nesium sulfate, 2 oz ammonium sulfate, and 2 oz ammonium chloride; or (3) feed 4 oz ammonium chloride and 4 oz ammonium sulfate. Though these recommendations will often work, there are times when they will not. Therefore, a more scientific approach is best. Selection of anionic salts should be based on availability, cost, potential toxicity, dietary deficiencies, palatability, and type of feeding system. To assist in ration formulation the following guidelines are suggested:

1. Balance Mg at 0.40% of DM. Use magnesium sulfate, magnesium chloride, or a combination. Magnesium sulfate, due to cost (Table 3), is the mineral of choice.

2. Balance S at 0.40% of DM. Use ammonium sulfate, calcium sulfate, aluminum sulfate or a combination. Calcium sulfate and ammonium sulfate are more cost effective on an equivalent basis. It should be pointed out that the National Research Council's *Mineral Tolerance of Domestic Animals* (1980) indicated that the maximum tolerable level of dietary sulfur for cattle was 0.40%. However, from personal experience this level seems conservative.

3. Balance Cl so as to provide a DCAD of at least -15 meq/100 g DM. Use ammonium chloride, calcium chloride or a combination. If the incidence of milk fever in cows freshening three or more times is to be maintained at less than 5%, then an excess of anions of at least 1.5 equivalents per cow per day must be provided. The major drawback in this regard is the level of potassium in the forages. High K feeds, such as rye, require high levels of dietary chlorine to offset their effect of K. Specifically, every 0.10% increase in total dietary potassium will require raising the level of Cl in the diet 0.09%. Chlorine, then, is the pivotal element since it must counterbalance K.

4. Provide a daily intake of 50 g of phosphorus and 150 g of calcium. Use conventional sources of calcium and phosphorus, such as calcium carbonate, monocalcium phosphate, dicalcium phosphate, etc.

5. Reduce the use of ammoniated salts if intake protein (IP) or degradable intake protein (DIP) become high. It is best to not let the protein content of the prepartum ration exceed 14% or DIP exceed 10%. Some situations to watch are as follows: when urea or other NPN source is present, when ammoniated forages or legume forages are being fed, and when animal proteins are being fed to acclimate prepartum cows. In these cases the use of ammoniated salts should be reduced or even eliminated.

It would be remiss not to mention that these ingredients are not palatable. It is best to incorporate them in a total mixed ration with some moist, highly palatable feeds. If this is not possible, then they should be combined with such appetizing ingredients as distillers grains and molasses in a grain mix. Pelleting the grain also improves consumption. The pellet should be formulated to be fed at the rate of 7 to 8 pounds per cow per day.

In summary, dry cow diet greatly affects postcalving performance, and, as such, it should be viewed as the most important phase of dairy cattle nutrition. The best way to provide proper nutrition for the dry cow is to formulate rations which provide the required nutrients, are nontoxic and have a DCAD of at least -15 meq/100 g DM.

Synchronizing Mineral Supplements With Forages For Beef Cattle

John Doyle, *DVM, PhD*
Hereford, Texas

Satisfying various levels of animal production (reproduction, lactation, growth and immune status) requires synchronizing nutrient inputs with the animal's physiological requirements. Aligning the animal's major nutrient requirements with forage growth may provide adequate supplies of energy and protein, but some elements are inadequate (antagonism, chelation, deficiency or toxicity) in the leaves of forages and may not satisfy the animal's total requirements. An important economic loss to a cow/calf operation is the non-pregnant cow; several trace elements required for early embryonic development are dependent upon daily intake to satisfy the animals requirement for pregnancy (not readily mobilized from tissue stores during estrus). Both major and trace elemental supplementation should be considered essential to insure optimal animal production. Consistent intake of a mineral supplement is the initial step to insure some quantity of elemental availability for a diversity of animal metabolic requirements and forages grazed.

