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RESPONSE OF BEEF CATTLE *TO* PASTURE IMPROVEMENT *WITH* BIRDSFOOT TREFOIL

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INTRODUCTION

When improving a pasture a practical decision must be made as to how far to go with improvement practices. Experiments have shown that lime and fertilizer alone will substantially increase the yield of infertile pastures. Further improvement can usually be obtained by tearing up the old sod and reseeding with adapted species. Many acres of poorly drained infertile areas are used for pasture in northeast Ohio. A test was designed to compare improvement of these areas by lime and fertilizer applications alone and by tearing up the old sod and seeding to European birdsfoot trefoil.

LITERATURE REVIEW

Mott **et al.** (3) studied pasture improvement by applying lime plus 300 pounds 0-20-10 per acre annually to a bluegrass sod, lime and 0-20-10 plus 120 pounds nitrogen per acre annually, and lime and 0-20-10 plus seeding with birdsfoot trefoil. The treatment of lime and 0-20-10 increased the pasture yield about 50% over the untreated pasture. Nitrogen at the rate of 120 pounds per acre gave an additional increase of beef production per acre of 45%. The mixture of birdsfoot trefoil-bluegrass gave about 60% more yield per acre when compared with bluegrass alone under similar fertility treatment and grazing management. There was little or no difference in the daily gain of steers for pastures with the same grazing management.

VanKeuren and Heinemann (5) compared legume-grass mixtures and grasses alone at high fertility levels for irrigated pasture. Steers made more gain per acre and a higher daily rate of gain on the legume-grass mixtures.

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Heinemann and VanKeuren (2) compared legumes alone, legume-grass mixtures and grass alone at high fertility levels as irrigated pasture for sheep. The sheep made more gain per acre on an alfalfa-orchardgrass mixture or alfalfa alone. The highest daily rate of gain was on legumes alone and the lowest daily gain on orchardgrass alone. The legume-grass mixtures were intermediate with respect to daily gain.

Davis and Bell (1) found that a high legume content of pastures was associated with a high daily rate of gain of lambs.

EXPERIMENTAL PROCEDURE

The test was conducted at the Mahoning County Experiment Farm. The soils of this section of Ohio are silt loams or silty clay loams with very poor internal drainage. Twenty acres of an unproductive sod on flat land was plowed and a bedding system installed for surface drainage. About 2/3 of the plowed area was classified as Ravenna silt loam and about 1/3 Trumbull silty clay loam. Ten acres were seeded to European birdsfoot trefoil-bluegrass and ten acres to European birdsfoot trefoil-reed canarygrass in the spring, 1952. An excellent stand of birdsfoot trefoil was obtained on both areas. A good stand of bluegrass was obtained but the stand of reed canarygrass remained unsatisfactory after an attempt to introduce more of this species. Bluegrass volunteered in the area seeded to reed canarygrass. Due to the inadequate stand of reed canarygrass and the similarity of results from the two seeded pastures, results are reported as an average of the two seeded to birdsfoot trefoil.

An adjacent, but better drained 10-acre area of sod was left undisturbed for comparison. The sod was composed primarily of meadow fescue, bluegrass, redtop, annual species and weeds. The proportion of these species varied some with seasons but the biggest noticeable change was a gradual increase in density of sod. The soil of this area was about 2/3 Ravenna silt loam and 1/3 Canfield silt loam.

All areas were limed and fertilized alike except for nitrogen. Four tons of lime and 500 pounds per acre of 0-20-10 were applied in 1951. 300 pounds per acre of 0-20-20 was applied annually thereafter. An additional three tons per acre of lime was applied in 1954. Sixty pounds per acre of nitrogen was applied on the grass sod only in April 1955 and 1956. Each 10 acres was divided into two paddocks for rotational grazing.

Experimental grazing started June 6, 1953 and continued to September 19. Yearling Hereford steers were used to graze the pastures. The "put and take" [1] system of stocking was used with five tester animals per treatment sorted by weight. The maximum number of animals per pasture in 1953 was 20. The cattle were rotated between the two paddocks of each treatment on about a 4-week schedule in 1953 as well as the other years of the test. The steers were weighed every four weeks unless it was necessary to adjust the stocking rate more frequently. The same weighing policy was used the remaining years of the test.

The same group of animals used in 1953 were held over and grazed as two-year-olds in 1954. The grazing period was May 14 to September 29. Three tester animals, sorted by weight, were used on each treatment. The maximum number of animals per pasture was 16. The animals were in very thin condition at the start of the grazing season.

Yearling Hereford heifers were the grazing animals in 1955 and 1956. Four tester animals, sorted according to their wintering ration, were used on each pasture both years. The maximum number of animals per pasture was 22 for each year. The grazing periods were May 16 to September 23, 1955 and May 23 to October 2, 1956.

RESULTS AND DISCUSSION

The carrying capacity of the pastures in terms of animal days per acre is shown in table 1. Although there was no true replication of treatments, the large differences leave little doubt of the superiority of

[1]The use of a variable number of animals during the grazing season, adjusted according to the amount of forage, with one or more animals (testers) remaining on the pasture the entire season.

