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STRATEGIC LOW COST SUPPLEMENTATION

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ABSTRACT: A number of forces influence nutritional management decisions of western rangeland ranchers. These forces include resource condition, cowherd condition, production goals achievement, labor cost, when to supplement, what to supplement, how much to supplement and the marginal returns to supplemental feed investment. Our range nutrition program has a research goal to develop a nutritional management program that includes desirable flexibility, biological results, financial benefits, and practical implementation considerations. We have progressed in achieving this goal by a series of collaborative research and extension efforts. We have tried to incorporate the results of the last forty-five years of range nutrition research at New Mexico State University into a well thought-out strategy. The foundation of this plan first focuses on range management and the continued improvement of range health while providing cows with all they can eat every day. Next, we ask ourselves if the color of the vegetation is green or brown. If it is brown, then we know that a protein supplement will most likely improve digestibility and intake. Third, the expected nutrient intake is compared with predicted cow nutrient requirements. If nutrient intake is unacceptable and productivity will be negatively, influenced then supplementation options are explored. Minerals and vitamins should be continually available to diminish the potential of productivity impacts due to deficiencies. The mineral and vitamin program should be implemented yearlong. If protein supplementation is needed, then one of five supplements can be fed based on a number of criteria. The five supplements are fed at different rates; minute (58 g per day-self fed), minimum (250 g per day - self fed or 1.5 kg 1 day per week), moderate (454 g per day - fed 2 to 3 times per week), maximum (908 g per day - fed 2 to 3 times per week) and supermax (908 g per day-fed 2 to 3 times per week). Minimum number of days protein supplement is fed is 80 days per year. The number of days can change depending upon forage, climatic, and animal conditions. This program will allow for a 90% plus fall pregnancy rate within a 60 day or less breeding season with total feed cost of less than $30 per cow per year. The purpose of this program is to provide strategic supplementation guidelines that will enhance cow nutrient status. This is accomplished cow needs in a timely manner. Overall, the program is designed to be efficient, satisfy cow nutrient needs and achieve production goals while minimizing purchased feed costs.

Key Words: range beef cows, supplementation, management

Introduction

One of the obstacles facing range cow/calf producers striving for profitable low cost production is developing nutritional management flexibility. A management scheme that is dynamic - that can change as years - change has the potential to reduce spending when appropriate and strategically enhance nutritional intervention when needed. Low cost producers are aware of the ease at which over, under, or incorrect feeding can occur. In any of these cases, the provision of supplemental nutrients may not provide any positive production response. Guidelines for nutritional managers to aid in supplemental feeding decisions oriented towards low cost production have been elusive. Included in such a guide should be the digestive or metabolic goal for each particular supplement. The supplements available to low cost producers require a minimum level of palatability, while providing biologically potent formulations that target those discrete nutrients that limit cow productivity. Lastly, supplements require low labor and ease of delivery while being easy to handle, transport, and store.

Dr. Joe Wallace provided the foundation for our strategic nutritional management plan. In 1993 in a paper entitled “What we have learned”, Dr. Wallace summarized the major findings of his research career at New Mexico State University. An important assumption of his research program was to insure that management of the range always allowed for adequate forage daily for every cow in the herd. He showed that high protein supplements (CP > 30%) would improve intake, digestibility and reduce weight loss equal to a larger amount of supplement fed providing an equal amount of total protein but at lower percentage (CP $\leq$ 20%). The provision of grain (low protein, CP < 15%) as a supplement will substitute for grazed forage with little if any improvement in animal production. Most likely 2.3 kg or more of a high grain-low protein supplement needs to be fed per day if a manager is attempting to improve body condition above what the native vegetation can provide. Another important finding was that supplementation 2 times (or once) per week was as effective as daily (while supplying the same quantity of protein) This work illustrated the importance of providing limiting nutrients in

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a concentrated form and the benefits of reducing the inputs required to deliver supplements.

