Applying ultrasound to the individual dairy cow and herd level reproductive management

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Modern dairy cattle have been described as subfertile.[1]   Implementing timed breeding synchronization programs (TAI) can improve heat detection efficiency, but conception rates can remain low. The majority of synchronization programs are initiated regardless of where the cow is within her estrous cycle, and it has been shown that conception rates vary greatly depending upon when these programs are started in relation to the cow's estrous cycle.[2]   Most important in predicting the stage of a cow's estrous cycle is identifying the presence of an active corpus luteum (CL). Ultrasound has been found to be far superior to rectal palpation in predicting an active CL and high progesterone levels,[3] and thus better predicting when cows fall into the optimum period to initiate or continue synchronization programs. By using ultrasound, cows can be assessed and synchronization programs can be modified when cows fail to respond to the first GnRH injection.

Ultrasound can also be used as a heat detection aid, especially for dairies that utilize tail chalk. Accuracy of heat detection when using tail chalk can vary, and often cows in diestrus or even pregnant are bred. Using ultrasound, cows with an active CL can be avoided, and only cows appearing in estrus will be bred.

Incorporating ultrasound intensively into TAI and estrus detection programs can improve pregnancy rates dramatically. Individual cow management along with techniques and strategies to apply these protocols on any size dairy will be discussed.

Keywords: Ultrasound, synchronization, timed AI

Introduction

Modern dairy cattle have been described as subfertile[1] and the expanding dairies of the western U.S. seem to be experiencing some of the greatest reproductive inefficiency. According to DHI-Provo data, since 1990, days open have increased by more than 30 days for dairies in the western United States, with conception rates declining almost 25% during that same period. Heat detection rates followed the same downturn during the 90's, but with greater implementation of TAI, conception rates have since risen to values approaching 45 to 50%. While the greater use of synchronization programs has improved heat detection efficiency, conception rates have still continued to decline. It is not uncommon to find herds in the western United States with conception rates to timed breeding programs mired in the 20% range. There are multiple contributing factors to this problem, such as those related to abnormal reproductive physiology, poor timing of initiation, and non-compliance to synchronization protocols.

Materials and methods

In order to achieve acceptable reproductive performance additional management tools need to be implemented to overcome this subfertility. Timed breeding synchronization programs are one such tool but conception rates with these programs, especially in expanding western dairies under current management conditions, are far from desirable. Reproductive ultrasound is another tool available to dairy practitioners to improve reproductive performance. Due to practical limitations and the cost of ultrasound equipment, dairy practitioners have been slow to adopt this technology. Recent significant improvements and less expensive portable ultrasound units make practicality and cost less of a concern.

Reproductive ultrasound in the dairy industry is most often thought of as a means of early pregnancy diagnosis.[2] With significant decreases in conception rates and failure to observe visual estrus, being able to identify open cows as soon as possible and then initiate a timed breeding program can improve pregnancy rates (percent of eligible cows becoming pregnant over a 21-d period) by increasing the heat detection rate. However conception rates to synchronization programs still are below desired levels and keep pregnancy rates low. Currently in the western U.S. dairy industry, the majority of cows found not pregnant at pregnancy diagnosis are immediately started on a synchronization program or in some cases the program is initiated a week prior to pregnancy diagnosis as because GnRH has not been shown to affect pregnancy.[3] Upon being diagnosed not pregnant, cows are then given prostaglandin and continued in the synchronization program. Both of these strategies initiate synchronization programs no matter where the cow is within her estrous cycle.

