



Managing Nutritional Challenges to Reproduction

Introduction

Nutritional challenges placed upon the lactating cow can be extreme in Arizona. One challenge placed upon the cow is the extra nutritional requirements caused by lactation. Figure 1 illustrates the weight loss which usually occurs in a lactating cow during the first 45 to 60 days of lactation. At the period of time at which the cow has lost the most weight, producers are trying to rebreed her in order to maintain a yearly calving interval. It is usually not possible to entirely prevent weight loss during early lactation with range cattle. A better strategy is to plan ahead to allow for weight loss by building or maintaining body fat stores before calving.

Another challenge with Arizona ranching operations is the reduction in forage quality with mature forage. Rainfall often occurs in a biannual pattern and forage quality before the monsoon rains and in late winter can be low. As forage matures, protein, total digestible nutrients (TDN), and phosphorus often decline below levels considered adequate. In addition, certain trace minerals may be deficient year round. It is a good practice to analyze dormant forage to determine protein, TDN, and phosphorus content. You can then match cowherd supplementation to the forage resource (Sprinkle, 1996a). It is also a good practice to analyze forage for trace mineral status over two or three years to establish baseline data for your ranch. Trace minerals in Arizona which may be of concern are selenium, copper, zinc, sulfur, and molybdenum.

There are several options one can take to help meet the nutritional challenges placed upon cows by lactation and the environment. Some of the most prominent strategies are listed below and shall be explained more fully:

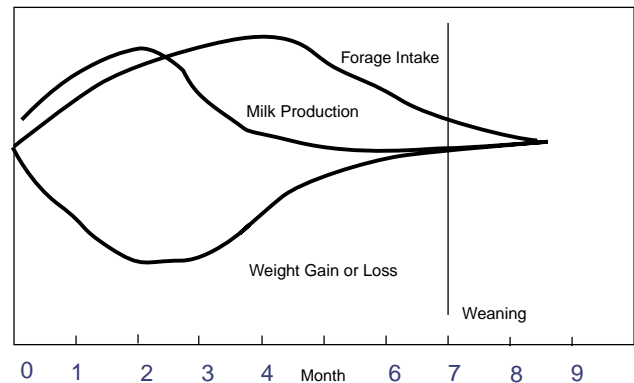
1. Create a “fat storage cushion” for lactating cows by maintaining body condition score (1 to 9, 9 = fattest; Richards et al., 1986) at 5 or greater before calving. As part of this strategy, utilize protein supplements for low quality forage to increase forage intake and digestibility.
2. If in spite of your best efforts, cattle are thin at breeding time, attempt to “flush” cattle with your best quality pasture and/or by supplementation. If combined with short term calf removal, flushing will be more effective.

3. Match calving season to the forage curve.
4. Genetically match the cow to the environment.

Option 1: Maintaining Body Condition Before Calving

As shown in Figure 1, it is an advantage to allow cattle to have fat reserves they can mobilize during early lactation. Research has shown that reproduction will suffer if cows are allowed to become too thin at calving, especially with younger cows. Table 1 illustrates the effects of different fat reserves with two-year-old cattle.

Milk Production, Forage Intake, and Body Weight Gain



After Coppock, 1985 (adjusted for beef animal)

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THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE
TUCSON, ARIZONA 85721

JIM SPRINKLE

Area Extension Agent, Animal Science

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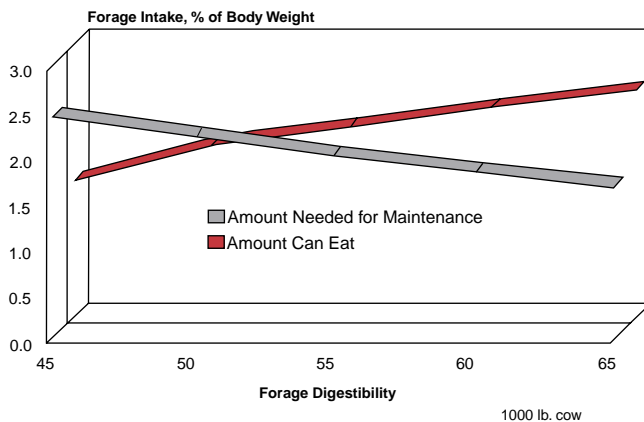
Table 1. Pregnancy % by Body Condition Score

Body Condition at Calving	Day 40 of Breeding Season	Day 60 of Breeding Season
4	43 + 5	56 + 5
5	65 + 4	80 + 4
6	90 + 9	96 + 8

Spitzer et al., May 1995, Journal of Animal Science

One problem faced in attempting to maintain body condition at 5 before calving is that during the last trimester of pregnancy forage quality can be quite low. As forage quality decreases, lignin and other more slowly digestible components of forage increase. The result of these changes in forage quality is that forage remains longer in the rumen before exit, reducing forage intake. Thus, the cow may be unable to eat enough forage to maintain body weight (Figure 2).

