Measurement of forage and sheep production on

Native Range and Pastures

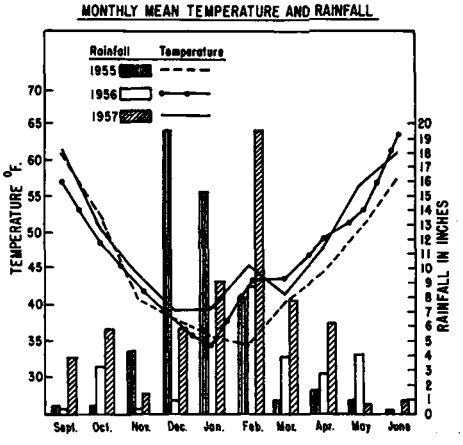
fertilized with nitrogen and phosphorus

A. H. Murphy, R. M. Love, M. B. Jones, and D. T. Torell

The untreated native woodland-grass area included in a study on sheep and forage production has annual grasses and forbs predominating, with less than 1% perennial grasses.

Much of the study area has a varying density of oaks. The more open stands are made up of deciduous blue oaks—*Quercus douglasii*—and the dense stands are primarily evergreen live oaks—*Quercus wislizenii*—under which little or no forage is produced. The major portion of the range is made up of Sutherlin soil series, followed by Laughlin and Yorkville in order of importance. Depth of soil in these series varies from 2′–3′. Topography is rolling, with slopes varying from level to 35°. Native area was divided into four pastures totaling 281 acres; the total pasturage was adjusted to 129 acres by subtracting 152 acres of dense oaks and rock areas. All of the calculations were based on the adjusted acreage.

The fertilized area was 89 acres that had been under cultivation for cereal crops when the University took possession of the Hopland Field Station in 1951. These fields, being eroded, were converted to dry-land pastures of a mixture of perennial grasses and annual and perennial legumes. For various reasons the conversion was only partially successful, and the vegetative cover is now typical of the California annual-type range, with the addition of some hardinggrass—*Phalaris tuberosa*—and subclover—*Trifolium subterraneum.* This fertilized area is made up of Sutherlin and Laughlin soils, with small areas of Climax and Montara soils. The average depth is 3′, sightly more than on the untreated area. Most of the treated area is open, except for an occasional valley oak—*Quercus lobata*—and some blue and live oaks on the uncultivated margins. The land is mostly level to moderately sloping, with an east and south exposure. For the experiment, the 89 acres were divided into four pastures of about equal acreage. These four pastures received an annual



fertilizer application, whereas the native pastures received no fertilizer at any time. The fertilizer treatments for each year were: 1955, fall, 400 pounds 12-39-0 per acre; 1956, fall, 110 pounds 46-0-0 per acre; 1957, spring, 110 pounds 46-0-0 per acre; 1957, fall, 175 pounds 46-0-0 per acre.

The first fertilizer application was a combination of ammonium phosphate-sulphate mixed with treble superphosphate; urea was used in the following years. All the fertilizer was spread by aircraft.

The period of the experiment, January to June, was characterized by several contrasting conditions.

From January to early March, temperatures were low, averaging 30°F to 50°F, with occasional minimums below freezing. Moisture was at a surplus, with soils usually at field capacity. Plant growth was slow unless fertilizer was applied.

March and April were a time of rapid plant growth, with feed usually adequate and even at a surplus. Mean temperature was 40°F to 50°F with moisture stress developing only occasionally, on thinner soils.

May and early June were characterized by plant maturity, seed production, and drying of the foliage. Temperatures were higher and soil moisture was lower. Feed was adequate, but the quality quickly declined as the plants dried.

The three years of the experiment also varied in amount and distribution of rainfall and mean temperature averages. The minimum rainfall necessary to start germination—about 1″ in this area—occurred two months later in 1955–56 than in 1957–58, which influenced the feed available at the start of the experiment, in January.

Resident desirable annuals in both pastures included soft chess—*Bromus mollis*—slender wild oats—*Avena barbata*—and ryegrass—*Lolium multiflorum.* The forbs included broadleaf filaree—*Erodium botrys*—native clovers—*Trifolium*—and many miscellaneous broadleaf herbs. In addition, the native pastures contained some purple stipa—*Stipa pulchra*—and the fertilized pastures included hardinggrass, orchardgrass—*Dactylis glomerata*—and subclover.

Most numerous of the undesirable annuals were annual fescues—*Festuca spp.*—ripgut—*Bromus rigidus*—wild barley—*Hordeum spp.*—and dogtail—*Cynosurus echinatus.*

Forage Measurement

To obtain a value for the plant component, the botanical composition in the pastures was estimated in May or June,

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W. G. Wilde.....*Editor*

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when vegetation was mature. Plant composition was compared by dividing it into types of desirable annual grass, undesirable annual grass, perennial grass, and forbs.