Supplementation used effectively can be profit generating. Supplements can enhance health, alter milk production, improve reproduction, and maintain body condition. However, supplementation is also a cost. The cost is not only composed of the feed itself but also the associated costs of delivery to the pasture, storage, transport from a production site, and other logistic processes. Every year is different so that calls for a different supplementation regime when supplied strategically. The long-term objectives have been to develop a practical, low cost, effective, simple strategy for supplementing the cowherd at the Corona Range and Livestock Research Center with the potential of application to other ranches in the West.

Discussion

Approach. The overall program goal has been to develop a nutritional management plan that provides for at least a 90% pregnancy rate, with 80% of the cows calving in the first 30 days of the breeding season while spending no more than $30 per cow per year in 3 out of 5 years. In New Mexico, cows graze dormant brown-colored vegetation for 9 months of each year. The lack of green color is indicative that diet consumed is of low nutritional quality. Dormant native vegetation contains a high concentration of slowly digestible fiber; low concentrations of highly digestible cell solubles and contains less than 7% CP (probably 5% CP or less). This class of forage is usually less than 50% digestible.

When cattle consume a low protein diet as described above, digestibility, intake and productivity are negatively impacted. Usually this negative effect occurs when forage crude protein content is less than 7%. Protein supplements that supply approximately 0.3 lb of ruminally degradable crude protein per day (0.45 kg of a 40% CP supplement) will usually improve digestibility and intake. Intake may improve from 5% up to 40% (on rare occasions) and digestibility will increase 2 to 5 percentage units. If a cow is consuming 9.1 kg of forage per day (50% digestible or 50% TDN) and she consumes 0.45 kg of a 40% crude protein supplement (70% TDN), we might expect a 5% (0.45 kg) increase in grazed forage intake. Both protein nutrition and energy nutrition are improved when protein supplements are fed to cattle grazing dormant range forage. There are many sources of protein available; these include non-protein nitrogen (NPN) such as urea, and natural protein sources such as oil seed meals (soybean, cottonseed, sunflower meals) and byproduct feeds (brewers dried grains, distillers dried grains, corn gluten meal, blood meal, feather meal, fish meal, etc.). Singular or combination additions of these sources in protein supplements have been shown to improve forage intake in many situations when forage protein was low

Strategic low cost supplementation. For strategic supplementation to be successful cows must first use available forage energy and mobilized body fat depots to supply metabolizable energy needs. Supplements are used only to complement metabolizable energy. Secondly, mineral intake limiting animal performance is balanced with a yearlong self-fed loose salt and mineral mix available at all times. Mineral intake is continually monitored and it is assumed that after implementation no mineral deficiencies exist. The third component of the management plan is the implementation of protein supplementation. We have developed “Five Strategies” that make up protein management depending upon magnitude of nutritional stress, physiological state and production goals. By using combinations of protein sources described previously, five defined high protein supplements (36% crude protein and greater) have been put into practice. They are:

Minute – 58 g supplement (80% CP) mixed with mineral (self-fed)

Mini – 250 g supplement (36% CP) per day (fed 1 day per week)

Moderate – 450 g supplement (36% CP) per day (fed daily to 2 times per week)

Max – 908 g supplement (36% CP) per day (fed 2 times per week)

Super Max – 908 g supplement (36% CP) per day (fed 2 times per week)

Minute is a self fed supplement in the form of a meal that is composed of 50% mineral mix and 50% protein sources which contain approximately 70% ruminally undegradable protein. The complete supplement is consumed at a rate of at least 120 g per day. Self-feeders are refilled once each week. It is effective when cows need a small amount of supplement to optimize the environment in the rumen. This supplement has been shown to be effective after weaning in the fall when nutritional stress is mild and body condition is moderate. The protein is used very efficiently. In a 3-year field trial this minute supplement was equivalent (in the reduction of body weight loss) to 450 g per day of a cottonseed/wheat middlings supplement (36% CP) fed 3 times per week (Table 1, Sawyer et a.,. 2005, Sawyer et al., 2000, Sawyer et al., 1998 and Stalker et al., 2002). The daily cow cost of this supplement may range from 25 to 50% of the Moderate supplement.

