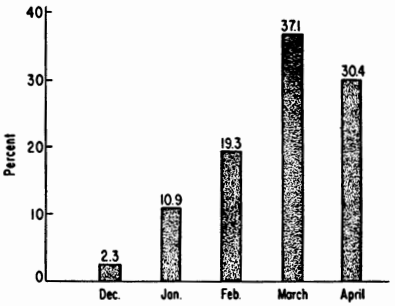


Figure 1. Monthly distribution of total annual animal gain in percent. Average of six small-grain pastures, 1955-56 and 1956-57.

Animal Gain by Months

Figure 1 shows animal gains by months, as percentages of total seasonal gain, for six small-grain pastures during the two years 1955-56 and 1956-57. About two-thirds (67.5 percent) of the total annual gain was made in March and April. Monthly animal gains were quite similar to monthly forage production data obtained in clipping experiments.

Pasture Costs and Returns

Table 3 presents annual data on the costs and returns from the Abruzzi rye and vetch pastures on the Stephenville soil on the Long Grove Farm. Figure 2 shows a comparison of costs and value of animal gains.

The increase in costs during the second and third years is principally due to more interest on the investment for more cattle needed to consume the forage produced.

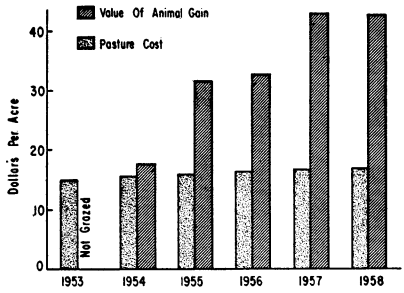


Figure 2. Effect of planting Abruzzi rye and hairy vetch annually on labor income from beef gains produced on Stephenville sandy loam that had been row cropped for more than 50 years. Noble Foundation Lone Grove farm, 1953-58.

The low labor income for the first two years reflects the low forage yields resulting from a lack of available nitrogen in the soil. The greatly improved return in 1954-55 and following years, can be credited to the soil-improving effect of the vetch and cowpea residues.

The fact that winter rainfall was below average for the Carter county area in four of the six years suggests that the results may be representative of those to be expected farther west in Oklahoma where average winter rainfall is lower.

Table 3.—Pasture Costs, Animal Gains, Value of Gain, and Labor Income from Grazing Abruzzi Rye and Hairy Vetch; Stephenville Sandy Loam, 1952-53 through 1957-58; Noble Foundation's Lone Grove Farm

Year	Pasture costs (dollars per acre)	Animal gain (lbs. per acre)	Price /cwt.* (dollars)	Value of gain per acre (dollars)	Labor income (dollars per acre)	Fall and winter rain (percent of average)
1952-53	15.10	---	-- --	-- --	-- --**	61.0
1953-54	15.75	93	18.85	17.53	1.78	69.0
1954-55	16.23	161	19.50	31.39	15.16	77.3
1955-56	16.41	191	17.10	32.66	16.25	55.0
1956-57	16.59	216	19.75	42.66	26.07	107.0
1957-58	16.59	158	26.75	42.26	25.67	112.2

*Average of choice and good grades in Oklahoma City on May 1, less hauling and selling costs.
**Not grazed in 1952-53; some income from grazing or vetch seed could have been obtained.

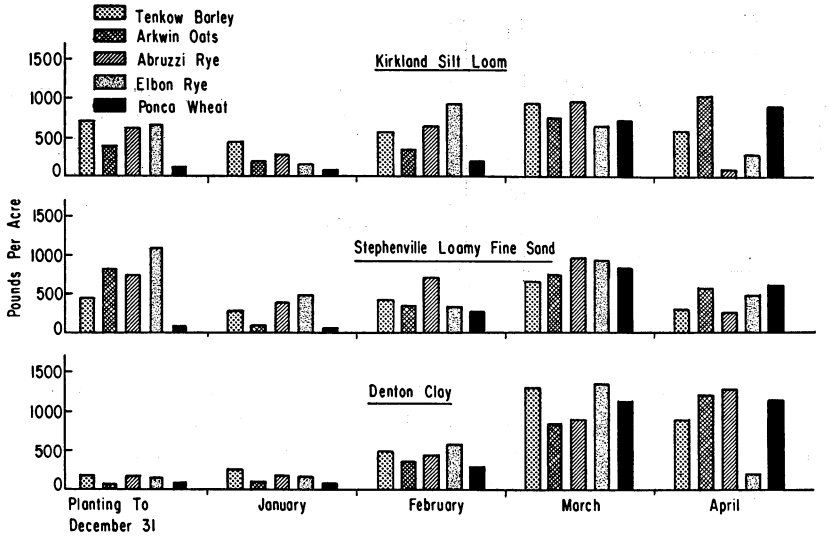


Figure 3. Average oven-dry weights of fall planted small-grains produced on three South Central Oklahoma soils, 1955-58.

