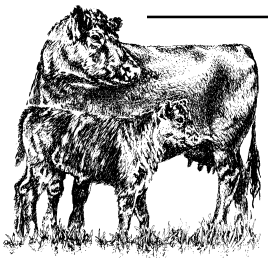

Western Beef Resource Committee

Cattle Producer's Library

Nutrition Section CL325

Supplemental Fat in Heifer and Cow Rations

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Background

To optimize reproductive performance and longevity, beef heifers and cows must be developed and managed efficiently. It is important to follow the general guidelines for developing and breeding heifers (CL745), and for managing for reproductive success in young (CL413) and mature (CL330) cows.

Current research has shown that lipid supplementation may be a useful management tool to optimize reproductive performance. Lipids can be solid (fat) or liquid (oil) at room temperature. The word "fat" is used in this fact sheet as a general term for "lipids." Consider the following information on supplementation with fat as a means to achieve reproductive goals more efficiently.

Why Use Fat?

The dairy and feedlot industries were the first groups to supplement livestock rations with fat. The purpose was to increase energy density of the ration to increase milk and meat production. However, improvement in cow reproductive performance was sometimes noted with dairy cows. Since then, researchers in beef nutrition and reproduction have been studying the effects of fat supplementation on reproductive performance in beef cows and heifers.

Fat can also be a cost effective source of energy for cattle. On a per gram basis, fat contains 2.25 times the energy as cereal grains, thus producers will need to feed less, which results in a possible decrease in feed costs (see Economics at end of this paper). Fat (in the form of oils) is sometimes applied to dusty hay and feed to improve palatability and to total mixed rations, which will increase binder qualities.

Sources and Considerations

Not all fats are created equal. Fats typically used in cattle rations come from many sources, including those of plant (corn, cottonseed, safflower, soybean, sunflower, and soybeans) and animal (tallow and fishmeal) origin. The fats from these sources are chemically and biologically different. They have different properties that dictate not only handling and use, but also differences that may affect animal response.

Vegetable oils, some which contain relatively high amounts of essential fatty acids, appear to have the greatest impact on beef cattle reproductive performance. It should be noted that researchers believe that feeding ruminant fat to ruminant animals does not pose a risk of disease (BSE) transfer.

To understand the affects of fat in livestock rations, it helps to look at this supplement in two ways. One is simply to use fat as a means to meet the energy requirements. The other is to feed fat to cause specific changes in the physiology of the cow over and above the increased energy in the ration. These specific changes are presumably because of the biochemical makeup of fats that affect the reproductive system of animals.

Production and Reproductive Responses

Research with supplemental fat has been conducted on cows that have had one or more calves, as well as replacement heifers. Fats have been fed before and during the breeding season, and also just before and immediately after calving. Responses examined include direct measurements, such as body weight and body condition score, age at puberty, calf birth weight, interval from calving to return to estrus (postpartum

interval), first service conception rates (for artificial insemination), pregnancy rates, days between calving (calving interval), mammary gland development, milk yield, and calf weaning weight. More intense investigations have looked at changes in the cows' ovaries, uterus, hormone levels, and brain function, as well as effects on the developing embryo.

Although the practice of feeding supplemental fat has improved reproductive efficiency in some instances, many times no effect on reproduction was found. And occasionally, negative impacts on reproduction have been observed.

Understanding how fats can influence reproduction and predicting response is difficult. It appears that animal response depends largely on body condition score (BCS; see CL720) and nutrients available in the basal diet (pasture or range conditions). The complexity of the reproductive system and the makeup of fat supplements are also often confounded by management conditions and forage quality both in research and in commercial feeding situations. In other words, it is hard to figure out what is happening and how to benefit from different fat supplementation schemes.

Research Summary

Currently, research is inconclusive on exactly how to supplement fat in order to take advantage of any special qualities that lipids may have to improve reproductive performance; that is, beyond the energy contribution of fat. Researchers and ranchers are optimistic in the ability of fat to improve the efficiency of reproduction.

A summary follows of research trials that reported results for growth and reproductive performance of beef heifers and cows fed supplemental fats. These examples may provide insights for producers considering the use of fats in commercial beef operations.

