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Cover picture: Yearling steers on crested wheat at the base of Squaw Butte.

MARKETING STEERS DIRECTLY OFF GRASS

H. A. Turner, D. L. Whittington and R. J. Raleigh

The probability of high grain prices and/or a shortage of grain for livestock feeding due to human competition has created a need for reevaluation of finishing cattle with a minimum use of grain. Cattle feeding, by necessity, may become more dependent upon range and pasture forage, thus rangelands may again be looked to as an area for production of slaughter cattle.

At one time animals were slaughtered directly off grass. We then went through a period of surplus grain throughout the United States and concentrates became a cheap source of animal feed. Now that grain surpluses are diminishing, grain prices have increased. This coupled with a weak fat-cattle market has forced many feedlots to produce grain-fed beef at a loss. As a result many young poorly conditioned cattle were slaughtered. They were marketed by retail stores under the term "grass-fat beef".

This helped to create renewed interest in grass-fat beef. However, grass-fat has received a lot of detrimental publicity due to a poorly marketed product. Much of the so called grass-fat beef was simply weaned calves or long yearlings fed for maintenance. Grass fat became a catch-all name for everything but grain-fat beef.

The vast majority of the semiarid and arid rangelands of the West have no alternate use for food production other than through grazing. It is important that we utilize our ranges and meadow lands to the fullest extent for meat production to conserve feedstuffs that could be consumed directly by man. Production of a slaughter animal, which is acceptable to the consumer, utilizing a maximum quantity of forage and a minimal quantity of grain is needed if we are to continue to eat beef at an acceptable price.

WINTER TREATMENT

Sixty-two steers, born in the spring of 1975 and weaned in September, were placed on one of four treatments for a winter calf study on October 8. These calves were on rake-bunched hay for most of the winter with baled hay fed as bunched hay became limited. The treatments were designed to test three *ad lib* fed energy-protein supplements against a daily hand fed control ration of 3 pounds barley plus biuret to make a 32% protein supplement. The liquid and soft-block supplements were composed of molasses, urea and fats. For the first half of the winter the soft block contained 20% protein and then was increased to 32%, with the liquid feed containing 32% protein throughout. The hard block was composed of crystalized molasses, containing animal and vegetable fats, with a protein content of 16%.

Gains and supplement consumption data for the winter period are presented in Table 1. These calves were on rake bunched hay for most of the winter, with gains being lower than desired. Previous work on the station indicates that steers should gain from 1 to 1.7 lb per day over the winter depending on relative price of cattle and feed and management program. Gains of these steers were lower than desired and may have been partially due to the hay feeding system as well as type of supplement. Forcing calves of this size to clean up bunched hay is not a good management practice. Results were particularly poor with the *ad lib* fed supplements. Problems with intake control contributed to the poor performance and, in some cases, it appeared that the time steers spent working on the supplements, may have resulted in reduced hay intake.

Table 1. Results of winter treatments

	Treatment			
Item	Control	Liquid	Solid block	Soft block
No. of steers	15	17	16	14
Initial wt., lb	336	333	329	331
Final wt., lb	491	380	378	432
Supplement intake, lb	3.3	0.6	1.5	4.4
Gain, lb	155	47	49	101
Average daily gain, lb	0.88	0.27	0.28	0.57

GROWING PHASE

Sixty steers with an equal number of calves from each of the four winter treatments were assigned to the growing and finishing study on May 11. Thirty-six steers were put on crested wheatgrass range and 24 split between alfalfa-fescue and clover-fescue irrigated pastures.

Management of the steers on range in the growing phase was such that they grazed the top third of each pasture, before moving to a fresh pasture. Attention was also given to feeding the supplement at the same time each morning in order to help maintain maximum grazing time and performance. Table 2 shows the daily supplement intake of the steers on range. Irrigated pasture steers were alternated between 2 pastures on each treatment every 2 weeks to allow for irrigation and regrowth. These animals received 3.2 lb of barley thru July 28 at which time barley was gradually increased to 5 lb by August 3.

Table 2. Daily supplement intake on range

Period	Biuret	Barley
5/11 - 6/15	.0	1
6/16 - 6/17	.03	1
6/18 - 6/19	.04	1
6/20 - 6/26	.05	1
6/27 - 7/3	.09	1
7/4 - 7/10	.10	1.3
7/11 - 7/17	.12	1.6
7/18 - 7/24	.14	1.8
7/25 - 8/3	.14	2.5

Results of the growing phase are presented in Table 3. The steers on range outgained the irrigated steers by .60 pounds per day on approximately one third the amount of supplement. The carrying capacity of the crested wheatgrass was about 2.5 acres per animal unit month (AUM). On ranges with a carrying capacity of less than 5 acres per AUM, the distance cattle have to travel for feed could have an adverse effect on rate of gain.

Table 3. Gain and consumption data during 84 day growing phase

Item	Range	Clover-grass	Alfalfa-grass
No. of steers	36	12	12
Initial wt., lb	435	443	440
Final wt., lb	707	664	663
Supplement consumption, lb	1.30	3.33	3.33
Gain, lb	272	221	222
Average daily gain, lb	3.23	2.63	2.65

FINISHING PHASE

On August 3, 10 steers from the range treatment and 5 steers from each irrigated pasture treatment were shipped to Corvallis to be finished in a feedlot at Oregon State University. Data from these animals are not available at this time.

