MELATONIN TO INDUCE PUBERTY IN VIRGIN HEIFERS

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SUMMARY

Developing a replacement heifer can be expensive. The expense includes such things as: value, feed costs, breeding costs, interest, mortality, etc. Under current market conditions, these costs are in the range of $800 to $900. If replacement heifers fail to become pregnant, her salvage value as a feeder is approximately $525, indicating a loss of about $325. If age at puberty could be reduced, cost effectively, success of pregnancy would be greatly increased. In addition, heifers would more likely become pregnant early in the breeding season, resulting in an earlier first-calving date. Heifers giving birth early in their first-calving season have previously been shown to have greater lifetime productivity and longevity.

Melatonin is a protein hormone released from the pineal gland during night. Its release increases with decreasing daylight hours and is usually associated with hair or fur growth in the fall and winter. Previous research by other investigators demonstrated that ewe lambs and beef heifers exposed to modified day length (short days) attained puberty at an earlier age. Additionally, other researchers, using a small number of animals, reported advanced puberty in heifers after exposure melatonin implants. If melatonin can indeed advance puberty, photoperiod (day length) requirements also need to be taken into account in addition to threshold age and body weight, which are considered essential for attainment of puberty. The objective of this experiment was to evaluate the ability of melatonin implants, administered to suckling heifers before summer turn-out, to reduce age at puberty and improve subsequent reproductive performance.

METHODS

Thirty suckling crossbred spring-born beef heifers, before summer turnout, were assigned randomly to one of two groups: 1) implanted, or 2) control. Implanted heifers (15 head) received 54-mg melatonin (three implants each containing 18-mg melatonin), and control heifers (15 head) received no treatment. At implanting, heifers averaged 96 days of age, and 258 ± 9 pounds. Implants were removed from implanted heifers at weaning. At weaning, heifers averaged 232 days of age and 522 ± 14 pounds.

Beginning in December (average age 285 days) and continuing until breeding (average age 411 days, averaged weight 746 ± 14 pounds and average body condition score 5.1 ± 0.1 (1 to 9 scale)) heifers were rectally palpated every 30 days to evaluate ovarian activity and determine age at puberty.

Regardless of reproductive status, all heifers were synchronized with Syncro-Mate-B® (SMB). Estrus response to synchronization (heifers displaying standing estrus between SMB implant removal and artificial insemination) was determined by visual detection. Heifers were time bred (mass-mated) to a single sire by no more than 2 technicians 48 hours after SMB implant removal. Seventy-two hours after artificial insemination (AI), heifers were exposed to a clean-up bull for the remaining 42 days of the 45-day breeding season.

First-service conception rate to AI was determined by calving date. Pregnancy diagnosis was determined approximately 150 days after completion of the breeding season. Subsequent pregnancy rate as two year olds and age at calving as three year olds was also determined for each treatment group.

RESULTS AND DISCUSSION

Melatonin implants administered to suckling beef heifers and removed at weaning had no effect on ovarian activity for the 4 months proceeding estrus synchronization, age at puberty or the proportion of heifers that had attained puberty by the beginning of the breeding season. The proportion of heifers displaying a synchronized estrus did not differ between treatment groups and averaged 55 percent.

Melatonin treatment also had no effect on first-service conception rate to AI or pregnancy rate, averaging 41.4 percent and 89.7 percent, respectively, for all heifers. Possibly the amount of melatonin released from the implant was not adequate or was not provided at the proper stage of development in this study.

Surprisingly, pregnancy rate as two year olds tended to be higher for heifers implanted as calves compared to their non-implanted counterparts (83.3 percent vs. 58.3 percent, respectively). Additionally, melatonin treated heifers were significantly younger at calving as three year olds compared to control heifers, averaging 1085 vs. 1074 days, respectively. These results were unexpected and should be interpreted cautiously. There were a limited number on animals in the current experiment and the proportion of heifers pregnant as two-year olds is affected dramatically by only few animals (10 of 12 implanted heifers pregnant vs. 7 of 12 control heifers pregnant). In addition, although implanted heifers calved at 10 days of age younger as three year olds compared to control heifers, it should be questioned if an implant administered at 3 months and removed at 8 months of age can have this type of long-term effect, and if 10 days is truly a significant reduction.

These results suggest that further assessment of melatonin implants administered to larger numbers of suckling beef heifers is warranted. Dosage, timing of administration, and long-term effects should be evaluated in future research.