

Proceedings, Western Section, American Society of Animal Science
Vol. 19, 1968

CHEMICAL CURING RANGE FORAGE FOR FALL GRAZING 1/

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The nutrient quality of range forage in most of the intermountain west decreases quite rapidly as forage matures. Consequently, the performance of range cattle during the late summer and fall is greatly reduced. Raleigh and Wallace (1963) and Raleigh et al. (1967) report daily gains by yearling cattle on eastern Oregon ranges to be 1.0 kg. plus during May and June 0.7 kg. during July, less than 0.5 kg. in August and relatively no gain after this time.

Sneva (1964, 1967) has proposed a method of providing higher quality late season forage which entails curing the grass while it is high in nutritive value, through the application of paraquat 3/, a bipyridinium herbicide. Wallace et al. (1966) found that range grasses cured with paraquat maintained higher nutritional value than naturally cured grasses as determined by in vivo and in vitro digestibility measures.

The purpose of the work reported here was to determine the value of chemically cured grass for grazing range cattle in late summer and fall.

Experimental Procedure

Grazing trials designed to determine the effect of chemically cured forage on animal performance and forage intake were conducted during the summers of 1966 and 1967. Two crested wheatgrass pastures of 12.2 hectares each were used for the study in 1966. One of the pastures was sprayed June 16-18 with 0.34 kg./hectare paraquat in 75 liters of water using 0.5% X-77. The other pasture was left untreated.

Yearling heifers with an average weight of 311 kg. were allotted to each pasture based on the estimated carrying capacity. Fourteen heifers were put in the control pasture and 13 in the treated pasture.

1/ Contribution of W-94 Regional Project on Range Livestock Nutrition

2/ Jointly operated by the Oregon Agricultural Experiment Station and the Crops Research Division, Agricultural Research Service, U.S.D.A.

3/ Paraquat [1, 1'-dimethyl-4,4'-bipyridinium di(methylsulphate)] was supplied by the Chevron Chemical Company which also partially financed this research. Paraquat, at the time of this writing, is not cleared through the FDA for use in curing herbage for forage.

Eight, 6.1 hectare crested wheatgrass pastures were used in the study in 1967, with four pastures for controls and four pastures sprayed with 0.22 kg./hectare of paraquat in 38.5 liters of water with 0.5% X-77. The spraying was done with a ground rig from June 23-26.

Twenty-four yearling heifers, with an average weight of 302 kg. were stratified by weight to each of four replications and two treatments with three animals per pasture, making 12 animals on paraquat treated forage and 12 animals on control forage.

The 1966 trial ran for a total of 36 days from August 16 to September 21, while the 1967 trial ran for a total of 75 days from August 14 to October 30. The animals were weighed at the beginning, midway through, and at the end of the trial period each year. Water, salt, and bonemeal intake records were kept for each pasture in each trial, and forage intake was determined using the water intake method described by Hyder *et al.* (1966), for cattle in each pasture. Forage samples were collected weekly from each pasture.

Results and Discussion

Gain data for both years of the study are presented in table 1. Animals grazing the paraquat treated forage gained significantly ($P < .05$) more in each study year than those grazing the naturally cured forage. Average daily gains were 0.77 and 0.54 kg. for the animals on the chemically cured and naturally cured forage, respectively, in 1966 and 0.42 and 0.15 kg. for the respective treatments in 1967. The extreme difference in years, significant at $P < .01$, can probably best be explained by table 2, which shows the crude protein values during the time of grazing each year. This follows the usual pattern for these particular type years. When moisture is short, as it was in the growing season of 1966, the quality of forage is higher than in high moisture years such as the growing season of 1967. However, the differences between animal gains from the chemically and naturally cured forage are of the same magnitude each year. From the work of Sneva (1967) it would seem that closer observation should be kept of climate during the crop year to determine time of spraying in order to provide an adequate quality of forage for higher animal gains consistent with total forage production.