TABLE 1.—Total observed animal days per acre from grass and birdsfoot trefoil-grass pastures

Treatment	1953	1954	1955	1956	Average 1953-54	Average 1955-56
Grass	98	111	183*	156*	104	170*
Birdsfoot trefoil-grass	136	172	258	178	154	218
Average	117	142	220	167	129	194

*60 pounds nitrogen per acre applied on grass, April 1955 and 1956.

the birdsfoot trefoil-grass pastures. The low yield of 1953 is due primarily to an unusually dry season, while the high yield of 1955 is due to an unusually wet season. Carrying capacity is a measure of the quantity of forage available and has nothing to do with the "quality" of the forage.

The sum of gains and losses of all cattle on the pastures is reported in table 2. Again the large differences leaves little doubt of the superiority of pastures seeded to birdsfoot trefoil. The gain per acre in 1954 was higher than that normally expected because very thin two-year-old steers were used as the grazing animal. Mott **et al.** (3) report much higher pasture gain from thin steers than from fat steers.

TABLE 2.—Observed gain per acre of all cattle on grass and birdsfoot trefoil-grass pastures

Treatment	1953	1954	1955	1956	Average 1953-54	Average 1955-56
	lb.	lb.	lb.	lb.	lb.	lb.
Grass	108	239	221*	226*	174	224*
Birdsfoot trefoil-grass	210	396	386	263	303	324
Average	159	318	304	244	237	274

*60 pounds nitrogen per acre applied on grass, April 1955 and 1956.

Table 3 shows the average daily gain of animals remaining on the pastures the entire grazing season (testers). The low rate of gain on grass in 1953 and 1955 may be partially due to stocking too heavy. VanKeuren and Heineman (5) reported that steers made a higher daily rate of gain on legume-grass mixtures than on grass alone. Mott **et al.**

TABLE 3.—Average daily gain of tester animals on grass and birdsfoot trefoil-grass pastures

Treatment	1953	1954	1955	1956	Average 1953-54	Average 1955-56
	lb.	lb.	lb.	lb.	lb.	lb.
Grass	0.66	1.98	0.68*	1.38*	1.32	1.03*
Birdsfoot trefoil-grass	1.36	2.14	1.32	1.65	1.75	1.49
Average	1.01	2.06	1 00	1.52	1.54	1.26

*60 pounds nitrogen per acre applied on grass, April 1955 and 1956.

(3) found very little difference in the rate of gain of steers on bluegrass and a mixture of birdsfoot trefoil-bluegrass. Daily gain is a measure of the "quality" of the pasture forage and is independent of the quantity available if properly stocked.

The tester gain per acre was calculated by the animal day method of Mott and Lucas (4) and is shown in table 4. It is the product of the tester daily gain and animal days per acre. Again the superiority of the pastures seeded to birdsfoot trefoil is evident.

TABLE 4.—Average tester gain per acre by the animal-day method on grass and birdsfoot trefoil-grass pastures

Treatment	1953	1954	1955	1956	Average 1953-54	Average 1955-56
	lb.	lb.	lb.	lb.	lb.	lb.
Grass	64	220	125*	216*	142	170*
Birdsfoot trefoil-grass	186	367	340	294	278	317
Average	125	294	232	255	210	244

*60 pounds nitrogen per acre applied on grass, April 1955 and 1956.

Table 5 shows the consumption of total digestible nutrient (TDN) of cattle calculated from factors for maintenance and gain reported by Lucas and Mott.[2] This is perhaps the best over-all measure of the pastures for comparative purposes since both quantity of forage and "quality" would affect the TDN yield.

[2]Lucas, H. L. and G. O. Mott. Methods of computing results of grazing trials. North Carolina State College and Purdue Univ. Mimeo.

TABLE 5.—TDN consumption per acre by cattle on grass and birdsfoot trefoil-grass pastures

Treatment	1953	1954	1955	1956	Average 1953-54	Average 1955-56
	lb.	lb.	lb.	lb.	lb.	lb.
Grass	806	1230	1080*	964*	1020	1020*
Birdsfoot trefoil-grass	1240	1510	1840	1180	1380	1510
Average	1020	1370	1460	1070	1200	1260

*60 pounds nitrogen per acre applied on grass, April 1955 and 1956.

The nitrogen application on the grass sod in 1955 and 1956 gave a visual response, but it is impossible to determine how much the yield of the grass sod was increased by the nitrogen in this test. The birdsfoot trefoil-grass pastures continued to yield more than the grass sod with nitrogen.

SUMMARY

The performance of beef cattle on grass and birdsfoot trefoil-grass pastures was compared for four years. Animal response was measured in terms of animal days, observed gain per acre, daily gain, tester gain per acre and TDN consumption. The yield from birdsfoot trefoil-grass pastures was substantially higher for all methods of measuring results.

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