Steers remaining on range and irrigated pasture were given increasing amounts of grain at the rate of one half pound every two days until they reached a full feed of grain using the pastures and range as a roughage source. When grain reached 8 pounds daily per head the steers were fed one half the daily allowance morning and evening. Composition of rations fed during the finishing phase are shown in Table 4. Gain and consumption data for the finishing phase are presented in Table 5. The steers on irrigated pasture were fed grass hay for the last 31 days after frost stopped pasture growth.

Table 4. Composition of finishing rations

Ingredient	Range	Irrigated pasture
Barley, %	96.90	98.1
Biuret, %	1.25	.4
Salt, %	.80	1.0
Limestone, %	1.05	.5
Vitamin A, IU/day	20,000	20,000

Table 5. Gain and consumption data during 103 day finishing phase

		Irrigated pasture	
Item	Range	Clover-grass	Alfalfa-grass
No. of steers	25	6	6
Initial wt., lb	707	664	663
Final wt., lb	971	959	942
Grain consumption, lb	1240	1159	1159
Gain, lb	264	295	279
Average daily gain, lb	2.56	2.86	2.71

Table 6 summarizes results through the growing and finishing phases. Two steers on irrigated pasture and 1 steer on range died from unknown causes. One of the clostridials was suspected and the remaining animals were vaccinated.

Table 6. Combined gain and consumption data for the growing and finishing phase

Item	Range	Irrigated pasture Clover-grass	Irrigated pasture Alfalfa-grass
No. of steers	25	6	6
Initial wt., lb	429	432	434
Slaughter wt., lb	971	959	942
Gain, lb	542	527	508
Average daily gain, lb	2.90	2.82	2.72
Total grain consump./hd, lb	1349	1439	1439
Av. daily consumption/hd, lb	7.22	7.71	7.71
Hay consumption/hd, lb	0	152	152

Of the 37 steers finished, 30 of the heavier animals were slaughtered at the Oregon State University meats lab in Corvallis. The slaughter and carcass data are summarized in Table 7. The range steers finished at a heavier weight and hung up a heavier carcass than the steers finished on irrigated pasture. The range steers also had a more desirable fat color. One steer went Choice with the remainder being split between Standard and Good. However, **remember** that the new guidelines for grading omit conformation, which under the old grading system would have raised these carcasses about one third of a grade. Seven steers on the range treatment had abcessed livers, with none from the irrigated pasture-hay treatment.

Table 7. Carcass data

Item	Range	Irrigated pasture Clover-grass	Irrigated pasture Alfalfa-grass
No. of steers	20	5	5
Live wt., lb	1003	985	967
Carcass wt., lb	556	524	518
Dressing, %	55.5	53.2	53.6
Fat color[a], %	3.5	2.4	2.6
Abcessed livers	7	0	0

a Fat color: 5=white, 4=slight yellow tingle, 3=slightly yellow, 2=moderately yellow, 1=dark yellow.

DISCUSSION

The effect of winter treatment on summer gains was minimal, with little or no difference in summer gains between treatments. The most obvious and perhaps a very important effect is the weight at which the steers go on pasture. The heavier control steers finished at a heavier and more acceptable weight than the smaller animals. The only difference in performance due to winter treatments occurred during a 39-day period between April 2 and May 11, when steers were put on a meadow containing small amounts of spring growth and the control ration. Animals from the control treatment lost weight during this period, while the others gained 10 to 20 pounds.

The approximate value of the calves on this project if sold at various times is shown in Table 8. By keeping these steers to finish, an additional $226 was added to the value of each weaner. Considering barley at $100/ton and 1400 pounds per steer the additional cost of feed is $70. This leaves $260 per head to pay fixed costs and other expenses and is $155 more than available from the sale of the weaned calf. The operator has to take into account the cost of forage, interest on money, and other expenses which varies among systems and operations.

Table 8. Alternative marketing dates

Time of year	Average wt.	Average price	Total value
	lb	$/cwt	$
9/4/75 weaning	318	33.00	104.94
5/11/76 spring	440	36.00	158.40
8/3/76 fall	700	40.00	280.00
11/13/76 slaughter	1000	33.00	330.00

FEEDING ALTERNATIVES FOR WINTERING STEER CALVES

M. Vavra and R. L. Phillips

Roughages and supplements available to ranchers vary with each operation. This study was conducted to observe the performance and intake (roughage and supplements) of steer calves on three different feeding regimes. Roughage, roughage plus barley, and roughage plus a protein-energy block were fed.

EXPERIMENTAL PROCEDURE

Thirty-six Hereford steer calves born in the spring of 1975 were allotted equally into three treatment groups:

Treatment 1: Second-cutting alfalfa-orchardgrass hay

Treatment 2: First-cutting alfalfa-orchardgrass hay + energy (barley) supplement

Treatment 3: First-cutting alfalfa-orchardgrass hay + protein-energy block

Cattle were fed in lots and had access to a heated water fountain and a salt-dicalciumphosphate mixture at all times. All roughage was fed in covered bunks. Barley was fed daily in an open bunk. The protein-energy block was fed daily in elevated boxes that were sheltered from precipitation. Cattle were weighed at the beginning, at 28-day intervals and at the termination of the trial.

All animals were subjected to a 28-day pre-trial adaptation period. During the first two weeks only hay was fed to establish intake. For the last two weeks supplements were included to the appropriate cattle. The study itself ran for 112 days.

