Livestock Efficiency

STRATEGIC SUPPLEMENTATION: NMSU SMALL SUPPLEMENT

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THE STORY IN BRIEF: Supplementation costs include not only the costs of the feed but also the expenses associated with transportation, storage and pasture delivery. A biologically potent effective supplement that can be fed in small amounts could be advantageous by decreasing associated costs. Self fed supplements have an advantage in that they can be delivered to the pasture in longer time intervals. There should be cost savings due to fewer trips to deliver supplement and reduce feed costs since the supplement is more efficient and with lower daily consumption by cows.

THE PROBLEM: Costs related to supplementation is one of the few variable costs that can be managed. Results of the New Mexico "SPA" analysis shows that one of the characteristics of the top 25% most profitable participating ranches is that they have lower purchased feed costs. A low cost self fed supplement may provide another alternative for New Mexico ranches to reduce feed cost while maintaining production goals.

OBJECTIVES:

The objective of this study was to field validate previous findings by evaluating the efficacy of a small size, self-fed protein supplement for maintaining body weight and body condition score (**BCS**) of gestating cows grazing dormant rangeland forage.

EXPECTED OUTCOMES:

Our previous work suggested that the NMSU Small Supplement could replace 1 lb of a 36% crude protein supplement fed every other day while maintaining cow body condition score and body weight.

DURATION: Spring 1997 to November 2006

APPROACH: This study was conducted over a four -year period at New Mexico State University's Corona Range and Livestock Research Center.. Rangeland at his site is characterized as a pinon-juniper woodland, with a moderate to dense overstory of one-seed juniper (*Juniperus monosperma*) and pinon pine (*Pinus edulus*). Herbaceous vegetation is predominately blue grama (*Bouteloua gracilis*) with minor components of wolftail (*Lycurus phleoides*), sideoats grama (*Bouteloua curtipendula*), threeawn (*Aristida spp.*), sand dropseed (*Sporobulus cryptandrus*), and black grama (*Bouteloua eriopoda*).
Each year, gestating Angus and Angus-cross cows ranging from 2.5 to 8.5 years old were utilized in this study. Cows were stratified by breed and weight at weaning and randomly

assigned to one of six replications or sub-herds, such that sub-herds contained the same proportion of Angus and crossbred cows. Each sub-herd was then randomly assigned to one of six pastures containing at least 260 ha. Treatments were then randomly assigned to each pasture, resulting in 2 sub-herd replications/treatment within each of the three years.

Treatments were supplementation strategies designed to be reflective of commonly applied practices, rather than as fixed protocols. Reflecting this approach, and due to variation in annual forage conditions and grazing constraints, the duration of the supplementation period varied by yr. In yr 1, supplements were fed for 27 d; in yr 2, 62 d, and in yr 3, 93 d. In all yrs, strategies were designed so that supplementation ended 2 wks prior to the expected initiation of parturition in the herd based on breeding season dates. Under management conditions in this study, the prepartum supplementation period ended the first wk in February each year.

A positive control strategy (**CON**) was developed based on a hand-fed, 36% CP pellet. Under this strategy, supplement was delivered to cows 3 times weekly. This strategy reflects common practice when prepartum supplementation is applied in this region. The CON supplement was composed of 57 % cottonseed meal, 10% soybean meal, 1.2 % urea meal, 21% wheat middlings, 9% molasses and was fortified with trace minerals and Vitamin A. The CON supplement was priced at $318/ton. Consistent with the annual variation in forage conditions, the feeding rate for CON varied by year. When prorated to a per day feeding rate, CON was supplied at 2.1 lb/d (Year 1), 1.7lb/d (Year 2), or 1 lb/d (Year 3) and 1 lb (year4). Cows receiving CON had ad libitum access to a salt-mineral supplement.

