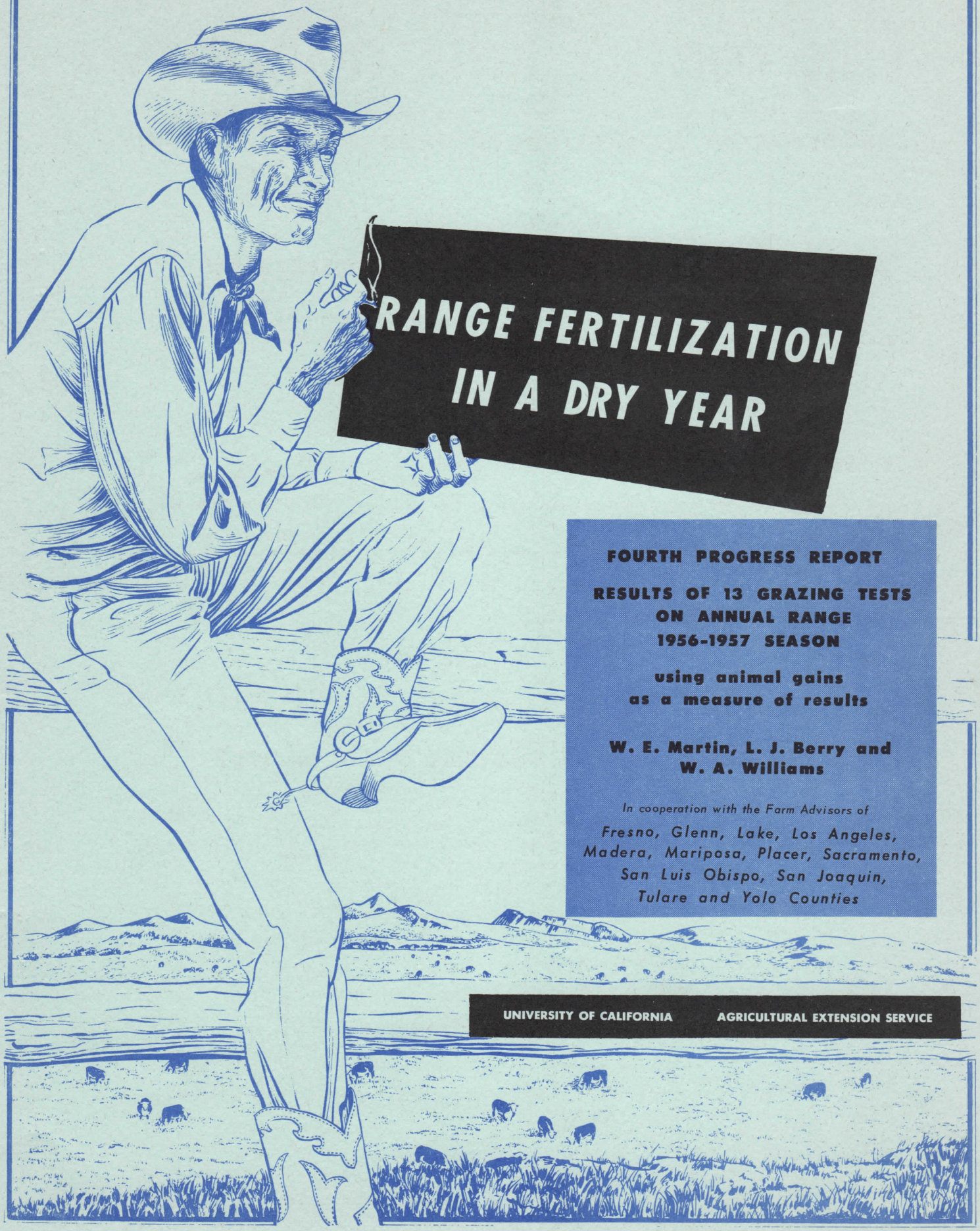


RANGE FERTILIZATION IN A DRY YEAR

FOURTH PROGRESS REPORT

RESULTS OF 13 GRAZING TESTS ON ANNUAL RANGE 1956-1957 SEASON

using animal gains as a measure of results

W. E. Martin, L. J. Berry and W. A. Williams

In cooperation with the Farm Advisors of

Fresno, Glenn, Lake, Los Angeles, Madera, Mariposa, Placer, Sacramento, San Luis Obispo, San Joaquin, Tulare and Yolo Counties

UNIVERSITY OF CALIFORNIA AGRICULTURAL EXTENSION SERVICE

#4

This report tells about ★★★

PROBLEMS OF RANGE FORAGE PRODUCTION

..... where fertilizer may help

THE TWO APPROACHES TO RANGE FERTILIZATION

PHOSPHORUS OR SULFUR TO PEP UP CLOVERS

NITROGEN TO HELP THE GRASSES DIRECTLY

RESULTS OF CLIPPING TESTS TELL

..... How yield and composition of forage are changed by .....

- N + NP Fertilizers
- Phosphorus Fertilizers
- Sulfur Fertilizers

RESULTS OF 13 GRAZING TESTS IN 1957

..... using cattle and sheep to measure results

These tests show how greatly Fertilization

Improved carrying capacity, and

Increased meat production per acre

Results are evaluated

as Fertilizer cost of "Extra Meat" per acre

and "Profit per Acre" at prevailing prices of cattle and sheep.

RANGE FERTILIZATION IN A DRY YEAR

Results of 13 Field Tests Comprising the Fourth Year's Progress of Range Fertilization

W. E. Martin, W. A. Williams and L. J. Berry

I. INTRODUCTION

Actual meat production by cattle or sheep over a period of years on typical range will decide whether or not range fertilization is economically feasible. Only by this means may we find whether dollars spent for fertilization have returned value enough to justify the expense.

This report for 1956-57 is the fourth of a series. In it are presented results of 13 field-scale tests in which weight gains of commercial grazing animals were used to measure effectiveness and economic value of fertilizer applications. As in previous years, the tests were carried out by farm advisors of the California Agricultural Extension Service in cooperation with commercial ranches in various sections of the state.

The 1956-57 season was one of limited fall and winter rainfall. At most locations little effective rain fell in November and December, with effective rains coming finally in mid-January. At most locations, except at the southern end of the San Joaquin Valley, spring rains were adequate and good spring range growth was observed.

Before discussing the results of these tests, it may be well to outline some of the problems of range forage production and to review some of the fertilizer work already done on California rangeland.

II. THE PROBLEM

California range makes up somewhat over a third of the area of the state. It includes about ten million acres of open treeless range, plus about 25 million acres of oak-grass woodland and brushy areas used primarily for grazing. Until recently little has ever been fertilized. Forage is composed principally of annual grasses, clover and filaree.

Most of the open range and low-lying portions of the oak-grass woodland are used for the production of green winter feed. Late summer and fall feed is from the dry grasses and legumes produced during the spring months.

Three problems of range forage production may be helped by fertilization:

First, there is usually a shortage of green feed in the early part of the winter grazing season. Annual grasses and legumes grow slowly during the winter months, even though adequate soil moisture is present. The major production of forage comes in a great flush in the spring when soil and air temperatures have increased and soil moisture is still adequate. Quickly available nitrogen fertilizers greatly speed up growth of grasses during the cool winter months.

Second, total feed production may be poor because of low soil fertility. Here little forage is produced even when temperature and moisture conditions are favorable. Such soils are often acutely deficient in phosphorus, sulfur, or nitrogen.

Third, forage quality is often poor. Winter and spring-growing annual grasses make good feed while green or approaching maturity. Many of these same species are of low nutritive quality and some are unpalatable and even injurious when mature and dry. Fertilizer treatments that increase the growth of legumes and desirable annual grasses, along with proper livestock management, will improve the quality of dry feed for summer and fall use.

III. TWO APPROACHES TO RANGE FERTILIZATION

Stimulation of range legumes by fertilization with phosphorus and sulfur:

The aim of legume fertilization is first, to improve current feed supplies; second, to help build up soil fertility; third, to improve forage quality.

A large number of range tests have been set up throughout the state by the Agricultural Extension Service, in cooperation with staff workers of the Department of Agronomy. At many locations phosphorus or sulfur-bearing fertilizers, alone or in combination, greatly increased growth of native or introduced clovers.

Sulfur fertilization of annual grasses and native clovers has increased average carrying capacity approximately 50 percent in grazing studies continued over a seven-year period at the San Joaquin Experimental Range in Madera County.

Phosphorus and sulfur fertilization of annual clover seedings on commercial ranches has resulted in two to threefold increase in grazing capacity. These tests by the staff of the University of California Agronomy Department demonstrated that rose, crimson, and sub-clover were better able to use phosphate and sulfur fertilizer than were native resident species. More feed of higher protein content was produced.

In these tests effective range improvement was achieved at low cost. The amount of spring forage was increased. The quality of feed, both green and dry, was improved by the greater proportion of high protein legume vegetation.

Legume fertilization has some limitations. First, it does not provide the early feed needed on many winter ranges; second, in many areas, soils are well enough supplied with phosphorus and sulfur so that added fertilizers cause no growth increase; third, some seasons, known as poor clover years, have temperature and rainfall conditions such that poor legume growth is made regardless of fertilizer applications.

Fertilization of grasses with nitrogen, using fertilizers containing phosphorus, and sulfur where needed:

The aim in using nitrogen on grass is first, to make more early winter feed; second, to increase total forage growth; third, to decrease growth of summer weeds.

Nitrogen treatments have been included in many of the small-scale fertilizer test plots carried out by the Agricultural Extension Service and the Department of Agronomy. In nearly every case grasses responded to nitrogen. In a few cases clover responded.

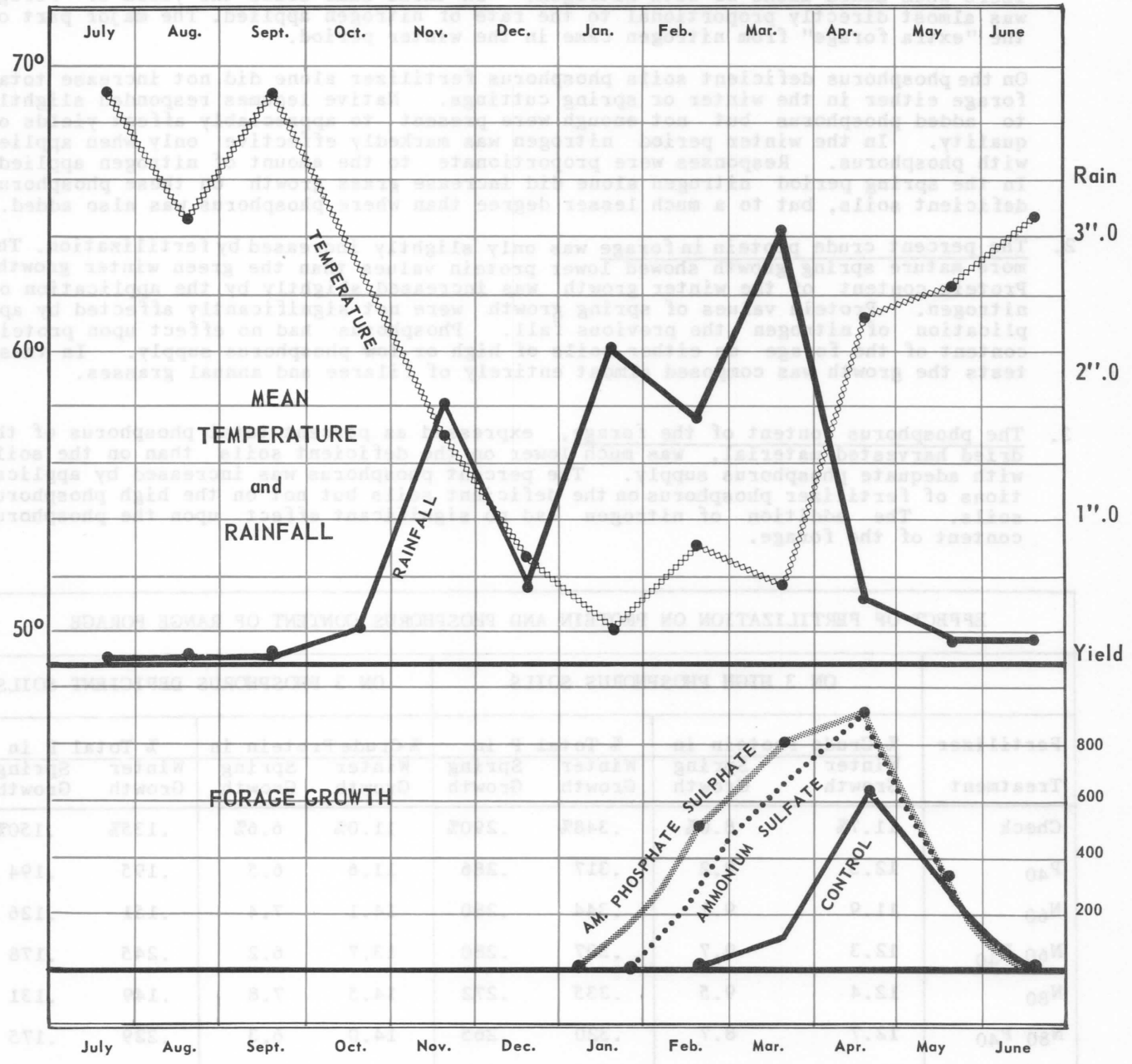
The most striking and consistent result in the entire series of range fertilizer plots and demonstrations has been the fact that supplemental nitrogen fertilizers stimulate early and continued winter and early spring growth of annual grasses. These responses have occurred during the cold season when little growth would normally be expected. Nitrogen appears to be the key to early growth, but was effective only if adequate phosphorus and sulfur were present or were applied in the fertilizers used.