Clipping Experiments

Forage Yields on Three Soil Types

Forage yields of small grains were measured during three winter grazing seasons by clipping nursery-size plots grown on three different soils: the Denton clay on the Foundation's Headquarters Farm; and Kirkland silt loam and Stephenville loamy fine sand* on the Lone Grove Farm. Figure 3 shows the average monthly production of five varieties of small grain on each of the three soils for a three year period. In two of the three years, fall growth and total production were reduced by delayed planting due to low rainfall in September and early October.

*Similar to, but not the same as, the Stephenville sandy loam on which the grazing trials were located.

The Denton clay produced the least fall and early winter growth, but forage production held up longer on this soil in late spring (except for Elbon rye). On the sandy Stephenville soil, lack of available nitrogen prevented optimum growth of all small grains in 1955-56. Rye made a much better growth than barley in all years on this soil.

Ponca wheat grew slowly during the fall and winter on all three soils; but March growth of this small grain compared favorably with that of the other grains. April growth of Ponca wheat was similar to that of Arkwin oats.

Effect of Delayed Planting

A one-month delay in time of planting cut the fall and winter yield of clipped small-grain forage in half in 1957-58 (Table 4). The delay had somewhat less effect on rye than on the other grains.

In a comparison of growth rates and atmospheric temperatures, Elbon rye grew more rapidly than Arkwin oats when the average daily temperature was 50° F., but the oats grew more rapidly than the rye when the average daily temperature was 64° F.

Table 4.—Relation of Date of Planting to Fall and Winter* Clipped Forage Yield of Small Grains; 1957-58.

Crop	Number of Varieties Averaged	Yield of oven-dry forage (lbs. per acre) when planting date was—	
		September 19	October 20
Rye	5	4610	2435
Oats	5	3821	1546
Barley	4	2471	1129
Wheat	3	1663	752

*Through April

Summary

Several studies involving winter small-grain pastures were conducted in south central Oklahoma during the period 1953-58.

In grazing trials, Abruzzi rye and hairy vetch on a sandy Cross Timbers soil low in natural feritlity (Stephenville sandy loam) produced average animal gains of about 180 pounds per acre annually during the last four years of a six-year study. During the first two years, before soil fertility had been built up by the rye and vetch residues and commercial fertilizer treatment, little or no grazing was obtained.

Other grazing trials over shorter periods of time on this soil and two other soils provided data on (1) the relative performance of Abruzzi rye, Elbon rye, Arkwin oats, and mixtures of these three, and (2) the monthly gains of the animals.

Less fall and winter growth was produced in small-grain clipping studies on Denton clay than on Kirkland loam or Stephenville loamy fine sand. Maximum rye forage production occurred in March on all soils. Pastures on Denton clay reached grazing condition somewhat later in the fall, but continued to produce higher forage yields later in the spring (except where Elbon rye was planted). Excessively hot weather in early September was less damaging to oats and barley than to rye and wheat.

Elbon rye grew more rapidly than oats when the average daily temperature was about 50° F., but the Arkwin oats grew more rapidly when the daily temperature average was 64° F.

Small grains planted in mid-September produced about twice as much fall and winter forage as those planted in mid-October, in a one-year comparison.

In both clipping and grazing trials, Elbon rye reached its greatest productivity earlier in the spring than did Abruzzi rye.