A negative control strategy was also developed. This strategy allowed for brief and intermittent supplementation due to periods of environmental stress, such as snow cover, and is best described as variable supplementation (**VAR**). This strategy relied on managerial discretion to supply feed when required, but with the directive to minimize usage of supplemental feed. The VAR strategy utilized the same supplement formulation at the same cost as CON, and when supplied, was always fed twice weekly, prorated to 1 lb g/d. Cows receiving VAR were fed for the equivalent of 9.5 d in yr 1, 8 d in yr 2, and 0 d in yr 3 and 4. The very low amount of supplement input with this strategy allows it to be considered a negative control. Cows receiving VAR had ad libitum access to a salt-mineral supplement.

To meet experimental objectives, a strategy utilizing a small package size, self-fed supplement (**SMP**) was developed based on previous findings. This supplement was formulated to contain in 2003, 2004 and 2005 40% CP and was composed of 25% feather meal, 25% blood meal, 27% minerals, 19% salt and 4% distillers dried grains whereas in 2006 it was 28% Cp and was composed of 50% corn gluten meal with the other ingredients the same as the previous years. . The mineral portion of the SMP supplement was designed to provide the same level of mineral intake as the ad libitum supplement supplied to cows receiving CON and VAR treatments. The SMP supplement was priced at $525/ton). Target intake rate of this supplement was 200 g/d. Cows actually consumed 0.2 lb/d of supplement in yr 1, 172 g/d in yr 2, and 249 g/d in yr 3. The mean intake across years for SMP (weighted by duration of supplementation period) was 230 g/d. For clarity, feeding rate, duration of supplemental feeding periods, and total consumption are shown for each supplementation strategy by year in Table 1.

Cows were weighed and body condition scores (BCS) were assigned on a 1-9 scale (1 = emaciated, 9 = obese) at weaning (October) of each year, at the initiation of the supplementation period (January, December, and November for years 1, 2 and 3, respectively), and at termination of the supplementation period (February). Feed deliveries were recorded and feed remaining (SMP) was recorded for each strategy to validate consumption rates.

Response data were analyzed as a completely randomized design with a 3 X 3 factorial treatment arrangement using General Linear Models procedures of SAS v.9 (SAS Institute, Cary, NC, USA). Year and supplementation strategy served as factors in the model. Treatments were applied per pasture, and therefore pasture was used as the experimental unit for all responses. Responses are expressed on a per cow basis for clarity. When model effects were significant ($P < 0.10$), means were separated using Fisher's Least Significant Difference.

Table 1. Feeding rate, duration of the supplementation period, and total amount of supplement fed to cows receiving different supplemental feeds during three years.

Item	**CON**	**SMP**	**VAR**
Year 1			
Rate, lb/d	2.1	0.6	1.0
Duration, d	27	27	9.5
Total fed, lb	57	17	9
Year 2			
Rate, lb/d	1.7	0.4	1.0
Duration, d	62	62	8
Total fed, lb	102	24	8
Year 3			
Rate, lb/d	1	.59	0
Duration, d	93	93	0
Total fed, lb	92	51	0

RESULTS: Year had significant impacts on measured responses (Table 2). Yearly differences in BW recovery from weaning to initiation of supplementation justify the variation in annual strategies. In years 1 and 2, cows gained weight from weaning until the initiation of supplementation, indicating that supplemental nutrients were not required during that time. In year 3, cows apparently lost weight from weaning to the initiation of supplementation, justifying the earlier intervention and longer duration of supplemental treatments during that year. Additionally, when pooled across supplementation strategies, cows either maintained (years 1 and 3) or lost BW (year 2) during the supplementation period. This indicates that cow nutrient requirements were not being met by forage alone, and again, that the timing of intervention was appropriate within each year. Differences in BW at the beginning of supplementation (initial BW) among years are reflected in cow body condition score at the beginning of the supplementation period.

Table 3 depicts the effects of different supplementation strategies on cow responses across years. Cows assigned to different strategies had similar BW at weaning ($P = 0.98$), and gained weight from weaning until the beginning of supplementation, so that BW at the initiation of supplementation was also similar among treatments ($P = 0.78$).