Feed consumption was calculated so that daily gains would be about one pound per day and similar among treatment groups. Nutritional values used in computations are presented in Table 1. Gains during the initial 28 days of the trial were lower than expected so roughage was increased to improve gains. The protein-energy block was to be available at all times, however, consumption was such that daily feeding was required to prevent overconsumption.

Table 1. Nutritional value of feeds

Feed	C. P.	TDN
	%	%
1st cutting hay	12	53
2nd cutting hay	16	56
Barley	12	74
Protein-energy block	20	70

RESULTS AND DISCUSSION

Performance of calves during the trial is presented in Table 2. Daily gains of all treatment groups was less than expected during the first period. Calves on the protein-energy block did not perform as well as the other two groups. Since gains were less than expected (1.0 lb/day) roughage levels of all groups were increased 2 pounds per head per day. Additionally, more protein-energy block (an additional 2 lb per head per day) was made available to treatment 3 calves to see if consumption would remain constant or increase with increased availability. Gains during the subsequent periods were higher than expected for all groups. Heavy precipitation and the resulting muddy conditions during the first period probably influenced gains during that time. Daily gains summarized over the four periods were the same (1.53 lb/day) for all groups.

Table 2. Performance of calves during each period and overall

Period	Average daily gain		
	Lot 1	Lot 2	Lot 3
	lb	lb	lb
Pre-test	1.25	0.88	0.55
1	0.73	0.76	0.51
2	1.98	2.27	2.24
3	1.63	1.66	1.73
4	1.81	1.45	1.65
Overall average (not incl. pre-test)	1.53	1.53	1.53

Average daily feed consumption and feed costs are presented in Table 3. Feed costs of treatments 1 and 2 were similar. The low cost of barley made it an attractive supplement. The increase in consumption of the protein-energy block made it an expensive alternative. However, if consumption had been limited to 2 pounds per head per day, daily feed costs would have been 49¢ per head per day which is more in line with the other treatments. If block fed calves and barley-fed calves perform equally, the block treatment would be an attractive alternative in years of high cost barley. Uncontrolled intake of a protein-energy supplement can become an expensive proposition, as Table 3 indicates.

Table 3. Average daily feed consumption and costs per head by treatment

Treatment	Ave. daily rough. consump.	Ave. daily supl. consump	Feed cost
	lb	lb	$
1	16.2	0	.45
2	14.0	2	.44
3	13.9	3.5	.60

Alfalfa-orchardgrass hay, 1st cutting--$50/ton; 2nd cutting--$55/ton; Barley--$90/ton; protein-energy--$139/ton.

PRODUCTION AND CHEMICAL ATTRIBUTES OF *KOCHIA PROSTATA*

C. M. Britton and F. A. Sneva

Investigations of *Kochia prostata*, introduced from Russia, have been in progress at the Squaw Butte Experiment Station since 1971. This species appears to have the potential of becoming a valuable forage plant on western ranges. It is widely distributed throughout the arid and semiarid regions from Russia to the Mediterranean Sea and central Europe. *Kochia* has been described as a long-lived, morphologically variable half shrub having thick roots with numerous branches penetrating deeply into the soil. The Russians report that *Kochia* is exceptionally drought resistant and is valued as a fattening feed for sheep, goats, and camels.

Several important questions require answers before *Kochia* is considered for use on western rangeland. First, how productive is *Kochia* under western rangeland conditions? Second, what are the seasonal variations in nutrient content and third, what oxalate content does the plant contain? The oxalate content is important because this is the substance that makes hologeton poisonous.

EXPERIMENTAL PROCEDURES

Two experimental plantings were established in 1974. On each area 2 subspecies of *Kochia prostata* were seeded. These subspecies will be referred to as the green and gray form. On one area the two forms were seeded in plots with row spacing widths of 6, 12, and 24 inches. Plots were replicated 3 times with 5 rows per plot. The plots were harvested to determine production during September of 1975 and 1976.

On the second area, 4 plots of the green form and 11 plots of the gray form were established in 1974. From September 1975 to September 1976, approximately 7 plants were harvested from each plot on a monthly basis. During this sampling period, plants were 2 years old and contained old and new growth. These plants were analyzed for crude protein and oxalate content.

RESULTS AND DISCUSSION

The green form of *Kochia* produced more total dry matter than the gray form regardless of row width (Table 1). It was slightly more productive when grown in the 6-inch row widths than in the 12-inch row width. Both forms were consistently more productive in the 6- and 12-inch spacings than in the 24-inch rows. The highest production was measured from the 6-inch row width of the green form with 819 pounds per acre which is similar to crested wheatgrass production. The lowest production from the 24-inch row width from the gray form with 364 pounds per acre.

Table 1. Production of the green and gray forms of *Kochia prostata* for different row widths

Row width	Green form	Gray form
inches	lb/ac	lb/ac
6	819	553
12	691	514
24	491	364

Since the number of plants varied greatly within all plots, production per plant was calculated to minimize this source of variation. Both forms yielded more per plant when grown in the 12-inch row spacings (Table 2). The green form, however, yielded about 50% more than the gray form at the 12-inch row width. Yields per plant from the 6- and 24-inch row spacings were similar regardless of form. This indicates that probably the best long term effects would be associated with a row spacing width of 12 inches.

