Strategically Using Pregnancy Diagnosis to Identify Nonpregnant Cows

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Highlights

- Obtaining the pregnancy status of each individual cow in the herd through the use of pregnancy diagnosis allows us to identify and cull less productive females.
- Revenue from cull cows represents 15–30% of the revenue in cow–calf production systems.
- Culling open females increases biological and production efficiency of cow–calf operations.
- Having a basic understanding of the methods available for pregnancy diagnosis will help producers determine the best option for their operation.

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Economic Importance of Pregnancy Diagnosis

Pregnancy diagnosis is an important part of reproductive management in productive beef cow–calf operations. Keeping a nonpregnant cow on the farm for an entire year has negative economic implications because she accrues the same cost of a pregnant cow, but without generating income. With the move toward more efficient operations and inclusion of artificial insemination (AI) and other reproductive technologies in cattle production, abstaining from pregnancy diagnosis may no longer be economically viable or practical. Establishing a pregnancy diagnosis program allows for the detection of cows that are not pregnant and allows producers to make management decisions to increase reproductive efficiency, such as culling of infertile females or resynchronizing females that are open.

Open cows decrease profitability as they use similar resources as pregnant cows without producing a marketable calf to justify these costs. In a hypothetical well–managed beef cattle operation with 100 brood cows exposed to a 75–day breeding season, we can expect pregnancy rates at the end of the breeding season to range between 85 and 95%. If we consider cow cost in this operation to be $700 per cow per year, and final pregnancy rates to be 90%, this operation is spending an extra $7,000 ($700 × 10 open cows = $7,000) per year maintaining cows that fail to produce a calf. Let us assume that this operation weans 85 calves every year (5% of the pregnant cows fail to wean a calf due to pregnancy loss and calf mortality prior to weaning). If this producer neglects the use of pregnancy diagnosis and fails to recognize the open cows after the end of the breeding season (10% of the cow herd), cost of production will increase by $82 per calf ($7,000 divided by 85 calves) in this particular operation. The above–mentioned costs and performance values can vary depending on the operation; however, as we move toward a more efficient cow–calf production system, identifying open cows is a requirement to optimize profitability of beef herds.

Another important consideration is the revenue obtained from marketing open cows. These cows normally represent between 15 and 30% of sales revenue in cow–calf operations. As with many other commodities, cull cow prices undergo seasonal fluctuations. Recognizing nonpregnant cows soon after the breeding season allows producers to develop a market plan for these animals and evaluate the ideal time to sell them in order to optimize profitability.

Although the economic benefits of incorporating pregnancy diagnosis are clear, the rate of adoption by beef cow–calf operations is considerably low in the United States (NAHMS, 2008; see Table 1). As observed with many reproductive technologies, a greater percentage of operations with a larger herd routinely use pregnancy diagnosis compared to smaller operations. This article provides an overview of the different methods available (rectal palpation, transrectal ultrasound, and blood tests; see Table 2) for pregnancy diagnosis and will provide a practical description of how to implement these methods. It is important to emphasize that there is no "one size fits all" when it comes to pregnancy diagnosis, and each producer should have an understanding of the currently available methods to decide on the most economically viable strategy to diagnose pregnancy in their operations. Developing a relationship with local veterinarians will help producers evaluate the different options available for pregnancy diagnosis and optimize the efficiency and accuracy of pregnancy diagnosis within their herds.

Table 1. Percentage of U.S. beef cattle producers adopting pregnancy diagnosis programs by method.

	Herd size (number of beef cows)				
Technology	**1–49**	**50–99**	**100–199**	**≥200**	**All operations**
Rectal palpation	10.8 (1.2)	25.8 (2.6)	51.2 (2.8)	58.3 (2.6)	18.0 (1.0)
Ultrasound	0.5 (0.2)	4.4 (1.1)	6.5 (1.3)	13.4 (1.6)	2.2 (0.3)

Note: Standard errors are in parentheses.
Adapted from *Part II: Reference of beef cow–calf management practices in the United States, 2007–08*, by the National Animal Health Monitoring System, 2009, p. 18 (https://www.aphis.usda.gov/animal_health/nahms/beefcowcalf/downloads/beef0708/Beef0708_dr_PartII_1.pdf).