Pre-Calving

- Supplementing heifer diets with safflower seeds at 7.8 percent of the diet (4.4 percent fat diet) for an extended period of time (age 254 days until puberty) did not improve heifer pregnancy rate compared to a control diet (1.9 percent fat diet). When supplemental fat was fed, percentage of heifers pubertal by the beginning of breeding was unchanged with Hereford sired heifers, increased with Piedmontese sired heifers, and decreased with Limousin sired heifers. That is, changes in age at puberty in response to supplemental fat may be breed dependent (Lammoglia et al. 2000).
- Supplementing soybean oil at 3 percent of the diet to a forage-based ration (hay plus oil as a topdressed supplement) of pre-pubertal heifers for approximately 100 days increased feed efficiency in one experiment, but not in another, compared to heifers receiving a corn-based control supplement. Additionally, in the second experiment, but not the first, heifers tended to conceive earlier in the breeding season.

  In these experiments, supplementing soybean oil at a level of 6 percent decreased feed efficiency compared to 3 percent added oil. Additionally, adding 6 percent oil did not change growth or reproductive performance compared to either the 3 percent oil or control diets. No improvement in final pregnancy rate was found among groups (Whitney et al. 2000).
- Feeding 1 pound/day of protected fat (calcium salts of palm oil; 5 percent fat in diet) to well developed heifers (1,036 pounds) from the beginning of the third trimester of pregnancy until the end of their third estrus after calving increased the time from calving until first estrus. That is, fat had a negative effect on reproduction (Oss et al. 1993).
- Supplementing the diet of late gestation heifers (day 230 until calving) with safflower seeds at 1.5 pound/day (about 4.7 percent fat in the diet) increased subsequent pregnancy rate by 19 percent compared to control diets with similar energy and protein content (Lammoglia et al. 1997).
- Supplementation with safflower, soybean, or sunflower seeds (4.7, 3.8, and 5.1 percent fat in diet, respectively) for the last 65 days before calving increased subsequent pregnancy rates (94, 90, and 91 percent, respectively) of first-calf heifers compared to controls (79 percent) receiving diets with equivalent energy (2.4 percent fat). In a second experiment, supplementing diets with sunflower seeds (6.5 percent fat in diet) the last 68 days before calving did not improve subsequent pregnancy rate compared to control diet (2.2 percent fat). The major difference between the two studies was forage availability. When adequate nutrients are available, the affects of supplemental fat may be masked (Bellows et al. 2001).

Post-Calving

- Feeding 0.5 pound/day of protected fat (calcium salts of palm oil; 4.7 percent fat in diet) to first-calf (BCS 5) heifers for 30 days immediately after calving increased beneficial prostaglandin hormones after calving. However, no improvements in days to first estrus or pregnancy rate were found (Filley et al. 2000).
- Supplementing rice bran (5.2 percent fat in the diet) from day 1 to 50 after calving tended to improve pregnancy rate in mature cows compared to cows receiving a control diet (3.7 percent dietary fat). Cow BCS were 6 to 7. (De Fries et al. 1998).
- Feeding 1.8 pounds/day of rice bran (5.1 percent fat in diet) to BCS 6 cows starting day 1 after calving increased cumulative rate of return to estrus by day 60 after calving compared with cows consuming control diets of similar energy level. However, diets

containing rice bran plus lasalocid had lower reproductive performance (Webb et al. 2001).

- Supplementing fishmeal to first-calf heifers at 5 percent dry matter intake (about 1 pound; 4 percent fat in diet) beginning 25 days before the breeding season and continuing through the 90-day breeding season tended to increase first service artificial insemination conception rates when compared to those receiving a corn gluten meal supplement at 8.7 percent of dry matter intake (3.7 percent fat in diet). However, overall pregnancy rates did not differ (Burns et al. 2002).
- Supplementing pasture fed first-calf heifers with 1 pound of fishmeal from 25 days before and continuing through a 70-day breeding season did not improve first service conception rate or overall pregnancy rate compared to heifers receiving pasture alone. All cows were adequate BCS and weight, with very good reproductive performance (Burns et al. 2002).
- Supplementation with approximately 3 pounds of whole cottonseed (5.5 percent fat in diet) 30 days before the breeding season increased the number of cows cycling at the start of the breeding season by 18 percent. Cow BCS was less than 5 (Wehrman et al. 1991).
- Cows calving with a BCS less than 4, and fed such that body weight and BCS do not increase, are unlikely to respond to short-term dietary fat supplementation (less than 20 days) in the post-calving period (Ryan et al. 1994).

Summary of Research

Based on the above research trials, positive results may be obtained when fats are used to supplement diets at 4 to 5 percent total fat in the diet (on a dry matter basis). Oils can be topdressed onto hay, while other fat sources can be mixed into and fed with 0.5 to 1.0 pound of another supplement (soybean meal, for example). About 30 to 60 days appears to be a reasonable duration of supplementation and can include times during heifer development, pre-calving, post-calving, and/or pre-breeding periods.