Three factors - moisture, temperature, and nutrient-supply govern the growth of range plants. Throughout California, rainfall usually comes during the winter months when temperatures are at their lowest. The bulk of the feed production comes in the spring when soil temperatures have increased and moisture is still adequate. The warming of the soil permits the liberation of nitrogen from organic materials. This causes forage to grow in a great spring flush, which slows as rains cease and the dry summer approaches.

The relationship of temperature, rainfall, and fertility to forage growth is shown graphically on the opposite page from data taken in 1954. This soil was deficient in both nitrogen and phosphorus. Growth of unfertilized forage occurred only when temperatures were rising, rainfall decreasing, and moisture still present. The yields decreased rapidly as spring rains ceased. Growth came earlier where both nitrogen and phosphorus were applied and total forage was greatly increased.

SEASONAL GROWTH OF ANNUAL RANGE AS RELATED TO FERTILIZATION, RAINFALL AND TEMPERATURE

Santa Clara County, 1953-54



IV. INFLUENCE OF FERTILIZER ON YIELD AND COMPOSITION OF RANGE FORAGE

A. Effects of N and NP Fertilizers on Yield and Composition of Native Annual Range

1. Yields of forage as affected by fertilization were measured from clippings of plots set on three high phosphorus and on three phosphorus deficient soils in 1956. Results obtained are shown graphically on the opposite page.

   On the high phosphorus soils there was no significant effect of phosphorus fertilizers when added alone or with nitrogen. On these same soils the yield of forage was almost directly proportional to the rate of nitrogen applied. The major part of the "extra forage" from nitrogen came in the winter period.

   On the phosphorus deficient soils phosphorus fertilizer alone did not increase total forage either in the winter or spring cuttings. Native legumes responded slightly to added phosphorus but not enough were present to appreciably affect yields or quality. In the winter period nitrogen was markedly effective only when applied with phosphorus. Responses were proportionate to the amount of nitrogen applied. In the spring period nitrogen alone did increase grass growth on these phosphorus deficient soils, but to a much lesser degree than where phosphorus was also added.

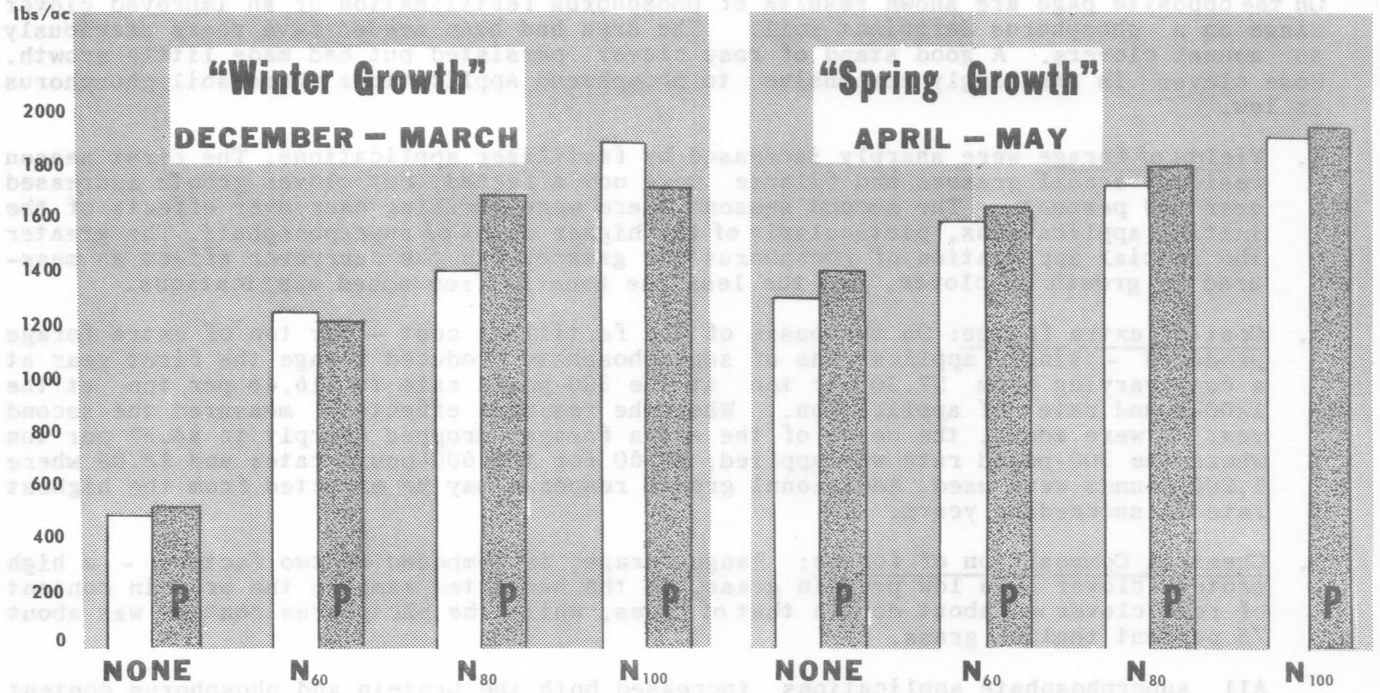
2. The percent crude protein in forage was only slightly increased by fertilization. The more mature spring growth showed lower protein values than the green winter growth. Protein content of the winter growth was increased slightly by the application of nitrogen. Protein values of spring growth were not significantly affected by application of nitrogen the previous fall. Phosphorus had no effect upon protein content of the forage on either soils of high or low phosphorus supply. In these tests the growth was composed almost entirely of filaree and annual grasses.

3. The phosphorus content of the forage, expressed as percent total phosphorus of the dried harvested material, was much lower on the deficient soils than on the soils with adequate phosphorus supply. The percent phosphorus was increased by applications of fertilizer phosphorus on the deficient soils but not on the high phosphorus soils. The addition of nitrogen had no significant effect upon the phosphorus content of the forage.

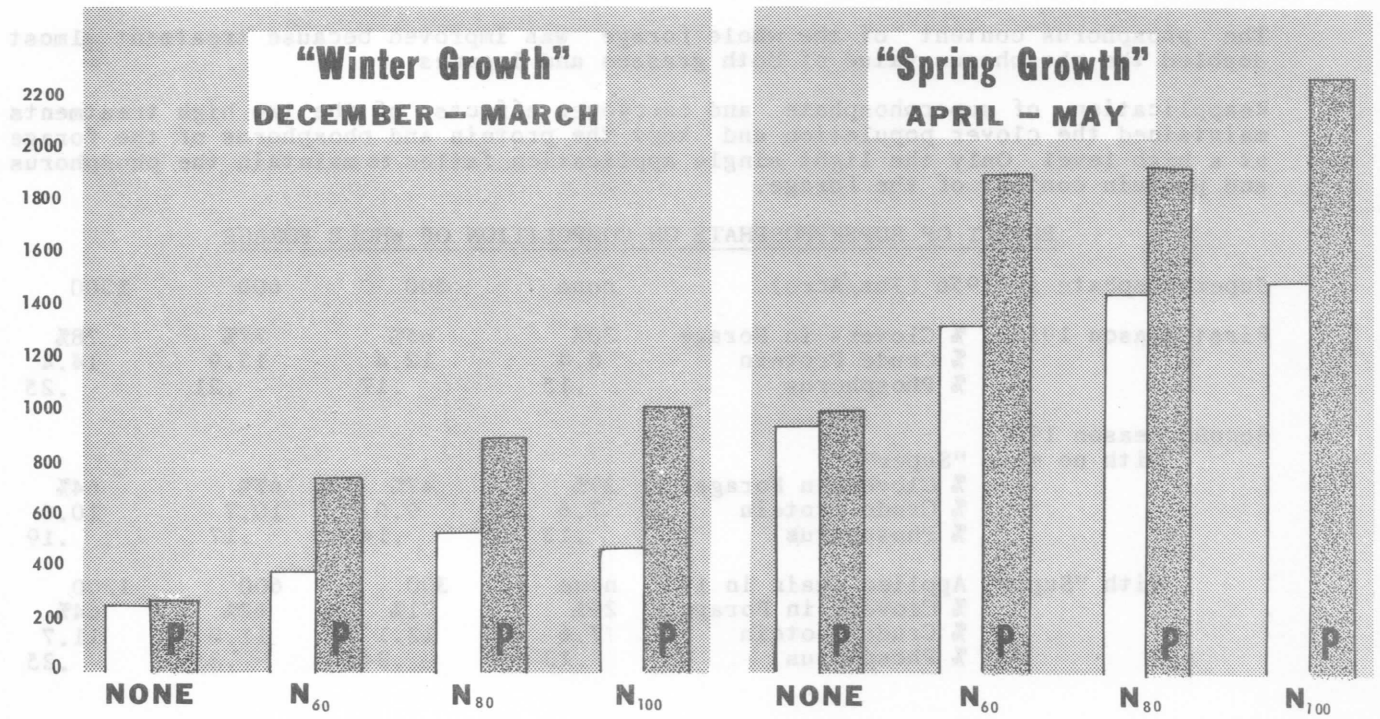
EFFECT OF FERTILIZATION ON PROTEIN AND PHOSPHORUS CONTENT OF RANGE FORAGE

	ON 3 HIGH PHOSPHORUS SOILS				ON 3 PHOSPHORUS DEFICIENT SOILS			
Fertilizer Treatment	% Crude Protein in		% Total P in		% Crude Protein in		% Total P in	
	Winter Growth	Spring Growth	Winter Growth	Spring Growth	Winter Growth	Spring Growth	Winter Growth	Spring Growth
Check	11.7%	8.0%	.348%	.290%	11.0%	6.6%	.135%	.150%
P_{40}	12.3	9.2	.317	.286	11.6	6.5	.195	.194
N_{60}	11.9	9.1	.344	.280	14.1	7.4	.151	.126
N_{60} P_{40}	12.3	9.7	.307	.280	13.7	6.2	.245	.178
N_{80}	12.4	9.5	.335	.272	14.5	7.8	.149	.131
N_{80} P_{40}	12.7	8.7	.320	.265	14.0	6.3	.229	.175
N_{100}	13.0	10.1	.345	.268	14.8	7.8	.138	.121
N_{100} P_{40}	12.9	9.8	.335	.275	15.5	6.4	.225	.162

EFFECT OF FALL FERTILIZATION ON YIELDS OF ANNUAL RANGE ON THREE HIGH PHOSPHORUS SOILS



ON THREE PHOSPHORUS DEFICIENT SOILS



Pounds of Nitrogen Applied per Acre

P = 40 lbs P_2O_5/ac

B. Effects of Phosphorus Fertilizers on Yield and Composition of Improved Clover Range Forage

On the opposite page are shown results of phosphorus fertilization of an improved clover range on a phosphorus deficient soil. The area had been seeded five years previously to annual clovers. A good stand of rose clover persisted but had made little growth. Rose clover is strikingly responsive to phosphorus applications where soil phosphorus is low.

