Mineral Supplementation in a Beef Cow-Calf Operation that is also utilizing Liquid Feed (Mix 30®)

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Introduction

Tennessee and surrounding states have the ideal combination of forage base, moderate climate and an existing beef cattle inventory for profitable beef production. However, producers often report difficulty in achieving optimal production efficiency. Specific limiting factors include low reproductive efficiency (less than 80% of cows wean a calf each year) and health problems such as high incidence of young calf problems (scours and pneumonia) and significant losses due to bovine respiratory disease complex when calves are shipped from the region.

It has long been documented that nutrition is an important factor in improving beef cattle production efficiency. What has not been known is that specific nutritional factors may have been limiting production efficiency in Tennessee. The 2001 – 2004 Tennessee Forage Mineral Survey clearly established that mineral deficiencies and imbalances may be a limiting factor in production efficiency and immune function of feeder calves (see rationale section following). Selenium and Copper, for example, were shown to be deficient in forages from all areas of Tennessee, and sulfur (long known to be antagonistic to copper and selenium utilization) was shown to be higher than expected. Zinc, manganese and magnesium were also routinely low, while potassium was often in excess of that needed for optimal production.

Trace mineral deficiencies, including copper, selenium, and zinc, alter various components of the immune system (Suttle and Jones, 1989). Research has demonstrated the importance of individual trace minerals on immune function. However, the immune system is a complex, interrelated structure, and calves coming from backgrounds of multiple trace mineral deficiencies have not been studied extensively.

Another aspect of nutrition that must be addressed is energy and protein deficiencies / imbalances. Numerous strategies are available, but one that has received recent attention is the use of liquid feed supplementation. One product, Mix 30®, is being used in several locations, include the subject farm for the proposed Demonstration (John West Farm). Mix 30 is manufactured by Agridyne (Springfield, IL) and is "a proprietary blend of corn and soy co-products designed as a safe, economical, nutrient rich, and easy to use liquid feed for the diet of all ruminants" (from company literature).

Hickman County is typical of Tennessee in that it has the same excess of sulfur, low copper, low selenium. Also, like practically all farms in Tennessee, the predominant forage is Tall fescue, which is likely to be low in both protein and, especially, energy, for lactating cows.

An observation reported by producers using Mix 30 is that mineral consumption tends to be low. The company (Beasley Feeds) has responded to this concern by developing a special mineral with high concentrations of various minerals that is designed to provide adequate mineral nutrition even at low consumption levels (2 oz. per head per day).

Goals and Objectives

- Evaluate the mineral supplementation strategy that has been developed to be used in association with Mix 30 in terms of:
    - Consumption of mineral
    - Cow performance (rebreeding, body condition, hair score)
    - Calf performance (average daily gain)
- Allow communication of this information to the largest number of producers possible so that benefits will accrue.

Demonstration Plan

This trial was conducted on beef cattle farms in Hickman County in middle Tennessee belonging to John West. The trial was conducted on 2 farms with 2 separate herd units, with conditions for both herds being as similar as possible. One farm, Wade's Branch, had 52 cows, 3 bulls and 30 calves. This farm was selected by coin toss to be designated as the "control." Cattle on this farm were provided with a free-choice mineral which was typical of the improved mineral blends for the area, ie. it had been formulated to meet the challenges documented to be found in Tennessee forages. This mineral was formulated for a predicted 4 ounces of consumption, which was on the label. Label guaranteed analysis: Calcium – 15 to 18%; Phosphorus – 4%; Salt – 18 to 22%; Magnesium – 4%; Copper – 2800 ppm (copper chloride), Selenium – 32 ppm (sodium selenite); Vitamin E – 150 IU.

The other farm, referred to as West Beaver Dam, was designated as the "treatment" farm. This farm had 48 cows, 2 bulls and 42 calves. Cattle on this farm were provided "Fescue Extra" A-Z (Beasley Feeds), formulated for 2 ounces of consumption. Label guaranteed analysis: Calcium – 15 to 18%; Phosphorus – 6%; Salt – 16.5 to 18%; Magnesium – 4.4%; Copper – 5000 ppm (copper chloride), Selenium – 52 ppm (sodium selenite); Vitamin E – 560 IU. This mineral was formulated to be low in iron and aluminum and other contaminants.

