

TENNESSEE KNOB RANGE FERTILIZATION TRIAL

FALL, WINTER AND SPRING 1956, 1957

This trial was conducted cooperatively by Robert F. Miller, Tulare County Farm Advisor who initiated and supervised the trial. John Guthrie and Jack Shannon, the cattlemen who provided the range and cattle and the Brea Chemical Company who provided the fertilizer.

Object of Trial

The object of the trial was to determine the additional pounds of beef that could be obtained by fertilizing native foothill range and the profit or loss which would result.

Plan of Trial

On October 30, 238 lbs. of ammonium sulfate was applied by airplane to 600 acres of open foothill range land located on the west side of Tennessee Knob located about 8 miles southeast of Porterville. An 800 acre field on the south of Tennessee Knob was left unfertilized to serve as a check. Each field was stocked to its normal carrying capacity and additional cattle were added to the fertilized field, as feed conditions warranted. Steers were used in the unfertilized field and heifers were used in the fertilized field. The reason for using heifers in the fertilized field was because they are generally more available through the winter, and it was recognized that for a paying response to be obtained from the fertilizer, additional cattle would be needed. These additional cattle were purchased in December and kept in a feedlot until feed conditions warranted turning them out on the fertilized field. The daily gains of the steer and heifers cannot be directly compared. However, the object of the trial is to compare pounds of beef produced per acre, and the trial is designed to give this information.

SUPPLEMENTAL FEEDING PRACTICES

A 25% salt 75% cottonseed meal mix was provided to both groups of cattle from the time the cattle were turned out. In addition, hay and silage with molasses sprayed on was fed to both groups starting the 7th of December. At this time the old feed was gone and green feed had not started due to the dry cold weather. The feeding of salt meal, hay and silage continued until the 13th of February when green feed started. The cattle were all weighed out of a feedlot into the pasture with a 4% shrink.

SUPPLEMENTAL FEEDING

FIELD A - UNFERTILIZED - STEERS

	DATES FED	TOTAL FEED	HEAD DAYS	LBS. HEAD DAY	COST HEAD DAY	TOTAL COST PER HEAD
Salt-meal @ \$56.50/ton	Sept. 20-Feb. 13	20 tons	44870	.89	2.51¢	\$ 3.65
Alfalfa hay @ \$33/ton	Dec. 7-Feb. 13	15 tons	21158	1.42	2.34¢	1.59
Silage @ \$12.50/ton	Dec. 7-Feb. 13	109 tons	21158	10.30	6.44¢	4.38
Molasses @ \$48/ton	Dec. 31-Feb. 13	3 tons	14166	.42	1.01¢	.45
					TOTAL	\$10.07

FIELD B - FERTILIZED - HEIFERS

	DATES FED	TOTAL FEED	HEAD DAYS	LBS. HEAD DAY	COST HEAD DAY	TOTAL COST PER HEAD
Salt-meal @ \$56.50/ton	Oct. 13-Feb. 13	10 tons	30924	.65	1.83¢	\$ 2.25
Alfalfa hay @ \$33/ton	Dec. 7-Feb. 13	13 tons	17355	1.50	2.47¢	1.65
Silage @ \$12.50/ton	Dec. 7-Feb. 13	67 tons	17355	7.72	4.82¢	3.23
Molasses @ \$48/ton	Dec. 31-Feb. 13	2.5 tons	14900	.34	.81¢	.36
					TOTAL	\$ 7.49

FERTILIZER COST

Cost of 71.4 tons fertilizer @ \$52/ton	\$3712.80
Cost per acre	\$ 6.19
Cost of application @ \$.75 CWT	\$1071.00
Cost per acre	\$ 1.78
Total cost per acre	\$ 7.97

STOCKING PROCEDURE

FIELD A - 800 ACRES, UNFERTILIZED - STEERS

DATE	NO. HEAD	IN WT/HEAD	PRICE/CWT	PRICE/HEAD	ACRES/HEAD	LBS. BEEF PER ACRE
Sept. 20	304	493 lbs.	\$18.50	\$91.20	2.63	187
Jan. 18	18	470 lbs.	\$18.50	\$86.95	2.48	198
TOTAL	<u>322</u>					

FIELD B - 600 ACRES, FERTILIZED - HEIFERS

DATE	NO. HEAD	IN WT/HEAD	PRICE/CWT	PRICE/HEAD	ACRES/HEAD	LBS. BEEF PER ACRE
Oct. 13	213	447 lbs.	\$16.50	\$73.75	2.82	158
Nov. 10	42	379 lbs.	\$16.50	\$62.53	2.35	185
Nov. 12	5	400 lbs.	\$16.50	\$66.00	2.31	188
Jan. 14	9	457 lbs.	\$16.50	\$75.40	2.23	195
Feb. 14	96	353 lbs.	\$18.00*	\$63.54	1.64	252
March 6	50	329 lbs.	\$18.00*	\$59.22	1.44	280
March 8	49	352 lbs.	\$18.00*	\$63.36	1.29	308
TOTAL	<u>464</u>					

* This 195 head were purchased in December so that additional cattle would be available to take advantage of the increased feed supply due to fertilization.