A perfect mineral supplement for all forage situations and various physiological requirements of all animals does not exist! An elemental percentage only guarantees a quantity and does not insure satisfying an animal/pasture situation if not consumed. 'Consistent intake' of a known quantity of a mineral supplement is required for proper supplementation. The hypothesis that 'animals eat what they need' or have 'nutritional wisdom' is an erroneous statement. Animals select a palatable diet with little nutritional value in preference to an unpalatable nutritious diet, even to the point of death (i.e. grass tetany & milk fever).

Consistent intake of minerals is generally depressed during the forage growing season. Growing forages may satisfy animals major nutrient requirements, but contents are minimal in trace elements. Commercial mineral supplement may contain an adequate concentration of trace elements, however obtaining sufficient intake among

individual animals within a herd to satisfy trace element requirements is the problem.

Least cost mineral supplements are not necessarily the best cost when performance is considered. Minerals that contain high levels of P (14%) and/or Mg (5%) may be the best elemental purchase, but will not benefit the animal if not adequately consumed. If choosing a mineral supplement for a consistent intake, begin with 10% P. The Ca:P ratio of a mineral mix should not substantially exceed 2:1, but can be as high as 7:1 as long as the animal meets its minimal P requirement.

Animals like salt and it is included in commercial supplements to enhance intake. Block and loose salt should be avoided when wanting to maximize consumption of a complete mineral supplement (animals choose salt over mineral supplement). In regions where forage and water contain high levels of sodium, a mineral supplement should contain minimal salt (< 5%) to encourage consumption.

Increased consumption of mineral is observed with added physiologic stress of lactation, gestation and calf crop increases in size. This group of animals has a higher nutrient requirement, and thus require a higher mineral intake.

Alternative feedstuffs that can be used to enhance intake of a mineral supplement include: protein meals, dried molasses, yeast products, fat or flavoring products.

The primary goal of a mineral supplementation program is to maintain 'adequate and consistent intake' throughout the year to meet the animal's physiological requirements. Consistent intake (cow = 85 to 113 gm/hd/d) of a loose balanced mineral supplement varied for forage conditions is superior to infrequent intake (cow = 28 to 57 gm/hd/d). Block mineral supplements are not generally consumed at adequate levels. Encourage use of a loose or pelleted complete mineral supplement for optimal intake.

Synchronizing mineral supplements with animals and forages is analogous to medical therapy for disease situations. Obtain a sufficient data base (avoid intense profiling, it is many times not economically justified for the producer) concerning animal physiological requirements and basic forage quality prior recommendations. A mineral supplementation program can only be evaluated if the producer monitors mineral consumption cost and animal response throughout the year.

References

Doyle, J.C. & Huston, J.E. "Mineral Supplementation For Beef Cattle on Rangeland" (Ed.) Howard, J. in press. In: Current Veterinary Therapy for Food Animal Medicine.

Lifting The Bovine Fore Leg

J. K. Harness, *DVM*
Franklin Veterinary Associates
2380 Buchanan Trail West
Greencastle, PA 17225

One of the challenges faced by the cattle practitioner is lifting the bovine foot for the purposes of examination and treatment. Because the shoulder is not a fixed joint like the pelvic limb, there is a great deal of anterior-posterior movement. Most cattle will drop to their carpus when the fore leg is raised, requiring the operator to place his knee under the axilla to support the animal. This is difficult and dangerous for the operator.

After trying a number of fore leg lifting devices, a workable solution was found.

The cow is first restrained forward in the stanchion or chute with a halter.

A beam hook or sling and block and tackle are attached to the ceiling in the customary manner. In the case of the front leg it is best hung directly over the shoulder. A 30 inch obstetrical chain, being the correct length, is passed through the axillary space and the ring at each end is placed over the "T" bracket or hook on the tackle. A nylon webbing loop with a 30 inch diameter works equally well. The shoulder is then raised until the weight is supported by the block and tackle and the foot is barely touching the floor. A nylon sling is placed around the pastern in a "larks head" knot and the foot pulled posteriorly and dorsally. The free end of the sling is looped over the tackle hook. The distal fore leg is now nearly parallel with the floor and the cow is supported comfortably. Examination and treatment of the foot can now proceed with a minimum of struggle by the cow and a minimum of strain to the operators back.