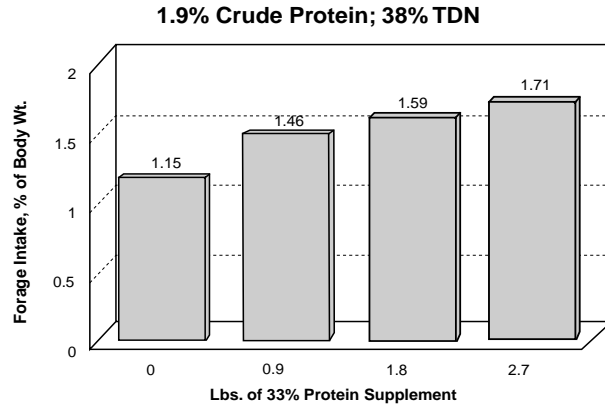
Figure 2. Forage Intake of a Nonlactating Range Cow



When forage contains less than 6.25% protein, protein supplementation can be effective. When additional protein is made available in the rumen, this increases the synthesis of new microorganisms in the rumen which are ultimately responsible for fiber digestion. This is illustrated in Figures 3 and 4 where forage intake and forage digestibility were increased by protein supplementation for cattle eating poor quality (2 % crude protein) prairie hay. For Arizona, data collected by Cooperative Extension workers has shown that the crude protein of blue grama native range during the winter months of December to February varied between 1.58 and 7.55%.

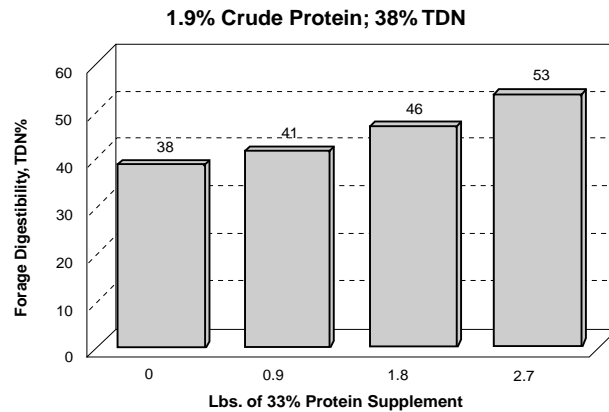
In the above scenario, nonlactating cattle fed 2.7 lbs. of protein supplement should maintain body weight

Figure 3. Forage Intake on Dormant Tallgrass Prairie Hay



Stafford et al., March 1996 Journal of Animal Science

Figure 4. Forage Digestibility on Dormant Tallgrass Prairie Hay



Stafford et al., March 1996 Journal of Animal Science

as the energy requirement for nonlactating cattle is around 52% TDN. Cattle fed less protein would probably lose weight; the greatest weight loss occurring with no protein supplement. Greater conception rates would be expected for the cattle fed 2.7 lbs. of protein supplement. If management will allow it, it is cost effective to separate thin cows from fat cows before calving and supplement protein to thin cows according to forage deficits. Research in West Texas (Huston et al., 1999) has indicated that protein supplements can be fed as infrequently as once a week without detrimental effect. If energy supplements are fed (e.g., corn, milo), they need to be fed daily.

Conception rate will be improved by keeping cattle in good body condition prior to calving. Forage intake and digestibility can usually be improved with late season dormant forage through the use of protein supplements. Cost effective supplementation can be integrated into prepartum nutritional management programs by analyzing forage for nutritional deficiencies and then supplementing accordingly.

Option 2: Flushing after Calving and Short Term Calf Removal

Table 2 shows the effect of flushing thin cattle with a high energy ration after calving. Cattle in this study (Richards et al., 1986) were fed different levels of energy after calving. Two of the groups were limit-fed a similar corn silage diet after calving to lose 1.00 to 1.50 lbs. of body weight per day. Two weeks before the breeding season started, one of these two groups was then flushed with 9 to 13 lbs. of corn and corn silage fed to appetite. The flushing ration was continued throughout the first 30 days of the breeding season. Both groups had calves removed from cows for 48 hours two days prior to the initiation of the breeding season. Flushing and calf removal had little effect upon cattle that were already in good condition at calving but increased conception markedly for thin cattle. Although it may be difficult to provide supplementation to cattle in extensive range operations, this principle can be applied by using excellent quality pastures after calving. For instance, if filaree was in abundance in a particular pasture, it could be used to help flush cattle before breeding.

