USING BYPASS PROTEIN SOURCES TO MINIMIZE SUPPLEMENTATION COSTS

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Introduction

Protein supplementation has been demonstrated to be an effective means of improving the performance of livestock grazing dormant native range forage. This practice has been successful for a number of reasons. First the forage is low in protein containing less than 6% crude protein. This low protein concentration creates two deficiencies one for the microorganisms in the rumen and the other for the animal. The traditional protein sources we have used are mostly used in the rumen. The microorganisms use the supplemental protein to satisfy their requirements which causes them to digest the fiber faster and better. The net effect of this is that the animal consumes more energy (calories) because the forage is more digestible and subsequently eats more feed. Additionally, more microbes grow and are flushed out to flow to the intestine for absorption, which provides more protein to the animal.

This scheme is effective but is totally dependent upon the growth of the microorganism to supply protein to the animal. The composition of the protein for absorption cannot be altered because it relies upon the microbes. The protein quantity and quality supplied to the small intestine is limited by the growth of the microbial population. What if we wanted to supply more protein to the animal? For example we have a two year old in March with a suckling calf at her side and we wish to increase her protein intake to meet her protein requirement. We could supplement her with a traditional protein supplement and improve her protein supply by whatever stimulation via microbial growth. But feeding a protein source with a high bypass value could significantly increase the animal's supply of metabolizable protein. It is quite likely that increasing the metabolizable protein supply may improve both animal energy efficiency, metabolism and reproductive performance.

Utilization of Bypass Protein for Beef Cows Grazing Native Winter Range

In the middle of the 1980's we conducted two studies to evaluate the effects of bypass protein on weight loss and nutritional status in range cows during the winter (Miner et al., 1990). These studies were designed to compare supplements containing blood meal or corn gluten meal with soybean meal to a supplement composed of primarily soybean meal. The soybean meal supplement was formulated to be fed at a rate of 1 pound per day and was 40% crude protein. The supplements with the bypass protein were formulated identical to the soybean meal supplement except they contained an additional 5 oz (150 g) of bypass protein.

The major benefit was that the cows fed the blood meal combination lost substantially less weight and showed improved nutritional status via measurement of blood metabolites. In fact, the efficiency of

the blood meal protein for reducing weight loss was better than 1 to 1. Meaning that for every pound of blood meal protein we fed the cows weighed one pound more. A cost effective benefit. However our nutrition program after calving was aggressive (alfalfa hay and cubes) so we did not find any differences in pregnancy rate in the fall even though body weight/condition varied at calving (Table 1).

Utilization of Bypass Protein After Calving

After this series of experiments during the winter with pregnant range cows. We decided that we should try formulating supplements to be fed after calving to two year old cows. Our first study (Halfpop et al., 1992) was conducted with first calf heifers that were in body condition score of 5.5 or better. After calving they were turned out into a dormant brome grass-white clover pasture. Cows received one of two supplements; one composed of soybean meal plus urea and the second soybean, blood and corn gluten meal. The second supplement supplied an addition 5 oz of bypass protein. The results were very surprising. The cows that received the additional bypass protein gained more weight, produced more milk, had heavier calves and had a higher pregnancy rate. These results were very encouraging. If the bypass protein would have such an effect on cows in good body condition then, we wondered what would happen if we tried this with young cows that were thin coming out of the winter.

So we designed another two years of studies (Wiley et al., 1991). In this study we fed one group of pregnant coming 2 year olds to maintain their body weight during the winter. A second group was fed 50% of what the first group received. After calving each group was split in half and each half received one of two supplements. The first was a traditional supplement formulated with soybean meal and the second was formulated with soybean , corn gluten and blood meal. The calves were born with equal vigor, body weight and health. The cows that received the bypass protein supplement after calving gained more weight (from calving to breeding) and 20 % more of the cows were pregnant in the first 21 days of the breeding season. This response occurred regardless of their pre-partum nutrition. This proved to be a cost effective supplement (Table 2).

This study was followed by an experiment with a similar design. The difference being that the cows were senior cows (4 years old or older) and were range cows. In this study the cows were divided by calving date in a late and early calving groups. The cows were fed one of two supplements both supplying sufficient protein to meet the needs of the rumen and one provided additional protein in the form of bypass protein. All cows were over 90% pregnant in the fall (it didn't matter if they were early or late calvers and received a traditional supplement or a supplement that contained more bypass protein). Following this the results of a study conducted at the Overton Station, Texas (Triplett et al., 1994) were released. In this study the researchers used all ages of cows. They found that the 2 year old cows cycled sooner and bred back better when they were fed the bypass protein but, in the older cows it did not make any difference as to the type of protein fed. From this we have assumed that the bypass protein in regards to improving reproduction is most effective with young cows.