Table 2. Average production of individual plants of the green and gray forms of *Kochia prostata* for different row widths

Row width	Green form	Gray form
inches	g/plant	g/plant
6	21.8	18.8
12	31.3	20.8
24	21.0	18.0

Crude protein content varied throughout the year (Fig. 1). The lowest concentration (5.4%) occurred during October. Two peaks were observed with the first peak in November during seed maturation at 6.6%. The second peak occurred during the period of leaf growth from April to June at approximately 9.5%. The increase observed during August and September of 1976 resulted from new growth initiated by the unusually high precipitation during August 1976. This trend in crude protein content suggests that *Kochia* has the potential of providing good quality forage production early in the spring. Also, since the crude protein content was comparatively high during late summer and fall, *Kochia* might provide protein needed to balance the grazing animals diet when native or seeded grasses are low (2-3%) in protein. Even with the mixture of old and new growth, *Kochia* maintained about 6% crude protein content through the winter months. This is adequate for maintaining animals and would be available because snow melts quickly around the protruding plants.

Oxalate content of *Kochia* plants also changed through the year, Fig. 2. The low point occurred during March at 0.49% while the peak occurred during July at 0.98%. This peak appeared to coincide with the period when plants would be under maximum water stress. These concentrations of oxalate appear to be well below the tolerance limit of grazing animals. They are very low compared to the 20-35% concentrations found in halogeton.

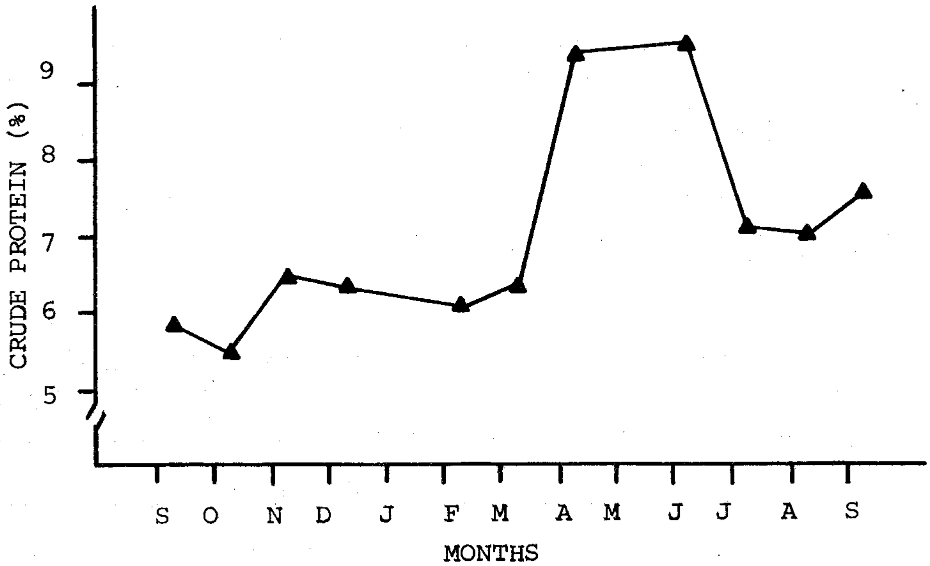

Figure 1. Average change in crude protein content for combined sample of the green and gray forms of *Kochia prostata*.

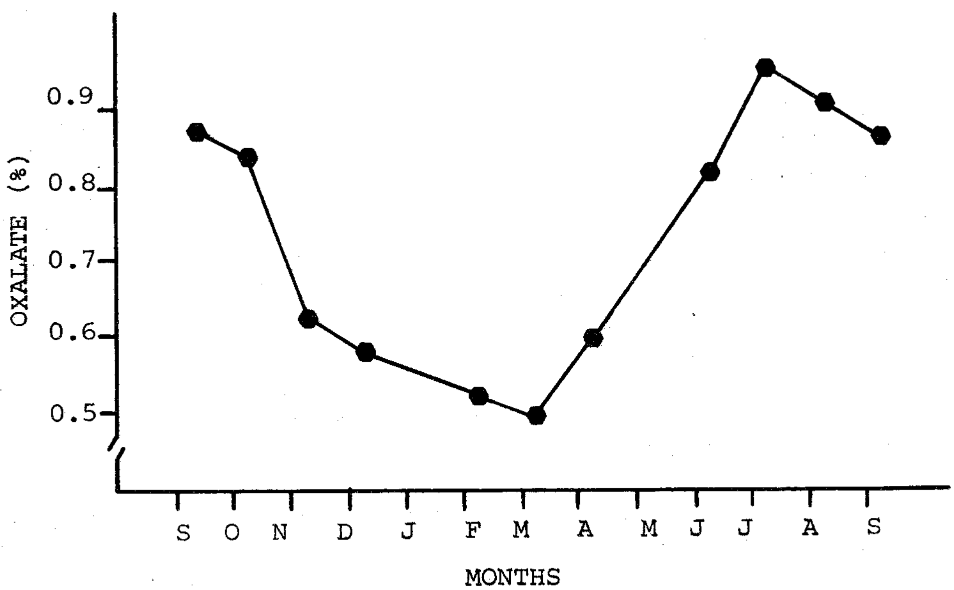

Figure 2. Average change in oxalate content for combined sample of the green and gray forms of *Kochia prostata*.