Table 2. Characteristics of commercially available pregnancy diagnosis methods.

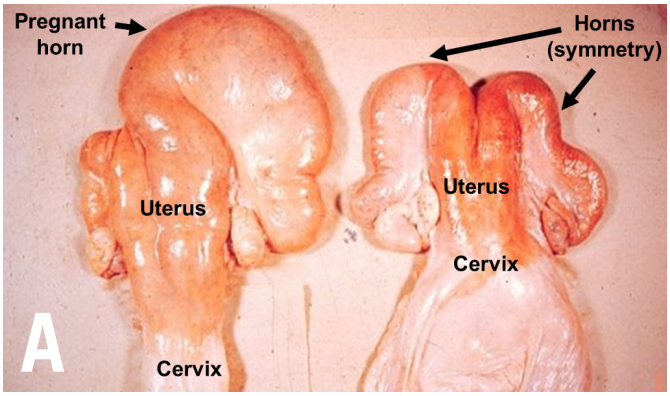
	How early detects pregnancy	Determines gestational age	Determines fetal sex	Requires experienced technician	Cost per cow (in $)	Chute–side results
Rectal palpation	35–50 days	Yes	No	Yes	3–10	Yes
Ultrasound	28 days	Yes	Yes	Yes	7–15	Yes
Blood test (PAG)	28 days	No	No	No	3–5	Depends on the test

Methods available to cattle producers

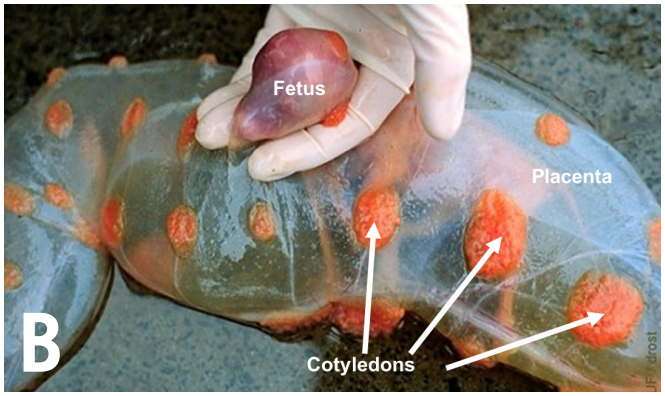
Rectal palpation

Rectal palpation is the most commonly used method for pregnancy diagnosis in beef cattle operation across the United States. During pregnancy, the reproductive tract of cows and heifers undergoes changes in size, location, and contents within the uterus. We can use these changes as landmarks during palpation to differentiate pregnant from open females as early as 40 to 60 days after breeding, depending on the skill of the examiner. This approach can be used thereafter until parturition to accurately determine pregnancy status. Additionally, an experienced examiner also can have a broad estimation of embryo/fetal age through rectal palpation. The main signs of a pregnant cow during rectal palpation are: uterine horn asymmetry, palpation of the fetal membranes (amnion and chorioallantois), presence of fluid in the uterus, palpation of the fetus itself, location of the reproductive tract, and palpation of the placentomes. Placentomes are the structures formed by the attachment of the placenta to the uterus and allow for the exchange of nutrients between the dam to the fetus. Figure 1a shows a reproductive tract from a cow that has been pregnant for 50 days on the left and the reproductive tract of an open cow on the right. Notice the enlarged and fluid–filled right uterine horn of the pregnant cow. The examiner can feel this asymmetry between the uterine horns, as well as the presence of fluid in the uterus to determine that this cow is pregnant. As mentioned previously, the examiner can also feel for placentomes when performing rectal palpation in later stages of pregnancy. In figure 1b, the fetus and fetal membranes (amnion and chorioallantois) were dissected from a pregnant uterus. The button–like structures in this figure are the cotyledons, the fetal part of the placentomes. The maternal part of the placentome is the caruncle and is not present in this figure. An experienced examiner can feel for these structures at approximately 120 days of pregnancy in order to recognize pregnant cows. Overall, rectal palpation is a reliable method to differentiate between pregnant and open cows.

