Production Characteristics of Oklahoma Forages

Grazing Characteristics and Clipping Responses of Small Grains

by
W. C. ELDER

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Content

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By W. C. Elder

Department of Agronomy

Winter pasturing of wheat grown primarily for grain has contributed greatly to Oklahoma's livestock production for many years. More recently, other small grains, chiefly rye and oats, have been planted for winter and spring pasture, without regard to grain production. Small grains are now being planted solely for pasture on more than a half million acres in Oklahoma.

Best use of winter small grain pasture requires more management decisions than does the use of native or other permanent pasture. Therefore the Experiment Station in the mid-1930's began a series of experiments in which the results from clipping and chemical analysis of small grain forage was used to measure production. More recently, the liveweight gain of grazing animals has been used as another measurement.

This publication reports a group of comparisons made on the Agronomy Farm at Stillwater between 1953 and 1959. It also briefly summarizes some of the work done at the Station's Perkins Farm south of Stillwater and the Southeast Oklahoma Soil Improvement Station near Heavener.*

Previous Work

Previous small grain grazing trials reported in Oklahoma are all from winter wheat pastures. All clipping trials were variety comparisons, fertility tests, or attempts to determine the best time to cease grazing for high grain production.

Feeder lambs grazing lush wheat pasture at the Ft. Reno Station near El Reno made excellent gains at a lower cost than in the feed lot (4). Staten and Heller (7), after a five-year clipping study of twenty varieties of small grain, reported that the forage yield was about tripled

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*Trials in which small grains were seeded in Bermuda grass to furnish winter pasture are being reported in a separate publication now in preparation.

when the crop was grazed until about May 15 instead of stopping grazing early enough to get a good grain yield, and that the protein content of the young small grain forage was 30 percent or higher. Fertility tests by Harper (2) showed small grain forage yields doubled or tripled by proper phosphate fertilization and a legume rotation system.

Several Southern states have reported excellent daily gain and high beef production per acre from winter grazing on small grains. On the Southern Mississippi branch station, oats produced more than 400 pounds of animal gain per acre per year with daily gains of approximately 2 pounds per head (1). Winter grazing trials on the Batesville station in Arkansas showed oats producing daily gains of over 2 pounds per head and 236 pounds of animal gain per acre per year (5). On the Coastal Plains Station in Georgia, oats and rye for winter pasture furnished 100 to 140 days of pasture and produced 250 to 375 pounds of annual gain per acre on beef cattle. In the Georgia test, steers grazing on succulent oats and rye made weight gains equal to steers fed high grain rations in dry lot.

General Methods and Conditions

All trials reported in detail herein were made on the Station's Agronomy Farm immediately west of Stillwater. The irrigation, rotation grazing trials and clipping tests were on soils classified as Port loam and Port silty clay loam. The other studies were conducted on Norge loam soil with 3 to 5 percent slope.

Monthly rainfall data for September through May for the six winter grazing seasons included in the trials are reported in Table I.

Except as noted later, the same winter pasture mixture was planted in all trials. This mixture was 1 bushel of Balbo rye, 1 bushel of winter

Table I.—Monthly and Total Rainfall During Winter Grazing Season; Stillwater, 1953-4 through 1958-9.

Year	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total Sept-May
1953-54	2.16	3.65	.92	1.04	.17	.61	.17	2.27	5.25	16.2
1954-55	.88	1.26	.16	2.50	.68	1.40	1.79	.32	9.51	18.5
1955-56	1.08	4.77	.15	0.00	.50	1.13	.59	.38	3.81	12.4
1956-57	.16	2.06	1.77	1.68	.84	1.71	2.40	5.10	14.91	30.6
1957-58	4.85	2.18	2.88	.98	1.70	.73	4.84	1.35	1.40	20.9
1958-59	3.72	.46	.80	.92	.22	1.34	2.28	2.12	4.49	16.4
Average	2.14	2.40	1.11	1.19	.69	1.15	2.01	1.92	6.56	19.17

oats and 20 pounds of vetch. The mixture was seeded at the rate of 90 pounds per acre.

Clipping results reported are in all cases average of four replications. All forage yields are reported as ovendry weights.

Type of Animals Used

All animals used in the grazing trials at Stillwater were choice grade Hereford heifers nine months to a year old, weighing 400 to 600 pounds when the grazing started.

Whenever possible, all heifers on all pastures being compared were from one sire. In other cases, heifers having a common sire were distributed uniformly among the pastures.