1. Yields of forage were sharply increased by fertilizer applications. The first season resident annual grasses and filaree were not affected, but clover growth increased over 300 percent. The second season there were striking carryover effects of the initial applications, particularly of the higher rates of superphosphate. The greater the initial application of phosphorus the greater was the carryover effect as measured by growth of clover, and the less the benefit from added applications.

2. Cost of extra forage: On the basis of the fertilizer cost - per ton of extra forage produced - single applications of superphosphate produced forage the first year at a cost varying from $7.30 per ton at the 300-pound rate to $16.46 per ton at the 1200-pound rate of application. When the residual effects - measured the second year - were added, the costs of the extra forage dropped sharply to $4.37 per ton where the 300-pound rate was applied; $4.60 for the 600-pound rate; and $8.08 where 1,200 pounds were used. Additional growth response may be expected from the highest rate in succeeding years.

3. Chemical Composition of forage: Range forage is composed of two factors - a high protein clover and a low protein grass. In the harvested samples the protein content of rose clover was about double that of grass, while the phosphorus content was about 75 percent that of grass.

   All superphosphate applications increased both the protein and phosphorus content of whole forage.

   The protein content was increased primarily because of the larger proportion of high protein clover in the mixture. The protein content of both grass and legume was increased only slightly by treatment.

   The phosphorus content of the whole forage was improved because treatment almost doubled the phosphorus value of both grasses and legumes.

   Reapplication of superphosphate and carryover effects of the two high treatments maintained the clover population and kept the protein and phosphorus of the forage at a high level. Only the light single application failed to maintain the phosphorus and protein content of the forage.

EFFECT OF SUPERPHOSPHATE ON COMPOSITION OF WHOLE FORAGE

Superphosphate in 1956 (lbs/Acre)		none	300	600	1200
First Season 1956:	% Clovers in Forage	20%	65%	77%	78%
	% Crude Protein	8.4	12.4	13.9	14.4
	% Phosphorus	.15	.17	.21	.25
Second Season 1957:					
With no more "Super"					
	% Clovers in Forage	29%	47%	67%	64%
	% Crude Protein	7.6	9.0	10.7	10.6
	% Phosphorus	.13	.14	.17	.19
With "Super" Applied again in 1957		none	300	600	1200
	% Clovers in Forage	29%	71%	62%	64%
	% Crude Protein	7.6	12.1	11.0	11.7
	% Phosphorus	.13	.24	.25	.25

MORE ROSE CLOVER FORAGE by use of SUPERPHOSPHATE

FIRST YEAR - 1956

"SUPER" APPLIED — Pounds per Acre: 300 | 600 | 1200

Cost per Acre: $5.20 | $10.40 | $20.80

"EXTRA" FORAGE PRODUCED (control 778): 1425 lbs/AC | 2355 lbs/AC | 2577 lbs/AC

COST PER EXTRA TON: $7.29 | $8.83 | $16.46

SECOND YEAR - 1957

WITH SAME AMOUNTS OF "SUPER" APPLIED AGAIN!: 300 | 600 | 1200

"EXTRA" FORAGE IN 1957 (Control 1313 lbs): 3080 lbs | 3298 lbs | 3267 lbs

BUT with no "Super" in 1957 CARRYOVER EFFECTS of 1956 applications: 952 lbs | 2167 lbs | 2618 lbs

NET EFFECT of "SUPER" in 1957: 2128 lbs | 1131 lbs | 651 lbs

EXTRA FORAGE IN 2 YEARS

WITH SINGLE APPLICATIONS	"Super" applied	300 + 0	600 + 0	1200 + 0
	Total Forage	2377	4522	5195 lbs/AC
	Cost per Ton	$4.38	$4.60	$8.06
SUPERPHOSPHATE EACH YEAR	"Super" applied	300 + 300	600 + 600	1200 + 1200
	Total Forage	4508	5653	5846 lbs/AC
	Cost per Ton	$4.62	$7.36	$14.35

C. Effects of Sulfur Fertilizers on Yield and Composition of Clover Range

Many range soils are deficient in sulfur. At such locations both forage production and forage quality can be improved by applying sulfur-bearing fertilizers, provided responsive legumes are either present or seeded.

Plants take up sulfur as the soluble sulfate ion. Any material yielding sulfate may be expected to cause legume growth increases on a sulfur-deficient soil. Elemental sulfur usually acts more slowly, as it must be converted to soluble sulfate by soil bacteria.

An example of the effectiveness of sulfur-bearing fertilizers in improving range production on Snelling sandy loam, a sulfur-deficient soil, is shown in the chart on the opposite page. This test was carried out on the Dolling Brothers ranch in eastern Stanislaus County and the results measured over a three-year period.

Five hundred pounds of gypsum containing 90 pounds of sulfur per acre in sulfate form caused yield increases over a period of three years, though in the third year only slight effects were observed.

Yield increases persisted for only two years where 230 pounds of single superphosphate were used (50 percent gypsum, or 21 pounds sulfur per acre), while 100 pounds of treble superphosphate containing two to four pounds of sulfur per acre as an impurity increased yield the first season only.

The improvement in forage production at this location was due almost entirely to the stimulation of rose clover which had been seeded the year prior to fertilization. The rose clover contained a higher percentage of protein than the native grasses and filaree. The protein content of the entire forage was sharply increased the first year because of the large amount of high-protein clover. However, the crude protein content of the whole forage was correspondingly reduced the second year after treatment, when the clover stimulation was less, although it remained greater than the control.

Cost of extra forage: The 500-pound application of gypsum in 1954 produced slightly over a ton of extra forage over a three-year period at a cost of $3.58 a ton. The 200-pound single superphosphate treatment produced about three-quarters of a ton extra forage, but at a higher cost of $5.42 per ton. The yield increase from the 100-pound treble superphosphate application amounted to only 600 pounds at a cost of $13.12 per ton. It appears that these were effective on this sulfur-deficient land only because of their sulfur content.

A gypsum rate test was performed on the same soil in 1956 and 1957. Extra forage was produced at a cost of $2.42 per ton from 100 pounds of gypsum; $2.73 per ton from 200 pounds of gypsum; and $5.46 per ton using 500 pounds of gypsum.

Gypsum - lbs/acre	none	100	200	400
Yield in 2 years	2410	3030	3510	3510
Increase		620	1100	1100
Cost of gypsum		$ .75	$1.50	$3.00
Cost/ton extra forage		$2.42	$2.73	$5.46

It would appear that for clover seedings on this soil the best rates of application was about 200 pounds per acre.

MORE
ROSE CLOVER FORAGE
from SULFUR FERTILIZERS

Materials Applied in 1954 only Sulfur/Ac.	100 Treble Super 2 – 4 lbs.	230 Single Super 21 lbs.	500 Gypsum 90 lbs.
Extra Forage Produced			
1954 – 1st Year (control 1970)	630	890	1110
1955 – 2nd Year (control 1540)	70	630	730
1956 – 3rd Year (control 940)	–60	50	260
Total Extra Forage in 3 Years	640	1570	2100
Cost of Fertilizer	$4.20	$4.25	$3.75
Cost per Ton of Extra Forage	$13.12	$5.42	$3.58

COMPOSITION OF FORAGE		Ck.	100 Treble	230 Super	500 Gyp
% Legumes Present	54	29%	30%	67%	64%
	55	38	39	50	53
	56	42	36	52	53
% Crude Protein	54	8.5%	8.5%	13.6%	12.4%
	55	10.1	10.3	11.4	11.9
	56	9.6	9.4	9.9	10.6

V. EFFECTS OF FERTILIZERS ON MEAT PRODUCTION OF RANGE LAND

Animal grazing tests on fertilized range were set up in 12 counties in the fall of 1956. They were set up for the specific purpose of finding out whether or not fertilizers could be profitably used at those locations.

Site Selection: All trials were carried out on lands typical of extensive areas in each county. Some were highly productive ranges. Others were poorer ranges on land of low fertility. Some were seeded to improved species. Test sites included soils known to be deficient in phosphorus or sulfur, as well as soils well supplied with these nutrients.

The site of experimental fields was often large, in order to get a fair cross-section of rangeland and to accommodate sufficient animals to obtain reliable results. Field size was also dictated by the location of stock water and by the size of fenced fields that might be used for treatment.

Stocking and grazing of experimental fields was as close to normal ranch operations as possible. Fertilized fields were stocked for the available feed. Untreated fields were stocked at rates selected by the rancher as the normal carrying capacity. Stocking rates were changed as the condition of the range indicated. Every effort was made to graze the fields so as to utilize the available feed but not to over-graze any of the treatments. Animals were removed and the tests terminated when nearly all of the green feed had been utilized, thus leaving enough growth to provide dry feed for normal fall use. The control and the fertilized fields were grazed during the same period.

Measurement of Results: All animals were weighed when placed in the fields and again when removed. Results are expressed as (1) total grazing days per acre; (2) average daily gains per animal; (3) pounds of meat per acre; and (4) fertilizer cost per pound.

A. Grazing Tests with Cattle in 1957 Using N & P Materials

The results obtained from ten field-scale grazing tests are listed on the opposite page. Six of the tests represent continuation of previous demonstrations, while four were entirely new undertakings.

Fall and winter drought was a factor at all locations. Only in Sacramento County were rains sufficient to make green feed before mid-January. Spring rains "brought on" the feed at most locations and made 1957 a fairly good range year. In the Tulare and southern Fresno County tests, with rainfall of 5.5 and 9.5 inches, continued spring drought greatly shortened the green feed period. The results are summarized as follows:

1. Carrying capacity doubled or trebled by treatment.
2. Higher daily gains in some but not all fertilized fields.
3. Meat production per acre about trebled in most tests.
4. Striking carryover effects of previous fertilizer treatments at three locations. These effects reduced costs obtained for 1956.
5. The average fertilizer cost of the extra beef per acre was 11.3 cents. This includes data from two tests where spring drought greatly reduced forage yields.

A comparison of the 1957 results with previous seasons may be of interest. It is recognized that strict comparison is not valid, since different ranches and fertilizer treatments were used. The figures at the bottom of the opposite page show a striking similarity in carrying capacity and beef production.