Appendix

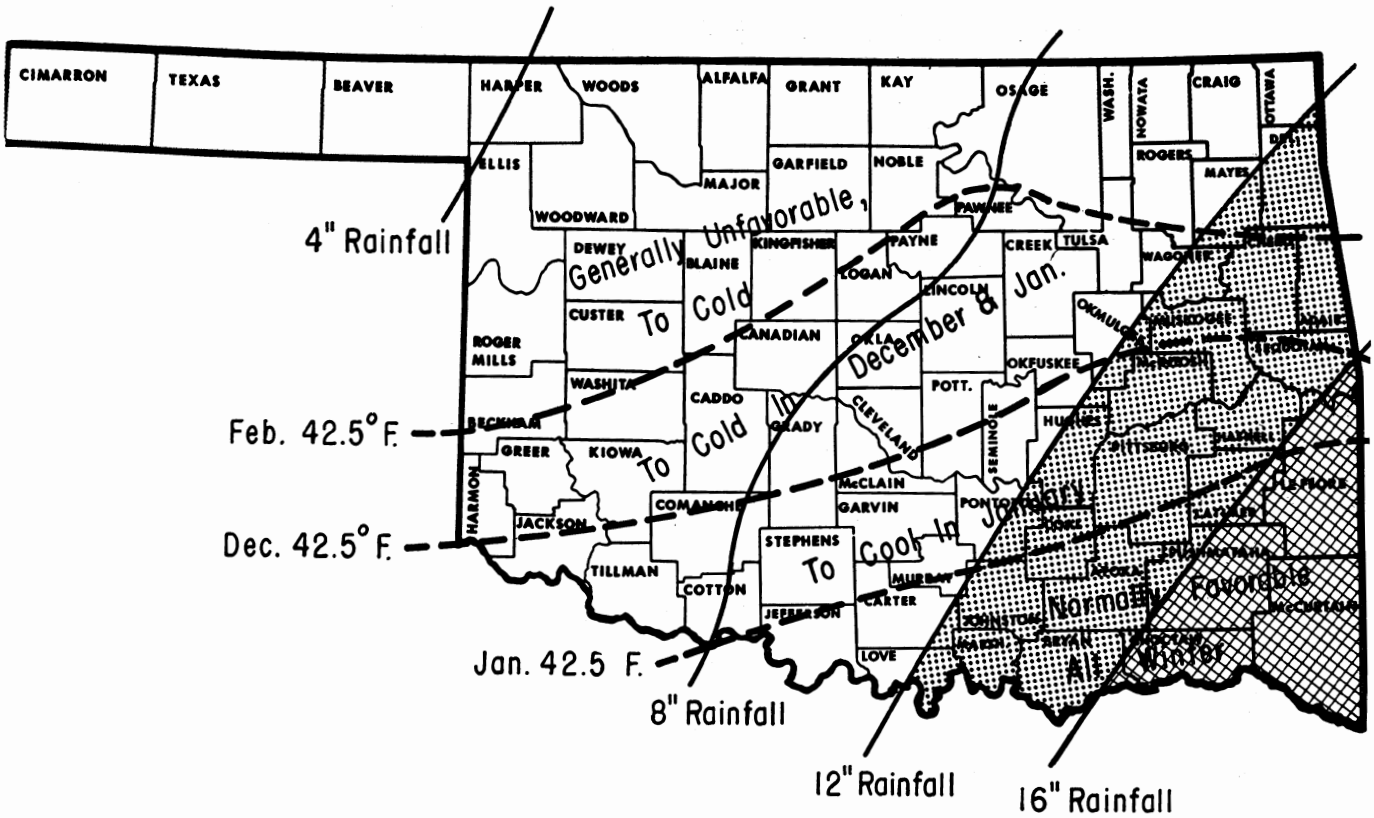
Some Observations on the Relation of Climate To Winter Forage Production

Appendix Figure 1 presents information on the average cool-season rainfall in Oklahoma, and shows the 42.5° F. isotherms for December, January, and February. The latter indicate the southern boundary of the areas where the average monthly temperature is often too low for cold-tolerant small grains to produce much winter growth.

When cold-tolerant plants are exposed to freezing weather, they become dormant. Some small-grain varieties such as Elbon rye recover from a dormant condition more quickly following a few days of warm weather than other varieties. However, the rate of plant growth will be slow unless the maximum daily temperature is above 60° F. and the minimum temperature at night is above 32° F. Length of day also affects rate of growth. More forage will be produced in late February and early March than in November, although the average daily temperatures are the same.

Below average rainfall in September and October will delay the planting of small-grain pasture about one-half of the years. Also, the growth of fall-planted small grains will be small when total rainfall from November 1 to March 31 of the following year is less than eight inches. More acreage per animal is required under such conditions.

Plant nutrients are released slowly from organic matter in a cold soil. Consequently, small-grain pastures fertilized with superphosphate or a mixed fertilizer when planted, and grazed heavily in late fall and early winter, should be top-dressed with nitrogen to increase forage production in late winter and early spring.



Appendix Figure 1. Average rainfall from November 1 to March 31 and 42.5° F. isotherms which indicate when different areas are usually too cold for cold-tolerant small grains to produce much winter growth.