Management of the Animals

Animals were weighed at monthly intervals, as nearly as practicable. They were corralled in dry lots for 15 hours before weighing.

Pasturing was started when sufficient growth was available to support one animal per acre. Animals were added to or removed from pastures as necessary to secure optimum grazing conditions. In some years it was necessary to remove all animals from all pastures in January and February to prevent overgrazing. In years when there was little or no fall grazing, more animals were needed in the spring months to maintain best pasture conditions during those months. When grazing started in November, fewer animals were needed the following spring.

All animals were removed by May 20. The land was plowed in June and summer fallowed until fall planting time.

Slight bloat was observed at times. It usually occurred in March or early April after succulent plant tissue had been injured by freezing.

Excessive scouring often occurred in animals grazing a succulent growth of cereals, especially in the early fall months when the forage analyzed 30 to 35 percent ash-free protein. Oat straw fed for a period reduced scouring but did not increase gains. The animals would consume four to five pounds of oat straw per head daily during October and November.

One animal was lost by hypomagnesemia ("wheat poisoning") while grazing rye and oat pasture.

Snow and ice cover prevented grazing for an average of 7 to 10 days each year.

On the Heavener Station it was necessary to remove animals from pastures located on fine-textured soils after excessive rainfall. On the level soils, the pasture had to be vacated for long periods during the winter months.

Results and Discussion

A five-acre tract on the Agronomy Farm at Stillwater was used from 1953-4 through 1958-9 to evaluate a mixture of small grains and vetch as winter pasture. This was done on the basis of days of grazing, carrying capacity and animal gains.

The date of planting varied, but was always as soon as possible after the first rains in September. Two hundred pounds of 0-20-0 fertilizer per acre was applied with the seed.

Date Grazing Started

The date when grazing could be started varied considerably from year to year, as shown in Table II. Comparison with Table I shows the close relationship with early fall moisture.

Number of Days of Grazing

There was much variation in the total number of days of grazing annually, especially in the days of grazing between November 1 and March 31. Again, there was a close relationship with moisture conditions.

It was observed that the probable amount of grazing likely to be available can usually be estimated fairly accurately by October 1. For example, in 1955 the pasture was planted following good rains the first few days of October. There was less than three inches of rainfall between the planting time and April 30 the following year; but the number of days of grazing was equal to the six-year average.

Table II.—Six Years of Grazing Results from Small Grain Pasture.

	1953-1954	1954-1955	1955-1956	1956-1957	1957-1958	1958-1959	6 yrs. Av.
Date Grazing Started	Nov. 23	Mar. 9	Nov. 15	Dec. 14	Nov. 1	Oct. 25	
Date Grazing Ended	May 18	May 17	May 13	May 12	May 20	May 19	
Total Grazing Days	174	70	132	109	201	157	140
Winter Grazing Days[1]	127	42	89	94	150	103	100
Av. Number of Animals per acre	1.0	1.7	1.0	1.5	0.8	1.0	1.07
Av. Daily Gain per Animal (lbs.)	1.46	1.5	1.7	1.5	1.40	1.7	1.54
Live Weight Gain per acre (lbs.)	254	179	224	245	227	267	233

[1]November 1—April 1.

Carrying Capacity

Average carrying capacity over the six-year period was 1.08 animals per acre, for the actual days grazed. There was, of course, great variation from year to year, ranging from 0.8 head in 1957-8 to more than twice that in 1954-5. If the entire 200-day period from November 1 through May 20 is considered, the carrying capacity was 0.7 head per acre.

Daily Gain per Head

The six-year average daily gain of 1.54 pounds per head is much better than can be expected from summer pastures. Animals used for only short periods when pasture was abundant made higher daily gains than those used for longer periods.

Pounds of Gain per Acre

Total pounds of animal gain per acre varied less than any of the other measurements used. The effect of fewer days of grazing tended to be offset by increases in both carrying capacity and daily gain during that part of the season when grazing was possible. This is illustrated in Figure I.

Moisture and Soil Fertility Relationships

The effect of seasonal moisture conditions on animal gain from winter pasture is graphically illustrated in Figure I, comparing two widely different seasons and the six-year average. Moisture conditions clearly were the major factor controlling the amount and time of grazing in these trials. However, unpublished data from the Southeast Oklahoma Soil Improvement Station near Heavener, where rainfall in fall and winter months is more favorable than at Stillwater, indicate that soil fertility rather than moisture was the limiting factor at that location.

Data from Stillwater presented in the following section suggest that in seasons when fall production is heavy, as it was in 1957-8, production the following spring could be increased by spring fertilization if moisture conditions are favorable.

