NUTRITION IS KEY TO GOOD REPRODUCTIVE PERFORMANCE

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Every cattleman knows that the number one priority on a cow calf operation is getting the cow bred and going from that point until she produces a weaned, marketable calf. As importantly, from a production efficiency stand point, she needs to produce this calf every 12 months. Ultimately, however, it comes down to getting that cow bred – naturally, artificially or even through embryo transfer. While nothing replaces good management and sound nutrition, there are a number of tools the producer can use to enhance reproductive performance. As I have said before there are no silver bullets and no magic potions but there are some steps a producer can take to make things work to his benefit.

Basic Nutrition

We've repeated it over and over again that for the cow to perform efficiently we have to meet her basic nutrient requirements. That means appropriate levels of protein, energy, minerals and vitamins based on her size, age, breed and so on. Research and practice has also shown that feeding increased levels (~30 percent increase) of protein, energy, minerals and vitamins (a practice known as flushing), 30 to 45 days prior to target breeding dates can enhance cycling and conception. We'll discuss some of these in particular as we go along.

One particular nutritional component that has shown to be very beneficial to reproductive function when fed correctly is fat. In the most basic of terms, fat is an energy source. The effects of feeding fat sources to cattle, as a source of increasing energy status, is well documented. Recent research into the effects of fat inclusion in the diet on reproduction have shown positive results. As early as the mid 1980's work was done comparing the reproductive status and return to cycling of cows in optimal condition and cows in poor condition receiving supplementation with whole cottonseed (which will run 18 to 22 percent fat on a dry matter basis). The reproductive performance receiving the whole seed supplementation was similar to that of the cows in better body condition. More recent studies have compared various fat types from different plant and animal (non-ruminant) sources as well as investigated the actual physiological changes that take place when fat is used as an energy supplement.

Various studies have shown the positive response noted. Several hypotheses currently exist for why this response is seen.

1) The feeding of the additional energy in the form of fat improves the cow's overall energy status so that she returns to estrus sooner after calving and therefore conceives earlier.

2) Cows fed fat secrete more progesterone, a hormone necessary for implantation and nutrition of the newly formed embryo. One of the effects seen from the feeding of fat is an increase in the size of follicles produced on the ovaries. A review of a series of studies investigating this concept showed that follicle size increased an average of 27.13 percent. The increase in follicle size also resulted in an increase in corpus luteum (CL) size. The CL is the structure which produces progesterone.

3) Specific individual fatty acids (components of fats) inhibit the by the uterus. This prevents the regression of the (CL) onαproduction of PGF2 the ovary so that the newly formed embryo survives. In other words, the CL has a longer lifespan which increased the length of the estrus cycle. This means that a cow has a longer period of time in which to be bred when she is in heat. Certain fat types have been shown to be especially effective in creating this result. Fats higher in linoleic acid (a specific long-chain fatty acid) have been shown to be especially useful in this area

4) Higher dietary fat levels may increase the concentration of cholesterol in the blood stream which acts as precursors or building blocks for reproductive hormones such as progesterone.

Regardless of the exact mechanism, the use of fat in supplementation of brood cows has proven very effective in improving reproductive performance. More research is needed to identify specific feeds or grains that possess the necessary fatty acid profile to produce an optimal response (or at least the best improvement. Cows should receive supplements higher in fats just prior to calving and in the early postpartum period to enhance this effect. Feeding a higher fat supplement which results in the cow receiving 3 to 5 percent fat in her overall daily diet should improve reproductive rates in most cases. Be sure not to exceed 6.5 to 7 percent fat in the daily diet since this can result in reduced fiber digestion in the rumen and prove counter productive.

Another nutrient found to be effective in stimulating reproductive function is Vitamin E. A study with beef heifers in 1991 found a high correlation between -tocopherol (the chemical, active form of Vitamin E)αserum concentrations of and pregnancy rate. Once serum concentrations were greater than 3 mg/liter, no additional improvement in pregnancy rate was observed. Few positive -tocopherol concentrations and measuresαrelationships between plasma (or serum) of mammary gland health have been found when concentrations are greater than -tocopherolαabout 4 mg/liter. Based on these data, plasma concentration of might be useful in assessing vitamin E status of dairy and beef cattle, and current data suggest the concentrations should exceed 3 to 3.5 mg/liter at calving to insure proper cycling and conception. Additionally Vitamin E deficiency can result in death and resorption of the fetus in the female and degeneration of testes in the male. In most cases, sources of Vitamin E are plentiful in fresh, growing forages and in cereal grains used in feeds and supplements, so a deficiency is unlikely to develop. Nonetheless, Supplementation with Vitamin E is believed to be very beneficial to insure good reproductive activity and performance. Commercial feed and mineral supplements can carry varying amounts of Vitamin E so any product used should be assessed for it's E content. While the required feeding rate of Vitamin E is not clearly defined commonly fed levels range from 50 to 100 units per head per day.

Another nutritional component that works hand in hand with Vitamin E is Selenium. Selenium is a trace mineral that is receiving a great deal of attention for it's involvement in a variety of systems, including reproduction. Both Selenium and Vitamin E work in anti-oxidant processes to “turn off” the components generated in the body that fight of infectious agents and neutralize foreign particles. They also aid in regeneration of tissues damaged during calving and have been shown to reduce the levels of retained placentas in newly calved females. Selenium deficiency alone can increase the incidence of embryonic death and uterine infections and can decrease fertility as a whole. Recent studies into different forms of selenium have shown benefit to the use of organic selenium in the form of selenium yeast. Selenium Yeast incorporates Se with the amino acid Methionine creating a selenomthionine molecule, essentially the same form of Se as is found in plants. This form is much more

bioavailable than inorganic forms of Se. This results in an increased Se status in the animal providing increased Se for the various processes in which it is required. Selenium Yeast has also been shown to be far less toxic than inorganic forms and is thus safer to handle and feed.