The average composition for three years as listed in the first table will vary within any one year, depending on climate. Thus, any one component might change considerably from the average. The fertilized pasture has a higher percentage of undesirable annual plants, which mature early and become rather unpalatable late in the growing season. Nitrogen application probably encouraged the annual fescue. At the same time, early grazing was not heavy enough to hold this aggressive grass in check. The higher percentage of desirable annual grass in the native pasture made for better late-feed supplies, for these grasses were palatable later than were the poor species.

Forage production was determined by clipping square-foot quadrats at 16 locations in each of the eight pastures. The clippings were made twice—once in January, when sheep were put into pasture, and again in early June, when sheep were removed. Clippings at the latter date were also taken within exclosure cages, so that forage utilization could be estimated. The second table shows the total estimated forage grown in the pastures in January and June, as determined by these clippings.

Protein content as derived from the above yield clippings showed a difference between the native and fertilized fields as illustrated in the third table.

Percent Forage Composition

	Native			Fertilized		
	1956	1957	1958	1956	1957	1958
Desirable annual grass	35	31	60	26	11	35
Undesirable annual grass	6	18	26	37	51	35
Perennial grass	1	1	1	5	17	6
Forbs	58	50	13	32	21	24

Forage Production and Forage Left on the Ground When Sheep Were Removed (in Pounds per Acre Dry Weight)

	Before grazing January		Excluded from grazing June		Unutilized forage June	
	Native	Fert.	Native	Fert.	Native	Fert.
1955–56	250	1100	2000	4300	518	2200
1956–57	300	700	2100	6900	1300	2900
1957–58	1300	2200	4200	13300	2000	3600
Average	617	1333	2767	8167	1273	2900

Effect of Fertilization on the Crude Protein Content of Forage at the Beginning and End of the Grazing Period.

Date	Native		Fertilized	
	January	June	January	June
1956	16.7	6.8	20.2	8.7
1957	12.4	5.8	15.3	7.7
1958	10.1	5.5	16.9	6.8
Average	13.1	6.0	17.5	7.7

Sheep Use and Measurement

The main flock, consisting of ewes and their lambs, began going into the pastures in January. The lambs were generally 2 to 4 days old when placed on the pastures. Grade Corriedale ewes that had bred to either Suffolk or Southdown rams were used in both types of pastures. At certain times, especially during the flush spring growth, when the experimental flock was unable to use the feed sufficiently, a cleanup band of sheep was used in the fertilized fields—in 1955–56, ewes and lambs; in the other two seasons, yearling ewes. The cleanup sheep were used only in the fertilized pastures, which produced more feed, especially the early-maturing weedy annuals. These animals grazed the pasture after the ewe-lamb band had finished a period on a pasture.

Both types of pasture—native and fertilized—were used at three different dates during each growing season. For the native range a measure of 20 sheep-days per acre per rotation was used as a gauge, whereas in the fertilized pasture 60 sheep-days per acre per rotation was the attempted measure.

The ewes and their lambs were distributed in the native and fertilized pastures so that proportional numbers of Suffolk-cross and Southdown-cross lambs were put in each type of pasture.

Sheep measurements were taken by weighing the ewes and lambs when they went on the pasture, again in early March, at shearing time in late April, and finally at the conclusion of the experiment, in May. For the cleanup animals, yearlings and ewes, sheep-days on the pasture was the measure obtained.

At weaning time, three lamb buyers sorted the lambs into fats and feeders. If two of the three buyers judged the lamb as fat, it was classified as fat.

Animal Production

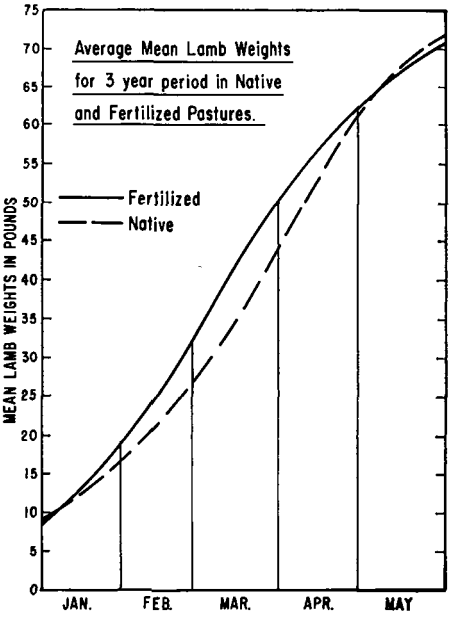
Flock numbers varied between years as well as between types of pasture.