Animal Gains on Irrigated Winter Pasture

The effect on animal gains resulting from irrigated winter small grain and vetch pastures was studied during the three-year period 1955-6 through 1957-8. The pasture mixture was planted the first week in September. Fifty pounds of P_2O_5 per acre was applied with the seed. Seventy-five pounds of actual nitrogen per acre was applied in the fall months, and another 75 pounds in March.

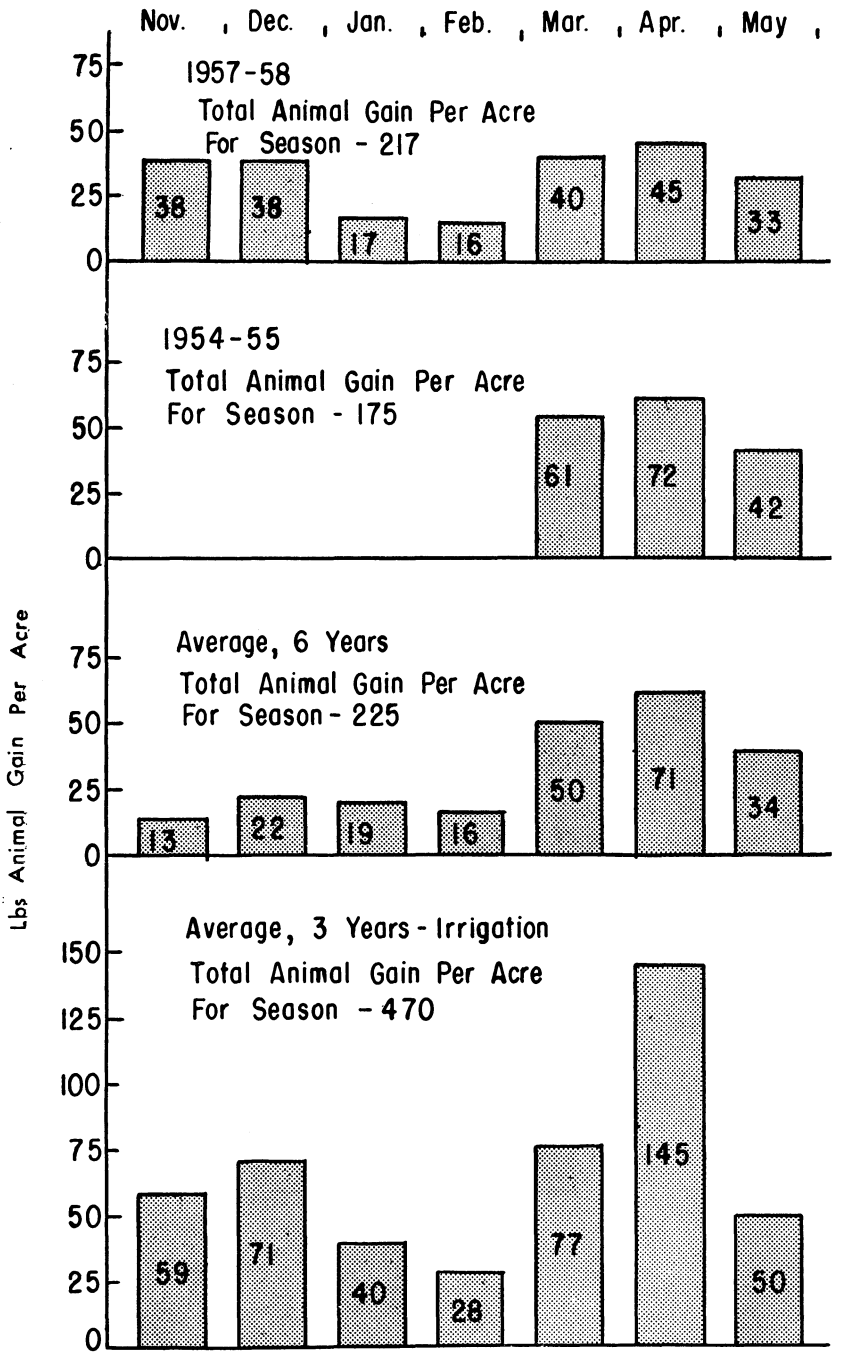

Figure 1. Animal gains per acre, by months. Six-year average, two seasons with different rainfall patterns and a three-year average under irrigation.