SUMMARY OF NITROGEN AND NP FERTILIZER GRAZING TESTS WITH CATTLE - 1957

County Ranch & Rainfall	Fertilizer Treatment	Stocking: Aver. Acres/ Animal	Stocking: Grazing Days/ Acre	Beef Production: Av. Daily Gain lbs.	Beef Production: Beef from Pasture lbs/Ac.	Beef Production: Gain from Fert. lbs/ac.	Evaluation of Results: Cost of Fert. & Applic. $/Acre	Evaluation of Results: Cost/lb of extra meat/acre 1957 only	Evaluation of Results: Cost/lb of extra meat/acre 2 yr.*** Basis
Fresno	Check	3.6	16.6	3.37	56.0	--	--	--	
Johnson	Check + Supplement	4.6	13.7	3.09	41.7	- 14.3	$ 1.25*	--	
9.5"	N_{60}	1.5	36.7	2.98	109.0	53.0	10.01	18.9¢	
	N_{60} + Supplement	1.5	36.2	3.41	123.5	67.5	10.01) 1.33*)	16.8¢	
Fresno	Check	4.0	26.2	1.85	48.4	--	--	--	
Sunland	N_{63} (N_{80})**	1.5	68.8	2.01	138.6	90.2	9.04	10.0¢	(13.9¢)
12.2"	N_{63} (N_{80} P_{40})**	1.3	79.4	1.98	157.3	108.9	9.04	8.3¢	(13.8¢)
	Carryover (N_{80} P_{68})**	2.3	46.4	1.71	79.0	30.6	--	--	(11.9¢)
Glenn	Check	7.9	13.1	2.14	28.2	--	--	--	
Sevier	N_{67}	3.3	31.7	2.33	73.7	45.5	10.93	24.0¢	
10.9"	Carryover (N_{64} P_{20})**	4.9	21.4	2.35	50.5	22.3	--	--	(12.5¢)
Los Angeles	Check	7.4	21.6	1.62	34.9	--	--	--	
Newhall	N_{65}	2.4	66.3	1.69	111.9	77.0	10.63	13.8¢	
13.3"									
Madera	Check	3.0	39.3	1.67	65.9	--	--	--	
Urrutia	N_{80}	1.0	118.0	1.73	203.5	137.6	11.94	8.7¢	
12.2"	Carryover (N_{80})**	1.3	88.5	1.52	134.5	68.6	--	--	(3.7¢)
Sacramento	Check	4.9	41.0	.96	39.0	--	--	--	
Van Vleck	Check + Supplement	3.3	61.0	1.38	84.0	45.0	5.07*	11.3¢	
19.1"	N_{74} P_{37}	1.8	114.0	1.30	149.0	110.0	16.16	14.9¢	
	N_{74} P_{37} + Supplement	1.8	112.0	1.16	130.0	91.0	16.16) 3.63*)	21.3¢	
San Joaquin	Check	3.6	24.2	1.76	50.2	--	--	--	
Beckley	N_{80} P_{38}	1.5	57.9	1.85	114.4	64.2	18.05	28.1¢	
16.7"	N_{80} (N_{80} P_{80})**	1.4	70.2	2.35	175.1	124.9	11.18	9.0¢	(12.7¢)
	Carryover (N_{80} P_{38})	2.1	41.8	1.85	87.4	37.2	--	--	(10.9¢)
San Luis Obispo	Check	3.1	42.0	1.74	72.9	--	--	--	
Hearst	N_{69} P_{55}	1.0	124.0	2.41	299.7	226.8	14.81	6.5¢	
16.0"									
Tulare	Check + Supplement	2.6	81.9	.66	32.8	--	3.91*	--	
Guthrie	N_{50} + Supplement	2.0	91.1	.80	55.9	23.1	3.25*) 7.97)	34.5¢	
5.5"									
Yolo	Check	3.3	30.3	1.45	43.9	--	--	--	
Karns	N_{41}	1.8	56.6	1.88	106.6	62.7	6.96	11.1¢	
11.2"	N_{84}	1.3	75.0	2.11	157.9	114.0	14.10	12.4¢	
Av.Values for	Check	4.3	33.6	1.57	47.2	--	--	--	
10 tests	"Best" Treatment	1.7	78.8	1.88	144.2	97.0	10.96	11.3¢	

* Cost of Supplement fed/acre
** Treatment previous year
*** Cost of extra beef/acre in 2 seasons

4-YEAR COMPARISON OF EFFECTS OF N AND NP FERTILIZERS ON BEEF PRODUCTION

	1953-54	1954-55	1955-56	1956-57
Number of Trials	4	9	13	10
Number acres in all trials	1118	1754	2543	4197
Grazing Days per acre				
Control	34 days	40 days	37 days	34 days
"Best" treatment	76	90	90	79
Meat produced/acre				
Control	55.8 lbs.	64.0 lbs.	64.8 lbs.	47.2 lbs.
Fertilized	158.6	188.0	162.1	144.2
Increase/acre	102.8	124.0	97.3	97.0
Average fertilizer cost/acre (Including application)	$13.09	$15.69	$15.93	$10.96
Fertilizer cost/lb. Extra Beef/acre	12.7¢	12.6¢	16.4¢	11.3¢

B. Effects of Phosphorus Fertilizers on Beef Production on Clover Range

On the opposite page is shown a summary of the results of a grazing test near Lincoln where fields seeded to annual clovers were fertilized with superphosphate. Two seasons' data are summarized to show the effects of the original treatment, its carryover effects, and the results of materials applied for the 1957 season. The fields used were adjacent to the small plots harvested and reported on pages 6 and 7, but had been fertilized several years previous to this grazing trial.

Animals made excellent gains during the green feed period regardless of treatment. Total beef yields per acre were increased 75 percent. Over a two-year period annual applications of superphosphate gave about the same results as a double application applied the first year only. The extra beef per acre was produced at a fertilizer cost of about 8-1/2 cents per pound.

C. Effects of Nitrogen Fertilizers on Production of Sheep

Results of the two grazing tests carried out with sheep are shown on the opposite page. Both were in areas of sulfur deficiency, while phosphorus was in adequate supply. They were laid out primarily to determine the effect of fertilization upon the production of grasses - particularly for winter and spring feed.

The 1957 Keithley test represents a continuation of the 1956 tests in which nitrogen from ammonium sulfate was reapplied to the same fields fertilized the previous season. Carrying capacity and meat production of both annual and perennial range were approximately doubled by fertilization. Without fertilization the Harding grass pasture showed 43 percent higher grazing income than the native range. With fertilization both produced about the same meat and grazing income per acre. Results in 1957 differ from those of 1956 in the greatly superior performance of the native range the second year of fertilization.

The Whipple test on soil clearly deficient in sulfur as well as nitrogen showed spectacular improvement, with meat production four times as great on the fertilized as on the control pasture.

Net incomes per acre after deducting fertilizer costs show clearly that fertilization was a profitable operation at both locations.

VI. RESULTS OF INDIVIDUAL COUNTY TESTS

Descriptions of the thirteen individual county tests arranged in alphabetical order, together with record of grazing data and weight records, are shown in the pages that follow.

EFFECTS OF SUPERPHOSPHATE ON BEEF PRODUCTION OF IMPROVED ANNUAL CLOVER RANGE

Two-Year Summary - Placer County - Alrich Ranch

Fert. Treatment 1956	Fert. Treatment 1957	**Average Daily Gain per Animal 1956	**Average Daily Gain per Animal 1957	BEEF PRODUCTION PER ACRE 1956	BEEF PRODUCTION PER ACRE 1957	BEEF PRODUCTION PER ACRE Total	BEEF PRODUCTION PER ACRE Increase	Fert.Cost/lb. Extra Beef per Acre
Check	Check	2.02	2.24	100	76	176	--	---
Check	P_{57}*	2.02	2.32	100	138	238	62	10.0¢
P_{49}	P_{55}	2.46	2.33	173	138	311	135	8.3¢
P_{108}	None	2.46	2.33	179	126	305	129	8.7¢

* as lbs. P_2O_5 per acre - Source normal 19% superphosphate
** during green feed period - April - June 1 each year

SUMMARY OF FERTILIZER GRAZING TESTS WITH SHEEP - 1957

County Farm and Type Range	Fertilizer Treatment**	Lamb Days per Ac.	Meat Production Total lbs./Ac.	Meat Production Av.Daily gain-Lamb lbs./Day	Evaluation of Results Total Inc./Ac. Lamb,Wool & Mutton	Evaluation of Results Gain due to Fertilizer	Evaluation of Results Fertilizer cost/Ac (applied)	Evaluation of Results Net Profit per Ac.
Lake Keithley					$/Ac.	$/Ac.	$/Ac.	$/Ac.
Native Range	Check	99.2	103.2	.64	$17.97			
	N_{87}	268.7	208.5	.56	41.03	$23.06	$11.67	$11.39
Lake Keithley								
Harding Grass	Check	198.1	121.0	.52	25.75			
	N_{98}	246.0	233.5	.64	42.76	17.01	12.99	4.02
Mariposa Whipple								
Native Range	Check	59.6	33.2	.46	7.76*			
	N_{62}	143.0	130.1	.76	33.48	25.72	9.63	16.09
Average Values								
Check	Check	119	85.8	.54	17.16			
Fertilized	N_{82}	219	190.7	.65	39.09	21.93	11.43	10.50

*value of wool weight not included
**lbs. of nitrogen applied per acre in ammonium sulfate

ACKNOWLEDGMENTS

We wish to acknowledge the splendid cooperation of the ranchers who provided the animals, weighing facilities and specially fenced fields for these tests.

Grateful acknowledgment is also made to the companies whose gifts of fertilizers made these tests possible. A total of 217 tons of materials was furnished by the following companies:

Badishe-Aniline, Germany
Best Fertilizer Company
Collier Carbon & Chemical Corporation
California Spray Chemical
Norsk Hydro, Norway
Shell Chemical Corporation
Stauffer Chemical Corporation
Western Phosphates

JOHNSON BROTHERS TEST - Fresno County

R. G. Jones - Farm Advisor

This test was begun in the 1957 season. The area selected was on the lower edge of the granite foothills 5 miles east of Orange Cove almost on the Tulare County line and adjacent to the point where Sand Creek leaves the foothills. The test was set up for the purpose of comparing the effects of nitrogen fertilization upon beef production with and without supplemental feeding. Four fields were set up for this trial; a 52-acre field as a control, a 28-acre field unfertilized but with provision for feeding supplement; and two 30-acre fields, both fertilized, but one with self-feeders for supplemental feeding.

Fertilizers were applied with a ground rig in November 1956 and consisted of 290 pounds of ammonium sulfate to provide 60 pounds of nitrogen. Fall rains were very sparse and not until February 21 was there sufficient rain to permit stocking of the demonstration fields. Yearling Hereford steers were used and the stocking rate of 1-1/2 acre per animal used in the two fertilized fields. The unfertilized fields were stocked at an average rate of 3.6 acres per animal. Additional animals were added on March 11. Owing to the continued and prolonged drought the test was terminated on April 25 after only 62 days of grazing. Total seasonal rainfall was only 9.5 inches.

Beef production without supplement was about doubled by treatment. Where supplement was provided for animals in a fertilized field, an additional increase in beef production was observed. For reasons unknown the untreated field where the animals received supplement produced slightly less meat than the control field.

The results of this test have been evaluated, using a beef-price of 20 cents per pound for gains during the grazing period. Using this figure and after deducting the cost of the supplement fed per acre in each field there was little margin left for profit. The extra beef on the fertilized field was produced at a fertilizer cost of nearly 19 cents per pound, while on the field receiving both fertilizer and supplement the value was about 17 cents.

It is felt that this test under the very limited rainfall conditions probably is not too significant. Fertilizer treatments will be repeated and supplement provided to the same fields during the coming season.

JOHNSON BROTHERS TEST - Fresno County

February 21 - April 25, 1957 — 62 Days

I. TREATMENT	(A)	(B)	(C)	(D)
Nutrient/Acre	Check	Check & Suppl.	N_{60}	N_{60} & Suppl.
Materials/Acre	---	---	290 Am.Sulf.	290 Am.Sulf.
Field Size	50.0	27.5	29.9	30.3
II. STOCKING AND GRAZING				
Av. In Wt./Animal	615	638	655	640
Acres/Animal (av.)	3.6	4.6	1.5	1.5
Head Days/Acre	16.6	13.7	36.7	36.2
III. WEIGHT GAINS				
Av. Daily Gain/Animal				
Group I Feb.21-Apr.9	3.37	3.12	3.14	3.65
Group I Apr.9 -Apr.25	3.36	2.99	2.43	2.14
Group II Mar.11-Apr.9	--	--	3.87	4.42
Group II Apr.9-Apr.25	--	--	1.33	2.26
For Entire Period	3.37	3.09	2.98	3.41
Beef Produced/Acre	56.0	41.7	109.0	123.5
Extra Beef	--	- 14.3	53.0	67.5
IV. EVALUATION				
Gross Grazing Income/Acre Beef @ 20¢	$11.20	$8.34	$21.80	$24.70
Less Supplement cost/Acre	--	1.25*	--	1.33**
Less Fertilizer Cost-Materials	--		9.01	9.01
Application			1.00	1.00
Net Grazing Income/Acre	11.20	7.09	11.79	13.36
Profit or Loss/Acre	--	- 4.11	.59	2.16
V. FERTILIZER AND SUPPLEMENT COST				
of Extra Beef/Acre	--	--	18.9¢	16.8¢

* (B) Control & Supplement: Animals consumed 1148 lbs. barley @ 3¢ = $34.40 or 9.2¢/day

** (D) N_{60} + Supplement: Animals consumed 1340 lbs. barley @ 3¢ = $40.20 or 3.7¢/day

SUNLAND TEST - Fresno County

R. G. Jones - Farm Advisor

This test is a continuation of the work undertaken at the same location the previous season. The demonstration area is located approximately 10 miles east of Clovis on flat terrace land lying between the cultivated farm land and the foothills. The area had been farmed to dryland grain years previously but has been used as range for the past 9 years. Four 50-acre fields were set up for the 1955-56 tests, each containing 50 acres, 40 of which were terrace land and 10 acres bottom land formed by a small valley crossing all four of the experimental fields.