The young, growing cow appears to be the most likely to respond to supplemental fat. An appropriate situation for fat supplementation may be when pasture or range conditions are limiting. Feeding supplemental fat to well-developed heifers or well-conditioned cows when pasture or range resources are adequate may **not** prove to be beneficial. With very underdeveloped, low BCS (< 4) heifers or cows it is suggested that traditional feeds be used to supply nutritional requirements for weight gain and improvements in BCS. Fat could be a part of the diet, but the goal would be to use fat as an energy source, not as a nutrient to target a specific reproductive effect.

Feeding and Handling Guidelines

Fats are highly digestible (approximately 80 percent digestible). However, high levels of fat in the ration have the potential to negatively impact fiber digestion, decrease calcium absorption by formation of calcium salts of fatty acids, and increase vitamin E requirements (NRC Beef 1996). In general, the amount of fat in predominantly forage-based cattle diets should not exceed 6 percent of the total ration on a dry matter basis. Cattle producers are advised to provide adequate calcium in the ration and to make sure the vitamin E content meets or exceeds requirements (CL381), especially when highly unsaturated oils are used.

Whole safflower seeds need to be processed to improve digestibility. Researchers recommend producers crack about 90 percent of the seed hulls while not causing any significant loss of oil (Lammoglia et al. 1999). Processed lipids can be either liquid or solid at room temperature, so transportation and storage of the fats will differ. Some fats need to be melted before mixing with feed, especially in cold environments.

It is important to keep moisture in the storage tank less than 1.5 percent water so that the fat does not go rancid (Zinn et al. 1995). Producers should check gossypol levels in whole cottonseed. Additionally, whole soybeans contain estrogenic compounds. However, no adverse effects on reproduction have been reported when soybeans are fed to mature heifers or cows.

Economics

Cattle producers are encouraged to complete an analysis on the cost of feeding fat to cattle. Suggestions for evaluation follow:

1. Compare the cost of the fat supplement to a cereal grain (corn, for example) based simply on its value as an energy source.
2. Consider the added value of fat for improving reproductive performance.
3. Factor in any difference in shipping, storage, and handling cost for supplements.

If cattle producers simply want to use fat as an energy source, they will need to consider the following:

- Account for differences in total percentage of fat (e.g., 90 percent for oils, 11 percent fat in fishmeal) in the supplements.
- Values for energy (TDN) and ether extract (EE) or crude fat are published in feed tables and might be available from a feed supplier.
- Be aware that fat is 2.25 times more energy dense than carbohydrates or proteins. To compare cost of energy for feeds with differing amounts of fat (or other nutrients) calculate the dollar amount per pound of fat or per pound of TDN. Follow the example calculations found for comparing cost of feeds based on nutrient content in CL309.

- Depending on the changes made, the ration containing supplemental fat may contain more or less protein than the original ration. Fat supplements sometimes, but not always, contain protein. Grains are usually about 12 percent protein and soybean meal is about 47 percent protein.
- Make sure you have a nutritionally balanced ration. Adjust the cost of your total ration by the appropriate amount.

It is more difficult to project economic advantage from any changes in reproductive efficiency. Based on the information in this fact sheet, cattle producers should use their best judgment for evaluating any potential for individual cow herds to benefit from fat supplementation. See the following example.

Example

A group of 100 young cows in moderate to low body condition are about to calve. Another year of drought has been forecast for the upcoming grazing season. You decide to use whole cottonseed (WCS) to help improve rebreeding success (see above research summary). At 30 days before the start of the breeding season, you begin feeding each of your 100 cows 3 pounds of WCS and you get a 12 percent increase in the number of cows cycling at the start of the breeding season. As a result more cows than usual breed earlier.

a. Feed costs: $160/T WCS. 3 lb/cow x 100 cows x 30 days = 9,000 lb or 4.5T WCS. 4.5T x $160/T = $720 for the feed
b. Production benefit: 12 percent of your cows breed 30 days sooner than usual. Out of 100 cows 12 calves were born 30 days earlier and so are 30 days older at weaning. Those 12 calves gained 2.5 lb/day for those extra 30 days and sold for $100 per cwt. Revenue off the extra gain = 12 calves x 2.5 lb/day x 30 days x $1.00/lb = $900
c. Benefit over cost of added feed = $900 - $720 = $180
d. Make other monetary adjustments to account for any feed removed from (or added to) the final ration.

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