Mini provides twice the CP that Minute supplement provides; however, this supplement contains only 35 to 40% ruminally undegradable protein. This supplement is preferably fed as cubes (or block) hand fed to range cattle. Since the daily feeding rate is low at 250 g per day, this does not provide enough supplement to be fed to a group of cows at one time. Cibils (personnel communication, 2006) has measured cube consumption rates in two and 3 year old cows and found that it varies by a magnitude of 10 - fold. To minimize over and under consumption by individual cows the recommendation is to feed this supplement one time per week at a rate of 1,600 g per cow to provide enough supplement to create opportunities for all cows to consume supplement. This strategy is best employed for cows or heifers when nutritional stress is low, as found in the fall after weaning and before consistent winter, weather sets in. In the fall of 2004 and 2005, replacement heifers (7 to 10 month old) developed at the Corona Range and Livestock Research Center were fed Mini supplement from November until February and gained from 45 to 270 g per day. The daily

cow cost of this supplement will be 50% of the Moderate supplement.

Moderate is a traditional formulation using oil seed meals and contains less than 40% ruminally undegradable protein. This supplement is most appropriate when cows are experiencing increased nutritional stress from either of two sources: pregnancy or winter stress. This supplement can be fed 2 times per week or more frequently, either as cubes or blocks. Prior to calving this supplement will reduce weight loss by 50% compared to non supplemented cows (Miner et al., 1990) and can add one-quarter to half of a body condition score when non-supplemented cows maintain body condition during the winter. (Figure 1). We consider this supplement our standard or traditional formulation that we compare to all other supplements. The daily cost of this supplement will range from $0.10 to $0.15 per cow per day.

Max is formulated to reduce body condition losses associated with serious nutritional stress. (Miner et al., 1990, Huntington and Richards, 2005). The Max supplement is most effective during severe winter weather events during pregnancy and after parturition when intake is inadequate and body weight loss is rapid. This supplement is programmed to be fed at a rate of 450 to 910 g per day and can be fed as infrequently as two times per week as either cubes or blocks. The protein in this supplement is composed of 50% ruminally undegradable protein (RUP). It is suggested that the increased fraction of RUP compared to the moderate reduces protein tissue catabolism as the supplementary RUP is utilized most likely for gluconeogenesis (Reynolds 2005). We can generalize that supplements with this type of formulation may decrease body protein tissue catabolism and supply limiting glucose precursors in the form of glucogenic amino acids for the pre-partum range cow (Van Saun et.al., 1993, Miner et al., 1990). Fed to the post-partum range cow this supplement has been shown to decrease milk fat, decrease days to first estrus after parturition and increase pregnancy rate depending on basal diet quality. (Hunter et al., 1989, Wiley et. al., 1990, Triplett et al., 1993, Appeddu et al., 1996 and 1997, Knox et al., 1998, Waterman et al., 2006). This supplement has also been effectively fed to developing replacement heifers in a four-year field study. It was shown to improve pregnancy rate 14% (66 versus 80%, $P<0.05$) over heifers fed the moderate supplement and reduced pregnant heifer development costs ($124.67) compared to feedlot ($163.25) raised heifers (Hawkins et al., 2005).

Super Max formulation contains the same ingredients as the Max supplement with the addition of 80 g per day propionate salt. Our research has shown that this supplement will improve insulin sensitivity, decrease milk yield and fat while decreasing days to first estrus (Waterman et al., 2006 and Endecott et al., 2005). Even though the propionate salt adds considerable cost per ton of feed it can decrease the number of days a cow requires to get pregnant. This improvement in days to first estrus has been calculated to pay for the additional cost of the propionate salt and improve total return per cow (Endecott et al., 2005; Table 2.