The same four fields used in 1955-56 were used in the current test. The test was designed to measure the carryover effects of previously applied fertilizer and of additional nitrogen added for the current season's growth. Treatments were as follows:

Field 1 was unfertilized as in the previous year.

Field 2, which had straight nitrogen previously, received an additional application of ammonium sulfate, at 300 pounds per acre.

Field 3, which had 80 nitrogen and 40 phosphorus previously, received a straight nitrogen treatment, the same as field 2.

Field 4, which had received 80 pounds of nitrogen and 68P_2O_5 in 1956, was left unfertilized to measure carryover effects.

Growth of green feed was greatly delayed by the fall and winter drought. After the rains began it was quite clear that winter growth was considerably advanced on both fields which had received phosphorus the previous year. Clipping of small plots had shown a seasonal phosphorus deficiency with NP treatments starting growth earlier but producing about the same yields as straight nitrogen during the spring months.

Stocking was not possible until January 28. The spring rains at these locations were good and large amounts of forage were produced on the two nitrogen treated fields.

Additional cattle were added as the feed progressed. Spring growth on the fertilized fields was more rapid than could be utilized by stocking with one yearling steer per acre. Animals remained in these fields until May 14 but did not completely utilize the large amount of grass and filaree produced.

The rate of gain of the experimental animals shows some rather striking differences. Animals on the fields fertilized for the entire period gained 40 pounds more than did comparable animals on the control field throughout the test.

Beef production in 1957 was slightly less on the unfertilized field than the previous year because of the shorter grazing period. Slightly more beef per acre was produced on the currently fertilized field that had phosphorus the previous year than on the one which had had a straight nitrogen treatment earlier. A substantial effect of the previous season's nitrogen-phosphorus treatment was observed in the carryover field.

The results of this test have been evaluated using a value of 20 cents per pound for the beef produced during the grazing period. After deducting costs of fertilizer and application there remains a profit of $9 an acre on the straight nitrogen field as compared to nearly $13 an acre on the nitrogen treated field which had had phosphorus previously. The fertilizer costs of the extra beef per acre produced in 1957 were 10 and 8 cents a pound on these two fields.

SUNLAND RANCH - Fresno County

January 28 - May 14, 1957 — 105 Days — Seasonal Rainfall 12.2 Inches

I. TREATMENTS	1	2	3	4
Nutrients/Acre (1955-56)	Check	N_{80}	$N_{80}P_{40}$	$N_{80}P_{68}$
(1956-57)	"	N_{63}	N_{63}	Carryover
Materials/Acre (1956-57)	--	300 Am.Sulf.	300 Am.Sulf.	--
Field Size	50	50	50	50
II. STOCKING AND GRAZING				
Av. In Wt./Animal	513	523	518	561
Av. Acres/Animal	4.01	1.53	1.32	2.28
Head Days/Acre	26.2	68.8	79.4	46.0
III. WEIGHT GAINS				
Av. Daily Gain/Animal	1.85 lbs.	1.94 lbs.	1.98 lbs.	1.71 lbs.
Av. Gain/Animal*	153 "	198 "	193 "	171 "
(Beef Produced/Acre in 1956)	(60.4) "	(128.0) "	(134.0) "	(182.3) "
Beef Produced/Acre in 1957	48.4 "	138.6 "	157.3 "	79.0 "
Extra Beef from Fertilizer	--	90.2 "	108.9 "	30.6 "
IV. EVALUATION				
Gross Grazing Income/Acre With Beef @ 20¢	$9.68	$27.72	$31.46	$15.80
Fertilizer Cost				
Materials	--	8.04	8.04	--
Application	--	1.00	1.00	--
V. FERTILIZER COST/LB.				
of Extra Beef/Acre - 1957 only		10.0¢	8.3¢	--
Cost of Extra Beef in 2 years				
Fertilizer Cost in 2 years		$21.26	$25.20	$18.11
Beef in 2 years		157.8	182.5	152.5
Cost/lb/Acre		13.5¢	13.8¢	11.9¢

* Only on original animals placed in fields January 28 and February 12, not including average weight gains of aninals added in the spring months.

J. W. SEVIER TEST - Glenn County

Glenn Eidman - Farm Advisor

This test represents the fourth year of results at the same location. The experimental area was located approximately 12 miles west of Willows on rolling hills which included both open grassland and oak-grass woodland.

The same 365-acre control field was used as in three previous years. The 133-acre field which had received nitrogen and phosphorus the first and third year was again left unfertilized to measure carryover effects. The 200-acre field which had been fertilized with a straight nitrogen treatment the second year and left unfertilized the third season was again refertilized with a straight nitrogen treatment. As before, fertilizer materials were applied by plane in November.

The rainfall distribution at this site was poor during the current season. Fall rains were not sufficient to start the feed and effective winter rain did not fall until mid-January. Spring rains were erratic and only 10.9 inches fell in the entire season.

Yearling steers were first placed in all experimental fields on February 9. Additional animals were added on March 8. The trial was terminated on May 24.

Gains of experimental animals were good in all fields, exceeding 2 pounds per day for the entire period with slightly better average daily gains in the fertilized and carryover fields.

The total beef production per acre was 28 pounds on the control, 50 pounds per acre on the carryover field and about 74 pounds on the field fertilized during the current season. The extra beef produced per acre by fertilization was produced at a fertilizer cost of 24 cents per pound.

The four years of results of this test are summarized in the table below. Here are shown the fertilizer treatments, the beef production of the control and the first and second year effects of fertilizer treatments. It seems clear that in evaluating results carryover effects must be considered. They amount to 23 to 33 percent of the gain in beef production observed the year of application. By giving credit for these second year effects the fertilizer cost of the extra beef is materially reduced. It will be noted that the NP treatments appear to have produced more beef at a cheaper rate than the straight nitrogen treatments. It is felt that these differences were probably due to differences in productive capacity of the fields rather than to any effects of phosphorus. Field C, used for straight nitrogen treatments in 1955 and again in 1957, had a larger proportion of thin soil and south slopes than did Field B, which had NP treatments in 1954 and 1956. Analyses of soil and forage samples from the control and straight nitrogen field showed a relatively high phosphorus status.

Season	Fertilizer Treatment		Beef/Ac.	Extra Beef from Fertilization			Cost/lb. Extra Beef/Ac.	
	Nutrients	Cost/Ac.	on control	1st Year	Carryover	2 yrs.	1 yr. Basis	2 yr. Basis
1954	$N_{48}P_{26}$*	$11.52	21.5	79.6 lbs.	18.4 lbs.	98.0 lbs	14.5 lbs.	11.7 lbs.
1955	N_{60} **	9.75	28.5	40.8	13.6	54.4	23.9	17.9
1956	$N_{64}P_{20}$*	12.59	29.7	79.5	22.3	101.8	15.7	12.4
1957	N_{67} **	10.95	28.2	45.5	--	--	24.0	--

* Field B
** Field C

J. W. SEVIER - Glenn County

February 9 - May 24, 1957 — 104 Days

I. TREATMENTS		A	B	C
Nutrients/Acre -	1954	Check	N_{48} P_{26}	---
" "	1955	"	---	N_{60}
" "	1956	"	N_{64} P_{20}	---
" "	1957	"		N_{67}
Materials/Acre	1957			150# Urea/Acre
Field Size		365 Ac.	133 Ac.	200 Ac.
II STOCKING AND GRAZING				
Average in weight/animal		643	680	692
Acre/animal				
Feb. 9 - March 8		11.1	6.7	5.7
Mar. 8 - May 24		7.3	4.4	2.8
Average		7.9	4.9	3.3
Grazing Days/acre		13.1	21.4	31.7
III WEIGHT GAINS				
Average daily gain/animal		2.15	2.36	2.32
Average gain/animal		205.7	223.7	211.6
Total beef produced/acre		28.2	50.5	73.7
Increase from fertilizer			22.3	45.5
IV EVALUATION FOR 1957				
Fertilizer cost/acre				
Material			--	$9.75
Application			--	1.18
V. FERTILIZER COST FOR 1957				
Per pound extra beef/acre			--	24.0¢

KEITHLEY TEST - Lake County

W. C. Lusk - Farm Advisor

The Glen Keithley test was a continuation of the test begun on the same fields the previous year. It was set up for the purpose of studying the effects of fertilization upon production of meat by sheep. The area selected was open pasture land five miles south of Lakeport lying between the steep brushy hills and the crop land in the cultivated area of Big Valley. The area is used as winter range and for the production of spring lambs.

Two fields were available - one of unimproved native range composed largely of annual grasses, and the second a field seeded to Harding grass a number of years earlier. Few clovers were present in either field.

The previous year each of these fields was split and half of each type of range fertilized with ammonium sulfate. The same fertilizer treatments were applied to the same fields in October of 1956.

There were reasonably good fall rains at this location and feed was available for stocking the Harding grass fields with ewes and young lambs on January 18. Additional animals were added and the annual range stocked initially on January 24. By March 8 it was evident that the unfertilized Harding grass was somewhat overstocked and some of the animals were weighed and transferred to other fields. By March 27 abundant feed was present and further additions made to both fertilized fields and to the unfertilized annual range. During the latter period until termination on May 22 the unfertilized annual range and Harding grass fields were equally stocked.

Forage production in the area was far better than the previous year because of the fine distribution of spring rains. The feed actually "got away from animals" in the fertilized fields.

The results of this test, as before, have been measured by the production of choice and feeder lambs and by the weight gains of the ewes during the grazing period. Credit was also given for the wool production prorated for the proportion of the year spent in the experimental fields.

A comparison of meat production on annual and Harding grass range showed the latter to increase meat production about 20 percent. With fertilization the annual range produced about twice the meat as the control. Similarly the Harding grass range was about doubled in meat-producing ability by fertilization. Slightly more nitrogen had been applied to the Harding grass than to the fertilized annual range. Much of the improvement in both fields was due to the increased growth of annuals. While Harding grass was present in considerable amounts, it is felt that the bulk of the stimulation in this field came from the increased growth of annual grasses also present.

The valuation figures show that total gross income on the annual range was increased from $18 to $41 for a fertilizer cost of $11.67, leaving a net profit of $11.39 per acre. Income from the fertilized Harding grass range was only slightly more than the fertilized annual range; but the net increase over the untreated field was considerably less, with the result that a profit of only $4 an acre was realized in this comparison.

Fertilization of winter range used by sheep in this area appears to offer great possibilities. Fall rains usually come in sufficient amounts to start growth of both annual and perennial species. This growth may be continued and provide good amounts of green feed during the winter months if nitrogen fertilizers are provided. This test is being continued for a third year.