Another tool that can be used in combination with flushing is short term calf removal (Smith et al., 1979; Richards et al., 1986). If cattle are being worked for spring branding, calves could be separated from cows

Table 2. Body Condition and Feeding Level (Pregnant 1 breeding)

Feeding Level ¹	Body Condition Score at Calving	
	4 or less	5 or greater
Low + Flushing	75%	70%
Low	54%	70%

Richards, et al., Feb. 1986, Journal of Animal Science

¹ The low energy diet consisted of a corn silage diet fed at approximately 62% of daily requirements (if cattle weighed 1000 lbs. and were milking 12 lbs. per day) from calving throughout the first 30 days of breeding season. Cows that were flushed received the same diet as the cows on the low energy diet until two weeks prior to the breeding season. At this time, cows on the flushing diet received a diet that provided approximately 1.5 times the daily energy requirement. The flushing diet was continued throughout the first 30 days of breeding. Both groups had calves removed from suckling for 48 hours at the initiation of breeding season.

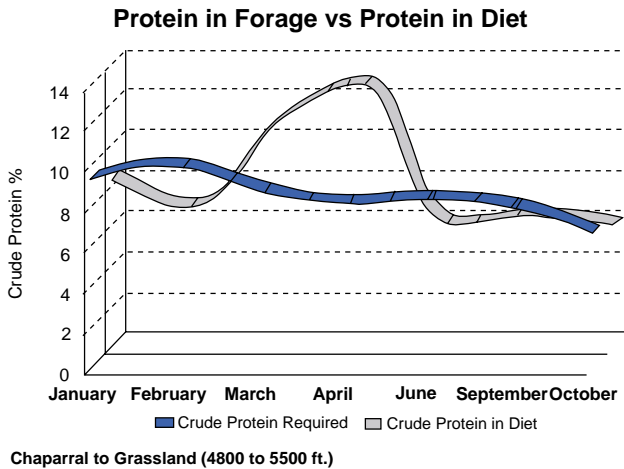
for 36 to 48 hours and not allowed to nurse. Research has shown this to be effective in increasing estrus with thin cows (body condition score 3 to 4; Nix et al., 1981). Researchers in Texas have shown that short term calf removal can be particularly effective with Brahman cross cattle which sometimes have long periods of time before the first estrus postpartum (Nix et al., 1981). A *note of caution*: short term calf removal with cows having a body condition score less than 4 may not be effective in increasing conception rate unless cattle are provided with some type of nutritional supplement as well (L. R. Sprott, Texas A & M University, personal communication). Additional research in Australia has suggested that lactating Brahman and Brahman cross cattle will preferentially shunt nutrients from supplements into milk for the calf (Hunter, 1991). Therefore, it may be necessary to combine short term calf removal with flushing in order to elicit a positive response for Brahman crosses in any supplementation done after calving. Researchers in Texas (Randel and Welker, 1980) compared Brahman x Hereford first-calf heifers fed at 125% of daily energy requirements in a drylot and either exposed to normal calf suckling or once-daily suckling. At 90 days postcalving, 100% of once-daily suckled heifers had returned to estrus compared to only 35.3% of normal-suckled heifers.

Option 3: Match Calving Season to Forage Curve

From Figure 1, it would make sense both physiologically and economically to match the calving season to times in which forage quality is at its peak. In fact, Deseret Ranches of Woodruff, Utah attributes moving calving forward to match the forage curve as one of the key ingredients in reducing cow costs and improving fertility (Simonds, 1991).

Figure 5 illustrates crude protein content of forage produced and consumed by cattle on a Mohave County Ranch (Rob Gumbles, Mohave County Cooperative Extension, unpublished data). The dark line indicates the crude protein requirements at different times of the year with estimated forage intakes at these times. Composition of the diet was determined on this chaparral-grassland ranch (4800 to 5500 ft.) by micro histological analyses of fecal samples. Crude protein of the diet chosen (light-colored line) was then determined by lab analyses of forage samples. The diet chosen during January and February was 50 and 60% turbinella oak, respectively. In April, the diet consisted of 30% filaree and 30% ceanothus. Forage intake and fiber and protein digestibility during January and February would have been reduced due to the negative effects of tannins present in turbinella oak. Crude protein content of filaree was very high in April (22.1%) and had a major effect on crude protein of the

Figure 5. Mohave Co. Ranch



diet consumed. Looking at Figure 5, it would appear that the ideal time for calving would be in early March. This would allow for nutrition to be at its peak during the 60 days preceding breeding. There are also two times of the year in which management decisions would need to be made. In January to February, it would appear that protein supplementation would be appropriate to prevent accelerated weight loss before calving. During June breeding season, supplementation decisions would be based upon body condition. If cows had gained sufficient weight during March and April, they would be able to coast through June without any supplementation. However, if cows were slipping in body condition in May or early June, supplementation would be advisable. Each ranch will be a little different in its forage curve and it is a good idea to analyze forage at different times of the year to gain an understanding of the forage curve for that ranch. Matching the calving season to the forage curve should improve cow nutrition and increase the number and size of calves weaned.