FUTURE WORK

The above mentioned measurements will be continued for at least another year. New studies will include an evaluation of *Kochia* tolerance to 2,4-D and burning at different dates. Work will be done on seed characteristics and seeding methods. A 2 acre area has been seeded for testing cattle preference and utilization. The effects of height of clipping will be evaluated in terms of sustained production.

THE EFFECTS OF NUTRITION LEVEL ON THE PERFORMANCE OF WINTERING COWS

R. L. Phillips, M. Vavra and R. J. Raleigh

Wintering cows is one of the most costly phases of beef cattle production. The cost of hay continues to increase as does the cost of energy and labor to harvest and feed this hay. One way to reduce wintering costs would be to feed less hay, but not to the point of reducing the reproductive performance of the cow. Spring-calving cows entering the winter period in good condition can lose some weight without affecting reproductive performance and calf viability.

This study is designed to evaluate the effect of nutrition level on pre-calving and post-calving weight change, days to first post-partum estrus, conception rate, calf birth weight and weaning weight.

EXPERIMENTAL PROCEDURE

This study has been conducted for two winters (1975-76 and 1976-77). The first year's data is complete and the second year's data will be completed in the fall of 1977.

1975-76 TRIAL: Sixty head of pregnant Hereford cows, ranging in age from four to ten years, were allotted by age and weight into three groups of twenty cows each. The treatments were high, medium and low levels of hay which were to approximate 120%, 100% and 80% of the NRC nutrient requirements, respectively, for maintenance of a 1100 pound cow. Cows were group-fed first-cutting alfalfa-grass hay (13% CP) from October 22, 1975 to January 28, 1976. The trial terminated several weeks prior to the calving season. Cows had access to a salt-dicalciumphosphate mixture and fresh water at all times. Initial, 28-day period, and final weights were taken after an overnight shrink off feed and water.

Cows were fed 19 pounds of first-cutting alfalfa-grass hay from the end of the feeding trial until they calved. After calving, cows and calves were moved into another field and were fed 24 pounds of hay until they went on range (May 10, 1976). Marker bulls were used to determine days to first estrus after calving. The bulls were turned with the cows two weeks after calving and estrus was checked daily until the breeding season started. The cows grazed the Hall Ranch during the summer. The calves were weaned and the cows pregnancy tested on September 17, 1976.

1976-77 TRIAL: The feeding trial was conducted the same as the previous year except the cows went on test October 22, 1976 and came off test January 12, 1977.

RESULTS AND DISCUSSION

1975-76 TRIAL: Cow performance data is given in Table 1. During the test period hay intake for the high, medium and low groups was 22.4, 18.7 and 14.9 pounds of hay, respectively. The cows on the high level gained 107 pounds as compared to 38 pounds for the medium and a 31 pound loss for the low level groups. Daily feed costs were 22 cents less on the low level of feed as compared to the high level.

Table 1. Hay intake, winter and summer weights for cows fed at three levels prior to calving during 1975-76

	Treatment		
	High	Medium	Low
Test period (98 days)			
Feed intake, lb	22.4	18.7	14.9
Initial weight (10-22-75), lb	1129	1118	1139
Final weight (1-28-76), lb	1236	1156	1108
Weight change, lb	+107	+38	-31
Cost of feed/hd/day, $	.67	.56	.45
Calving and breeding period (103 days)			
Spring weight (5-10-76), lb	1058	1034	1030
Weight change, lb	-178	-122	-78
Range period (129 days)			
Weight at weaning (9-17-76), lb	1227	1201	1200
Weight change, lb	+169	+167	+170

The cows fed at the high level lost 100 pounds more than the cows fed at the low level (-178 vs -78 pounds) and the cows fed the medium level lost 122 pounds from the end of the test period until the cattle went on range. Summer weight gains for the three groups were similar.

The performance of the calves from cows fed at the three levels are given in Table 2. Birth weight and suckling gains of calves were similar for all three groups. The average age of the calves was within 10 days of each other between treatments.

Table 2. Calf weight and average daily gain as influenced by dam's treatment in the 1975-76 trial

	Dam's treatment		
	High	Medium	Low
	lb	lb	lb
Birth weight	94	91	89
On-range weight (5-10-76)	182	176	186
Days from birth to 5-10-76	58	56	66
Average daily gain	1.52	1.52	1.47
Weaning weight (9-17-76)	496	482	490
Average daily gain	2.43	2.38	2.41

The number of days from calving to first estrus was similar among the three groups, with conception rate being 85% on all treatments. From the limited data presented it would appear that cows can be fed at about 80% of NRC several weeks prior to calving with no adverse effects on reproductive performance, providing cows are in adequate condition coming into the winter and are fed to meet their nutritional requirements prior to and after calving.

1976-77 TRIAL: The hay intake and performance of cows during the test period are shown in Table 3. The intake for the cows on the three treatments was 20.2, 16.8 and 13.4 pounds of hay for the high, medium and low groups respectively. Weight change for the high, medium and low groups was 72, 14 and -54 pounds respectively. These weight changes are closer to the expected performance than last year.

The cost of feed per cow daily on the low level was 21 cents less than for the high level (Table 3). Over a 100-day period this would amount to $21 per cow or $2100 for 100 cows. Feeding 100 cows for 100 days at the low level rather than the high level would save 34 tons of hay or 50 more cows could be fed on the same amount of hay.