Before turning out, they were kept in a feedlot on a maintenance ration of 1.75 lbs. alfalfa hay, .68 lbs. molasses, 13.66 lbs. silage and .96 lbs. of cottonseed meal. There was also a small pasture bill on the cattle of 10 cents per head per day for 2079 head days. The cattle were purchased in Montana and their cost was \$15.91 laid in locally. Their daily gain while being held, did not pay for the feed bill and their actual cost into the fertilized pasture was \$18.00 per CWT.

It is necessary to anticipate additional feed due to fertilization and purchase cattle before they are needed, since when green feed is available, stocker cattle usually are very scarce.

TENNESSEE KNOB FERTILIZER PLOT

PLOT I

In the first series of plots different sources of nitrogen, as well as nitrogen combined with sulfur and phosphorous, were tested to see which material would give the greatest increase in yield and to determine what changes, if any, would occur in the population of the various plant species present. Besides a check plot to which no fertilizer was applied, Urea at \$121.25 per ton, ammonium nitrate at \$86.50 per ton, ammonium sulfate at \$52.00 per ton and ammonium phosphate or 16-20 at \$81.13 per ton were used. The rate of nitrogen from these different sources was held constant with 60 lbs. of actual nitrogen being applied per acre. The various treatments were replicated four times to overcome any variation in soil.

				COST OF FERTILIZER PER ACRE	APPL. @ .75 CWT	TOTAL COST
1	Check		00 lbs/acre	-----	-----	-----
2	Urea	N - 60	133 lbs/acre	\$ 8.60	\$1.00	\$ 9.60
A 3	Am. Nit.	N - 60	180 lbs/acre	7.78	1.35	9.13
4	Am. Sulf.	N - 60 + S - 66	286 lbs/acre	7.44	2.14	9.58
5	16 - 20	N - 60 + P - 75 + S - 58	375 lbs/acre	15.22	2.81	18.03

NITROGEN SOURCE COMPARISON YIELD RESULTS

TREATMENT	TOTAL COST/ACRE	AVG. DRY MATTER YIELD/ACRE
Check	\$.00	748 lbs.
Urea - 133 lbs/acre	\$ 9.00	1278 lbs.
Am. Nit. - 180 lbs/acre	\$ 9.13	1281 lbs.
Am. Sulf. - 286 lbs/acre	\$ 9.58	1344 lbs.
16 - 20 - 375 lbs/acre	\$18.03	1625 lbs.

The object of this trial was to determine the time of response as well as the total response different sources of nitrogen as well as nitrogen and phosphorus would give. Some sources of nitrogen are available quicker to the plants and phosphorus often stimulates growth during cold weather. However, since the winter of '56 - '57 was extremely cold and dry, no winter growth from any of the materials was obtained. When response was obtained about the middle of February, there was practically no difference between different sources of nitrogen, and the addition of phosphorus did not materially increase yields.

PLOT II

III TON

Since sulfur will give a response in some areas, nitrogen alone, nitrogen with varying amounts of sulfur, and sulfur alone was put out in the second series of plots. Urea at \$121.25 per ton, ammonium sulfate at \$52.00 per ton and gypsum at \$13.25 per ton were used as sources of nitrogen and sulfur. The plot was replicated three times.

TREATMENT	FERTILIZER PER ACRE	COST OF FERTILIZER PER ACRE	APPL. @ .75 CWT	TOTAL COST
1 Check	00 lbs/acre	-----	-----	-----
2 N - 60	Urea 133 lbs/acre	\$ 8.60	\$1.00	\$ 9.60
3 N - 60 + S - 18	Urea - 100 lbs. Gyp/acre	9.26	1.75	11.01
4 N - 60 + S - 36	133 lbs Urea + 200 lbs Gyp/acre	9.92	2.50	12.42
5 N - 60 + S - 72	133 lbs Urea + 400 lbs Gyp/acre	11.24	4.00	15.24
6 N - 60 + S - 66	286 lbs. Am. Sulf/acre	7.44	2.14	9.58
7 S - 72	400 lbs. Gyp/acre	2.64	3.00	5.64

NITROGEN-SULFUR COMPARISON YIELD RESULTS

TREATMENT	TOTAL COST/ACRE	AVG. DRY MATTER YIELD/ACRE
Check	\$.00	615 lbs.
133 lbs Urea/acre	\$ 9.60	1035 lbs.
133 lbs Urea + 100 lbs gyp/acre	\$11.01	897 lbs.
133 lbs Urea + 200 lbs gyp/acre	\$12.42	930 lbs.
133 lbs Urea + 400 lbs gyp/acre	\$15.24	847 lbs.
286 lbs Ammonium sulfate/acre	\$ 9.58	896 lbs.
400 lbs Gyp/acre	\$ 5.64	674 lbs.

