Responses to selenium in a range beef herd

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Calves born of cows supplemented with selenium had significantly higher weaning weights.

Selenium has long been known to be toxic at high levels, but it was less than thirty years ago that it was shown to be an essential element also in livestock diets. In California, selenium deficiencies were first recognized in the northern part of the state. Early research showed that these deficiencies could be corrected by intramuscular injection of a selenium-vitamin E compound or by provision of additional selenium in the diet.

A broader survey of the state was undertaken in 1981-82, using blood levels of resident cattle to indicate selenium status. This survey identified deficient areas in a number of Central Valley counties. Blood selenium concentrations above 0.08 parts per million (ppm) are generally regarded as adequate, and less than 0.04 ppm as deficient. Several herds along the east side of Fresno and Tulare counties had readings well below the 0.04 ppm level. Clinical symptoms of deficiency (white muscle disease, retained placentas), however, had not been observed in cattle grazing native range in foothill areas of that part of the state.

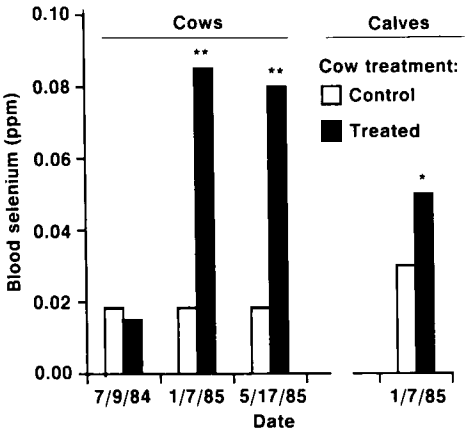
One of the herds sampled was on the Johnson ranch, in the lower foothills on the Tulare-Fresno county line. This is a well-managed herd with relatively high conception rates and weaning weights. In most aspects, it is typical of other cow-calf ranches in that area.

Because of the owners' interest in further improving economic returns from their cattle, we began a study in July 1984 to determine whether providing additional selenium would elevate blood content and improve productive performance. The method chosen was to place two pellets, or boluses, into the animal's reticulum. Each bolus weighed about 1 ounce and contained 10 percent selenium and 90 percent iron. Rumen action causes the boluses to rub together and release small amounts of selenium over an extended period.

The production characteristics measured were cow fertility and calf weaning weights. The breeds of cows used in the trial were Hereford, Angus, and Hereford-Angus cross.

1984-85 study

On July 9, 1984, we assigned 200 mature range cows, due to calve in the fall, to one of two treatment groups. The first served as untreated controls, and the second received the boluses. All cattle also received an injection of a parasiticide (ivermectin) at that time. Stratified within these two groups were the three breeds. A representative number of each breed was bled for selenium level determination at the beginning and subsequently on January 7 and May 17, 1985 (fig. 1).



**Significantly different at 1% probability level.
*Significantly different at 5% probability level.

Fig. 1. Blood selenium was significantly higher in treated cows and in their calves than in the untreated control group.

At birth, about 40 calves from each group were caught and given colored ear tags to indicate the treatment of their dams. No selenium was provided to any of the calves other than what they received from their dams or the forage they consumed. On January 7, 1985, the calves were processed, and blood samples taken. Significant differences in blood selenium levels resulted from dam treatment, but no breed effect was apparent. (Numbers [n] of animals represented in each of the treatment averages depicted in figure 1 are, left to right, 39, 40, 13, 17, 19, 21, 15, and 14. The corresponding standard errors [s.e.] of these averages are .007, .006, .007, and .006.)

On May 8, the heifer calves were sold, and those with ear tags were weighed by dam treatment group. The steer calves were sold and weighed on May 25. Since individual weights were not taken, statistical analyses of these results were not possible. Both heifer and steer calves from pelleted cows, however, were heavier than their counterparts from untreated cows (table 1).

