REPRO TRACKS

by Cliff Lamb, Texas A&M University

Opportunities for Doppler Ultrasonography to Manage Reproduction in Beef Cattle

New opportunities exist for cattle producers to create the best reproductive management strategies on their operation.

The development of reproductive technologies continues to affect the productivity and efficiency of beef cattle operations. Typically we think of artificial insemination (AI), synchronization of estrus and embryo transfer (ET) as the primary reproductive technologies.

However, rectal palpation and the subsequent development and use of ultrasound and/or use of blood samples for pregnancy diagnosis are also significant developments that assist cattle producers in managing reproduction within their herds.

Doppler predictions

Improvements in technology to allow the use of Doppler ultrasound are now a reality and provide opportunities for increased accuracy for reproductive processes and earlier detection of pregnancy. Researchers are currently exploring how Doppler ultrasound can be incorporated into reproductive management programs.

With the use of Doppler ultrasound, it is possible to detect changes in the frequency of the sound waves reflected off a moving object. Therefore, Doppler ultrasonography can be used to detect blood flow in blood vessels. The velocity and direction of the blood flow is expressed via color signals (see Fig. 1), which can be utilized to determine the functionality of reproductive tract structures.

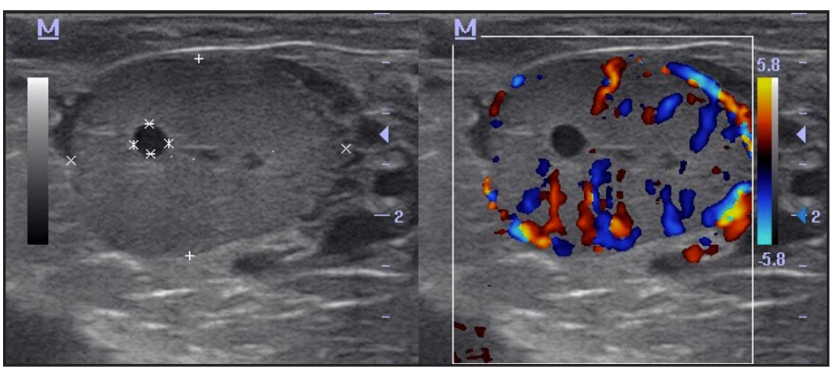
Eye on the CL

Among the numerous opportunities for this technology in the reproductive field, Doppler ultrasonography has been explored as a tool for real-time assessment of *corpus luteum* (CL) blood perfusion (passage of blood through blood vessels).

The CL is a structure on the ovary that secretes the hormone progesterone. Progesterone is responsible for maintaining pregnancy in beef cattle. The use of Doppler ultrasound may enhance the opportunities to assess the "health" of the CL and subsequent success of a reproductive management protocol.

Concentrations of progesterone tend to be more correlated with CL blood perfusion than with CL size during its regression (two to five days before the female expresses estrus). Thus the detection of CL blood flow

Fig. 1: ***Doppler ultrasound image of an ovary demonstrating blood perfusion (red and blue) of a bovine*** **corpus luteum.**



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via Doppler ultrasonography has been suggested by some scientists as a potential tool for early pregnancy diagnosis.

Using Doppler ultrasound, scientists have successfully identified nonpregnant females as early as 20-22 days after mating with 97%-100% sensitivity. Therefore, there is a low probability of misdiagnosing pregnant females as nonpregnant during that period.

This technique has allowed for the development of early estrous resynchronization programs that promote opportunities to resynchronize nonpregnant cows and reduce the interval between inseminations by up to 16 days when compared with conventional programs.

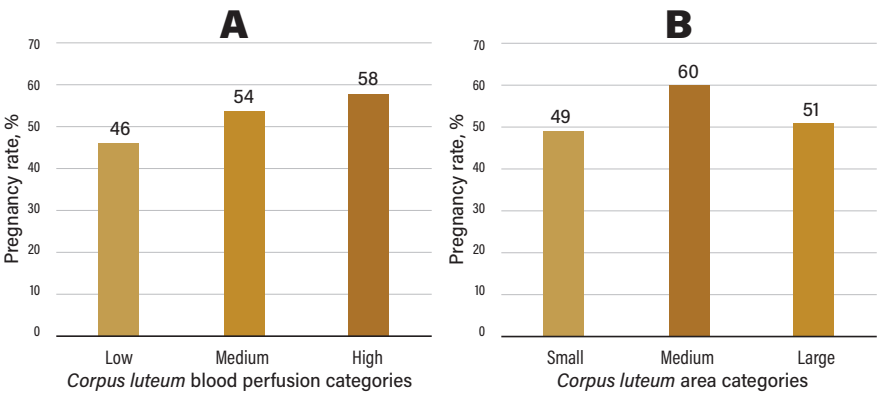
In one recent report, ET recipients were synchronized and received an embryo seven days after synchronization. Six days after receiving an embryo all the females were resynchronized with a progesterone-based protocol, and 15 days after receiving an embryo, recipients were evaluated by Doppler ultrasonography. The females diagnosed as not pregnant were resynchronized and received a second embryo 24 days after the first embryo, resulting in acceptable pregnancy rates.

This project demonstrated Doppler ultrasound was both accurate and provided an opportunity to increase the earlier detection of nonpregnant females, thereby reducing the interval between embryo transfers.

Fixed-time ET

CL evaluation through Doppler ultrasonography can also be performed for recipient selection in fixed-time ET programs.

Fig. 2: ***Pregnancy rates in recipients after embryo transfer based on retrospective analyses of blood perfusion (panel A) and CL area (panel B).***



As both price decreases and trained professionals increase, the use of Doppler technology will become more popular in the future.

Conventionally, recipients are selected based on the presence of a CL assessed by gray-scale ultrasonography or rectal palpation. However, since the presence of a CL is not always an indication of its function, there may be situations where an embryo is transferred to a nonreceptive uterus, resulting in reduced pregnancy rates and a waste of potential highly valued embryos.

When Doppler ultrasonography was used to evaluate crossbred recipients on the day of embryo transfer, females were categorized into three groups according to CL size and blood perfusion. Pregnancy rates increased according to the CL blood perfusion category (low, 46%; medium, 54%; high, 58%).

Pregnancy rates did not differ by luteal size category (see Fig. 2). There also was no difference in concentrations of progesterone among the blood perfusion groups on the day of embryo transfer.

This suggests blood perfusion within the CL could be a better indicator of CL function than progesterone concentrations, and could allow for the selection of suitable embryo recipients with a greater chance of maintaining pregnancies.

Cost is a challenge

Additional opportunities will develop as a result of the initial positive results of Doppler ultrasound. However, before the technology becomes commonplace for producers, the cost of the equipment will need to decrease sufficiently to ensure that technicians reap the benefits. In addition, use of Doppler ultrasound requires the expertise of a trained technician.

As both price decreases and trained professionals increase, the use of this technology will become more popular in the future. AJ

Editor's note: Cliff Lamb is the animal science department head and a professor at Texas A&M University in College Station, Texas.