CHICKEN

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Preliminary studies indicate that utilization of chicken manure as a rangeland fertilizer is a possibility, especially in areas of nitrogen and phosphorus deficiency.

ACCUMULATION AND DISPOSITION of poultry and other animal manures are ever increasing problems in California. In the past, a considerable portion of the estimated 150,000 to 200,000 tons of manure production in San Diego County has gone to vegetable crop growers along the coast. Other avenues of disposition included the commercial fertilizer trade for nurseries and home gardens. New uses and markets are now needed on a regular basis throughout the year to dispose of the increased supplies of chicken manure and to permit the poultryman to clean out his pens on a frequent basis, as required by local health codes.

Rangelands are defioient in nitrogen and also phosphorus in many areas, and poultry manure is relatively rich in these two elements. Some of the questions that must be answered before fertilization with chicken manure can become attractive to the rangeland operator are:

1. What is the average increase in yield of forage that could be expected?

2. Is the forage of a better quality with than without fertilization?

3. Does the application of chicken manure produce an increase in annual forage legumes? The first year? Later?

4. What is the best rate of application of chicken manure?

5. Under usual circumstances, may a carryover effect from fertilization be expected; and if so, how long?

6. How does chicken manure applied in the fall and winter compare with fertilizer applied in the spring and exposed to the sun all summer?

7. How do chicken manure and commercial fertilizer compare in efficiency of forage production?

8. What is the yearly variation in forage yield under fertilization?

To answer these and other questions, a three-year study was started in San Diego County during the fall of 1962. Preliminary results are reported here for the consideration of range and poultry advisors and operators.

The study

Through the cooperation of Victor Cauzza, an area of approximately 10 acres along Highway 79, about two miles north of Santa Ysabel, was fenced to provide an experimental area. The site is on an alluvial plain with a gentle slope to the west from hills on the east. The soil is a clay loam. Resident forage species include filaree (*Erodium botrys*), ripgut (*Bromus rigidus*), red brome (*Bromus rubens*), annual fescue (*Festuca megalura*), native annual legumes and broadleaf weeds.

Analysis of soil samples recovered from the experimental area indicated a deficiency in nitrogen, a marginal deficiency in phosphorus, and adequate potassium.

Rainfall during the 1962–63 season was sporadic and inadequate (less than 12 inches) for maximum plant growth. In contrast, rainfall for 1963–64 occurred at well-spaced intervals during the spring growing season and totaled approximately 20 inches, which produced abundant forage.

The field study was based on a set of seven treatments, replicated four times: (1) no fertilization; (2) 1 ton chicken manure per acre; (3) 2 tons chicken manure per acre; (4) 4 tons chicken manure per acre; (5) 70 lbs nitrogen plus 40 lbs phosphorus per acre; (6) 140 lbs nitrogen plus 80 lbs phosphorus per acre; and (7) 280 lbs nitrogen plus 160 lbs phosphorus per acre.

The rates of chicken manure and commercial fertilizer were calculated to be approximately equivalent in fertilizer value. A new set of treatments was applied each fall, winter, and late spring. The plot size was 30 × 30 ft—large enough to split for reapplication of fertilizer to half-plots in the second year.

Data collected included green and oven-dry forage harvested by a mower

MANURE
Rangeland Fertilizer

from a 36-inch wide swath through each plot, species composition of forage, nitrogen and phosphorus content of forage, chemical analysis of manure samples at application time and after exposure to weather for various periods, soil analysis at the beginning of the study each succeeding year, and evaluation of forage palatability.

Results

Fertilization with chicken manure increased forage production almost four times more than production from nonfertilized check plots in 1962–63. In 1963–64, the increase was 2½ times greater than check plot yields. Forage yields from plots fertilized in mid-winter or at the beginning of the summer were similar to the yield curves shown in the line graph, thus indicating that fertilization may be carried out on a year-round basis. The slope of the yield curves indicates that rates of chicken manure up to 3 tons per acre would be appropriate for efficient first-year forage responses. Significant fertilizer carryover may be expected to result in additional forage growth. Equivalent rates of commercial fertilizer resulted in yields approximately equal to chicken manure—except when the nitrogen and phosphorus content of the chicken manure was below the expected value.