Irrigation prior to planting was necessary in two of the three years, 1955-6 and 1956-7, in order to get a stand. For quick germination and early growth, more irrigation water was applied in September than at any other time. During the winter, 2 inches of water per month maintained maximum rate of growth. Only occasional irrigation was needed in the spring.

Figure I shows average monthly animal gains per acre. The effect of irrigation, in assuring good forage growth in the fall, may be seen by comparing the irrigated plots with the unirrigated plots. Total annual gain per acre on irrigated pastures fertilized with nitrogen was twice that secured on the dryland pastures without nitrogen as reported in Table I, 470 pounds as compared to 233. The increased gain on the irrigated pastures resulted from both a longer grazing season and a higher carrying capacity. The individual animal performance was the same for both types of pasture, when adequate forage was available.

Even with irrigation, production was low in January and February. Perhaps this period might be bridged to some extent by controlled grazing in November and December, so as to carry over into January the extra forage which can be produced in the late fall with irrigation.

Rotation vs. Continuous Grazing

Rotation grazing was compared at Stillwater with continuous grazing during the four years 1953-4 through 1956-7, using two areas of equal size. One area was divided into four parts and the animals rotated as often as necessary to maintain optimum grazing conditions. On the other, animals had access to the entire area at all times. The rotation system was alternated between the two areas annually.

The two areas were treated alike in every respect except grazing management. The pasture mixture planted was rye-barley-vetch or rye-oats-vetch. In the last two years of the trial, 1955-6 and 1956-7, both areas were fertilized with 100 pounds of actual nitrogen per acre, and were irrigated.

Average annual animal gain per acre was 14 percent higher on the rotated pasture (Table III), although there was no difference in daily gain per head. Extra forage was always built up in the rotated pasture during the spring, making it necessary to increase the number of animals and thereby increasing the gain per acre. Other factors which may have contributed to better gains on the rotated pastures include: (1) the forage in the rotated pastures was more mature when cattle were turned in, and therefore the cattle consumed more energy; (2) more forage was destroyed by trampling where animals had free access to the entire pasture area at all times.

Table III.—Beef production (live weight) on rotated and non-rotated small grain and vetch pastures during winter grazing season; Stillwater, 1953-4 through 1956-7.

	Beef Production (lbs. per Acre)	
	Rotated	Not Rota ed
1953-4	307	264
1954-5	208	172
1955-6*	552	471
1956-7*	520**	471
4-yr. Average	397	345

*Irrigated, and 100 pounds of nitrogen per acre applied.
**Removal of all animals on May 9, due to floods, reduced the advantage of the rotated pasture.

Forage Production Clipped at Different Heights and Frequencies

The effect upon total annual forage production of variations in height and frequency of clipping was studied during the four-year period 1955-6 through 1958-9. Clippings were made at four different time intervals: 15, 30, 45, and 60 days. For each time interval there were two plots, one of which was clipped at a height of two inches and the other at a height of four inches.

All plots were irrigated, and all were uniformly fertilized with phosphorus and nitrogen. The same rate and methods of application of fertilizer was used as previously employed on the irrigated winter pastures. All were planted at the same time in September, the exact date varying with moisture conditions.

Table IV shows the total yearly forage production. No statistically significant differences were found between the two heights of clipping in any of the four years. However, the 30-day interval always had a significantly higher yield than the 15-day interval. In most years the higher production at the 60-day interval was statistically significant as compared to the 30- and 45-day intervals.

Figure 2 shows production by months for the 15- and 30-day intervals. October production was materially larger for the 2-inch clipping height, but the 4-inch clipping was somewhat more productive during the spring period. In general, neither height nor frequency greatly affected yields after November.

Forage from the 45- and 60-day clippings was more fiberous than from the more frequent clippings, especially in the spring months during head formation. Some varieties tended to mature and form heads in the fall when clipped less frequently; and plants which were in the jointing stage often were killed by close clipping in November and December.

Table IV.—Effect of Height and Frequency of Clipping on Total Annual Forage Production of Small Grain Pastures; Stillwater, 1955-6 through 1958-9. (Pounds per acre; oven-dry)

Frequency of Clipping	Height of Clipping (inches)	1955-6	1956-7	1957-8	1958-9	4-year Average
15 days	2	4263	3859	3940	3428	3873
"	4	4237	4047	3781	3036	3775
30 days	2	6647	4833	4643	4696	5205
"	4	6059	4589	5010	4544	5050
45 days	2	7283	5867	5171	4865	5796
"	4	7080	6122	5501	4931	5908
60 days	2	9893	5886	5737	5124	6660
"	4	9502	5454	5470	5006	6358

The months showing the widest range of variability from year to year were November and March. This is believed to be related to greater variability in temperature and in percentage of cloudy days, as compared to other months during the winter grazing season.

