Street

Range Roundup In California

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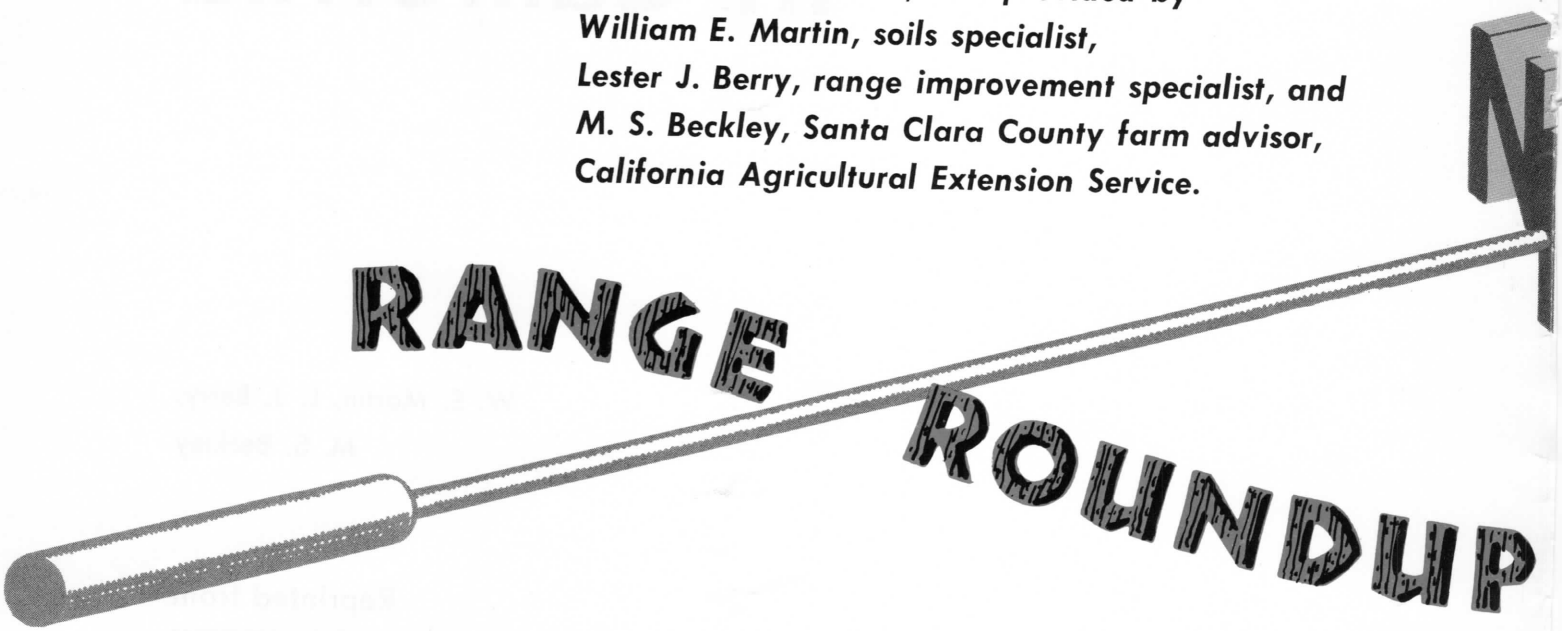
That rangeland fertilization can be a paying proposition in California seems certain as the result of numerous tests over the past few years in all parts of the State. Information for this article, which describes the results of the California studies, was provided by William E. Martin, soils specialist, Lester J. Berry, range improvement specialist, and M. S. Beckley, Santa Clara County farm advisor, California Agricultural Extension Service.



RANGE fertilization is beginning to pay off in trials under actual field conditons in California.

Research and field demonstrations begun in 1952 by California State Polytechnic College and by a commercial concern in cooperation with the College and several Soil Conservation Districts have produced very promising results.

The University of California began a series of field-scale grazing tests in 1953-54 with 5 cooperating ranchers. The program was expanded to 10 tests in 9 counties in 1954-55, and to 16 tests in 13 counties in 1955-56. Meat production by grazing animals was used to evaluate results in all of these tests. In addition to these field scale tests, the University has been carrying on a large number of plot checks throughout the State.

In 1955-56, the 16 tests on 2,543 acres showed that cattle and sheep grazing on the fertilized fields needed less acres, produced more meat per acre, and made enough extra meat at prevailing prices to pay for fertilizer or show a profit in 13 of the 16 tests.

There also is reason to believe that the fertilized areas were left in a higher state of fertility at the end of the grazing season, although no attempt has been made to assign a dollars and cents value to this factor.

The winter of 1955-56 was one of the wettest of record. In spite of the heavy winter rains, spring drought occurred at most locations.