Table 3. Intake and cow performance for the 1976-77 trial

	Treatment		
	High	Medium	Low
	lb	lb	lb
Initial weight (10-20-76), lb	1127	1123	1123
Final weight (1-12-77), lb	1199	1137	1069
Weight change, lb	72	14	-54
Hay intake, lb	20.2	16.8	13.4
Cost of feed/hd/day[1], $	.61	.50	.40

[1] Alfalfa-grass hay @ $60 a ton.

PARAQUAT PLUS MEADOW EQUALS WINTER GRAZING

Forrest A. Sneva and H. A. Turner

Chemical curing of grasses is a potential alternative method of haying some of our flood meadows. Currently, this method, using Paraquat has not been approved by the Environmental Protection Agency. Clearance for this use, however, is being sought, but the outcome is uncertain.

Paraquat (1,1' dimenthyl - 4,4' bipyridinium bis (methylsulfate), is a nonvolatile, moderately toxic chemical used as a contact herbicide and crop dessicant in many areas of modern agriculture throughout the world. As a chemical for curing grasses, it is the rapid dessicating action that is important. Drying the plant rapidly prevents the nutrients in the herbage from being translocated. As long as the crop treated is not subjected to numerous heavy rains, which will leach some nutrients, the forage quality can be retained in the standing crop for 6 to 8 months with only minor losses. Thus, chemical curing is ideally suited to those haylands within the semiarid region where summers and falls are dry. These haylands occur throughout the area bounded by the Rockies on the east and the Cascade-Sierra Nevadas on the west and extend from northern Arizona to central Washington.

Research on chemical curing at the Squaw Butte Experiment Station began in 1960. Initially, and in the following 10 years, the studies concentrated on the curing of desert grasses for late season grazing. Results of those studies were published. With the cost of labor, machinery, and fossil fuel driving the cost of haying to exceptional high levels in the earlier 1970's, we diverted the research effort to the meadows. This report summarizes the results of studies conducted in 1974 through 1976.

PROCEDURES

In the summer of 1974, meadow hayland was treated as follows: (Pasture 1) mowed, baled, and stacked (13.5 ac) on July 19; (Pasture 2) treated with 0.5 lb Paraquat[1/], active ingredient/ac plus 0.5% X-77 (wetting agent) in 17 gallons water (14.4 ac) on July 24 and (Pasture 3) left standing to cure naturally (19.1 ac). Seventy head of spring calving cows were stratified by weight and age and randomly allotted to the three hay treatments on November 5, 1974. Pastures 1, 2 and 3 were assigned 16, 24 and 30 head, respectively. The feeding-grazing schedule is shown in Table 1.

Table 1. Spring cow feeding and grazing schedule - winter 1974-75

	Hay treatment		
	Baled	Paraquat cure	Natural cure
	(Pasture 1)	(Pasture 2)	(Pasture 3)
11/5/74-12/3/74	Pasture aftermath	Pasture	Pasture
12/3/74-1/10/75	Baled hay	Pasture	Pasture
1/10/75-2/13/75	- - - - Common pasture	- stacked long hay - - -	
2/13/75-2/25/75	Baled hay	Pasture	Pasture

In 1975, during the first days of August, all 3 pastures (60.5 ac) were treated with Paraquat at the same rate as in 1974. Pasture 2 (14.4 ac) was cross-fenced into 3 smaller pastures. On November 11, 63 head of spring calving cows were stratified by weight and age, with 28 being allotted to Pasture 2 and 35 to Pasture 3 (19.1 ac). The cattle remained in these pastures until January 7. By that time cattle in Pasture 2 had utilized 2 of the 3 small pastures. At this time 2 early calving cows were removed, the remaining 61 head were transferred to the unused Pasture 1. On the fourth day of February, cows due to calve were again removed and the remaining 29 head were transferred back to the unused portion of Pasture 2. These cattle were removed on the third day of March. During the period of March 9 to April 23, 39 head of replacement heifers cleaned up the remaining forage in the three pastures.

Pasture production was estimated from clipped plots at normal haying time and prior to grazing in the fall. The average bale weight and number of bales were used to estimate the production of Pasture 1. Crude protein concentrations were determined from field grab samples, compositing 20 locations per sample. Hay samples for determining Paraquat residue were obtained 131 and 159 days after treatment. Each sample consisted of 3 pounds of oven dry hay obtained from 12 random locations within each field. Residue analyses were conducted by the Chevron Laboratories in Richmond, California.

1/ Paraquat has not been registered by the U.S. Environmental Protection Agency for this use. The use of a trade name does not imply its endorsement above that of similar products.

Cattle were individually weighed onto the pastures following an overnight shrink off feed and water. They were weighed thereafter at approximately 28 day intervals. Records were maintained on calf birth weight and calf drop date. These cows were bred during June and July and were pregnancy checked in the fall by rectal palpation.

In 1975 plots of meadow vegetation were treated July 31 with 0, 0.2, 0.3, 0.4, and 0.5 lb Paraquat per acre plus 0.5% X-77 in 19 gallons of water. Application was with a standard, tractor mounted, crop spray boom. On half of the boom the spray was released above the canopy and on the other half it was released within the vegetation using 18" drop tubes. Treatments were replicated 4 times. Vegetation within each plot was sampled on July 28, September 8, October 3, and November 5 and crude protein concentrations of all samples determined.