Clipped Forage Production from Different Planting Dates

To determine the effect of time of planting on forage production, a winter pasture mixture was planted on six successive dates: the 10th and 25th of September, October, and November. The test was continued for four years, 1955-6 through 1958-9.

Forage was clipped at a height of 2 inches every 30 days, beginning October 10. Table V shows total annual production for all planting dates. Production by months for the plantings made on the 10th of the month are shown in Figure 3.

Although the October 10 planting made more growth after early November than did the September 10 planting, the September 10 planting had produced more than twice as much total forage by January.

Total annual production for the September 10 and October 10 plantings showed no significant difference by the 5 percent multiple range test.

Plantings made October 25 and thereafter did not make enough growth for clipping until March. Total production was lowered significantly with each date of planting after October 25.

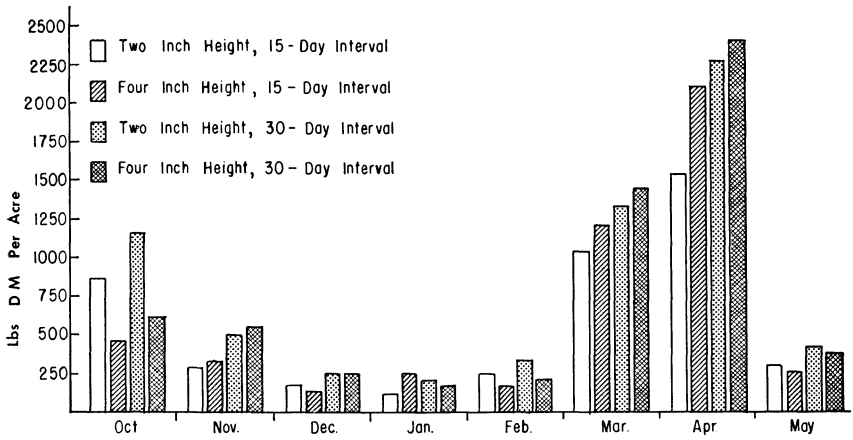

Figure 2. Monthly production of winter small grain forage clipped at two different heights at 15 and 30 day intervals.

Table V.—Effect of Time of Planting of Small Grains on Total Forage Production.

Date Planted	1955-56	1956-57	1957-58	1958-59	Average
September 10	6647	4477	4715	5443	5320
September 25	6338	4360	4978	5924	5400
October 10	5738	4278	4689	4941	4911
October 25	5751	3784	3752	3352	4009
November 10	5197	3110	2962	2522	3448
November 25	5250	2697	2793	2132	3218

Elbon Rye vs. Balbo Rye

Balbo, the variety of rye commonly used in Oklahoma, was compared during the four-year period 1955-6 through 1958-9 with the new variety Elbon. Elbon was released in 1956 by the Samuel Roberts Noble Foundation at Ardmore, Oklahoma, and the Oklahoma Agricultural Experiment Station.

Four small pastures were used, two being planted to each variety. The varieties were alternated annually between the areas. Volunteer growth from the previous year was destroyed by summer fallow cultivation. All four pastures were planted when there was moisture after the first of September. Seeding rate was 60 pounds of rye and 20 pounds of vetch per acre. Two hundred pounds of 0-20-0 fertilizer per acre was applied at planting time to all four pastures.

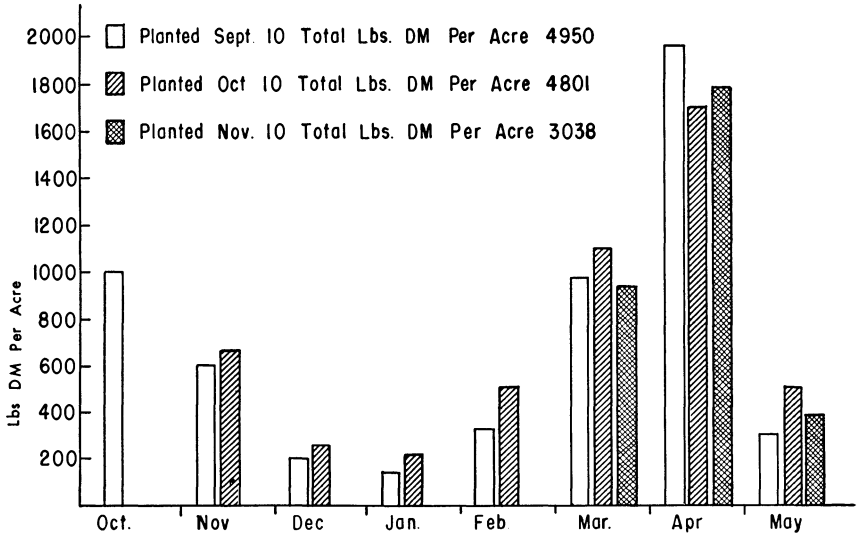

Figure 3. Relation of dates of planting to monthly forage production of small grains.