KEITHLEY TEST - Lake County — Lambs and Ewes

January 18 - May 22, 1957 — 125 Days

I. TREATMENTS		Annual Range		Harding Grass Range	
		(1)	(2)	(3)	(4)
Nutrients/Acre	1955-56	Check	N_{84}	N_{82}	Check
	1956-57	---	N_{87}	N_{98}	---
Materials/Acre	1956-57	---	415 Am. Sulfate	465 Am. Sulfate	---
Field Size		12.69 Ac.	16.15 Ac.	17.96 Ac.	15.64 Ac.
II. STOCKING AND GRAZING					
No. of Pairs/Acre					
Jan. 18 - Jan. 24		---	---	.72	.83
Jan. 24 - March 8		.32	1.86	1.67	1.91
March 8 - March 27		.79	1.86	1.67	1.28
March 27 - May 22		1.26	2.48	2.23	1.28
"Pair Days"/Acre		99.2	268.7	246.0	198.1
III. WEIGHT GAINS					
Av. Daily Gains (lbs/animal day)					
Lambs		.64	.56	.64	.52
Ewes		.38	.22	.33	.08
Meat produced/Acre					
Lambs - choice		57.1	142.2	153.3	44.3
" feeders		7.4	7.9	---	57.6
Mutton		38.7	58.4	80.2	19.1
Total meat/acre		103.2	208.5	233.5	121.0
Wool - prorated for grazing period (lbs/ac.)		2.25	5.96	5.46	4.39
IV. EVALUATION					
Grazing Income/acre from					
a. choice lamb @ 23¢		$13.12	$32.71	$35.26	$13.14
b. feeder lamb @ 20¢		1.48	1.59	---	8.86
c. mutton @ 5¢		1.93	2.92	4.01	.95
d. wool @ 64¢		1.44	3.81	3.49	2.80
Total gross income		$17.97	$41.03	$42.76	$25.75
Less Fertilizer Cost					
Materials		--	11.00	12.32	--
Application		--	.67	.67	--
Net grazing income		17.97	29.36	29.77	25.75
Profit/Acre from Fertilization			11.39	4.02	

NEWHALL TEST - Los Angeles County

Chester Perry - Farm Advisor

This test was begun in the 1957 season. The demonstration area lay on Highway 99 about 5 miles south of Castaic junction. The lands were part of a dissected plateau covered with annual grass with a few scattered oaks. Considerable filaree but little clover was present.

A 900-acre field of rolling rangeland was divided; 673 acres for control and 236 acres fertilized in November, 1956 with 124 pounds of urea per acre to provide 65 pounds of nitrogen. Because of the steeply rolling nature of the land airplane application was used.

Straight nitrogen treatment was used at this site, since soil tests showed the soil to have a high phosphorus status.

Good and choice grade yearling heifers (average weight 440 pounds) were placed in the fields on December 16, since there was a considerable amount of dry feed to be utilized. By February 10 there had been sufficient rain to start considerable green feed. Additional animals were added to both fields to give a stocking rate of approximately 6 acres per animal on the control and 3 acres per animal where fertilized. On March 13 additional animals were added to the fertilized field, bringing the stocking rate up to 1.7 acre per animal. For the entire period the carrying capacity was trebled by fertilization from 22 to 66 head days per acre.

Cattle gained well, both in the fertilized and control fields. Actually a surplus of feed existed in the fertilized field, which was not completely utilized by the termination of the test on May 25.

Beef production per acre was increased from 35 to 112 pounds per acre, an increase of 77 pounds. Using a value of 19 cents per pound, this extra beef produced would have a value of $14.63, or $4 an acre more than the cost of fertilizer and application. The fertilizer cost per pound of extra beef produced per acre was 13.8 cents.

NEWHALL LAND AND FARMING COMPANY TEST - Los Angeles County

December 16, 1956 - May 25, 1957 — 160 Days

I. TREATMENTS

	Check	N_{65}
Nutrients/Acre		
Materials/Acre	--	144 lbs. Urea/Acre
Field Size	673	236

II. STOCKING AND GRAZING

Average In Weight/Animal	424	465
Acres/Animal		
Dec. 16 - Feb. 10	13.5	4.7
Feb. 10 - March 13	5.9	2.9
March 13 - May 25	5.9	1.7
Average	7.4	2.4
Grazing Days/Acre	21.6	66.3

III. WEIGHT GAINS

Average Daily Gain	1.62	1.69
Beef/Acre	34.9	111.9
Increase Due to Fertilizer		77.0

IV. EVALUATION

Value of Increased Beef/Acre @ 19¢	$14.63
Fertilizer Cost	
Materials/Acre	9.36
Application/Acre	1.27
Profit/Acre from Fertilization	$4.00

V. FERTILIZER COST/POUND

of Extra Beef/Acre	13.8¢

URRUTIA TEST - Madera County

Walter Emrick - Farm Advisor

This test was a continuation of the grazing trial carried out the two previous seasons at the same location. It was located approximately 5 miles west of Friant Dam in brush-free open range on soil mapped as Vista fine sandy loam. Forage was composed of native grass, considerable filaree and native clovers. The 40-acre field fertilized the previous year was left to measure the carryover effects. The other 40-acre field fertilized in 1955 but not in 1956 was refertilized with 380 pounds of ammonium sulfate. An adjacent 120-acre field not previously in the test was used as control.

Fertilizers were applied by Ezy-Flo ground rig in October of 1956. Rains came late and stocking was not attempted until February 15. There were good spring rains and green feed persisted into June, with the animals being weighed out of the fields on June 14. As in the past the fields were stocked with yearling Hereford steers; three acres per animal on the control field and one acre per animal on the currently fertilized field. One and a third acres per animal was allowed on the carryover field. This rate was perhaps a little excessive in the early part of the season, with the result that animals on this field gained at a slightly lesser rate than did animals on the control or on the field fertilized for the 1957 season.

Beef produced per acre was 66 pounds without fertilization and increased up to 203 pounds by fertilization. The carryover effect in terms of beef produced was about 50 percent of the increased beef production resulting from currently applied fertilizer.

The results of this test have been evaluated, using beef at 19 cents a pound. On this basis the grazing income per acre was increased from $12.62 up to $26.72 after deducting cost of fertilizer, or a profit of $14.20 per acre. The fertilizer cost of the extra beef produced per acre in the field fertilized in 1957 was 8.7 cents per pound.

The carryover effects of the ammonium sulfate applied in this test are important in evaluating the results. Below is shown a summary of the three years' beef production in this test, together with the extra beef the year of fertilization and the carryover effects of the first year's application. In 1955, 163 extra pounds of beef were produced on the fertilized field. The following year 70.7 pounds additional increase was measured. The results of the 1956 fertilization are similar; 176.5 pounds were produced the first year, with an additional 68.6 pounds the carryover year. When the carryover effects are figured in, fertilizer cost of the extra beef produced per acre is reduced from about 7 cents per pound on a one-year basis to about 5 cents per pound when the results are evaluated for a two-year period.

Season Fertilized	Fertilizer Cost/A.	Beef/A. on Check	EXTRA BEEF/ACRE FROM FERTILIZATION			Fert.Cost/lb. Extra Beef/A.	
			First Year	2nd. Yr. Carryover	Total 2 Years	1-Yr. Basis	2-Yr. Basis
1955	$11.71	44.3	163.0 lbs.	70.7 lbs.	233.7 lbs.	7.2¢	5.0¢
1956	12.00	79.4	176.5	68.6	245.1	6.8	4.9
1957	11.94	65.9	137.6	--	---	8.7	--

URRUTIA TEST - Madera County

February 15 - June 14, 1957 — 118 Days

I. TREATMENT			
Nutrients	None	(N_{80} in 1956) Carryover	N_{80}
Materials/Acre	--	--	380 Am.Sulfate
Field Size	120 Ac.	40 Ac.	40 Ac.
II. STOCKING AND GRAZING			
Acres/animal Feb. 15 - June 14	3.0	1.33	1.0
Average in weight/animal	351.7	360.0	355.2
Grazing days/acre	39.3	88.5	118.0
Increase from fertilization	--	49.2	78.7
III. BEEF PRODUCTION			
Average Daily Gains	1.67 lbs.	1.52 lbs.	1.73 lbs.
Average gain/animal	197.8	179.6	203.5
Beef produced/Acre	65.9	134.5	203.5
Gain from fertilization	--	68.6	137.6
IV. EVALUATION			
Gross grazing income/Acre beef @ 19¢	$12.52	$25.56	$38.66
Less fertilizer cost			
Material	--	--	11.20
Application	--	--	.74
Net grazing income/Acre	$12.52	$25.56	$26.72
Net profit from fertilization	--	$13.04	$14.20
V. FERTILIZER COST			
per pound extra beef/Acre	--	--	8.67¢ (for 1957)

WHIPPLE TEST - Mariposa County

John Anderson - Farm Advisor

This test, in which sheep are used to evaluate results, was initiated in the 1957 season. The areas selected were two adjacent fields of nearly open oak-grass woodland in the Sierra foothills some 25 miles southeast of Mariposa at an elevation of 1500 feet. The soil was a residual one formed on granite - probably of the Vista series.

Vegetation was primarily native annual grasses and clovers, though some improved annual clovers had been sown. Some years earlier excess brush had been removed by control burning.

Three hundred pounds of ammonium sulfate per acre were applied in late November, 1956, to a 30-acre field. Adjacent lands had shown striking responses to sulfur on legume growth, with no response to added phosphorus. Soils tests had shown high phosphorus status. An adjacent 36-acre field was used as control.

Fields were first stocked with ewes and lambs on December 18, 1956. Supplement was provided until there was ample green feed. Additional animals were added to the fertilized field as the feed developed. All animals entering the fields were weighed and records made of weights at time of removal for sale or at the termination of the test on July 27.

The average daily gain of lambs and ewes was substantially greater on the fertilized field. The total meat production was increased from 33 to 130 pounds per acre by treatment.

The results of this test have been evaluated on the basis of income produced from the two fields. Actual prices received for the fat lambs from each field are entered in this calculation. Feeder lambs not sold at termination date of this test were evaluated at 18 cents a pound. Ewe gains were calculated at 5 cents per pound. The summation of these figures shows that the gross income per acre was increased from $8 to $34 an acre by fertilization. After deducting the cost of supplement fed to animals in each field and the cost of fertilizer applied, there remains a profit of $16 an acre as a result of fertilization.

The results of this test point out the potential of range fertilization in this area.

Since both nitrogen and sulfur were deficient, ammonium sulfate - a material containing both nutrients - was particularly effective. Other tests in the same granitic foothill soils have shown that grasses respond spectacularly to nitrogen plus sulfur combinations, but make relatively little response from either nutrient alone. It is anticipated that increased clover growth may be expected on a soil such as this from the residual effects of the sulfur provided by the ammonium sulfate.

WHIPPLE TEST - Mariposa County

December 18, 1956 - July 27, 1957 — 221 Days

I. TREATMENTS		
Nutrients/Acre	None	N_{62}
Materials/Acre	--	300 Am.Sulfate
Field Size	36	30
II. STOCKING AND GRAZING		
Lamb days/Acre	59.6	143.0
Ewe days/Acre	91.0	194.0
III. WEIGHT GAINS		
Average Daily Gain-Lambs	.46	.76
" " " -Ewes	.06	.11
Meat produced/Acre		
Lamb gains/Acre	27.4	108.8
Ewe " "	5.8	21.3
	33.2	130.1
IV. EVALUATION		
Income/Acre		
Fat Lambs @ 21¢ Control	$6.46	
" " @ 22¢ Fertilized		$27.07
Feeder Lambs @ 18¢	1.36	6.00
Ewe gains @ 5¢	.29	1.09
Total	$8.11	$34.16
Less cost of Supplement Feed	.35	.68
	$7.76	$33.48
Gain due to Fertilization		$25.72
Less fertilizer cost		7.88
" materials application		1.75
Profit/Acre from fertilization		$16.09

ALRICH TEST - Placer County

Walter Johnson - Farm Advisor

This test is a continuation of the one set up the previous year at the same location. The experimental area was made up of a series of improved non-irrigated pastures on Placentia sandy loam about 3 miles north of Lincoln and just east of Highway 99E. Four fields were available which had been planted with improved annual clovers six years previously. Some superphosphate had been applied about three years before the beginning of these tests. A good stand of rose and sub-clover was present along with annual grasses and filaree.