Other trace minerals such as Zinc, Copper and Manganese have also been shown to improve reproductive function when supplemented appropriately. While we are going down this road, let me make one statement here: It is important to provide a quality mineral and vitamin supplement to the cow herd year-round for reproduction, health and performance (milking, growth, etc.) purposes. While this paper is emphasizing the use of specific nutritional components in the periods before and after breeding it is ALWAYS important to keep out a palatable, high-quality mineral. OK, back to the discussion.

Zinc is essential to all animals and plays significant roles in the metabolic activity of cattle. Zinc functions in many if not most enzyme systems and is largely involved in nucleic acid metabolism, protein synthesis and carbohydrate metabolism. One series of studies reported a need for Zn for mobilization of Vitamin A from the liver. Zinc is found in all body tissues which are high in protein or calcified material. The absorption of the metal appears to be directly dependent on the body's physiological need. Many deficiency symptoms appear to be related to the role of zinc in protein synthesis and energy metabolism. Reading between the lines we see all these issues are involved directly in the reproductive system. Thus less than adequate zinc levels can contribute to decreased cycling and conception.

Likewise copper has also been show to be important in breeding activity. As we have discussed before the metabolism of energy is directly involved in the normal functioning of the tissues involved in the reproductive system. Copper is required for optimum performance of cellular structures known as mitochondria for the metabolism and transference of energy in the cells and tissues.

Finally, like the other trace elements, manganese is also involved in a large number of enzymatic processes in the body. While not as well defined as other trace minerals such as zinc and copper it is believed that manganese status is involved in heat expression. Some researchers believe that improved manganese status in the animal can result in stronger heat expression, an obvious benefit in A.I and embryo transfer programs.

Finally, similar to our discussion of selenium, organic forms of the trace elements have shown to be more available to the animal and thus are useful in improving the status of the various minerals. Use of organic sources of zinc, copper, manganese, etc. can improve the absorption of these nutrients significantly, insuring adequate or greater than adequate levels of these minerals at the cellular and tissue levels. While numerous types of organic minerals are available and that's a topic for a completely different article, many nutritionists prefer the use of more basic or pure organic traces. There has been some research suggesting that trace minerals bound to specific amino acids are even more available to the animal than those bound to other organic molecules such as peptides, or protein fragments.

Other Tools

Aside from the feeding or supplementation of specific nutrients to enhance reproductive performance, other components in the form of additives have shown some improvements in reproductive performance. Let's consider a few of these.

The use of feed additives containing live microorganisms and/or their metabolites (compounds they produce as waste) to improve the efficiency of production in cattle has increased, to a large degree, as a response to consumer demand for more “natural” growth-promoting or efficiency enhancing substances. Yeast Products, direct fed microbials, probiotics and other terms are used to identify a host of products that are based on populations of microbial organisms be they yeasts, bacteria or fungi which are thought to have a beneficial role in the rumen or lower digestive tract. Subsequently the use of these materials has shown or is believed to have shown benefit by improving the digestion of various nutrients, especially forages in the bovine digestive system.

Direct-Fed Microbials (DFM) have been of great interest in recent years. There have been several hypotheses put forth to explain the usefulness of DFM. One of the most common explanations for improved animal health or production suggests that the addition of beneficial bacteria prevent the colonization of pathogens in the lower gut by competing for space and nutrients. Production of antimicrobial end products such as acids and antibiotics has also been discussed. Some of the proposed mechanism for how DFMs work include:

• Production of antibacterial compounds (acids, antibiotics).

• Competition with undesirable organisms for space and/or nutrients in the digestive tract.

• Production of nutrients (e.g. amino acids, vitamins) or other growth factors which stimulate growth and reproduction of other microorganisms in the digestive tract.

• Production and/or stimulation of enzymes.

• Breakdown and/or detoxification of undesirable compounds

• Stimulation of the immune system in the host animal.

Similarly, yeast usage has found applications in many areas. One particular area of interest is in cattle grazing fescue pastures. Much of the eastern and southern United States has endophyte-infected fescue as the main source of forage protein and energy. While new lines of endophyte-free fescue exist, it is unlikely that there will be wide-spread replanting of fescue areas. There is a renewed interest in year-round or extended grazing to reduce the feed cost of cow-calf production programs. Additionally, yeast products may assist in digestion of forages.

Yeast cultures have been shown to positively affect animal performance and mineral consumption. Studies in Florida and California resulted in improved feed intake, production, and reduced rectal temperatures during summer heat stress in dairy cattle. Other research trials have shown that yeast cultures have also increased rumen bacteria numbers and improved the digestion of feedstuffs in both beef and dairy animals. Both mineral consumption and absorption have been positively affected by the addition of yeast culture to free-choice mineral mixes. Obviously, all these factors will contribute favorably to maintenance of reproductive performance.

A lot of research is still needed as to how these compounds actually function in the animal and what the overall mode of action really is. The intervening results, however, have been good enough that producers and researchers alike should give attention to these tools.

Finally, feeding of compounds such as Rumensin™ or Bovatec™ (ionophores), when managed properly can also improve reproductive performance, mainly through the improvements in feed efficiency and allowing the animal to extract more energy from the feeds and forages it consumes.

Conclusions

While nothing beats an on-going, sound management and nutritional program there are tools that can be applied in a timely fashion to improve breeding and overall reproductive performance. As mentioned at the onset, there are no silver bullets so the implementation of any one or groups of these will not offset glaring holes in management or nutrition. The items and areas mentioned should be incorporated as a part of an overall program designed to maximize the efficiency and productivity (not to mention profitability) of the operation.

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