Table 1. Average daily gain of animals on naturally cured and chemically cured forage for 1966 and 1967

Year	Grazing period	Naturally cured	Paraquat cured
		(kg.)	(kg.)
1966	8/16 - 9/13	0.55	0.77
1967	8/15 - 9/19	0.11	0.52
	9/19 - 10/30	0.20	0.33
	8/15 - 10/30	0.15	0.42

Table 2. Crude protein content of the diet of animals grazing naturally cured and chemically cured forage during the grazing periods for 1966 and 1967 1/

Date	Naturally cured	Chemically cured
	(%)	(%)
<u>1966</u>		
8/17	5.3	9.1
8/25	4.2	8.2
9/2	4.2	6.8
9/8	3.8	6.2
9/16	4.2	5.3
<u>1967</u>		
8/18	3.2	5.6
8/25	3.1	5.5
9/1	3.1	5.5
9/7	2.9	5.3
9/14	3.0	5.0
9/21	3.0	5.3
9/29	2.7	5.0
10/5	2.6	4.6
10/12	2.7	4.8
10/19	3.0	5.2
10/26	2.7	5.4

1/ Samples were taken from the grazed pastures and values reflect change in forage quality due to both maturity and selective grazing.

Forage moisture, water intake, and estimated forage intake are presented in table 3. Forage intake follows the same pattern as daily gain with the animals on the treated pastures consuming more forage than animals on the control pastures, indicating no problems with palatability or acceptability. No particular pattern was evident with regard to salt and bone-meal intake with the treated or untreated forage.

Table 3. Daily feed and water intake data on heifers grazing naturally cured and chemically cured forage in 1966 and 1967

Year	Treatment	Forage moisture	Salt intake	Bonemeal intake	Water intake	Forage intake
		(%)	(gr.)	(gr.)	(liters)	(kg.)
1966						
	Naturally cured	21.1	35	14	30.2	10.2
	Chemically cured	8.0	38	14	37.8	11.3
1967						
	Naturally cured	13.9	22	22	28.6	8.36
	Chemically cured	8.9	21	27	30.9	8.86

These trials were designed to evaluate the comparative quality of the forage from chemically and naturally cured forage. Therefore, stocking rate was not controlled as it would need to be under practical operations. The pastures were stocked at a relatively light rate so the animals would have an opportunity to express their full potential in terms of daily gain. Studies (Frischknecht *et al.*, 1953 and Lang, 1955) have shown that stocking for light (about 50%) utilization will give greatest daily gain, whereas stocking to a moderately-heavy (about 75%) utilization will reduce daily gain per head but increase gain per acre. Type of cattle, other available resources, cost of pasture and other factors enter into making the decision on stocking rate. Generally the higher stocking rate would be employed. The gain per hectare in the second year of this study was 5.1 kg. from the untreated forage and 15.5 kg. from the paraquat-treated forage. Assuming a value of 60 cents per kg. for this gain gives a gross return of \$3.06 and \$9.30, respectively, from the control and treated forage. It was estimated that about two-thirds of the forage available, under a practical stocking rate, was used in this study indicating that the pastures could have been stocked 50% higher which would have resulted in a return per hectare approaching \$4.07 and \$12.60, respectively, for the control and treated pasture.

The application of paraquat curing of forage would seem to be best adapted to higher producing ranges, since cost of application per land unit would be near equal for high or low producing ranges. Fertilization can increase production up to 50% and this could make the economics of chemical curing of forage more favorable. These factors need further evaluation.

Summary

Grazing studies were conducted in two separate grazing seasons to determine the effect of forage chemically cured with paraquat, a bipyridinium herbicide, on nutrient intake and livestock performance.

Crested wheatgrass forage was chemically cured and left standing in mid-June when nutrient quality was adequate to meet the requirement of yearling cattle for normal gain. Yearling heifers were grazed on chemically cured and naturally cured forage in late summer and fall. Forage intake and daily gains were measured.

Cattle grazing the chemically cured forage gained significantly ($P < .05$) more than those grazing naturally cured forage in each of the two years. There was a significant ($P < .01$) difference in gain between years on both the chemically and naturally cured forage. However, in each year of the study the animals on the chemically cured forage gained about a quarter kg. more per day than those grazing naturally cured forage.

Forage intake was calculated by correlating water intake to dry matter intake. Forage intake was greater with cattle grazing the chemically cured forage than with those grazing naturally cured forage, indicating the chemically cured forage is acceptable to grazing animals.

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