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SYMPOSIUM

Invited Review: Nutrition and management of cows: Supplementation and feed additives[1,2]

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ABSTRACT

Reproductive efficiency is the primary factor affecting profitability of a cow-calf enterprise. Our objective was to review how nutrition affects reproduction in beef females and subsequent calf performance. Body condition is an indicator of nutritional status, and when used in conjunction with BW change, it can be a useful method to assess reproduction. Body energy reserve at calving is the most important factor influencing pregnancy rate in beef females. Energy and protein are the nutrients required in the greatest amounts and are the first priority in nutritional programs to optimize reproduction. Beef females underfed or in poor body condition lack ovarian activity as a result of suppression of pulsatile release of luteinizing hormone under the control of gonadotropin-releasing hormone. Factors affecting postpartum interval to estrus and pregnancy rate include breed type, suckling status, age, dystocia, energy and protein supplementation before and after calving, and BCS before and after calving. Management strategies that influence when a beef female calves during the calving season affect future productivity of both dam and offspring. Feeding an ionophore results in earlier puberty in beef heifers. The effect of feeding fat pre- or postpartum on reproductive performance in beef females has been researched, but results are inconclusive. Prenatal nutrition appears to have potential effects on subsequent performance of female and male offspring. There is no single feed ingredient that can be fed to enhance reproduction in beef cows when a diet is deficient in any nutrient or when beef females are in poor BCS.

Key words: beef cow, management, nutrition, reproduction

INTRODUCTION

Net calf crop or number of calves weaned per cow exposed is an important calculation for commercial cow-calf producers. The greatest loss in potential calves to wean is due to cows not becoming pregnant during the breeding season (Bellows et al., 1979). It has been well documented that body condition of beef females at calving affects reproductive performance during the next breeding season. Body condition of beef females is affected by feeding and supplementation strategies. The greatest cost for cow-calf producers is feed. Research has been conducted to elucidate the effect of strategic supplementation and supplementation of specific nutrients to cost effectively enhance reproductive and production efficiency in beef females. This review will focus on the current status of nutritional strategies and the effect of supplementation of nutrients and additives on beef cow reproduction and performance of their progeny.

REVIEW AND DISCUSSION

Effect of Energy and Protein Supplementation and BCS on Reproduction

Feeding a balanced diet to beef females in the last trimester of pregnancy through the breeding season is critical. Nutritional demands increase

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from early gestation to lactation (NRC, 2000). Reproduction has low priority among partitioning of nutrients for the subsequent pregnancy. Consequently, thin cows at calving typically remain thin because excess energy in the diet is directed to milk production first. The effect of energy and CP supplementation before and after calving and the interrelationship with body condition in beef females has been extensively reviewed (Randel, 1990; Short et al., 1990; Dunn and Moss, 1992; Banta et al., 2005; Hess et al., 2005; Whittier et al., 2005). The common theme among these reviews is, at least for spring-calving cows, BCS at calving is related to postpartum interval and rebreeding performance. Plane of nutrition the last 50 to 60 d before calving affects postpartum interval (Randel, 1990). The importance of pre- and postpartum CP and energy level on reproductive performance has been consistently demonstrated (Selk et al., 1988; Hess et al., 2005). It is a challenge to increase body condition after calving or elicit a reproductive response to high energy intake in postpartum beef females (Spitzer et al., 1995). However there are limited data suggesting a positive energy balance postpartum is essential for prompt rebreeding of heifers calving in thin condition (Warren et al., 1988; Lalman et al., 1997; White et al., 2001; Ciccioli et al., 2003; Whittier et al., 2005). These data also illustrate the challenge of attempting to increase body condition after calving on reproductive performance and, for producers, the need to proactively manage body condition before calving.

Bearden and Fuquay (1992) summarized the effects of inadequate and excessive nutrients, amounts greater than or less than requirements, on reproductive efficiency. Excessive CP and energy in the diet of beef females can result in reduced conception rates and increased feed costs. Excessive dietary nutrients during the last trimester of pregnancy may negatively influence calf birth weights and dystocia. Selk (2000) summarized the effects of providing either adequate or inadequate amounts of dietary energy on calving difficulty, reproductive performance, and calf growth. Reducing energy prepartum had virtually no effect on dystocia rates even though birth weights were increased in some experiments. Reducing dietary CP prepartum does not decrease calving difficulty and may compromise calf health and cow reproductive performance. Overfeeding CP to dairy heifers during the breeding season and early gestation, particularly if the rumen receives an inadequate supply of energy, may be associated with decreased fertility (Elrod and Butler, 1993). This decrease in fertility may result from decreased uterine pH during the luteal phase of the estrous cycle in cattle fed high levels of degradable CP. The combination of high levels of degradable CP and energy concentrations in early-season grasses may contribute to lower fertility rates in females grazing lush pastures near the time of breeding in the spring. Negative effects of excess RDP intake on reproduction are documented in dairy literature (Ferguson, 2001). However, there was no negative effect on reproductive performance when heifers grazed wheat pasture before breeding that would provide CP and energy in excess of nutrient requirements even though BUN concentration was elevated (Bryant et al., 2011).

Visual assessment of body condition for beef females has led to a subjective scoring system. A 9-point system is commonly used to condition score beef cows (Wagner et al., 1988). The importance of body condition at calving on subsequent reproductive performance has been documented extensively. Dunn and Kaltenbach (1980) summarized data noting body condition at calving and prepartum BW changes are important factors that affect the length of the postpartum interval in beef cows. Body condition score is correlated with several reproductive events such as postpartum interval, services per conception, calving interval, milk production, weaning weight, calving difficulty, and calf survival, which affect net income in a cow-calf enterprise (Richards et al., 1986; Richards et al., 1989, Kunkle et al., 1994; Marston et al., 1995). Body condition score at calving also influences response to postpartum energy intake. Spitzer et al. (1995) fed primiparous cows differing in body condition (BCS 6 vs. 4; 1 = emaciated, 9 = obese) to gain either 0.90 or 0.45 kg/d. The percentage of BCS 6 cows in estrus during the first 20 d postpartum increased from 40 to 85% when fed to the higher rate of gain, whereas cows in BCS 4 only increased estrous response from 33 to 50% during the first 20 d postpartum. Cows should have an optimum BCS of 5 to 6 at calving that should be maintained through breeding to ensure optimal reproductive performance. The most important factor influencing pregnancy rate in beef females is body energy reserves at calving (Wettemann et al., 2003). In addition, low energy intake before calving appears to be the major culprit to reduced reproductive performance during the subsequent breeding season. The research cited suggests body condition at calving is the single most important factor determining when beef heifers and cows will resume cycling after calving, and BCS is a better indicator of the nutritional program than is BW.

Although energy and CP together or separately have been implicated in lower beef cow reproductive performance, some early studies designed to evaluate low CP intake on reproduction used low quality forages and grains high in starch in various combinations. It is difficult in these studies to determine whether low reproductive performance was a result of low CP intake or a result of low energy intake as a result of reduced digestibility of the forage when grains and low quality forages are fed together (Sanson et al., 1990). The results cited above and volumes of other data not cited substantiate the importance of body condition and the effect on beef female reproductive performance. Because terms such as “energy” or “CP supplementation” can be fairly