This was a pre-weaning study, initiated in May, 2006. Both herds were provided a liquid supplement, Mix 30®, free-choice. Animals were worked at the initiation of the study and at the end (127 days). At each working, these measurements were made: weight of calves and cows, body condition score of cows, blood selenium / copper and hair score.

Results and Discussion

Table one shows the differences in blood copper levels. At the beginning, levels were below the normal range (normal range – 0.8 to 1.5 ppm) but not in deficient range (< 0.55). Both control and treatment minerals increased the blood serum levels, but the treatment mineral, with 5000 ppm copper, increased the blood serum copper level more (29 vs 14%).

Table 1. Blood Serum Copper Levels

	Beginning, ppm	End, ppm	Difference %
Control	0.72	0.80	11%
Treatment	0.68	0.89	31%

Table two shows similar trends in selenium levels, however neither product elevated blood serum levels out of the marginally adequate range (30 to 70 ppb). This is typical of results in Tennessee because of interfering factors (high sulfur, low soil pH) which prevent selenium from reaching the range (80 to 300 ppb). This is true even though both the mineral products used in this trial were formulated to provide selenium at or near the legal limit.

Note the treatment product did increase selenium levels, possibly due to a combination of factors: higher level of selenium and a higher level of Vitamin E, which has been shown to improve selenium utilization.

Table 2. Blood Serum Selenium Levels

	Beginning, ppb	End, ppb	Difference %
Control	55	65.8	20%
Treatment	49	66.6	36%

Cow weights and calf weights are presented in Tables three and four. It is important to note that these differences, while interesting, were likely due to obvious differences in the amount of pasture forage provided. All observers agreed that the treatment group had considerably less forage, to the degree that weight differences are almost assured to be due to this factor.

Table 3. Cow Weight and Body Condition[1]

	Beginning Weight, lbs./ BCS	End Weight, lbs. / BCS	Difference % Weight / BCS
Control	1017 / 3.5	1256 / 5.6	+23.5% / +60%
Treatment	1065 / 4.3	1087 / 4.6	+2% / +7%

[1]Using 1 to 9 Body Condition Scoring System with 1.0 being extremely emaciated and 9.0 being extremely obese

Table 4. Calf weights

	Beginning, lbs	End, lbs	Difference, lbs.
Control	252	554	302

Treatment	265	551	286

Cow hair score (Table 5) also showed interesting differences, but this could be due to either of two factors. Factor one is related to the fact that high levels of copper (5000 ppm), zinc (12000 ppm) and selenium (52 ppm) in the treatment mineral could have allowed the animals to grow a healthier hair coat. Another factor, however, should be considered. The larger amount of pasture forage in the control group had a high percentage of fescue which has been shown to affect the appearance of hair on cattle. There was also limited water in the treatment group, due droughty conditions toward the end of the experiment.

Table 5. Cow Hair Score[1]

	Beginning,	End,	Difference %
Control	2.8	1.7	-39%
Treatment	3.1	1.2	-61%

[1]Using 1 to 5 system, with 1.0 being excellent and 5.0 being extremely unthrifty, off-color hair, indicative of definite nutritional stress; copper deficiency

Free-choice mineral consumption is presented in table 6. There were more calves in the treatment group, so a correction was made as shown in the table. It is a concern that the consumption of the treatment mineral, which was labeled for two ounces of consumption per day, was nearly twice that level. The primary nature of the concern is due to the fact that the inclusion rate of various micronutrients such as copper, selenium and Vitamin E is more appropriate for the two ounce consumption rate. The manufacturers of this mineral should continue to monitor this situation. There was no sign that this level of consumption caused problems. In fact, the levels of copper and selenium in blood serum, while adequate, were not indicative of toxicity.

Table 6. Free-Choice Mineral Consumption[1]

	Measured, ounces per head per day	Corrected for different calf nos.
Control	3.9	3.9
Treatment	4.2	3.9

[1]Correction assumed the 12 additional calves in the treatment group were eating 0.75 ounces for 90 days