In these tests, average carrying capacity was more than doubled on the fertilized fields. Meat yields were increased by an average of 93 pounds per acre.

During 1954-55, meat yields were increased by an average of 125 pounds per acre. The extra meat was enough to more than pay for the fertilizer in 7 of the 10 tests, and to break even on fertilizer costs in the other 3 tests. More "normal" weather conditions prevailed in 1954-55.

The accompanying table gives a comparison of average responses with cattle for 1954-55 and 1955-56. A strict comparison is not entirely valid, however, since different ranches and fertilizer treatments were used in the two seasons.

Say W. E. Martin and L. J. Berry of the Califorina Agricultural Extension Service:

> "The most striking and consistent results in the entire series of range fertilizer plots and demonstrations have 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 adeqaute phosphorous and sulfur were present or were applied in the fertilizers used." (Many California soils are well supplied with potash.)

Throughout California, rainfall usually comes during the winter months when temperatures are at their lowest. Winter temperatures apparently are too low to permit bacterial action which decomposes and mineralizes natural organic matter thus releasing plant nutrients.

As a result, forage growth usually comes in a great spring flush as warming soils permit liberation of nitrogen from organic reserves, and moisture is still adequate. Growth comes to a stop, however, as rains cease and the dry summer approaches.

The same winter temperatures are

not too low for growth of grass, alfilaria and other forage plants *if adequate plant nutrients are available*. When commercial fertilizer is applied, it is possible for grasses to grow in much of the California winter range area at the season when they do not do so normally.

M. S. Beckley of Santa Clara County is one of the farm advisors (county agents are called farm advisors in California) who has been cooperating in the range studies. Mr. Beckley has been working a great deal with ranchers on the problem of better forage production. Checks on seasonal forage growth as related to temperature, rainfall and fertilization were made in Santa Clara County in 1953-54. The accompanying chart, supplied by Mr. Beckley, shows the results.

Mr. Beckley points out that winter rains generally come in October or November. By putting on the proper fertilizer in the latter part of October, early feed — 6 to 8 weeks ahead of the unfertilized fields — is produced. What's more, says Mr. Beckley, this early feed is better forage and results in a considerable saving of labor. It is this saving in labor which doesn't show up in the usual cost comparisons.

Tests conducted in Santa Clara County by Mr. Beckley in 1954-55 are fairly typical of similar tests in other parts of California. On the Frank Nelson range, an application of 60 pounds of nitrogen (N) and 20 pounds of phosphate (P_2O_5) per acre produced 224.8 pounds of beef. The adjacent control field produced only 52.7 pounds. Sixty pounds of nitrogen alone produced 150.3 pounds of beef per acre on the same ranch. Returns per dollar spent on fertilizer were \$1.91 and \$2.08 respectively, but the N-P combination gave the greatest increase in profit per acre.

Comparative field tests on the Nettles range using 64 pounds of nitrogen per acre in each case, but three different phosphate rates—80, 40, and 20 pounds per acre — produced beef yields of 95.5, 79.5, and 97.5 pounds per acre respectively. The unfertilized range produced only 17.4 pounds of beef per acre. This trial was in a dry year on poorer soil. Summaries of the tests on these two ranges are shown in the accompanying tables.

As a result of these tests, Mr. Beckley concludes that the most economic yields were obtained with 60 pounds of nitrogen and 20 pounds of phosphate per acre. His general recommendation is for a 2:1 nitrogen/phosphate ratio.

As to labor-saving possibilities, Mr. Beckley quotes from another rancher's experience in Santa Clara County. Sixty acres of a 100 acre field of rolling rangeland adjacent to corrals was fertilized January 4 with 400 pounds of 16-20-0. On February 15, 150 cows with calves (127) at their side were turned into the field for 30 days. The field provided excellent green feed sufficient to produce lots of milk for the calves. The calves were vaccinated for black leg, branded and castrated during the month. Bulls were turned in to concentrate the next year's calf crop.

On an animal-unit-month basis, an estimated equivalent of 75 tons of hay worth \$20 per ton was produced on the fertilized area. This \$1,500 worth of hay-feed equivalent easily paid for the 12 tons of fertilizer representing a \$1,080 cost. Additional response from the fertilized area later in the spring brought more feed.

This arrangement saved considerable labor and was much more convenient than the usual practice. It was necessary to round up the cattle

RESULTS OF CATTLE GRAZING TESTS FERTILIZED CALIFORNIA RANGE—1955 AND 1956

(All comparisons are based on an average of the fertilizer treatments which gave the best results in each of the 13 tests during 1955-56 and 10 tests during 1954-55.)