TABLE 1. Effect of cow treatment on 1985 weaning weights of all calves

Calf sex	Calf weight: Dam treatment: Control	Calf weight: Dam treatment: Treated	Increase due to treatment
	lb		
F	510	518	8
M	565	612	47
Average	544	581	37
	n = 44	n = 36	

The treatment effect on cow fertility was estimated by pregnancy test and confirmed by calving dates of the 1985-86 calf crop. On May 17, 1985, all cows were palpated and fetal age was estimated. No differences due to treatment could be determined at that time. We observed a nonsignificant difference, however, upon examination of calving records. Calves from treated cows averaged 5.26 days older than those from control cows. Breed of cow or calf had no significant effect on any of the treatment responses.

1985-86 study

Because the first-year response to selenium treatment was greater than expected, we decided to continue and refine observations through 1985-1986. We used the same cows in each group again with no further treatment, since blood selenium levels of treated cows were still adequate on May 17.

At birth, 100 calves were identified by dam treatment, and 69 of these had their birth dates recorded on their ear tags. Thirty calves from each cow treatment group were injected with a selenium-vitamin E solution on January 28, 1986, and identified with a second ear tag. On May 1, all tagged calves were individually weighed and recorded. All data in tables 2 to 4 are based on actual weights; adjusting these weights for age differences did not affect the results.

TABLE 2. Effect of cow treatment on 1986 weaning weights of calves not receiving selenium injection

Calf sex	Calf weight: Dam treatment: Control	Calf weight: Dam treatment: Treated	Increase due to treatment
	lb		
F	500	540	40
M	504	554	50
Average	502	546	44*
	n = 21	n = 19	s.e. = 14.2

*Increase significant at 5% probability level. LSD .05 = 40.8 (when both sexes combined).

Fresno County Farm Advisor Aaron Nelson draws blood from a cow that received selenium boluses, which gradually released enough selenium to raise blood levels from deficient to adequate. Calves of treated cows also had elevated blood selenium levels.

TABLE 3. Effect of calf treatment on 1986 weaning weights of calves born to untreated cows

Calf sex	Calf weight		
	Calf treatment		Increase due to treatment
	Control	Treated	
	lb		
F	500	531	31
M	504	615	111**
Average	502	576	74**
	n = 21	n = 30	s.e. = 11.7

** Increase significant at 1% probability level. LSD .01 = 63.2 (within sex). LSD .01 = 44.3 (when both sexes combined).

TABLE 4. Combined effect of cow and calf treatments on 1986 weaning weights of calves born to treated cows

Calf sex	Calf weight		
	Calf treatment		Increase due to treatment
	Control	Treated	
	lb		
F	540	540	00
M	554	601	47
Average	546	569	25
	n = 19	n = 30	s.e. = 23

Conclusions

The response to selenium supplementation in the two-year study was remarkable, possibly larger than might be expected in other locations or at another time. Since both environmental conditions and management practices on the test ranch are typical of those on many others in the area, however, similar responses might be expected in other herds.

These studies did not show a direct benefit to mature cows from providing additional selenium. Cows receiving the two-bolus treatment had blood selenium raised from deficient to adequate levels, a condition that was maintained for at least 10 months. This elevation, however, did not measurably affect fertility during the subsequent pregnancy, or any observed trait such as body condition or health status.

It was the calves born of these supplemented cows that received this benefit, as demonstrated by their own elevated blood selenium and increased growth rate from birth to weaning. Calves receiving extra selenium only from their mothers had weaning weights significantly greater than those of their counterparts from untreated cows. This effect was observed in both years, demonstrating the long-term effect of the bolus treatment.

Injecting calves at processing time (two to three months of age) provided an even greater boost in growth rate, irrespective of the prior treatment of the dam. These responses were consistent in both sexes of all breeds. Steer calves, however, responded to a greater degree than did their heifer mates. We do not know the reasons for this apparent sex-related interaction.

Although economic comparisons are not presented, treatment costs were relatively low in light of the growth response that resulted. Under the conditions of this study, supplemental selenium supplied either through the cow (bolus) or directly to the calf (injection), provided a significant economic return.

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