It has been shown that conception rates vary greatly depending upon when synchronization programs are started in relation to the cow's estrous cycle. Most studies find that the Ovsynch timed AI program results in the greatest conception rates when initiated between d 5 to 12 of the estrous cycle.[4-6] Research conducted in Colorado on commercial dairies found that a large percentage of cows at first service or diagnosed not pregnant are not within this optimal 5 to 12 d window to start synchronization programs. When these cows are allowed to continue through programs, conception rates are extremely low. Not only are these non-synchronized cows outside the d 5 to 12 window, but a large percentage are acyclic, have cystic ovaries, contain dead fetuses, or have pyometra, which make them poor candidates for enrollment in a synchronization program.[7]

An advantage of ultrasound over rectal palpation is the ability to completely assess ovarian structures and better predict when cows fall into the optimum period to initiate or continue in synchronization programs. Most important in predicting the stage of a cow's estrous cycle is identifying the presence of an active corpus luteum. Ultrasound has been found to be far superior to rectal palpation in predicting an active corpus luteum and high progesterone levels.[8,9] By using ultrasound, cows can be assessed and synchronization programs can be modified when cows fail to respond to the first GnRH injection. Combining ultrasound with a synchronization program can be a powerful management tool to maximize not only heat detection rates, but also conception rates resulting in improved overall pregnancy rates.

Ultrasound can also be used as a heat detection aid, especially for dairies that utilize tail chalk. Accuracy of heat detection when using tail chalk can vary, and often diestrus or even pregnant cattle are bred. By using the ultrasound, cows with an active corpus luteum can be avoided, and only cows appearing in estrus (hyperechoic uterus, ovulatory follicle and no corpus luteum) will be bred.

However, western U.S. dairies are also experiencing an increased cow-to-employee ratio, which makes increasing the level of reproductive management a challenge. In order to implement this reproductive management system, dairies must increase the number of times cattle are handled for ultrasound examination, injections, and artificial insemination. Only dairies capable of handling large numbers of cattle in a short period of time will be able to incorporate these protocols effectively. Currently most large dairies in the western U.S. utilize lock-ups to handle cattle. This system requires that cows actively enter and lock themselves, which is not always ideal. Almost 100% of the time this system results in some loose cattle requiring time to find and then restrain.

Management/palpation rails were created and gained popularity with the advent of bovine somatotropin. If designed properly, this system can be very efficient in working large numbers of cattle in a short period of time. Currently on one client's 10,000 cow dairy, our practice incorporates ultrasound exclusively and provides 100% TAI. Cattle are handled in a roofed double-40 palpation rail. With three ultrasonographers, our practice scans 300-450 cows/hour, and using multiple AI technicians we inseminate approximately 250 cows/hour. By ultrasounding, injecting, and inseminating hundreds of cows in a very short time period, we maintain the time intervals for synchronization and thus maximize conception rates. Only producers willing to restructure their reproductive management and build facilities around it will be able to implement these protocols effectively.

Conclusion

Cows have changed so much reproductively over the last 20 years that it takes greater attention to detail and a better understanding of reproductive physiology to get cows pregnant. Producers are reluctant to truly admit that cows have changed. They still want to manage cows reproductively as if they were in the 1980s. Acknowledging that cows are not the same and then implementing intensive management protocols to overcome these obstacles is critical to improving reproduction. Everything we thought we knew about the reproduction of lactating dairy cows has to be reconsidered. Thinking outside the box and applying new strategies to reproductive management can pay big returns. Incorporating ultrasound intensively into TAI and estrus detection programs can improve rates dramatically, but requires a different mindset for managing cows.

Managing reproduction is unlike any other task on the dairy. To succeed, attention to detail has to border on obsessive-compulsive. Synchronization programs require attention to detail,

strict adherence to injection schedules, and proper AI technique. Managing high numbers of cows within these programs also requires strict data entry and retrieval within dairy software programs. So, no matter how well the cows are started on these programs, if compliance is inadequate, results will be inferior. Failure to strive for perfection in every aspect of reproductive management is doomed to poor results. Finding people that have the work ethic and are knowledgeable of reproduction is exceedingly difficult for producers.

Other tasks within the dairy industry have been contracted over the years, such as crop production and calf/heifer production. By designing a veterinary practice around the management of reproduction and employing highly skilled individuals to conduct all aspects of reproduction from ultrasound, injections, and AI to data entry/retrieval reproduction can be improved. The greatest chance of reproductive success occurs when incorporating ultrasound into both synchronization and heat detection programs on dairies.

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