1. Carrying capacity was increased in every test and is recorded as average no. grazing days/acre

	Average Results of Tests	
	13 tests 1956	10 tests 1955
Unfertilized range	**37** days/acre	**40** days/acre
Fertilized range	**90** days/acre	**102** days/acre

2. Beef production per acre was increased in every test

Unfertilized range	**65** lbs/acre	**72** lbs/acre
Fertilized range	**162** lbs/acre	**197** lbs/acre
Gain from fertilization	**97** lbs/acre	**125** lbs/acre

3. Fertilizer cost per acre was:

for materials	**$13.44**	**$13.57**
for applications	**1.49**	**2.12**

4. Fertilizer cost of extra beef per acre was:

for materials only	**13.9¢**/lb.	**10.9¢**/lb.
for materials and application	**15.3¢**/lb.	**12.4¢**/lb.

5. Carry-over effects of 1955 treatments were measured in three tests.

   Nitrogen alone from urea gave a **slight** carry-over effect in the Glenn County test where spring droughts in 1955 had prevented nitrogen utilization.

   Nitrogen and sulfur from ammonium sulfate gave a **striking** carry-over effect in Madera County. On this sulfur deficient soil a striking growth of native clovers resulted from the 87 pounds of sulfur applied in ammonium sulfate in 1955.

   Phosphorus carry-over in Sacramento County enabled nitrogen alone to do nearly as well as the 1956 NP treatment on soil where both nitrogen and phosphorus must be used initially for satisfactory results. Similar results were observed in a San Mateo test that was abandoned because of the sale of animals.

6. Superphosphate on improved clover range greatly increased spring forage, which was converted into extra meat at a fertilizer cost of only 7.2¢/lb. The pastures, however, were not ready to graze until April, while a nitrogen-phosphorus treated field which made beef for 16¢/lb. was ready by February 1st.

7. The "fertilizer cost" of extra beef/acre produced on fertilized fields was used to evaluate results. In six of the thirteen tests this fertilizer cost was below 15¢/lb. In three tests costs were 15-18¢, while in four tests in areas of high rainfall or subject to prolonged soil water-logging, the costs were in excess of 24¢/lb.

   Using an arbitrary beef value of 18¢/lb., nine of thirteen tests returned fertilizer costs or showed a profit. For the entire group the average profit with 18¢ beef was $2.60/acre after deducting costs of fertilizer and application.

only once. It was possible to hold them near corrals to work them. There was no daily hay feeding, and the calving efficiency was increased.

As a result of this trial, 100 acres of a 200 acre field were fertilized with 400 pounds per acre of 20-20-0. One hundred heifers were held in the field all winter. Three bulls were used. This field was near headquarters where special care and daily checks were easily possible. Feed has been ample to carry these heifers through to calving time with some supplemental feeding during the dry summer months.

Open rangeland is one of the more important agricultural resources in California, as well as in most other Western States. In California alone, range makes up somewhat over a third of the area of the State. It includes about 10 million acres of open treeless range and about 25 million acres of oak-grass woodland and brushy areas. Much of this rangeland has been grazed by cattle and sheep for at least a century.

To date, very little California range has been fertilized. Experimental evidence and field trials in recent years indicate, however, that range forage production may be helped by fertilization in three principal ways.