The test begun in the 1956 season was laid out to measure the beef production on improved clover range and to determine how much improvement might be obtained from application of superphosphate. Small plots for clipping had been set up in 1956 on a section of one of the fields which had never been fertilized. The results of these clipping trials have been shown on pages 6 and 7 of this report.

Treatments the first year were made to find out how much superphosphate might profitably be used. Rates of 300 and 600 pounds per acre were applied to provide 49 and 108 pounds P_2O_5 per acre. The first year the two treatments produced about the same amount of beef per acre, both well over the control.

Treatments the second year were designed to measure the carryover effects of the heavy treatments(P_{108}) and to compare these with the effects of half the amount applied annually. For comparison a field previously unfertilized was treated initially with the same rate of superphosphate as used in the light annual treatment.

The clover pasturesmade little growth during the winter months and were not ready for grazing until nearly April. Forage growth would have permitted grazing earlier, but the wet, soft condition of the fields delayed stocking until April 1. Cattle were allowed to remain in the fields for about two months and removed about June 1 so that the clovers could set seed.

Weight gains of cattle on the improved annual clover pastures were over two pounds per day during the green feed period each year. The first year gains appeared slightly greater on the phosphate fertilized pastures than the control. The second year little difference between the fertilized and the control pasture was observed.

Beef production was used to measure results. The first year the phosphate fertilized pastures produced about 75 percent more beef than the control. The second season the field currently fertilized produced about 80 percent more than the control. The field which had had the double rate application the first year showed a striking carryover effect, with the result that beef production over a two-year period was about the same as when the single rate of application was applied both years.

Some of the total gains per acre on fields 3 and 4 were from dry feed used during the summer of 1956. Likewise, there was excessive dry feed left in fields 3 and 4 in 1957. The two fields were intended to be grazed in the fall of 1957, but the early and continuous rains prevented such grazing.

The results have been evaluated and grazing income determined, using a beef value of 17 cents per pound for increases in weight of experimental animals during the grazing period. Over a two-year period the grazing income per acre was increased from about $30 an acre up to approximately $50, for a fertilizer cost of about $11. This left a net profit per acre of approximately $10.70 after deducting fertilizer costs. In other words, at this location a dollar's worth of superphosphate stimulated enough extra forage to make $2 worth of beef. In the first two years of the test there was no difference between an annual application of approximately 50 pounds P_2O_5 per acre and a single application of double the amount applied only the first year.

ALRICH TEST - Placer County

Initial Stocking Dates: 1956 - April 7. 1957 - April 1

I. TREATMENTS		#5	#4	#3	#2
Nutrients/Acre-1956		--	Check	P_{49}	P_{108}
" " 1957		Check	P_{57}	P_{55}	P_{0}
Field Size		38 Acres	124 Acres	85 Acres	64 Acres
II. STOCKING AND GRAZING					
Head Days	(1956	--	56	91	73
Grazing/Acre	(1957	34	59	59	54
		34	115	150	127
III. WEIGHT GAINS					
Average Daily Gains	(1956	--	2.02 lbs.	2.46 lbs.	2.46 lbs.
Green Feed Period only	(1957	2.24 lbs.	2.32	2.33	2.33
Beef produced/Acre- 1956		--	100 lbs.	173 lbs.	179 lbs.
" " " 1957		76	138	138	126
Increase due	(1956	--	--	73	79
to Treatment	(1957	--	62	62	50
			62	135	129
IV. EVALUATION					
2-Year Treatment		Check	$P_{0}+P_{57}$	$P_{49}+P_{55}$	$P_{108}+_{0}$
Beef/Acre		176	238	311	305
Grazing Income/Acre Beef @ 17¢		$29.92	$40.46	$52.87	$51.85
Fertilizer Cost/Acre including Application		--	6.19	11.18	11.24
Net income from Pasture		29.92	34.27	40.69	40.61
Profit/Acre in 2 Years Fert.			4.35	10.77	10.69
V. FERTILIZER COST					
of extra Beef Produced/Acre		--	10.0¢	8.3¢	8.7¢

VAN VLECK TEST - Sacramento County

James Elings - Farm Advisor

This test is a continuation of the one carried out at the same location for the two previous seasons. The experimental area was located on open range land near Michigan Bar. A 160-acre field composed principally of Pentz loam and Peters adobe clay had been divided into four parts; 70 acres as a control and three 30-acre fields for treatment.

The plan of the test for the 1956-57 season was to compare the effects of fertilization with and without the use of supplement during the winter period.

The fields which had both received nitrogen and phosphorus the previous year were fertilized with a uniform application to provide 74 pounds of nitrogen and 37 pounds of P_2O_5. Materials were applied on October 1, 1956. The remaining two fields were left unfertilized.

Rains came early in the fall and continued throughout the fall so that green feed was available for stocking on November 16. The two fertilized fields were stocked at the rate of 1.8 acre per animal, compared with 4.9 acres on the large control field and 3.3 on the smaller control field to be used for supplemental feeding. A mixture composed of barley and cottonseed meal, with 10 percent salt was placed in self-feeders in one of the fertilized fields and in the smaller control field. Supplement was removed from the fertilized field on January 22 but was kept before the animals in the control field until March 8.

The test was continued until June 6, a total of 202 days. During the initial period from November 16 to January 22 animals on the two fertilized fields gained about the same per day whether supplement was provided or not. On the unfertilized fields where ample dry feed was available the animals fed supplement in addition greatly outgained those with no supplement and gained at a faster rate than on either of the fertilized fields. During the period from January 22 to March 8 animals on straight supplement continued to gain, while animals on the control field without supplement lost a little weight. During this latter period animals on the straight fertilized field did not gain quite as much as did the animals on the adjacent fertilized field which had received supplement during the winter period. In the final period of spring growth, from March 8 until June 6, animals on the straight control field gained slightly more than animals on the fertilized fields or those which had received supplement only during the winter months.

The beef production per acre was increased from 39 to 150 pounds by fertilization. The fertilized field in which the animals received supplement produced slightly less beef than the straight fertilized field. This difference is thought to be due to inherent differences in the productive capacity of the two fields. Field A (fertilizer plus supplement treatment) being probably a little poorer field than Field B (straight fertilizer). Beef production on the unfertilized field where supplement was provided was approximately double that on the control.

In evaluating the results of this test the increased beef production over the unfertilized control has been given a value of 20 cents a pound. On this basis $9 worth of beef per acre was produced from the use of $5.07 worth of supplement, a profit of $4.93 per acre at a supplemental cost of 11.3¢ per pound for the extra beef so produced. On the straight fertilized field the value of the increased production was $22.36. After deducting fertilizing costs and application a profit of $6.10 per acre was made. The extra beef in this field was produced at a fertilizer cost of 14.4 cents per pound. The field in which both fertilizer and supplement were provided made $17.60 additional income from beef. This amount was $2.23 less than the combined cost of fertilizer and supplement. The extra gain under this set of circumstances was produced at a fertilizer and supplement cost of 22-1/2 cents per pound. In order to get further information on the relative effects of fertilizer and supplement upon beef production these fields will be reversed during the next season and the same fertilizer and supplement treatment provided.

VAN VLECK TEST - Sacramento County

November 16, 1956 - June 6, 1957 — 202 Days

I. TREATMENTS	D	C	B	A
Nutrients/Acre	Check	Supple.only	Supplement	
Fertilizer	--	--	$N_{47}P_{37}$	$N_{47}P_{37}$
Material/Acre	None	--	160 urea 80 Treb.Sup.	160 urea 80 Treb.Sup.
Field Size	70 acres	30 Acres	30 acres	30 acres
II. STOCKING AND GRAZING				
Acres/Animal				
Nov.16 - Jan. 22	5.8	4.3	3.0	3.0
Jan.22 - June 8	4.7	3.0	1.5	1.5
Average	4.9	3.3	1.8	1.8
Grazing Days/Acre	41	61	114	112
III. WEIGHT GAINS				
Average In Wt./Animal	478	454	477	478
Average Gain/Head	183	248	223	230
Average Daily Gain				
Nov.16 - Jan. 22	.39	1.16*	.76	.81*
Jan.22 - March 8	.14	1.38	.56	.81
Mar. 8 - June 6	1.88	1.52	1.90	1.46
For whole period	.96	1.39	1.30	1.16
Beef Produced/Acre	39.2	84.2	150.0	127.2
Increase due to Fertilizer Supplement		45.0	111.8	88.0
IV. EVALUATION				
Value of Gain/Acre @ 20¢		$9.00	$22.36	$17.60
Less Fertilizer Cost/Acre		--	13.76	13.76
" " Application			2.40	2.40
" Supplement Fed		5.07 (to Mar.8)		3.67(to Jan.22)
Profit/Acre		$4.93	$6.10	$2.23
V. FERTILIZER & SUPPLEMENT COST				
of Extra Beef/Acre		11.3¢	14.4¢	22.5¢

* Gains during period when animals were receiving supplement

BECKLEY TEST - San Joaquin County

H. A. Moore - Farm Advisor

This test was a continuation of the one initiated at this location the previous year on an area of open range six miles southeast of Linden. A 160-acre field composed principally of San Joaquin loam, Redding gravelly loam and Bear Creek loam had previously been divided into two 80-acre fields which were treated the first year and an 80-acre control field.

Treatments in 1957 were designed to compare effects of currently applied fertilizer with results of the previous season and to measure carryover effects of materials applied in 1957. The original 80-acre control field was divided into two 40-acre fields, one for current treatment and the other as control. Treatments were as follows:

1. The field which received 80 pounds N and 38 P_2O_5 previously was left unfertilized to measure carryover effects.

2. A new field received this same treatment (N_{80} P_{38}) in November 1956.

3. The field which had 80 pounds N and 80 P_2O_5 from nitric phosphate in 1956 received 80 pounds nitrogen from ammonium sulfate.

Growth of vegetation was greatly delayed at this location because of the fall and winter drought. Not until February 6 was there sufficient feed to stock the experimental fields. Additional animals were added in March to the fertilized fields. Hereford heifers were used in this test.

The beef production per acre of the heifers used in this test is shown on the opposite page. Weight gains in this test are not reported with any great degree of confidence, since a considerable number of pregnant heifers were unknowingly included in the experimental animals. The beef gains include weights of calves born during the trial. In spite of this difficulty some points may be established:

1. Production of beef on the unfertilized field was virtually the same both years.

2. Where 80 pounds of nitrogen and 80 pounds of phosphorus from nitric phosphate were used the previous year, there was sufficient carryover effect from the original phosphorus to produce excellent growth. Small plots within the same field showed clearly that nitrogen without phosphorus was very ineffective in stimulating forage. The production of beef was increased two and a half times the control in this treatment. The extra beef was produced for a cost of 8.9 cents per pound. The previous year almost exactly the same yield increase was obtained from this field with the NP treatment. Over the two-year period the fertilizer cost of the extra beef produced per acre was 13.8 cents per pound.

3. The carryover field showed some residual benefit from the 420 pounds of 19-9 applied the previous year. The increased beef production of 37 pounds when added to 119 pounds per acre in 1956 reduced fertilizer cost of extra beef per acre to 10.9 cents per pound on a two-year basis.

4. No clear explanation is available for the poor performance of the field currently fertilized with 420 pounds of 19-9 in 1957.