RESULTS AND DISCUSSION

Crude protein concentrations of standing hay treated with Paraquat in 1974 was equal to that of the baled hay at the start of grazing (Table 2). Concentrations 1975 (Table 3) were not as high as they were in 1974. The lower hay quality in 1975 was caused by delayed harvesting due to a long flooding season. Good retention of crude protein in the plant is an expression of chemical effectiveness and favorable weather following application. In both years the small amount of rain received during August, September, and October (Table 4) caused very little leaching of crude protein. Physical loss of cured vegetation is minimized when the herbage remains dry and retards biological breakdown of plant tissue. A declining trend in crude protein through the winter of 1974-75 is evident but this was the result of sampling unused vegetation during a grazing period. Thus, by the 21st of February the remaining forage left ungrazed contained only 4.4% crude protein. The rapid decline in crude protein concentrations in standing meadow grasses left to cure naturally (Table 2) is convincing evidence that this is not a good management technique. Crude protein can be effectively retained by chemically curing for 6 months or longer. This was evident in 1975-76 when samples from the ungrazed sub-unit of Pasture 2 sampled on February 25, 1976 was somewhat higher than samples taken 7 months earlier.

Table 2. Crude protein concentrations in forage-hay samples, winter 1974-75

Date	Hay treatment: Baled	Hay treatment: Paraquat cure	Hay treatment: Natural cure
	%	%	%
7/24/74	---	7.8	6.8
11/4/74	6.8 1/	7.6	3.6
12/2/74	7.7	6.6	3.2
12/30/74	6.8	6.4	2.8
2/21/75	---	4.4 2/	2.2

1/ Crude protein concentrations of pasture aftermath.
2/ Crude protein concentrations of forage remaining in grazed fields.

Table 3. Crude protein concentrations in Paraquat cured hay, 1975-76

Date	Pasture no. 1	2	3
	%	%	%
August 5, 1975	6.6	7.0	6.3
November 4, 1975	---	7.6	6.8
December 10, 1975	---	5.1 1/	6.1
January 16, 1976	5.9	---	--- 1/
February 4, 1976	---	---	5.8
February 25, 1976	---	7.8 2/	---

1/ Crude protein concentrations of available herbage in pastures being grazed.

2/ Sample from ungrazed sub-unit pasture.

Table 4. Precipitation, snowfall, and mean temperature in the test years 1974-75 and 1975-76

Period	Precipitation 1974-75	Precipitation 1975-76	Snowfall 1974-75	Snowfall 1975-76	Temperature 1974-75	Temperature 1975-76
	Inches		Inches		°F	
Aug. - Oct.	0.45	1.61	----	----	----	----
November	0.11	0.82	0.1	5.2	37	34
December	1.36	1.64	9.9	9.9	25	28
January	1.54	1.49	15.9	11.8	25	30
February	1.78	1.46	13.0	10.5	30	30

Forage production, animal performance, and hay treatment costs are presented for the 1974-75 study in Table 5. Pasture 1, on the basis of past production is the most productive pasture with Pasture 3 being the lowest. The low yield of Pasture is in part due to a loss of cured plant parts and cessation of growth shortly after the plant was treated with Paraquat. In the 2 years, it was estimated that this loss ranges from 10 to 15%. The yield of Pasture 3 is also high relative to Pasture 2 because growth continued after Pasture 2 was treated with Paraquat.

Table 5. Summary of hay treatment costs and returns 1974-75

	Hay treatment		
	Baled	Paraquat cure	Natural cure
	Pasture 1	Pasture 2	Pasture 3
Number of cows	16	24	30
Mean pasture yield, t/ac	3.58	2.01	2.39
Average daily gain, lb 1/	0.47	0.38	-0.38
Intake, lb/hd/dy 2/	28.1	27.8	22.3
Cost/ton of hay, $	20.0 3/	6.91 4/	---
Animal unit days	72.3	71.9	89.7
Cost/animal unit day, $	0.28	0.10	0.20 5/

1/ Mean from 11/5/74 to 2/25/75.
2/ Computed from pasture yield & days of grazing.
3/ Estimate of 1974 contract costs of harvesting and feeding out.
4/ Paraquat at $44.50/gal, X-77 at $12.00/gal and $1.70/ac application cost.
5/ Supplement cost in final grazing period of 20% protein at $150/t and daily intake of 2.7 lb/hd.

Cows gained weight on forage alone from all pasture treatments during the first 28 days. Cows on Paraquat cured hay and natural cured hay lost weight thereafter except when fed long hay during the month of January. The average daily gain for cows grazing Paraquat cured forage, however, was only 0.1 lb/day less than cows fed baled hay (Table 5). The poor quality of natural cured hay is clearly shown by the 0.38 lb daily loss even when supplemented in the final period. In the 1975-76 wintering period of 144 days the average daily loss of cows on Paraquat treated forage was -0.04 (Table 6). The average daily gain ranged from a +3.1 in the late fall period to a negative loss of -1.9 lb during the winter period.

