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Summary

The use of ultrasound technology in reproductive management of beef cow herds is currently being evaluated in ongoing projects with cooperator herds in South Dakota. The projects include the use of ultrasound for the purposes of evaluating 1) cycling activity of heifers on estrous synchronization programs immediately prior to breeding and 2) early pregnancy detection and aging of fetuses in heifers and mature cows. Information obtained from these images will be used by producers to make management decisions associated with the breeding season, selection of heifers, and nutrition. Ovaries are evaluated for the presence of follicles and a corpus luteum, while pregnancies are determined from the presence or absence of a viable fetus. Age of the fetus is determined by the relative size of the fetus which can be measured by the machine. Initial data indicate that ultrasound technology can be used for all of the above mentioned purposes. One hundred fifty-eight heifers have been evaluated for cyclicity and 416 heifers have been scanned for early pregnancy. Pregnancy will be determined in 900 head of mature cows. As this is an ongoing project, calving data will be collected during the 1995 calving season to confirm ultrasound results.

Key Words: Ultrasound, Heifers, Cows, Cycling, Pregnancy

Introduction

Reproductive efficiency continues to be an extremely important factor in determining the profitability of a given cow-calf operation. In addition to reproductive efficiency, cost of production is also important in determining profitability. Management decisions based on sound information can help obtain optimum reproductive performance, minimize production costs, and maximize profits. Incorporation of tools and technology that can help a producer obtain these goals is an ongoing process. New tools or technologies need to be constantly evaluated under environments in which they are to be utilized.

While ultrasound technology itself is not new, the application to the livestock industry and especially the beef industry is relatively new. The technology utilizes high-frequency sound waves generated by the machine and emitted through a transducer. The sound waves then encounter tissues and based upon their density, some, all, or none of the sound waves are reflected back to the transducer and into the computer part of the ultrasound machine. Utilizing shades of gray, the computer interprets the returned sound waves and produces an image on the screen. The images produced will vary in shades of gray from fluid filled structures (black) to bone (white). While many tools or new technologies are limited in the number of potential areas of application, ultrasound is unique in that, by utilizing various sizes of transducers, the machine can be applied to many different areas of production.

Initial uses of ultrasound in the beef industry have been directed at evaluating some carcass traits on the live animal. These include measurement of loin eye area and fat thickness with more recent efforts directed at measuring the amount of marbling in the loin eye muscle. Another area which has received little attention except in research has been the use of ultrasound in reproductive management. Research has demonstrated that images of the

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reproductive tract and fetuses can be produced and used in managing reproductive events. Structures (follicles, corpus luteum, cysts) on the ovaries can be visualized and cyclic activity determined. Such information can aid in developing strategies prior to and during the breeding season on individual animals. Results from research has shown that pregnancy in cattle can accurately be detected as early as days 22 to 25 of gestation. This type of information at this early stage of gestation allows flexibility in management of females for continued breeding, selection of replacements, and nutritional programs.

Incorporation of any new technology or tool by a producer should occur only after proper evaluation of the practicality of utilizing such a tool in a ranching situation. With that in mind projects were developed to evaluate the use of ultrasound technology for purposes of reproductive management with four cooperator herds in western South Dakota as well as the herds at the Cottonwood and Antelope Research Stations.

Materials and Methods

The projects began in the spring of 1994 and will continue through the spring calving season of 1995. This will allow collection of calving data to confirm the data collected with the ultrasound machine. A total of 158 head of bred yearling heifers were scanned to determine cycling activity. Additionally, 416 head of heifers were scanned for early pregnancy determination. These heifers were between days 22 and 90 of gestation. Nine hundred head of mature cows will be scanned for pregnancy determination. Cows will be between day 1 and 90 of gestation.

Ultrasound scanning of heifers and cows is accomplished with an Aloka 500 ultrasound machine equipped with a 5 MHz transducer. The transducer is introduced rectally and held in the palm of the hand. The reproductive tract of heifers is scanned and images of the ovaries are used to determine the presence of follicles and a corpus luteum. Based upon structures found on the ovaries and the size and tone of the reproductive tract, a tract score (1-5: 1 = immature and noncycling to 5 = presence of corpus luteum and good tone indicating cyclicity) was also assigned to each individual. This was done to determine cycling status on the day of prostaglandin injection in heifers that had been on a MGA-PGF estrous synchronization program. Reproductive tracts of mature cows and heifers were scanned for the presence of a fetus to determine pregnancy status. Presence of a viable fetus was used to indicate pregnancy and the age of the fetus was determined by its relative size. In all instances heifers had been artificially inseminated (AI) prior to the use of clean-up bulls. Established pregnancies were determined to be either due to AI or bulls based on size of the fetus.