Implementation at Corona Range and Livestock Research Center. The strategic supplementation concept is currently implemented with the Corona Range and Livestock Research Center cowherd. As a part of the supplementation strategy all cows have;

- Loose salt and mineral available year long targeted at 58 g consumption per cow per day (Cost $0.022 per day or $8.03 per year)
- Super Max supplement fed for a minimum of 60 days postpartum fed at a rate of 908 g per cow per day (Cost $0.35 per day or $21.00 per year)
- Minute supplement fed for 30 days prior to parturition (Cost $0.057 per day or $1.73 per year)
- Minimum total purchased feed cost per cow per year $30.75 ($8.03 + $21.00 + 1.73)

Due to changes in rainfall and vegetation production, purchased feed costs vary from year to year (ranging from less than $30 to nearly $50 per cow per year). According to our IRM-SPA analysis (26 May 2005) we achieved a 91% weaning percentage of cows exposed to bulls with 86% of our calves born in 42 days. In comparison to our contemporary ranches in the IRM-SPA analysis, we are in the top quartile for net return per cow.

There are two important underpinnings to an effective strategic supplementation program. The first is that a cow must have the ability to consume all of the forage required every day and secondly there needs to be continual assessment of forage and cow conditions to implement the most effective and lowest cost nutritional intervention to achieve production goals.

Implications

We have attempted to organize various supplement designs into a single nutritional management plan creating flexibility, a measure of control over costs, and impact. Supplying range cows with biologically potent, discrete supplements provided in a manner to reduce delivery and other associated expenses has implications towards reducing variable costs of running a cowherd while achieving production goals.

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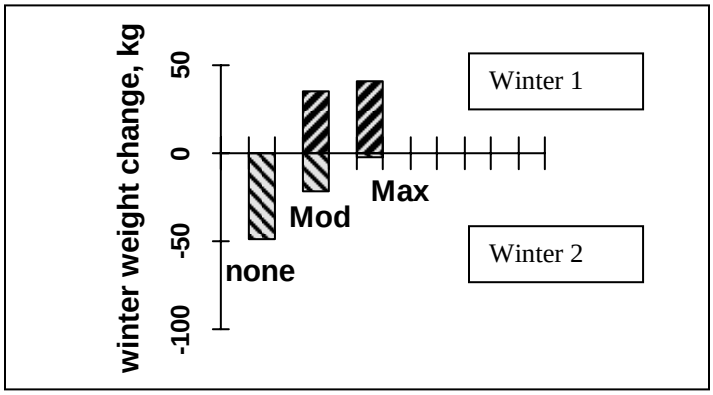

Figure 1. When pregnant range cows cattle lost weight in winter 2 the Max supplementreduced (P<0.05) weight loss. (Miner et al. 1990) Mod=moderate and Max=Maximum

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

Item	Moderate	Minute	Control
Year 1			
Late, g/d	953	281	454
Duration, d	27	27	9.5
Total fed, kg	25.7	7.6	4.3
Year 2			
Rate, g/d	757	172	454
Duration, d	62	62	8
Total fed, kg	46.9	10.7	3.6
Year 3			
Rate, g/d	454	249	0
Duration, d	93	93	0
Total fed, kg	42.2	23.1	0
Average			
Rate, g/d	721	200	454
Duration, d	60	60	8
Total fed, kg	38.2	13.8	2.6
Body wt change	-0.2	1.8	-12.6
BCS change	-0.1	-0.1	-0.4
Cost, $	10.08	5.30	0.68

Table 2. Economic comparison of 3 different postpartum supplements fed to young cows at Corona Range and Livestock Research Center 1995 to 2004.

Item	Moderate	Max	SuperMax
Supplement $/ton	230	245	345
Feed cost/cow	16.10	17.15	24.15
Calf age weaning	205	215	214
Calf weaning wt	451	473	471
Lb calf weaned/cow exposed	388	412	424
Calf $ at weaning	388	412	424
Income diff. $	--	24	36
Feed cost diff $	--	1.05	8.05
Net income diff $	--	22.95	27.95