Supplementation strategy influenced weight change during the supplementation period whether expressed as absolute weight change (P = 0.06) or as a percentage of initial BW (P = 0.09). Cows receiving CON or SMP exhibited similar BW changes, neither of which were different from zero, essentially reflecting BW maintenance. Cows receiving VAR lost BW during the supplementation period. These results indicate that nutrient limitations existed during this period, and that these deficiencies were corrected by provision of either CON or SMP. Weight changes are reflected in BCS changes. Supplements affected BCS change (P = 0.10), with cows receiving CON or SMP exhibiting minimal BCS reduction during the supplementation period, while cows receiving VAR lost condition.

Table 2. Year effects on measures of cow body weight and condition score.

Item	**Yr 1**	**Yr 2**	**Yr 3**	**SE[a]**	**P**
Body Weight Responses					
Wean BW, lb[b]	972^{e}	1069^{f}	1192^{g}	34	<0.01
Initial BW, lb[c]	1042^{h}	1260^{i}	1166^{j}	28	<0.01
Final BW, lb	1038^{h}	1227^{i}	1179^{i}	28	<0.01
Change[d], lb	-4^{h}	-33^{i}	13^{h}	8	0.01
Change, %	-0.4^{e}	-2.5^{f}	1.4^{e}	0.8	0.02
Body Condition Responses					
Initial BCS	4.4^{h}	5.4^{i}	5.0^{j}	0.1	<0.01
Final BCS	4.3^{h}	5.4^{i}	4.7^{j}	0.1	<0.01
BCS change	-0.2^{e}	0.0^{f,h}	-0.4^{g,i}	0.1	0.01

[a]n = 6
[b]Cow weight at weaning in October
[c]Cow weight at initiation of supplementation period
[d]Cow weight change (Final – Initial)
[e,f,g] Means differ, <0.10
[h,i,j] Means differ, P <0.05

Table 3. Body weight and body condition responses of gestating cows to different supplementation strategies.

Item	CON	SMP	VAR	SE[a]	P
Body Weight Responses					
Wean BW, lb[b]	1073	1082	1078	37	0.98
Initial BW, lb[c]	1148	1146	1174	31	0.78
Final BW, lb	1148	1150	1146	31	0.99
Change[d], lb	-0.6[e]	4[e]	-28[f]	9	0.06
Change, %	0.1[e]	0.5[e]	-2.2[f]	0.8	0.09
Body Condition Responses					
Initial BCS	5.0	4.9	5.0	0.1	0.49
Final BCS	4.9[e]	4.9[e]	4.6[f]	0.1	0.12
BCS change	-0.1[e]	-0.1[e]	-0.4[f]	0.1	0.10
Total Feed Consumed, lb	84	30	6	--	--

[a]n = 6
[b]Cow weight at weaning in October
[c]Cow weight at initiation of supplementation period
[d]Cow weight change (Final – Initial)
[e,f,g] Means differ, <0.10

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POTENTIAL APPLICATION: Increased utilization efficiency resulted in decreased feed costs of maintenance for cows fed SMP relative to CON despite higher per unit feed costs for SMP. Applying the unit feed costs for CON, SMP and VAR to the total consumption pooled across years results in per cow costs of $10.08, $4.70, or $0.60/cow, respectively. Because cows receiving VAR failed to maintain BW, SMP was the most economical strategy for BW maintenance in this study. This cost comparison does not include additional charges for labor and equipment that might be associated with any of the feeding strategies employed.

9. **EDUCATIONAL PLAN:** To make this information available through the NMSU extension service. In addition we hope local New Mexico feed companies will pick up this new formulation.

REFERENCES: J.E. Sawyer, R.C. Waterman, and M.K. Petersen. 2005. Small quantities of supplemental undegradable intake protein are efficiently used with low quality forage diets. Submitted August 2005. Feed Sci. Tech.