# Daily Versus Every-Third-Day Versus Weekly Feeding of Cottonseed Cake To Beef Steers On Winter Range<sup>1</sup>

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Stockmen who feed protein range supplements to beef cattle in winter have diverse opinions about the relative merits of daily and every-other-day feeding. This is because little experimental work has been done on length of feeding interval. And yet, high wintering costs and low winter gains seriously affect economic production of range livestock.

Development of a management system to lower wintering costs in the Southern Great Plains also promises to benefit range forage production. Stockmen could afford to graze their ranges less heavily during the physiologically critical summer months if production efficiency could be increased during winter.

The present study was conducted to determine winter, and subsequent summer, gain responses of beef steers to various intervals of protein supplement feeding on winter range. Smith *et al.*, (1950) reported lower winter gains from every-other-day than from daily feeding, when cattle were fed equal protein supplements. Other investigators, Melton (1960), Melton *et al.*, (1960), and Rowden *et al.*, (1960) found little or no difference in gains of range cattle fed winter protein supplements daily, thrice weekly, twice weekly, or weekly.

## Procedure

Intervals for feeding protein supplements to weaner calves on winter range were compared for a 4-year period beginning November 1956 on the Southern Plains Experimental Range in northwestern Oklahoma. Annual precipitation on the experimental range is 23 inches; annual variation is from 10 to 43 inches. The range in absolute temperatures has been -27° to 113°F. Predominant soil type of the rolling dunes is Pratt loamy sand. The vegetation consists of sand sagebrush with an understory of mixed sod-forming and bunch grasses. Crude protein in the 10 most abundant grasses averages 3.7 percent in winter.

A randomized block experimental design with one replication in 1956-57, two in 1957-58, and four in each of the last two years was used. Treatments studied for 4 years were daily feeding versus every-third-day feeding. A third treatment, weekly feeding, was added during the last 2 years (Table 1).

A uniform group of commercial steer calves was obtained each October from the same herd of grade Hereford cows. All calves were weighed individually for 2 consecutive days at beginning and end of each grazing season and on single days at end of each month. Calves were allotted to treatments at random within weight classes on the basis of average individual weight, and then a few non-random adjustments were made to minimize feeder-conformation grade and fleshing-condition score differences between lots.

Average initial weight of the steers varied yearly from 470 to 502 pounds. The average winter grazing season started November 3 and ended April 26. The summer season ended October 4. Stocking rates varied yearly from 7.1 to 8.9 acres per steer. Steer lots were rotated among pastures at 2-week intervals throughout the year to minimize pasture variables.

Salt was fed free choice and no roughages were given during the 4-year trial except during one 16-inch snow storm. The range supplement was 41 percent pro-

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Table 1. Data relating to conduct of feeding interval studies with Hereford steers.

	No. of replica- tions	Steers per treatment			Supplement per steer per feeding			
Grazing year		Daily	Every- third-day	Weekly	Daily	Every- third-day	Weekly	
	-		– (number)	)		– (pounds) –		
1956-57	1	6	6		1.5	4.5		
1957-58	2	14	14		1.3	3.9		
1958-59	4	36	36	36	1.0	3.0	7.0	
1959-60	4	40	40	40	1.5	4.5	10.5	

tein cottonseed pellets. All feeding was done in troughs. The daily rate of feeding was 1.5, 1.3, 1.0, and 1.5 pounds per steer for the winters of 1956-57 through 1959-60, respectively. Total quantity fed per steer for the same respective winters was 246, 206, 158, and 252 pounds (Table 1).

Regardless of feeding interval, each steer lot received an equal quantity of the protein feed each week. Feeding started in mid-November and ended in late April. All lots were fed daily during a 2-week training period, and then the feeding interval was gradually increased. Lots fed every third day were usually on schedule by December 1 and weekly-fed lots by December 25.

## Results

Steers fed every third day made essentially the same winter and summer gains as did steers fed daily. During the last 2 years of the study a slight downward trend in winter gains occurred as length of feeding interval increased (Table 2). The small differences were not statistically significant. The 2-year average summer gain of 76 steers fed weekly in winter was 6 pounds greater than that of steers fed daily, but this difference was not significant. Average yearlong gains of cattle fed daily and every third day were coincidentally the same over 4 years, 352 pounds.

A feeding-interval study conducted with sheep in Australia showed lower gains due to feeding the entire ration at weekly rather than daily intervals (Bull *et al.*, 1951). In this instance, nutrition was below maintenance level, weather was cold and wet, and the week's ration was consumed in 3 to 3.5 days.

Conversely, another Australian study showed a material advantage of weekly feeding over daily feeding (Franklin and Sutton, 1952). A drouth ration was fed to sheep for 344 days. Death losses were 30.2 percent in lots fed daily and 11.8 percent in those fed weekly. Wool production and fiber length were greater in lots fed weekly. The weekly-fed lots consumed their ration in 4 to 5 days.

Briggs *et al.*, (1957) found that body weight of adult Merino ewes increased more with daily than with weekly feeding. In this instance, a near-maintenance ration of oat grain was fed for 223 days. In the same study, no significant differences were found in body weights, survival rates, or wool production of groups fed daily or weekly when levels of feeding were only 75 and 50 percent of the near-maintenance level.

The feeding intervals used in

Table 2	2.	Average	seasonal	gains of	Herefor	d steers	fed eq	ual	weekly	quan-
titie	s c	of protein	supplem	ents at	three fee	eding in	tervals	on	winter	range.