Grazing use varied, because a cleanup flock was used at certain times in the fertilized pastures.

In addition to animal use during the experiment, sheep used the areas also in late summer and fall, adding an average annual use of 68 sheep-days per acre on fertilized pasture and 43 sheep-days on native.

Deer use of both types of pasture was important, for they compete most intensely with sheep for feed during January through March. In 1956 deer fecal counts indicated a stocking of 1.3 acre per head on fertilized pasture and 5–6 acres per head on native pastures. This value was probably true for the other two years also.

The daily animal gains were separated into two periods—the first half from January to March, and the second half from March to the end of May or first of June, whenever the experiment for that year was concluded. In 1956 and 1957 the lambs on fertilized pastures gained more rapidly than lambs on native pastures during the first half of the grazing period but less rapidly in the second half



Distribution of Ewes and Lambs

	1955–56		1956–57		1957–58		Mean value	
	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs	Ewes	Lambs
Native	51	52	57	71	61	68	56	64
Fertilized	104	109	116	123	111	121	110	118

Grazing Days per Acre

	1955–56		1956–57		1957–58		Average		3 yr. total	
	Native	Fert.	Native	Fert.	Native	Fert.	Native	Fert.	Native	Fert.
Ewes	58.5	155.7	61.6	176.7	57.7	159.2	59.3	163.9	177.8	491.6
Lambs	60.1	162.0	72.6	186.4	64.7	150.7	65.8	165.8	197.4	499.1
Cleanup		62.0—Ewes 54.0—Lambs		66.5—Yearling		210.4—Yearling				

of the period. In 1958 the gains in the two types of pastures were about the same.

Production in pounds of lamb on an acreage basis provides an appraisal from a different aspect. In all cases, as might be expected, yield was higher in fertilized pastures than in the untreated native range.

Although ewe gains were not an objective of the study, it was noted each year that ewes in the native pastures lost weight during the first period but recovered the weight loss in the second period. In the fertilized pasture, in contrast, the ewes either maintained or gained weight over the entire period.

One part of the study was to determine the quality of lamb that could be marketed at weaning time under the conditions of the experiment.

Put on an acreage basis, the native pasture produced 0.13 fat lamb per acre and the fertilized pasture 0.33 fat lamb per acre.

When the lambs were weaned, at the end of the experiment, they were shipped to irrigated pasture. Lambs from fertilized pastures gained more per day than lambs from native pasture in 1956 and 1957, but less in 1958. It is possible that the increased gains in the fertilized pastures during the first half of the preweaning period produced lambs with a larger frame. This frame was then filled out faster when the lambs were put on irrigated pastures, and the difference was probably due to interaction of season, type of pasture, and stocking rate.

Economic Aspects

The values of products and grazing use were determined for both types of pastures. For ewes and lambs on the experiment, products consisted of meat plus wool for the lambs and wool plus grazing use for the ewes. Where other animals were used at occasional periods, their value could be determined only by value of grazing use.

For three years, the yield of the fertilized pastures averaged $13.04 per acre more than that of the native pasture. The difference of value between the two pastures in any one year was usually determined by the cost of fertilizer application, by climate, and by the number of extra animals able to utilize feed.

In 1956, fertilizer costs were high, first effective rainfall was late—November 10—and extra animals used in fertilized pasture were low. With that combination of factors, the native pastures produced $8.18 more per acre than the fertilized pastures.

In 1958, by contrast, fertilizer cost was lowest, first effective rains came by September 27, and many extra animals were used. Profit was thus $13.63 per acre greater from the fertilized pasture than from the untreated native pasture for this year.

Value of Fertilization

The experiment demonstrated the value of fertilizer applications on range pastures to increase the availability of early feed. When fertilized pastures were not used until January, much feed was not utilized at the most opportune time, especially in years when the fall rains were early. When lambing started around January first, some of the pastures were not stocked until late February with the

Lambs Produced in Pounds per Acre

Range	1955–56		1956–57		1957–58		Mean	
	1st half	2nd half	1st half	2nd half	1st half	2nd half	1st half	2nd half
Native	11.7	13.9	19.0	17.5	11.0	20.5	13.9	17.3
Fertilized	40.0	37.6	54.5	39.1	29.4	51.6	41.3	42.8

Number and Percentage of Fat and Feeder Lambs

Lambs	1955–56		1956–57		1957–58		Average	
	Native	Fert.	Native	Fert.	Native	Fert.	Native	Fert.
Fat	14– (27%)	32– (29%)	22– (32%)	25– (22%)	14– (24%)	30– (28%)	17– (28%)	29– (27%)
Feeder	38	78	46	87	44	76	43	80