Grass and filaree dominance of the forage did not appear to change as a result of the fertilizer treatment. Considerable variation existed from place to place over the field in the proportion of filaree and grass. The annual legumes did not respond to the phosphorus portion of the applied fertilizer because of intense grass competition for the high nitrogen content. Legume growth is expected in subsequent years after the nitrogen is used.

Laboratory analysis of forage indicated increases in crude protein and phosphorus content as shown in table 1. Without any fertilizer applied, the average protein content was 9.7%. At the highest rate of chicken manure fertilization, the crude protein percentage of the forage was 10.7 as compared with 15.8 for commercial fertilizer. The phosphorus percentage of forage was also increased over that of nonfertilized forage and showed the greatest increase in winter fertilized forage.

The increased nitrogen and phosphorus content of the forage on fertilized plots is important not only from a nutritional standpoint, but also from a palatability aspect. It is a common observation that fertilized forage is more acceptable to livestock because of increased crude protein, sugars, and other components. Cows turned into the study area in July cleaned up the very dry filaree and ripgut grass, as indicated in the bar graph. Animals seemed to instinctively pick out the areas receiving the highest fertilizer rates and then remained in such areas to graze on the dry forage.

Consistent values have been obtained on the rate of breakdown and the fertilizer value of the chicken manure used in the study as shown in table 2. A considerable amount of chicken manure was still evident on the surface of the plots several months after application. Samples of this manure still contained about half of the original nitrogen percentage and about the same percentages of phosphorus after seven months. These results hold promise for a favorable second-year response from fertilization.

Inasmuch as this is only a preliminary report, detailed discussion must await more complete data. The problem of determining the average forage yield increase and fertilizer carryover in areas of large annual variations in plant growth must be studied for several years. Future studies will also analyze the economic feasibility of increasing rangeland forage with chicken manure fertilizer.

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PALATABILITY SCORING OF FORAGE IN DRYLAND RANGE FERTILIZATION TESTS

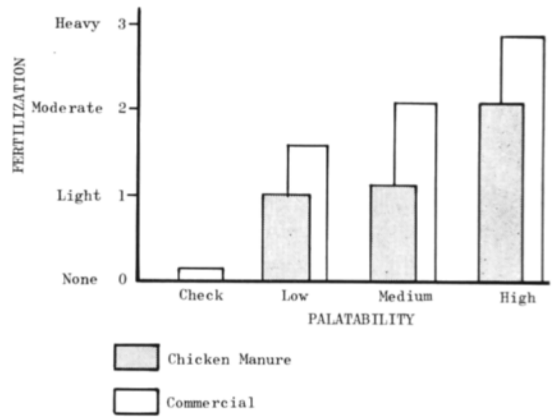

TABLE 1. CRUDE PROTEIN AND PHOSPHORUS PERCENTAGES OF FORAGE FROM FERTILIZER TEST PLOTS HARVESTED AT MATURITY*

Fertilizer treatment	Crude protein		Phosphorus	
	Fall 1962 fertilized	Fall 1963 fertilized	Fall 1962 fertilized	Fall 1963 fertilized
	%	%	%	%
Check	9.7	6.6	.29	.33
Manure, 1 T	8.7	7.0	.29	.34
Manure, 2 T	10.2	7.7	.33	.39
Manure, 4 T	10.9	8.9	.31	.43
$N_{70}P_{40}$	9.8	7.1	.29	.38
$N_{140}P_{80}$	12.3	9.7	.33	.45
$N_{280}P_{160}$	15.8	12.6	.41	.54

*Figures are a mean of four observations.

TABLE 2. CHICKEN MANURE ANALYSIS AND RATE OF BREAKDOWN

Date of application	Date of recovery	N %	P %	Duration (months)
Nov. 1962		4.28	2.35	
	March	1.84	2.19	4
	June	2.12	2.48	7
March 1963		4.59	2.28	
	June	3.31	3.18	3
June 1963		4.22	3.43	
	Oct.	2.62	3.47	5
	Jan.	2.52	3.40	7
Oct. 1963		5.40	2.89	
	Jan.	2.88	3.00	3
Jan. 1964		3.23	2.00	

FERTILIZATION EFFECTS ON FORAGE YIELDS OF DRYLAND RANGE