In the last three years we have conducted a series of experiments at the Corona Range and Livestock Research Center.

The purpose of these studies have been to determine if a specific combination of protein formulated into supplements will have a stimulating effect on reproduction in two year old range cows. In the first two years we found that cows receiving a 45% crude protein supplement (fed at a rate of 2.5 pounds per day) formulated with cottonseed, feather, blood and meat meal compared to one formulated with mostly cottonseed started to cycle sooner. However this was not demonstrated by cows getting pregnant sooner or at a higher rate (Appeddu et al., 1996, 1997).

In the third year we fed a lesser amount of protein, a 36% crude protein fed at 2 pounds per head per day. A traditional formula was used in one supplement, mostly cottonseed meal, and the other used cottonseed, fish and blood meal. The supplement was fed for 100 days at a rate of 2 pounds per head per day fed 2 times per week. In the fall an improved pregnancy rate by 20% was found (73% in cows fed traditional and 91% in cows fed the mixture of proteins). The cost of the traditional supplement for the spring was $24.40 and for the protein mixture supplements $25.00 (Knox et al., 1998) (Table 3).

Other Benefits of Bypass Protein Fed to Range Cows

Other positive effects due to bypass protein appear to influence animal metabolism. These include bypass protein improves body weight changes by reducing milk production about 2 pounds of milk per day and using those nutrients for replacing lost maternal tissues (Appeddu et al., 1996). It may increase milk production but will do this without causing additional loss of protein tissue from the body (Appeddu et al., 1997). This occurs partially through changes in the hormone insulin. Insulin is the key that unlocks cells so that nutrients will flow in. When insulin is elevated which occurs with bypass protein then more nutrients can flow into the cows tissues and she will lose less weight or gain weight sooner. The blood sugar glucose is usually limiting when cows are grazing dormant pasture. (A cows has to make all of her own glucose and absorbs very little). The normal body metabolites that she can use to produce glucose are absorbed in very limited quantities. When bypass protein is fed a part of it maybe preferentially used to produce glucose. I f the glucose supply increases this may have a positive effect on energy metabolism, milk production and reproductive processes.

Recommendations

At this point our research and that of others show that bypass protein is most effectively used in thin two year` old cows to improve pregnancy rate or breeding date (we have received reports that in fleshy cows the bypass protein will inspire large increases in milk production with a consequence of a negative effect on reproduction). This supplement is most effective when fed after calving until breeding and it can also be used in most situations when weight loss is expected. We have been feeding .75 pounds of protein per cow per day fed 2 times per week (2.6 pounds at each feeding). The crude protein in our supplement is 50% ruminally degradable and 50% ruminally undegradable protein. This can be fed in 2, 3 or 4 pounds of supplement. We have used wheat midds as the carrier for our supplements. In our studies we have used 2 pounds per day of 36% crude protein supplements as a minimum feeding level. Depending on conditions of

cattle and the range the quantity of supplements may need to be increased to give cows the best chance of early cycling. The protein sources we have used are cottonseed meal, urea, feather meal, meat and bone meal, blood meal and fish meal. Sources have been selected based upon protein composition and cost of protein.

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Table 1. Bypass protein reduces weight loss in range beef cows during the winter.

Item	Supplements			
	None	Soybean meal (SBM)	SBM + corn gluten meal	SBM + blood meal
Weight change, lbs	-102	-46.2	-33	.4

Dec 15 to March 6
Standard error ± 11 lbs.

Table 2. Bypass protein improves reproduction in 2 year old cows.

Item	Supplements	
	Traditional	High bypass protein
Estrus, %[a]	44	60
Bred, %[b]	43	65
Pregnancy, %[c]	81	79

[a]Percentage showing estrus prior to breeding.
[b]Percentage bred during first 21 days P<.02.
[c]Percentage pregnant in fall.

Table 3. Bypass protein improves fall pregnancy in 2 year old cows at Corona Range and Livestock Research Center.

Items	Supplement	
	Traditional	High bypass protein
Pregnancy, %[a]	73	91
Cost, $	24.40	25

[a]P<.11.