Figure 1. Uterine characteristics of pregnant cows used as physical markers in rectal palpation exams.



Reproductive tract of a pregnant (left) and open (right) cow. The asymmetry between the uterine horns can be used to detect pregnant females through rectal palpation between days 40–90 of gestation.



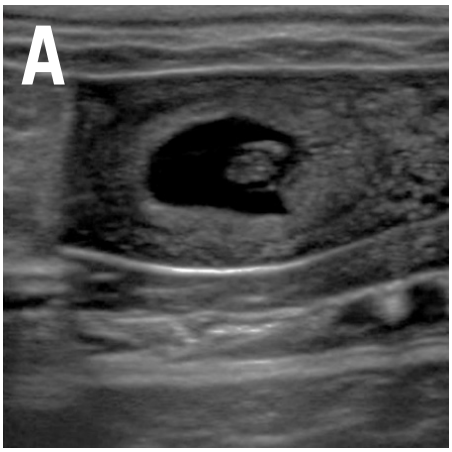
Dissected fetus and fetal membranes. The button–like structures are the fetal part of the placentomes (cotyledons). The examiner can feel for these placentomes during rectal palpation to identify pregnant cows.

From *Visual guides of animal reproduction*, by the Drost Project, 2020 (https://visgar.vetmed.ufl.edu/en_bovrep/diagnosis/diagnosis.html). Copyright 1982 by M. Drost. Reprinted with permission.

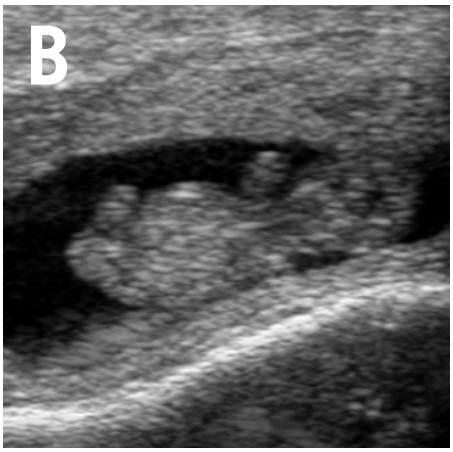
Transrectal ultrasonography

There has been a continuous increase in the adoption of transrectal ultrasonography (TUS) as a pregnancy diagnosis tool over the last few decades. A trained examiner can provide an accurate pregnancy diagnosis using TUS as early as day 26 of gestation in heifers and day 28 of gestation in cows. However, most pregnancy diagnoses via TUS that are performed commercially are scheduled no earlier than 30–35 days of gestation. This decreases the chances of false negatives (considering a pregnant cow open) and makes the exam relatively quicker, which is beneficial for operations that perform pregnancy diagnosis on a large number of females in a single day. Other advantages of TUS compared to rectal palpation are the ability to determine the sex of the fetus and more accurate estimations of embryo/fetal age. In order to determine fetal sex, it is recommended that TUS be performed between days 60 and 90 of gestation. The greatest accuracy for estimating fetal age via TUS occurs up to day 100 of gestation. Examiners usually rely on rectal palpation to estimate fetal age after this point because the fetus is too large to fit on the ultrasound image. Figure 2 represents ultrasound images from an embryo on day 29 of gestation (Figure 2a), and a fetus on day 49 (Figure 2b) and 70 (Figure 2c) of gestation.

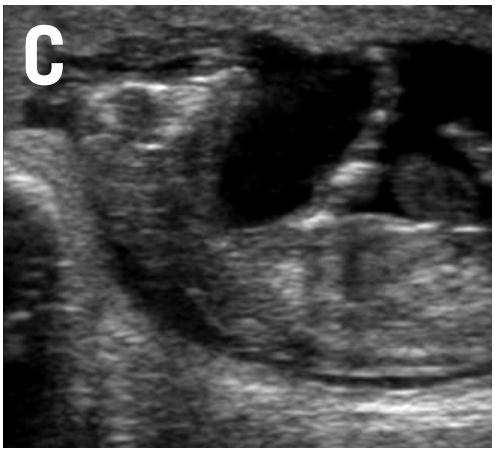
Figure 2. Ultrasound images of bovine pregnancies.