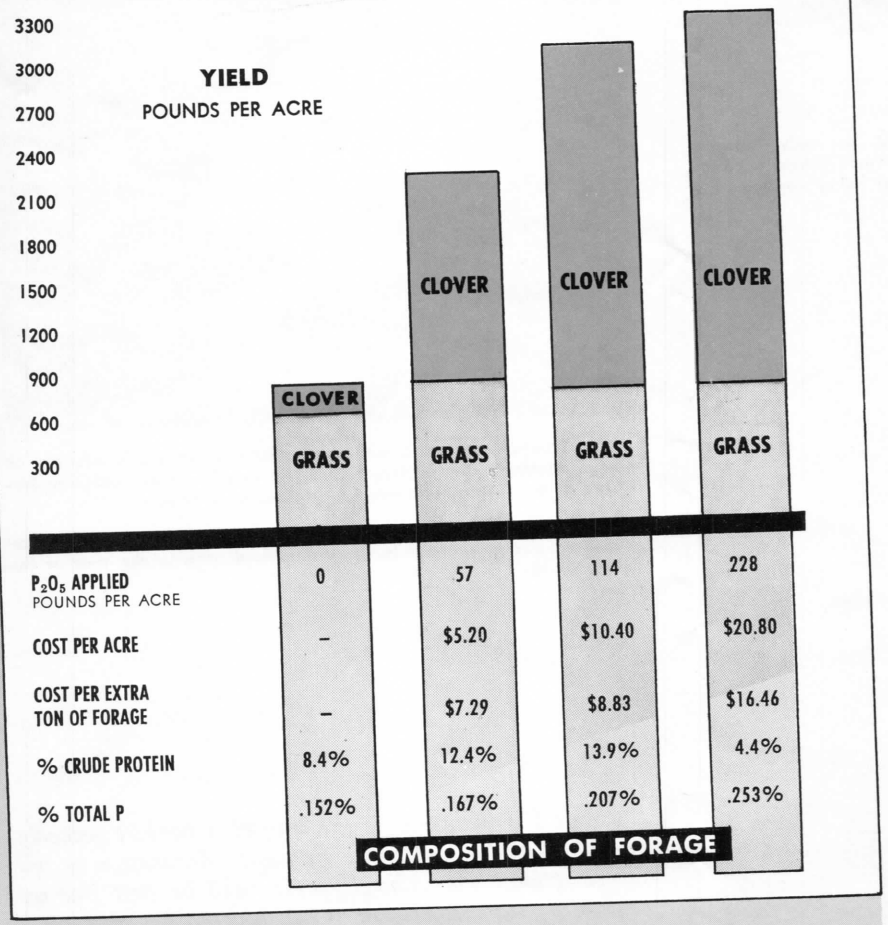
1. Quickly available nitrogen-plus-phosphate fertilizer greatly speeds growth of grasses during the cool winter months. This can help overcome the shortage of green feed in the early part of the winter grazing season.
2. Total forage production can be improved considerably on soils of low fertility. On the poorer soils, little forage is produced even when temperature and moisture conditions are favorable. Such soils often are acutely deficient in phosphate and sulfur as well as nitrogen.
3. Forage quality often can be improved by fertilization. Applications of phosphate and sulfur-bearing fertilizers have greatly increased growth of native or introduced legumes on experimental plots. Winter and spring-growing annual grasses make good feed while green or approaching maturity. Many of these same species are of low nutritive value and some are un-

Nitrogen-Phosphate Treatment Proves Best in Santa Clara County Demonstration[1]

Grazing Period	Pounds of Beef Per Acre		
	Unfertilized	Ammonium Sulphate (300 lbs. per Acre)	16-20-0 (400 lbs. per acre)
Feb. 24 to Mar. 27		46.3	101.2
Mar. 27 to May 9	40.1	82.0	103.2
May 9 to May 27	12.6	22.0	20.4
TOTAL (90 days)	52.7	150.3	224.8
Increase due to fertilizer		97.6	172.1
Value of gain @ 20¢ cwt.		$19.52	$34.42
Fertilizer cost per acre		9.39	18.00
Additional profit per acre		10.13	16.42
Return per dollar spent for fertilizer		$ 2.08	$ 1.91

[1] Frank Nelson range. Grazing period, February 24 through May 27, 1954—90 days.

EFFECT OF SUPERPHOSPHATE ON P DEFICIENT IMPROVED ROSE CLOVER RANGE



palatable or 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. Weed growth also can be inhibited through good stands of desirable species.

In addition to the field-scale demonstrations described above, the California Agricultural Extension Service in cooperation with the University of California Department of Agronomy has carried on a large number of range tests throughout the State aimed at range improvement through legume fertilization. These tests generally have shown excellent promise but have revealed limitations.

Phosphate fertilization of annual clover seedings on commercial ranges near Lincoln resulted in a three-fold boost in grazing capacity. Both protein and phosphorous content of the forage was increased. These tests indicated that rose, crimson and subclover were better able to use phosphate fertilizer than were native resident species. This fact has been confirmed in other tests. For phosphate alone to improve yields, responsive legumes must be present.

The accompanying chart shows the effect of superphosphate on yield and forage composition of an improved rose clover range. This range had been seeded to annual clovers five years previously. While a good stand of rose clover persisted, little growth had been made. The rose clover made a striking response to the phosphate fertilizer.

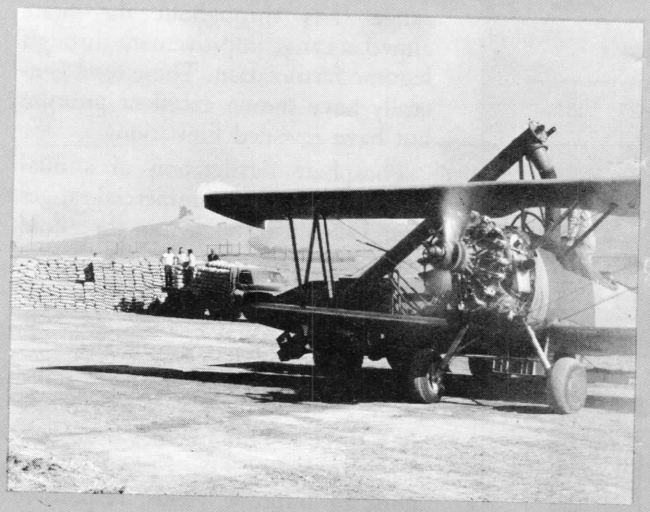
The results from this test are in sharp contrast, however, to results on unimproved annual range on similar phosphate-deficient soils. In these cases, either there was not a sufficient stand of native or resident legumes or they were not responsive to phosphate fertilization.