**Option 4:
Match the Cow to the Environment**

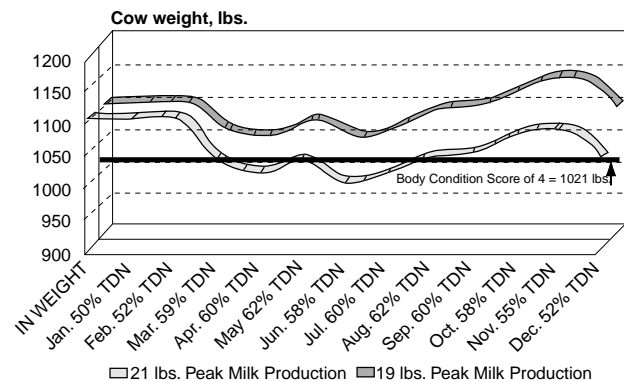
Cattle of intermediate size (1000 to 1200 lbs.) and milk production (18 lbs. or less peak milk production per day) appear to work best in more arid environments. Low desert or chaparral rangelands with limited herbaceous forage may require the use of small framed cattle (850 to 900 lbs.) with low milk production (8 to 12 lbs. peak milk production). Modest increases in cow size are accommodated more readily than are increases in milk production.

If forage availability is not a problem, cattle with greater milk production can increase forage intake to meet increased energy demands due to milk production. On areas with greater rainfall (e.g., Midwest) this

can be easily accomplished. In more arid areas of the West, cattle with greater milk production are often at a disadvantage. Each additional lb. of milk production (butterfat content = 4.03%) would require an additional .52 lbs. of forage intake if forage TDN was equal to 56%. By increasing peak milk production by 2 lbs. per day, calf weaning weights could be increased by 26 lbs. at 205 days while also increasing forage demand of the cow by 1.04 lbs. per day. If the cow was unable to satisfy this demand due to constraints placed upon her by lesser forage quality and quantity, weight loss would occur.

Figure 6 compares a hypothetical cow with peak milk production of 19 lbs. to one with peak production of 21 lbs. Forage TDN ranged from 50 to 62% in this example and forage intake was adjusted downward in December, January, and February. In this fictitious example, cattle were supplemented with adequate protein in January and February to maintain weight. Cattle in this example had a frame score of 4 with a weight of 1103 lbs. at a body condition score of 5 (Fox et al., 1988). The average weight difference between body condition scores (1 to 9) was 86 lbs. The cow with the lower milk production achieved a body condition score at 5 at the end of the year. The cow with increased milk production had less body condition at the end of the year, being approximately 4.25 at 1042 lbs. At breeding time in June, the cow with greater milk production would have a body condition score of 3.7 (1004 lbs.) as compared to 4.4 (1052 lbs.) for the other cow. If we assume a modest decrease in conception from 85 to 77% for the greater milk production, there would be a net loss of \$1269.80 for 100 cows with the following parameters: 477 lb. weaning weight for lesser milk production, 503 lb. weaning weight for greater milk production, 70¢ per lb. calves.

Figure 6. Effect of Increased Milk Production



Frame Score 4 cow, Weight at BCS of 5 = 1103 lb.

$$\begin{aligned} &(477 \text{ lbs.} * .85 * .70 * 100) - \\ &(503 \text{ lbs.} * .77 * .70 * 100) = \\ &\$ 1269.80 \end{aligned}$$

In Figure 6, cattle with greater milk production were not adjusted upwards for greater forage intake to show the effects of greater milk production in a more limiting environment. In periods of time with better forage quality and adequate forage availability, cattle with greater milk production can have greater forage intake. Therefore, weight loss could be somewhat less than that projected above. However, the extra milk production would result in greater weight loss for these cattle and most likely would result in lower body condition at the end of the year. Ultimately, it is expected that the greater milk production cattle would wean less lbs. of calf per cow exposed.

Cattle can be selected to match Arizona's environment. Data is available online from the Meat Animal Research Center of Clay Center, Nebraska to compare breeds for different traits (<<http://www.ansi.okstate.edu/breeds/research/marccomp.htm>>). Selection within breeds can also be practiced by using EPDs (Expected Progeny Differences) as a selection criteria (Sprinkle, 1996b) for targeting production goals. Important traits to set selection criteria for to achieve optimum reproduction in Arizona could include fleshing ability, mature size, milk production, and longevity. If cattle are not properly matched to our Arizona environment, an additional handicap is placed on the cowherd during years with unfavorable precipitation. On average, this occurs in Arizona four years out of 10 (Holechek et al., 1998).

Conclusion

Maintaining body condition at a score of 5 at calving should help enhance conception rates for Arizona range cattle. A key component of management is to have a knowledge of forage quality at different times of the year. Supplementation and calving season can then be matched to the forage resource. Finally, matching the cow to the environment can help overcome nutritional challenges to reproduction.

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