Calving data from all herds will be collected during the spring calving season of 1995 to confirm the ultrasound data. Additionally, cooperating producers will be asked to evaluate the use of the ultrasound for the above mentioned purposes. Their evaluation will include the amount of time involved in carrying out the ultrasound scans as well as accomplishing the goals they had set for utilizing the machine.

Results and Discussion

Reproductive tracts of heifers (n = 158) from three separate herds were scanned with the ultrasound to determine cycling status. All heifers were on a MGA-PGF estrous synchronization program. Scans occurred on the day of prostaglandin injection to evaluate the ability of the ultrasound to distinguish heifers that would respond to prostaglandin injection due to the presence of a corpus luteum (tract score = 5). All heifers were artificially inseminated subsequent to the prostaglandin injection and following heat detection. Table 1 illustrates the breakdown of tract scores and cyclic activity of the 158 heifers scanned.

Based on ultrasound scans, 81.0% of the heifers had tract scores of 5, while an additional 13.3% had tract scores of 4. Together, a total of 94% of the heifers had the potential to be detected in heat and be bred during the subsequent AI period. Since the heifers with tract scores of 4 would cycle naturally during the AI period and not in response to the prostaglandin injection, one could expect only

Table 1. Tract scores[a] indicating cycling activity of heifers at the time of prostaglandin injection

Number of heifers	158
Tract scores	
1	0
2	1
3	7
4	21
5	128
Cystic ovary	1

[a]Tract scores: 1 = immature tract, no tone; 2 = larger, no tone; 3 = good tone to tract with medium size follicles; 4 = good tone and erect tract, possible C.L.; 5 = good tone and erect tract, C.L. present.

5.0% to cycle per day. At that rate only about 5 heifers out of that group may have cycled. Together, one might only expect 133 or 84.0% of the heifers to cycle during the AI period. In fact, 85.0% of the heifers were detected in heat and bred to AI. Ultrasound scans also indicated that approximately 5.7% of the heifers would have little if any chance of cycling and being bred during the AI period due to tract scores of 2's and 3's and in one instance the presence of a cystic ovary.

Early pregnancy detection was carried out on 416 head of heifers that ranged from day 22 to 90 of gestation. Pregnancies were classified as AI or bull bred as well as nonpregnant. Table 2 illustrates the results of the ultrasound scans for pregnancy status and age. Determination of pregnancy status of heifers early in gestation allows producers to make selection and culling decisions earlier. Such information allows for selection of the early conceiving heifers as replacements. Also, such information adds more flexibility to marketing opportunities of bred and open heifers that will not be kept and added to the cow herd. In addition, costs for keeping replacements that are open or that conceived late in the season can be cut due to earlier identification of such heifers. Yet another advantage of earlier pregnancy detection and subsequent selection of replacements is realized in years when availability of grass may be limited due to less rainfall. Confirmation of the above data will be made with calving data collected in the spring calving season of 1995.

Table 2. Early pregnancy data for heifers ranging in gestational age from day 22 to day 90 as determined from ultrasound scans

Number of heifers	416
Nonpregnant	74
AI conception	239
Bull conception	103

Finally, 900 head of mature cows from two cooperator herds and the Antelope Range Station ranging in days of gestation from 30 to 90 will be scanned with the ultrasound. Data from these scans will be used to accomplish two goals of the cooperators. One is to determine pregnancy in cows that will be sent on to a public lands allotment. The cooperating producer has been concerned that his conception rates coming off of the allotment have been less than satisfactory. His concern is that the terrain in the allotment is extremely rugged and that all cows are not covered properly by the bulls. The goal in this case was to send only pregnant cows to the allotment and to keep open cows in a more desirable breeding pasture for the remainder of the breeding season to determine if conception rates in that herd of cows could be increased. In this herd 137 cows that had been with the bull for 52 days were scanned for pregnancy. One hundred eighteen cows were detected as pregnant and sent to the allotment. Ten head were determined to be open and 9 were classified as unclassifiable due to the fact that some may have been less than 22 days pregnant. As mentioned in the introduction, accuracy of detecting pregnancy prior to day 22 is considerably less than 100%.

The goals of the second cooperating producer is to age the fetuses for the purpose of dividing the cow herd into management groups as they relate to nutrition and calving and to get an indication as to fetal mortality in the cow herd. Ultimately, the producer hopes to better manage the herd for nutrition immediately prior

to calving and to reduce both feed costs and labor. A video tape record of all pregnancies will be made to allow evaluation of fetal mortality through calving. Again, calving data collected during the spring of 1995 will be collected to confirm the ultrasound results.

The initial results of this project indicate that the use of ultrasound imaging for reproductive management can probably be easily justified for several purposes. Obviously a cost factor needs to be considered and will be evaluated at the conclusion of the projects by the cooperating producers. It appears that ultrasound technology may offer an extremely valuable tool for producers to utilize to improve the reproductive efficiency in their herds and help in reducing production costs.

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