Phosphate fertilization where responsive legumes were present increased spring feed supply and improved forage quality, but had the disadvantage of not providing early feed. Grazing was not possible until

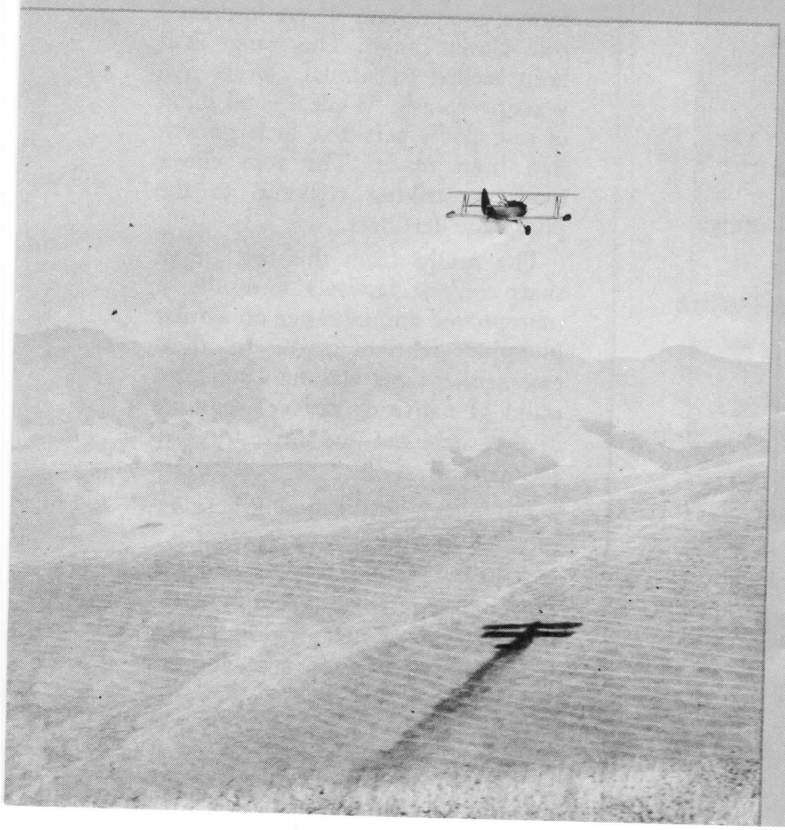
Field Tests May Be Key to Economic Range Fertilization[1]

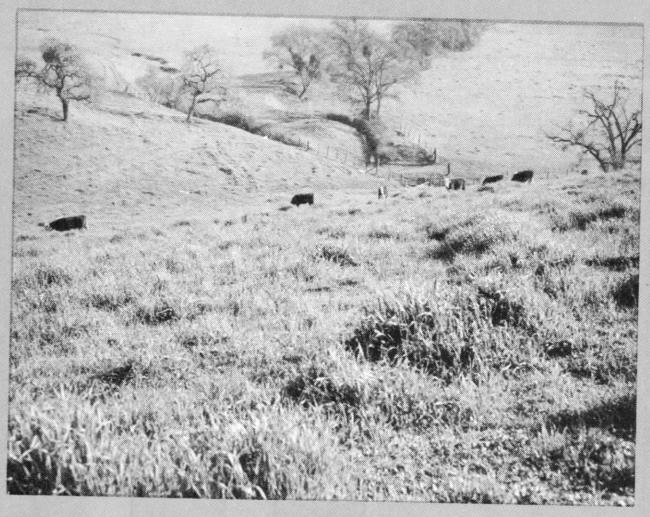
Fertilizer Treatment	Gain Per Acre (Pounds)	Value of Gain[2]	Fertilizer Cost	Gross Profit Per Acre
Unfertilized	17.4	$3.48		$3.48
16-20-0 (400 lbs./Ac.)	95.5	19.10	17.60	1.50
16-10-0 (400 lbs./Ac.)	79.5	15.90	13.60	2.30
16-5-0 (400 lbs./Ac.)	97.5	19.50	11.60	7.90

[1] Nettles range in Santa Clara County, Califorina, 1955. This is poorer soil, and a drought occurred between February 28 and April 17.
[2] Beef figured at 20 cents per pound.