BECKLEY TEST - San Joaquin County

February 6 - May 6, 1957 — 89 Days

I. TREATMENTS

Nutrients/Acre 1956	Check	$N_{80}P_{80}$	Check	$N_{80}P_{38}$
Nutrients/Acre 1957	--	N_{80}	$N_{80}P_{38}$	Carryover
Materials/Acre	--	380 Am.Sulf.	420 19-9	--
Field Size	40	40	40	40

II. STOCKING AND GRAZING

Acres/Animal				
Feb. 6 - March 23	3.64	2.11	2.11	2.11
Mar. 23-April 3	3.64	1.18	1.18	2.11
Apr. 3-May 6	3.64	.82	1.18	2.11
Average	3.64	1.37	1.49	2.11
Grazing Days/Acre	24.2	70.3	57.9	41.8

III. WEIGHT GAINS

Average In Weight	598	576	572	595
Average Daily Gain	1.76	2.35	1.85	1.85
(Beef Gains/Ac.1956)	(50.2)	(170.3)	(50.2)	(169.5)
Beef Gains/Ac.1957	50.2	175.2	109.6	87.4
Increase from Fertilizer (in 1957)	--	125.0	59.4	37.2

IV. EVALUATION

Fertilizer Cost/Acre			
Material	$10.18	$17.05	--
Application	1.00	1.00	--
Fert.Cost/Extra lb.Beef/Acre	8.9¢	30.3¢	--
Extra Beef in 2 years	225.0	--	156.5
Fert. Cost in 2 years	$30.98	--	$17.04
Fert. Cost/lb. Beef	13.8¢		10.9¢

SAN SIMEON TEST - San Luis Obispo County

Russell Helphenstine - Farm Advisor

This test was located on the Hearst ranch approximately 30 miles up the coast from Morro Bay. A large field of gently sloping terrace land adjacent to the ocean was divided into two fields; one of 68 acres, which was fertilized, and the other of 153 acres to serve as control.

Fertilizer was applied by ground rig on November 19 and 20, 1956. Urea and diammonium-phosphate (21-53) were mixed in the hopper of the Ezy-Flo and applied together to give 216 pounds per acre. This mixture provided 69 pounds of nitrogen and 55 pounds available P_2O_5 per acre.

Previous fertilizer trials at this location had shown striking grass responses to nitrogen-phosphorus combinations but little effect from either nutrient alone. Sulfur was not found to be a factor on this area adjacent to the ocean.

Native vegetation prior to fertilization was composed of weakly-growing annual grasses and native clovers, with a large amount of plantain. One of the striking results of this trial was a transformation of the stand to a desirable mixture of ryegrass and clover through stimulation by nitrogen-phosphorus fertilizers applied.

Fall and winter drought was severe and little green growth was produced until the heavy rains in mid-January.

The control and experimental fields were stocked on February 19. At that time 40 yearling heifers were turned into the 68-acre fertilized field and 50 heifers into the 153-acre control field. On March 7, 30 additional heifers were turned into the fertilized field, bringing the stocking rate up to one animal per acre. Late rains persisted at this location well into May, with the result that there was green feed available throughout most of the month of June. Cattle were weighed out of both fields on June 28. Neither field was over-grazed, but there was more feed left in the fertilized field than in the control.

The number of head-days per acre was increased threefold by treatment. The average daily gain per animal was far superior on the fertilized field and the animals on this field gained nearly 70 pounds more than those on the unfertilized area.

Beef production per acre was increased from 73 up to nearly 300 pounds per acre, an increase of 227 pounds of beef per acre. An evaluation of these results shows that the additional 230 pounds of beef produced per acre was achieved for a fertilizer cost, including application, of $14.81. This extra beef per acre was then produced at a fertilizer cost of only 6-1/2 cents per pound.

SAN SIMEON TEST - San Luis Obispo County

February 19 - June 28, 1957 — 129 Days

I. TREATMENTS		
Nutrients/Acre	--	$N_{69}P_{55}$
Materials/Acre	--	106 Urea 106 21-53
Field Size	153	68
II. STOCKING AND GRAZING		
Acres/Animal		
Feb. 19 - March 7)	3.06	1.70
March 7 - June 28)		.97
Average	3.06	1.03
Grazing Days/Acre	42	126
III. WEIGHT GAINS		
Average in Weight	444	450
Average out Weight	667	742
Gain/Animal	223	292
Average Daily Gain	1.74	2.41
Beef produced/Acre	72.9	299.7
Increase from Fertilization		226.8
IV. EVALUATION		
Fertilizer cost/Acre		
Materials		$13.81
		1.00
Fertilizer cost/extra Lbs. Beef/Acre		6.5¢

TENNESSEE KNOB TEST - Tulare County

Robert Miller - Farm Advisor

This trial was located about 8 miles southeast of Porterville and consisted of a 600-acre fertilized field on the west side of Tennessee Knob and an adjacent 800-acre unfertilized field on the south side of Tennessee Knob. Two hundred and thirty-eight pounds of ammonium sulfate supplying 50 pounds of nitrogen per acre was applied to the 600-acre field by fixed wing aircraft on October 30, 1956. Ammonium sulfate was selected as the source material because the general area was believed to be deficient in sulfur as well as in nitrogen. The cost of the fertilizer applied was $7.97 per acre.

Stocking: Each field was stocked suitably to its normal carrying capacity and additional cattle were added to each field as feed conditions warranted. At the time of fall stocking considerable dry feed was present in both fields.

The control field was stocked with 304 head of 493-pound animals on September 20, 1956 and an additional 18 head were added January 18, 1957, to bring the total stocking to 322 head, or 2.56 acres per animal.

The fertilized field was stocked with 213 head of 443-pound animals on October 13, 1956. Additional animals were added in November, January, February and March; providing a total stocking of 464 head in the fertilized field, or 1.98 acres per animal.

Only 5-1/2 inches of rain occurred from the time the fertilizer was applied until the test was terminated on April 19, 1957. Little effective rain fell until the middle of January and green feed was not available before that date.

All cattle were supplemented from the time they were added to the fields to utilize the dry feed until February 13, 1957, when sufficient green feed became available to carry the cattle without further supplementation. Because of varying stocking dates and numbers the supplement costs per acre on the two fields differed slightly. The supplement cost on the fertilized field was $3.25 per acre and was $3.91 per acre on the unfertilized field.

In order to get an approximate value of beef produced by pasture alone, an attempt was made to remove the effect of the supplement. This was done by deducting from beef production of each pasture an amount (@ 19¢ per pound) equal in value to the cost of the supplement fed.

Since there was not enough rain after the trial was started to utilize all of the nitrogen applied, it is likely that considerable carryover effect of this treatment will be observed during the next grazing season.

TENNESSEE KNOB TEST - Tulare County

September 20, 1956 - April 19, 1957 - 210 Days

I. TREATMENTS	(1)	(2)
Nutrients/Acre	Check	N_{50}
Materials/Acre	-	238 Am. Sulf.
Field Size	800	600
II. STOCKING AND GRAZING		
Acres/Animals		
Sept. 20 - Jan. 18	2.63	2.38 (Oct. 13 - Feb. 14)
Jan. 18 - April 19	2.48	1.44 (Feb. 14 - Apr. 8)
Average	2.56	1.98
Grazing Days/Acre	81.90	91.07
III. BEEF PRODUCTION		
Average Daily Gain	.66	.80
Beef produced/Acre	53.4	73.0
Supplement cost/Acre	$3.91	$3.25
Less Beef @ 19¢/lb. to pay for supplement	20.6 lbs.	17.1 lbs.
Beef from Pasture only	32.8	55.9
Gain due to Fertilizer		23.1
IV. EVALUATION		
Cost of Fertilizer		
Material		$6.19
Application		1.78
V. FERTILIZER COST/POUND		
of Extra Beef/Acre		34.5¢

KARN BROTHERS TEST - Yolo County

Carl Schoner — Farm Advisor

This test was a continuation of the one carried out the previous year at the same location. The experimental area was located on open rolling rangeland near Brooks, some 9 miles northwest of Esparto on the edge of the Capay Valley. The native vegetation was composed largely of wild oats, soft chess, bronco grass and burr clover.

In 1956, two fields were fertilized; one with straight nitrogen and the other with a nitrogen plus phosphorus treatment. No effect of added phosphorus was observed. These same two fields were used for the 1957 demonstration, which was set up as a nitrogen rate test comparing 41 pounds versus 84 pounds of nitrogen per acre. The heavier rate was applied to the field that had the NP treatment the previous year. The same control field was used both years. Ammonium sulfate was used as source of the nitrogen and was applied by plane on October 27, 1956.

The test was carried out with rainfall of 11.25 inches, compared to a normal of 16 inches. Fall and winter drought was severe and continued until the mid-January rains. There was not enough green feed for stocking until February 19.

The experimental fields were stocked with steer calves weighing 425-450 pounds at the rate of 3.5 acres per animal on the control; 1.8 acres per steer on the N_{40}; and 1.3 acres per animal on the N_{84} field. Animals remained in the fields until May 31. Carrying capacity was increased from 30 grazing days per acre on the control to 75 head days per acre on the high nitrogen rate.

Average daily gains of animals on the fertilized fields were greater than on the control, with the best gains on the most heavily fertilized field. In this the average gain per steer was 66 pounds greater than in the control field.

The cattle were weighed on and off the test fields after an overnight stand without feed or water to equalize any possible shrink differences.

Beef production per acre was more than doubled by the light nitrogen treatment and more than trebled by the high nitrogen treatment. The increase per acre from N_{84} was not quite twice that from N_{41}.

Evaluation of results shows that the extra beef per acre on the fertilized fields was produced for a fertilizer cost of 11 - 12 cents per pound. The profit per acre, using a value of 20 cents per pound for beef and deducting the fertilizer costs, was $8.70 for the N_{84} treatment and $5.58 per acre where 41 pounds of nitrogen were applied.

Thus in a year when rainfall was below normal, range fertilization showed a greater profit and benefit than in the preceding year when rainfall was far above normal. Apparently rainfall of 11 inches in this area is sufficient to make range fertilization profitable.

KARN BROTHERS RANCH - Yolo County

101 Days - February 19 to May 31, 1957

I. TREATMENTS	Check	Heavy N	Light N
Nitrogen/Acre	--	84	41.3
Ammonium Sulfate/Acre	--	400	197
Field Size/Acre	29	34	48
II. STOCKING AND GRAZING			
Acres/animal	3.33	1.35	1.78
Grazing days/Acre	30.3	75.0	56.6
III. WEIGHT GAINS			
Average daily gains (Feb. 19 - May 31)	1.45	2.11	1.88
Average gain per animal, lbs.	146.3	212.3	190.1
Total gain/Acre, lbs.	43.9	157.9	106.6
Increase over control, lbs.		114.0	62.7
IV. EVALUATION			
Grazing income/Acre beef @ 20¢	$8.78	$31.58	$21.32
Less fertilizer cost		$10.70	$5.26
Application		$3.40	$1.70
Total fertilizer cost plus application		$14.10	$6.96
Net grazing income	$8.78	$17.48	$14.36
Profit or loss from fertilization		$8.70	$5.58
V. COST OF ADDED GAIN			
Per lb. beef		12.4¢	11.1¢

This report has shown ★ ★ ★ ★ ★ ★

RESULTS OF CLIPPING TESTS ON ANNUAL RANGE

which show

NITROGEN FERTILIZERS – plus P & S if needed

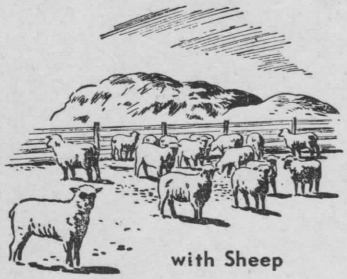
- make more winter feed
- reduce frost damage
- increase spring growth

PHOSPHORUS & SULFUR FERTILIZERS – on deficient soils

- increase growth of improved clovers
- raise Protein content of whole forage
- may last 2 or more years

GRAZING TESTS WITH NITROGEN AND N P ON ANNUAL RANGE

showed in 1957



with Sheep

with Cattle

from 119 to 219 Pair Days/Acre	Increased Carrying Capacity	..... from 34 to 79 Head Days/Acre
from 86 to 191 lbs.	More Meat Produced/Acre	..... from 47 to 144 lbs.
105 lbs.	"Extra Meat" due to Fertilizer	..... 97 lbs.
$11.43	Cost of Fertilizer used	.....$10.96
10.8¢/lb.	Fertilizer Cost of Extra Meat Produced/Ac.	..... 11.3¢/lb.
$10.50	"Profit per Acre"	.....$7.47

4/58--1500 5/58---1000

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