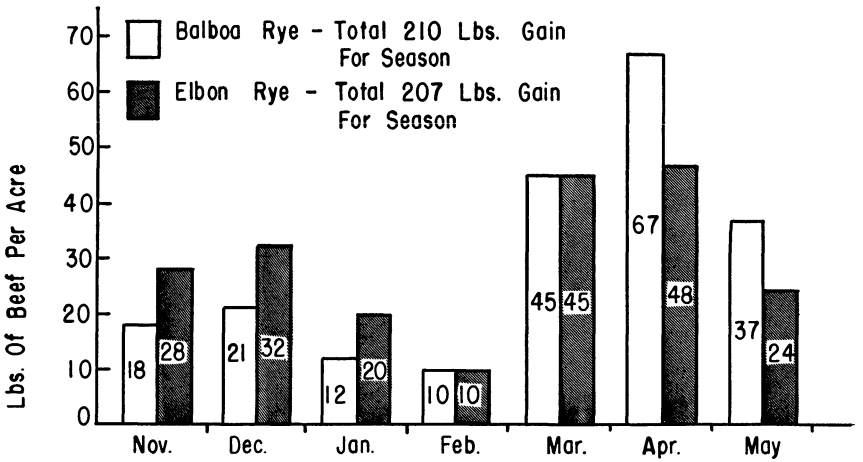

Figure 4. Monthly beef gains from grazing Elbon rye compared with Balbo rye.

In the fall and winter months, Elbon produced more animal gain per acre than did Balbo (Figure 4). Fifty percent more animals were carried on the Elbon during the first three months of grazing. Carrying capacity was more uniform throughout the season on the Elbon pastures. In the Balbo pastures, it was always necessary to increase the number of animals in April and May. This resulted in greater gains per acre

on the Balbo pastures in those months. Vetch growth was more abundant in the Elbon pasture during April and May because of early maturity of the Rye.

Differences in animal gains on the two varieties agree in general with differences in clipped forage yield reported by Huffine et al. (3).

Summary

Several different grazing and clipping trials with small grain winter pastures were conducted during the period 1953-4 through 1958-9. The principal pasture used was a mixture of rye, winter oats and vetch.

In a 6-year test of production as measured by gains of short yearling beef heifers (400 to 500 pounds when grazing was started), animals grazing throughout the season gained an average of 1.54 pounds per head daily. Annual gain per acre average 233 pounds. Pasture was available an average of 140 days per season. Gain per acre varied less than pasture days per season; if fall growth was small, more animals were needed to make full use of the heavy spring growth. Carrying capacity averaged 1.08 head per acre. Time of starting grazing varied with planting date, which in turn varied with September rainfall; it ranged from October 25 to March 9. Amount of forage growth by November 1 was a good indicator for estimating carrying capacity for the rest of the season.

Irrigated and dryland pastures were compared during three seasons. Irrigation insured establishment in time for fall grazing. Beef production was doubled by irrigation plus 150 pounds of actual nitrogen per acre as compared to dryland pasture without nitrogen. Irrigation was seldom needed in winter or spring.

Rotation grazing increased animal gain per acre by 14 percent.

Clipped forage yields were obtained on irrigated pasture during four seasons, for two heights and four frequencies of clipping. At the 2-inch height, clipping every 30 days increased yields 27 percent over the 15-day interval. Small grains were injured severely by early clipping.

Six planting dates were compared during four seasons, using clipped forage yields as a measurement. Plantings on September 10, September 25 and October 10 gave the same total production for the year. However, the September 10 date produced twice as much forage before January 1 as did the October 10 planting. Seeding later than October 25 eliminated all possibility of pasturing before March. One day's growth in September was equal to around five to ten days in the winter months.

Elbon rye with vetch produced 50 percent more animal gain than Balbo with vetch from November through January in a four year comparison. Total annual gain was the same for both varieties because the Balbo and vetch had a higher carrying capacity in April and early May.

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