AIRPLANE APPLICATION of fertilizer is almost the only feasible method on much of the open rangeland of the West. Above, a plane is being loaded between sweeps. Below, fertilizer being applied to a typical California range.

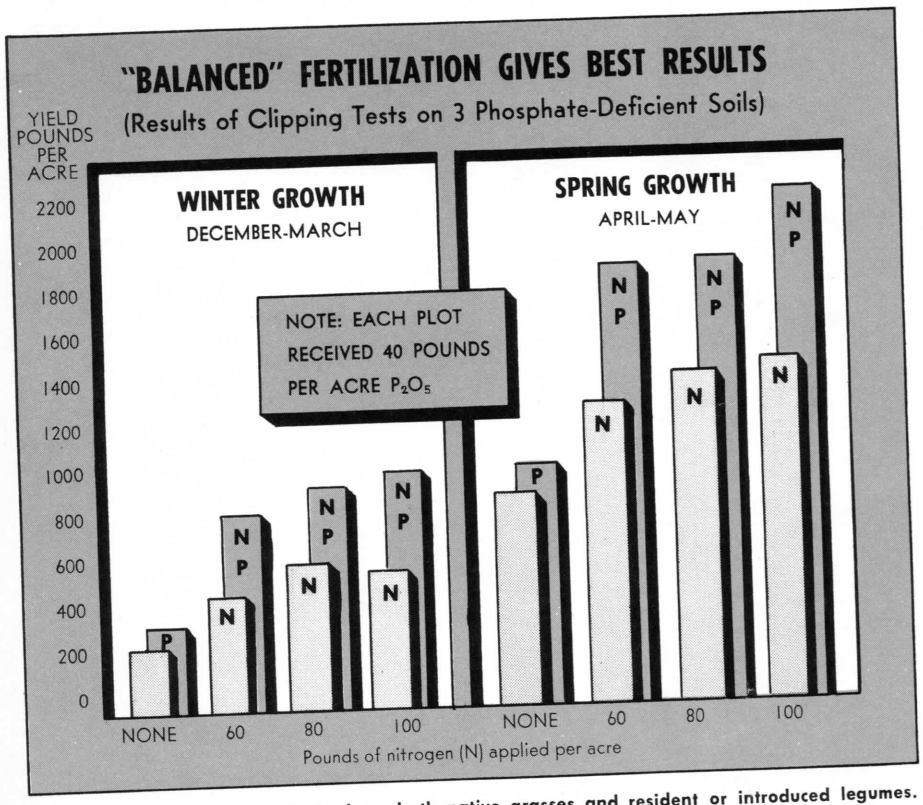




TOP—Ground application with conventional spreaders is possible on many rangeland areas. Note contrast in forage growth between fertilized field in foreground and unfertilized area at rear.

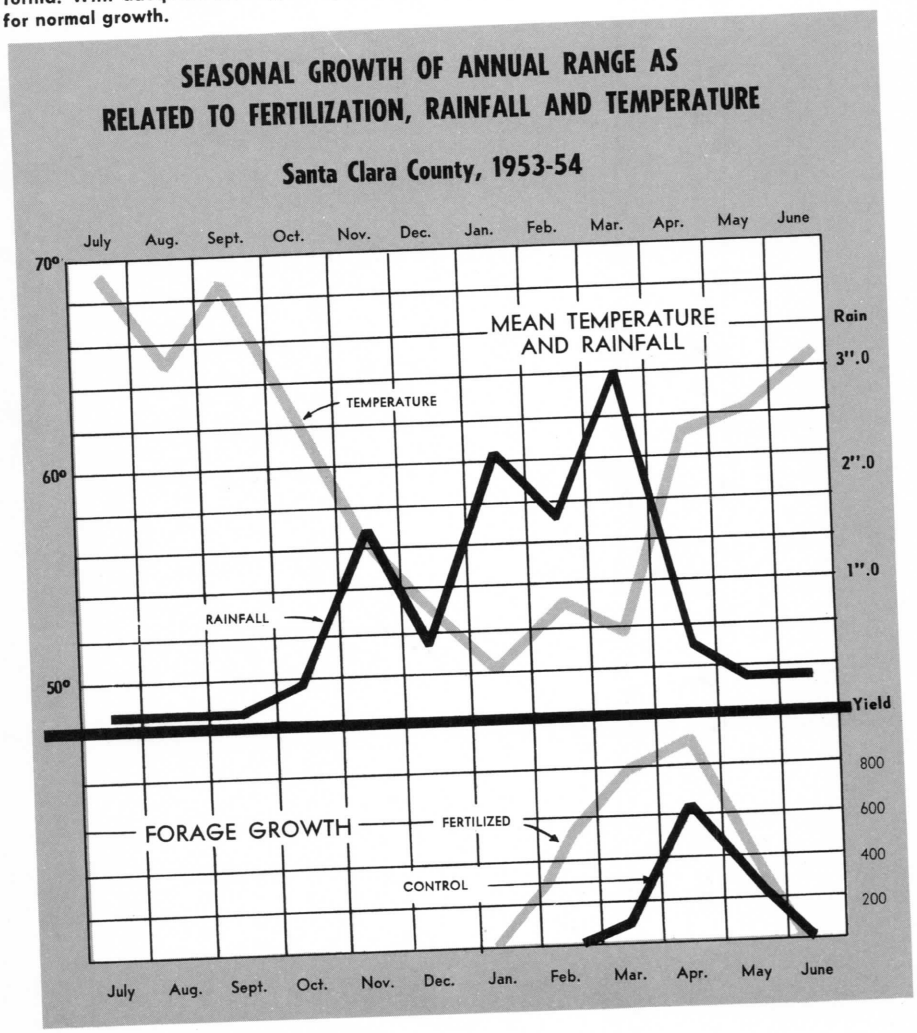
CENTER AND BOTTOM—Note the excellent forage on these two fertilized ranges in contrast to the unfertilized area in the rear of the lower photo.