Legume plants will respond to sulfur on some range soils. This trial was designed to determine if a sulfur response could be obtained in the trial area from gypsum alone, gypsum plus Urea and ammonium sulfate which also provides sulfur and nitrogen. The yield figures indicate that no sulfur response was obtained.

PLOT III

In this series of plots, different rates of nitrogen were applied using the same fertilizer material, ammonium sulfate. In these plots, 30 lbs. of actual nitrogen and 50 lbs. of actual nitrogen were applied per acre with the 50 lb. rate being the same rate as that used in the 600 acre field.

TREATMENT	APPL. @ .75 CWT	COST OF FERTILIZER PER ACRE	COST OF FERTILIZER PER ACRE	APPL. @ .75 CWT	TOTAL COST
A-1 N - 30	150 lbs. Am. Sulf/acre	\$ 3.90	\$ 1.12	\$ 5.02	
2 N - 50	238 lbs. Am. Sulf/acre	\$ 6.19	\$ 1.78	\$ 7.97	

NITROGEN RATE COMPARISON YIELD RESULTS

TREATMENT	TOTAL COST/ACRE	AVG. DRY MATTER YIELD/ACRE
Check	\$.00	615 lbs.
150 lbs. Am. Sulf./acre	\$ 5.02	986 lbs.
238 lbs. Am. Sulf./acre	\$ 7.97	1070 lbs.

This trial was designed to show what response might be obtained from applying different amounts of nitrogen fertilizer. Almost the same increase in production was obtained with 30 lbs. of N per acre as was obtained with 50 lbs. of N per acre. Rainfall rather than fertility was the limiting factor in growth in this trial with only 5½ inches of rain being registered during the trial period. Since there was not enough rainfall to leach the fertilizer and it was not used up by the plants, a carry-over effect can be expected. This carry-over will be measured by clipping yields and in pounds of beef produced per acre.

SUMMARY OF CATTLE RESULTS

	FERTILIZED FIELD	UNFERTILIZED FIELD
Avg. in weight	398.2	492.1
Avg. out weight	492.6	625.9
Avg. daily gain	.801	.66
Head days/acre	91.07	81.9
Gain/acre	73.0	53.4
Gain/acre from fertilizer	19.6 lbs.	-----
Cost/lb. gain from fertilizer	\$ 40.66 cwt	-----

A higher proportion of head days per acre occurred in the fertilized field during the spring growing season than occurred in the unfertilized field. For this reason a higher daily gain is not unexpected. The total head days per acre does not represent the true carrying capacity of the pastures for the 1956-57 feed year because of the large amount of supplemental feeding that was necessary. The additional gain per acre on the fertilized field was due to the higher daily gain and the increased stocking rate that was employed when warmer weather and moisture allowed the feed to respond to the fertilizer.

SUMMARY AND REMARKS

About twice as much forage as determined by clipping yields was produced when 30, 50 and 60 pounds of nitrogen per acre was applied. No response to sulfur and only a very small response to phosphorus was obtained. About 20 pounds additional gain at a cost of 40 cents per pound was obtained from the fertilized field as compared to the unfertilized field. Since it appears that not all the nitrogen applied was utilized, some carry-over effect is expected. This carry-over will be measured in pounds of beef per acre and until next years results are in the final cost per pound gain due to fertilization cannot be evaluated.

Advantages of range fertilization may include more total feed, more feed in late fall and winter during cold weather and improved feed quality. In this trial more total feed was produced and a higher stocking rate was obtained where fertilizer was applied. However, no growth was obtained during the winter due to continuous days of frost and lack of moisture. Feed quality was excellent on both fertilized and unfertilized fields. The feed in the fertilized field dried and matured more quickly during the March drouth and the stocking rate had to be reduced before it was necessary to remove the cattle from the unfertilized field. This March and early April drouth necessitated all the cattle being removed from both trial pastures two weeks to one month earlier than normal.

Hazards of range fertilization include cold weather, extremes in moisture and a downward fluctuation in the cattle market. Weather has already been commented on as it affected this trial. The additional cattle, which must be purchased to stock a fertilized pasture above its normal carrying capacity, represent the biggest factor in profit or loss of range fertilization. In this trial, these cattle were purchased in December and held on a maintenance ration until the forage responded to fertilization. During this time they increased in cost \$16 cwt. to \$18 cwt., because their gain did not pay the feed bill. This increase in cost, plus the margin bought and sold on, can affect profit or loss as much as the cost per pound of gain produced by the fertilizer.