Table 6. Average daily gain of cows wintered on Paraquat cured standing meadow hay, 1975-76

	Pasture no.		
Period	1	2	3
	lb	lb	lb
11/11/75 - 12/10/75	---	2.1	3.0
12/10/75 - 1/7/76	---	-0.9	-1.3
1/7/76 - 2/4/76	-1.0	---	---
2/4/76 - 3/3/76	---	-1.9	---
114 day mean		-0.04	

The high positive gains in the fall period is evidence that the forage quality is adequate and that these cows are getting a full feed. The weight losses are all occurring after climatic conditions worsened, i.e., colder temperatures and the occurrances of cold rains or snowfall (Table 4). The presence of snow interfered with the availability of forage and intake was reduced. Diurnal thawing and freezing at the ground surface level further complicated grazing. Cold wet weather also increases the animals' nutrient requirements and the wet frosty forages may require more energy for conversion inside the rumen. Greater negative gains in the 1974-75 winter would have occurred in cows on the Paraquat cured and natural cured forage if emergency feeding of long hay had not been done. The winter of 1974-75 was colder and snow depth greater and more continuous than in 1975-76.

If cows go into the winter in a fleshy condition, as the above animals on study, little or no gain or even negative gains are acceptable. This is a decision that must be made based upon the condition of the cows and feed resources which are available prior to and after claving. Weight loss of 100-200 pounds for fat cows during the early winter period is acceptable as long as the cow is fed to place her in a positive gain status a few weeks prior to calving to prepare her for milk production. Adequate post calving feed levels are important to allow for cycling and breeding back within the desired breeding season.

Grazing Paraquat cured meadow hay in the winter caused some problems that a rancher needs to consider. These problems are related more to assuring adequate intake rather than hay quality. The degree to which these problems affect cow performance will depend greatly on weather conditions and thus the magnitude of the problem will fluctuate from year to year. In those areas where snow is light, there may not be a problem. A wise rancher, however, w'll maintain an emergency forage supply or be ready to purchase outside forage if and when climatic conditions shut off a hay grazing program.

We believe that the reduced cost of treating meadow hay by chemical curing is great enough to offset the management problems one might encounter (problems that may also be reduced as we become more adept in management of such a system). Management of cured forage would be similar to that of bunched hay in that it would be beneficial to have large numbers on a small area to assure rapid cleanup and improved livestock performance. The local contracting cost in 1974 for swathing, baling, stacking and feed-out was estimated at $20.00/ton (Table 5). The total cost of chemical curing these pastures was $6.90/t. The cost of chemical curing in 1975 was estimated at $6.43/t, the difference being due to slightly greater pasture yields in 1975 than in 1974. The cost of an animal unit day during winter for the chemical curing treatment was approximately 1/3 that of the conventional method ($0.10 vs $0.28). It is also important to recognize that this reduction in cost reduces directly the annual operating cash expense.

In the two years of testing, Paraquat treated forage has not influenced calving date, birth weight or the ability of the cow to recycle and conceive. However, numbers of cattle for these kinds of information were limited and definite conclusions are not warrented at this time.

The initial study on rate of Paraquat suggests that 0.2 lb/ac Paraquat (active ingredient) is sufficient. No difference in crude protein concentration content resulted from any of the Paraquat rates tested (0.2, 0.3, 0.4, and 0.5 lb Paraquat, a.i./ac).

Dispensing the spray solution within the canopy was equally as effective as dispensing above the canopy. These results are important but need to be confirmed with additional testing. These results indicate that the cost of chemical curing may be further reduced by using lower application rates, consequently the residues of the chemical in the forage could be reduced, and the chance of spray drift and contamination to off-site areas would be reduced.

Residue analyses for Paraquat in standing cured hay for the 1974-75 have been completed. Paraquat residues from hays treated with 0.5 lb Paraquat/ac in 1974 ranged from 16 to 21 ppm at 131 and 159 days after treatment. The acceptable safe level of Paraquat in grazed forages is not known at this time. We would like to see it as low as possible. Should a rate of 0.2 lb Paraquat be proven suitable, a significant reduction of Paraquat residue in forage should occur. Also, the residue level in forage may not be as critical for animals that are not being fed for market as long as the residues are not transmitted to the fetus and accumulated therein.

IMPLICATIONS

Over 50% of the native hay produced in the Great Basin area is used for wintering the beef cow. The results so far indicate that cows can be wintered satisfactorly grazing hay cured with Paraquat. The potential exists, therefore, to reduce the annual cash outlay for haying costs in the region by about 25%. In Harney County alone, a small unit of this large area, the use of Paraquat on a portion of its 211,000 acres of meadow could effect a savings of over $1 million annually.

Money, of course, is not everything. Paraquat is a toxic chemical. If taken orally, it can cause death. The Environmental Protection Agency has tentatively classified Paraquat as one of the restricted use chemicals. Its final fate for agricultural use is yet to be determined. However, the toxicity of Paraquat is only one of the hazards a rancher might face. Ranching and farming by conventional means also risks life and limb. On western ranches the activities associated with harvesting and feeding the hay to animals constitutes a large percentage of the total ranch equipment operation time. Mowers, swathers, balers, and farmhand equipment by necessity require, open, moving parts. As such they contribute heavily to deaths and accidents. Chemical curing would reduce the operation time of these kinds of equipment and should reduce significantly the overall safety problem on ranch operations.

The U.S. is currently facing an energy crises and is striving to become independent of foreign based energy supplies. Conventional haying mehtods require from 3 to 4 separate operations over the same field, each requiring considerable draft power. Paraquat curing is accomplished with a single operation which requires very little draft power. Thus chemical curing can effectively reduce energy needs on the ranch.

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