("Range Fertilization" *is the title of a booklet recently published by the California Fertilizer Association to tell the rangeland story. Single copies will be sent free on request by the Association at San Marino 9, California.)*



BALANCED FERTILIZATION stimulates both native grasses and resident or introduced legumes. These results on three phosphate-deficient ranges show clearly that the N-P combination was superior at every level.

EARLIER SPRING GRAZING is one of the principal advantages of range fertilization in California. With adequate fertility, forage growth begins when temperatures normally are too low for normal growth.



April, while adjacent range fertilized with nitrogen-phosphate combinations had ample feed for grazing by early February.

These tests seem to indicate that legume fertilization alone has serious limitations: (1) It does not materially advance winter feed production; (2) on some soils already high in available phosphate and sulfur, no additional growth results from application of these elements, and (3) some seasons have temperature and rainfall conditions such that little legume growth occurs regardless of fertilizer applications.

For best results on phosphate-deficient ranges, a balanced fertilizer which will stimulate growth of native grasses as well as the clovers seems to be the best bet in most circumstances. Results of clipping tests on three phosphate deficient soils each of which received 40 pounds of available phosphate (P_2O_5) per acre and varying rates of nitrogen (N) from zero to 100 pounds is shown in the chart on page 30. The N-P combination was clearly superior at every level, while phosphate alone increased yields only nominally.

While soil tests may give reliable information upon which to base a fertilizer treatment in many areas, the problem is particularly complicated in California with its hundreds of different soil types. In Santa Clara County alone, there are 248 different soil types, and some ranches have as many as five different types.

Farm advisor Beckley recommends that ranchers in his county establish checkerboard test plots to study fertilizer requirements of their own particular soil. In a simple leaflet he explains how to lay out the plots so that every likely combination can be studied under field conditions.

Much additional work needs to be done in evaluating the economics of range fertilization as well as developing more agronomic information upon which to base recommendations. Needed particularly is more information on the economics of such "fringe" benefits as labor saving and more convenient herd management.

Range fertilization seems to be proving out under at least some California conditions. Equally exciting results are being reported from other Western rangeland areas.

File Santa Clara

Monterey County
San Benito County

Santa Clara County
Santa Cruz County

(3)

Oct. 10, 1961

UNIVERSITY OF CALIFORNIA
AGRICULTURAL EXTENSION SERVICE
FARM MANAGEMENT SHORT COURSE FOR COMMERCIAL BANKERS

RANGE COSTS AND EVALUATION

by
Francis F. Smith, Farm Advisor, Santa Clara County

Seventy per cent of the land in farms in these four counties was non-crop land grazed by livestock according to the 1959 Census of Agriculture. Harvesting the annual seasonal growth on the two million acres of range is mostly by beef cattle but with some dairy cattle and sheep. This results in a large livestock business for which valid values would be difficult to obtain since many of the animals grazed come in as stockers or are dairy heifers being raised by local dairymen.

COSTS of range to the livestock producer are a large part of his total costs of production and may be either the costs of ownership, interest on investment plus taxes, or the rent he pays plus, in either case, the annual costs of maintenance. These costs vary considerably with the production and the work that must be done to obtain it. Table 1 below shows some sample costs per acre for typical examples of local range land.