Season	Av. gair	n per steer <sup>a</sup>	Standard deviation of seasonal gain				
and		Every-			Every-		
year	Daily	third-day	Weekly	Daily	third-day	Weekly	
			(pound	ds)			
Winter:							
1956-57	84	86	·····	32	18	••••	
1957-58	58	58		21	26		
Average	71	72		26	22		
1958-59	44	39	32	30	30	23	
1959-60	54	48	44	25	23	24	
	<u> </u>	·				_	
Average	49	44	38	28	26	24	
4-vr. av.	60	58		27	24		
Summer:							
1957	263	274		19	24		
1958	311	311		23	32		
Average	287	292		21	28		
1959	290	291	296	34	47	36	
1960	305	302	311	30	33	41	
Avorago	208		304		40		
A wr ow	200	204	501	04 96	24	50	
Vearland.	494	234		20	94		
1056-57	347	360		46	40		
1057-58	360	360		-10 90	40	· · ·	
1997-90		309		20	47		
Average	358	364		37	44		
1958-59	334	330	328	41	56	42	
1959-60	359	350	355	31	34	45	
2000 00							
Average	348	340	342	36	45	44	
4-vr. av	352	352	<b>U</b> 18	36	44		
	000				**		

<sup>a</sup>Treatment differences were not statistically significant at the 5-percent level in any season or year or group of seasons or years. Differences in winter gain between daily and weekly intervals approached significance. the Woodward study did not materially affect variability of individual steer gains. Standard deviations of winter gains were somewhat smaller for steers fed every third day than for those fed daily (Table 2). On the other hand, standard deviations for summer and yearlong gains were slightly larger for steers that had been fed every third day in winter. These differences were small and not statistically significant.

No instance of scours, constipation, or other digestive disturbance was noted in any steer throughout the 4-year study, and the cattle were closely observed for these and other abnormalities. These results are in agreement with those reported by Melton (1960) when 10.5 pounds of 41 percent protein cottonseed cake was fed at each feeding to 2-year-old heifers on a twiceweekly feeding regime. Lots fed daily and every third day in the Woodward studies ate their ration avidly and without pause. The lots fed weekly received 7 pounds per steer at each feeding in 1958-59 and 10.5 pounds per steer in 1959-60. On cold, rainless days they usually ate their ration on the day of feeding. On some rainy or warm days the lots did not eat all of their feed until the next day and in a few instances not until the third day.

These studies were conducted in pastures 50 to 118 acres in size and about one-half mile long. Thus, conditions for observing grazing behavior as related to feeding intervals were limited. The cattle fed daily were usually at the feed troughs at feeding time. Those fed every third day waited to be fed less frequently but they could usually be called to the feed trough. Steers fed weekly were seldom waiting to be fed; and occasionally during the training period or on warm days in late winter it was necessary to gather them. Melton *et al.*, (1960) and Rowden et al., (1960) found that cattle fed less frequently than daily ranged farther from the feed grounds and spent less time waiting to be fed.

#### Discussion

Two possible problems arise with feeding at extended intervals. The first relates to possible physiological injury caused by over-consumption of protein or by protein fasting. The second, gain responses in relation to economic factors, will be discussed in another paper.

Physiological responses other than gain were not included in this study. The literature on animal nutrition, however, forecasts some of the expected results. From National Research Council (1958): "When protein feeds are in liberal supply and low in cost, the listed requirements can be greatly exceeded without toxicity and without sacrificing performance of animals." Morrison (1956) reported that calves on a fattening ration should not ordinarily be fed more than 8 to 10 pounds of cottonseed meal per head daily, as they tend to grow rather than fatten.

Maynard (1947) stated that a liberal protein intake tends to cause a high level of "deposit protein" in the tissues and plasma, but that protein can be stored only in very limited amounts. He also stated: "The higher the level of previous nutrition (prior to a protein-fasting diet), the larger the reserve of protein and the longer the time to reach the minimum level. It may be reached in a week with a rat previously on a low-protein diet, whereas on a high-protein diet four weeks or longer may be required."

Another reason for the apparent success with beef cattle of extended feeding intervals using range supplements is the size and complexity of the rumen. A period of 4 to 7 days is usually required for all residues of a former feed to pass out of the digestive tract of cattle.

This experiment yielded no in-

formation applicable to extending the feeding intervals with range supplements under severe winter weather, extreme shortage of roughage, with ill or weak animals, or with classes of cattle other than weaner Hereford steers.

#### Summary

Cottonseed cake was fed at daily, every-third-day, and weekly intervals to weaner Hereford steers on winter range in northwestern Oklahoma. The study was conducted for 4 years, 1956-60. The ration per feeding was usually 1.5, 4.5, and 10.5 pounds per steer for daily, everythird-day, and weekly feeding, respectively. All lots of steers consumed the same weekly quantity of 41 percent protein cottonseed pellets regardless of feeding interval. The steers were then summered on grass with no supplement except salt.

Average winter gains were 49, 44, and 38 pounds per steer for daily, every-third-day, and weekly feeding, respectively. Average summer gains for the same respective treatments were 298, 296, and 304 pounds per steer. Yearlong gains were 348, 340, and 342 pounds, respectively. None of the differences was statistically significant. Standard deviations of steer gains in winter averaged 28, 26, and 24 pounds for daily, every-thirdday, and weekly feeding. Again, these differences were not statistically significant. No digestive disturbances were noted. Grazing behavior and some physiological aspects of extended feeding intervals were discussed.

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