Cost Data Lamb Production Study (Dollars per Acre Basis)

	Native	Fertilized	
1956			
Cost of fertilizer (400 lbs. 12-38-0)			$26.75
Lamb produced @ 20¢/lb.	$ 5.12	$15.52	
Ewe wool @ 62¢/lb.	.58	1.93	
Lambs wool @ 28¢/lb.	.28	.84	
Ewe grazing days 5¢/hd/day	2.93	7.79	
Cleanup ewes 5¢/hd/day		1.04	
Cleanup lambs 2¢/hd/day		.36	
		27.48	
1956 profit per acre	8.91	.73	
1957			
Cost of fertilizer (220 lbs. 46-0-0)			$14.31
Lamb produced @ 20¢/lb.	$ 7.30	$18.72	
Ewe wool @ 62¢/lb.	.76	2.27	
Lambs wool @ 28¢/lb.	.36	.98	
Ewe grazing days 5¢/hd/day	3.08	8.84	
Cleanup yearling @ 3¢/hd/day		2.00	
Other grazing use	2.23	2.82	
		35.63	
1957 profit per acre	13.73	21.32	
1958			
Cost of fertilizer (175 lbs. 46-0-0)			$13.12
Lamb produced @ 20¢/lb.	$ 6.30	$16.20	
Ewe wool @ 62¢/lb.	.82	2.32	
Lambs wool @ 28¢/lb.	.36	.84	
Ewe grazing days @ 5¢/hd/day	2.88	7.96	
Cleanup yearlings @ 3¢/hd/day		6.30	
Other grazing use	4.41	7.90	
		41.52	
1958 profit per acre	14.77	28.40	
Three-year profit per acre	37.41	50.45	

Branch showing both the bud-failure and the roughbark characteristics, taken from a seedling of the progeny Nonpareil Bf x Peerless Bf

Eradication of noninfectious

Bud-Failure in Almonds

objective of breeding program

Dale E. Kester and E. E. Wilson

Noninfectious bud-failure, or crazy-top as it is often called, is a disorder that affects certain almond varieties and not others. The disorder occurs extensively in Nonpareil, Peerless, Jordanolo and, to a limited extent, Mission (Texas). It is not known to occur in Ne Plus Ultra, Davey, or IXL.

Noninfectious bud-failure is bud-perpetuated, carried in propagating wood, and not transmitted through a graft union to other parts of a plant. Transmissibility tests over many years have pretty well determined that the cause is not a virus. Noninfectious bud-failure appears in seedlings originating from a tree with the disorder.

A virus disease found naturally in the Drake almond produces similar symptoms but differs from the noninfectious disorder in that healthy trees contract the disease when grafted with scions from infected trees but do not transmit the disorder to seedlings.

Noninfectious bud-failure has two

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grazing system used. The native pastures, in contrast, were very low in feed production at this time. Under Hopland conditions, range utilization was best for livestock production by using fertilized pastures from about November 15 until March 1 and then moving the stock to the native pastures. Considerable feed would be left in the fertilized pastures by the end of the growing season if grazing concluded about March 1, but this surplus could be put as hay, or otherwise used.

The gain of lambs after March 1 was less in the fertilized pastures than in the native pastures. One possible reason is the difference of species in the two areas. The fertilized pastures had a high percentage of weedy undesirable plants, which mature early and become relatively unpalatable earlier than do the native pastures. The greater abundance of weeds in the fertilized field probably developed from the previous use. The fields were used for hay production, and influx of weeds was considerable under this type of cultivation. The lambs in the fertilized pasture thus had less palatable feed to select from late in the growing season, which probably accounts for the inferior gain.

Gains

Protein percentage was 4.4% higher in January on fertilized range than on native pastures and only 1.7% higher at the conclusion of grazing. This higher protein, plus more feed available, may be one reason for better lamb gains in the fertilized fields during the first half of the grazing period.

The value received in meat, wool, and grazing use indicated that the cost of fertilizer was returned plus a profit of $13.04 per acre. An average of one and one-half tons of feed residue per acre was left on the fertilized field each year when the lambs were sold in June. This remaining dry feed was partially used during the summer by ewes. Phosphorus fertilizer was applied the first year only, but the cost was distributed over all three years, since this heavy application would have considerable carry-over value.

A. H. Murphy is Superintendent, Hopland Field Station, University of California.

R. M. Love is Professor of Agronomy, University of California, Davis.

M. B. Jones is Assistant Agronomist, Hopland Field Station, University of California.

D. T. Torell is Associate Specialist in Animal Husbandry, Hopland Field Station, University of California.

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