YIELD of range or pastures varies widely per acre with type of land and from year to year with different rainfalls. It is measured in Animal Unit Months (AUM) per acre or acres to carry an animal unit a year. See data sheet No. 1 for further explanation. Average for the area is 0.6 AUM per acre.

TABLE 1--SAMPLE COSTS AND VALUES PER ACRE OF RANGE WITH DIFFERENT YIELDS

Yield--Animal Unit Months Per Acre Acres per Animal Unit year (12AUM)	0.4 30.0	0.6 20.0	1.0 12.0	2.0* 6.0
Annual costs per acre				
Fence repairs, weed control, etc.	.30	.40	.50	.60
Optional improvement expenditures fertilizing, clearing, seeding, etc., 5 yr.av.				2.00*
County taxes - assessed value times local tax rate	.24	.48	.60	.90
Total cash costs	.54	.88	1.10	3.50
Interest on investment, land and fences at 5%	.85	1.20	2.40	3.50
Total cost per acre	1.39	2.08	3.50	7.00
Cost per AUM of grazing produced	3.50	3.50	3.50	3.50
Value of grazing at $3.00 per AUM	1.20	1.80	3.10	6.00
3.50 per AUM	1.40	2.10	3.50	7.00
4.00 per AUM	1.60	2.40	4.00	8.00
Rental value per acre--above values less tenant's costs: with grazing at $3.00 per AUM	$0.90	$1.40	$2.50	$3.40
3.50 per AUM	1.10	1.70	3.00	4.40
4.00 per AUM	1.30	2.00	3.50	5.40
"Agricultural Value" per acre to earn 5%, Value of grazing less cash costs and taxes with grazing worth $3.00 per AUM	$13	$18	$38	$50
3.50 per AUM	17	24	48	70
4.00 per AUM	21	30	58	90

*Last column shows the higher yield obtainable on good land with expenditures for improving yields at about $10 over five years.

WHAT SETS THE PRICE OF RANGE FEED?

The price that stockmen can afford to pay for grazing, in the long run, depends upon the type of livestock, the production expected from such land, the operating costs other than for grazing and the prices for stock or products. Few stockmen calculate this carefully but from experience they know about what they can pay as rent per AUM per month or per acre for land of a certain carrying capacity and still make a little profit. From this rental value they can figure the "Agricultural Value" by deducting taxes and capitalizing the net rent at the desired rate of return on investment, such as 4 to 6%.

For any livestock enterprise at any time or place it is possible to make a budget of probable production, income and costs to see the probable value that can be placed on range pasturage. Range land appraisers frequently do this as one approach to range land values.

The most profitable use for the seasonal range in this area is to buy stockers near the start of the grass season in late fall or winter, graze them until the grass dries up in summer, then sell them as feeders to go in a feed lot to finish for slaughter. Below we present two sample budgets applicable to this enterprise in this area with slightly different price situations. Both are based on buying weaner steer calves in the fall at about 450 pounds and selling 700-pound feeders the following summer. The stocker averages .7 of an animal unit over the 8-month period and would need a total of 5.6 AUM's of grazing. Allowance is made for 2% death loss by buying 1.02 head per head sold.

TABLE 2-- SAMPLE CALCULATIONS OF VALUE OF RANGE FORAGE

	Case 1			Case 2		
	Quantity	Price	Per hd. sold	Quantity	Price	Per hd. sold
Value per head sold (at ranch)	700 lb.	22¢	154.00	700 lb.	24¢	168.00
Cost pf stockers bought, 1.02 head	459 lb.	25¢	114.75	459 lb.	26¢	119.34
Net stock income			39.25			48.66
Supplemental feed, hay, conc., etc.	300 lb.	2¢	6.00	300 lb	2.2¢	6.60
Labor	3 hr.	1.40	4.20	3 hr.	1.50	4.50
Miscel., vet., taxes, auto, etc.			4.00			4.50
Depreciation on equipment			1.00			1.00
Interest on investment, eqt. and stock			6.00			6.50
Management			2.00			2.00
Total all costs except range			23.20			25.10
Residual for Range AUM's	5.6	$2.87	16.05	5.6	4.21	23.56

The above table is presented to show the method of calculation rather than as a valid determination of the value of range pasturage. A similar budget for a beef cow herd or ewe flock would be more complicated and, at prices in line with the above, would probably come up with a lower permissable value of range.

Case 1 with a 3¢ minus margin per pound between buying and selling prices, and with the other costs shown, results in a range value at $2.87 per AUM. Case 2 with a 2¢ difference in prices and slightly higher costs results in a range value of $4.21 per AUM. These values per AUM can be converted to range land rents or agricultural value as in the lower part of Table 1. "Agricultural Values" in this region are considerably below market values because of the demand for land.

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George B. Alcorn, Director, California Agricultural Extension Service.