An embryo on day 29 of gestation.
Note: Images are not in the same scale



A fetus on day 49 of gestation.



A fetus on day 70 of gestation.

Blood tests

The blood–based test is a more recently developed and increasingly adopted tool for pregnancy diagnosis among both commercial and seedstock operations. There currently are three different commercially available blood tests for cattle producers: BioPRYN (BioTracking, LLC), DG29 (Genex Cooperative Inc.), and the IDEXX Bovine Pregnancy Test (Idexx Laboratories Inc.). These three tests work in a relatively similar way, relying on the detection of pregnancy associated glycoproteins (PAG) in the blood circulation of pregnant cows or heifers. PAG are produced by a specific cell population within the bovine placenta. These proteins make their way into the maternal blood circulation and then can be detected in the peripheral blood of pregnant females. BioPRYN accepts blood samples as early as 25 days post breeding in heifers and 28 days post breeding in cows; IDEXX recommends day 28 blood samples; and DG29 has been validated using day 29 blood samples. Currently, PAG testing is accurate and can serve as a reliable tool to diagnose pregnancy commercially. The main advantage of the blood tests is that producers do not have to rely on a trained examiner to differentiate pregnant and open females. By learning how to collect blood samples, producers can ship these samples to a laboratory and obtain the pregnancy status of their females in a couple of days. One of the disadvantages of these tests compared to rectal palpation or ultrasonography is the absence of immediate chute–side results. However, a chute–side blood test was released by Idexx Laboratories Inc. that can be performed on–site by producers and results are obtained after a sample processing procedure that takes approximately 30 minutes.

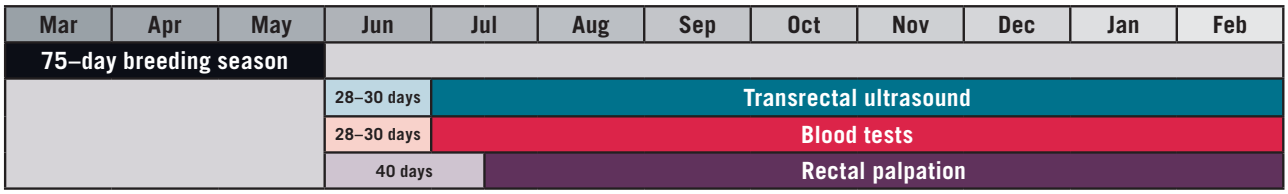
Current blood–based pregnancy tests have true–positive rates of 98–99% and false–positive (considered pregnant by the test but actually is open) rates of 1–5%. The main factors influencing the accuracy of these tests are human error (e.g., wrong blood tube identification or incorrect sample handling), embryonic mortality, and cows too early into their postpartum period. Human errors can lead to both false–positive and false–negative (considering a pregnant cow open) results. A cow that recently has experienced embryonic mortality and still has some PAG in circulation can generate a false–positive result. Similarly, a cow very early into the postpartum period also can have PAG in circulation from their previous pregnancy, leading to a false–positive result. For these reasons, it is recommended that cows are at least 60–90 days postpartum (depending on the blood test) when blood is collected in order to avoid false–positive results. Cattle producers must follow the manufacturers' recommendations for pregnancy blood tests to optimize the accuracy of the pregnancy diagnosis.

Scheduling a pregnancy diagnosis

Cow–calf producers that have an established breeding season can perform a single pregnancy diagnosis after the bull is removed from the herd and accurately detect the females that failed to become pregnant. The method used to diagnose pregnancy will determine how long after bull removal the pregnancy check can be scheduled. For example, if we are using a blood test or TUS, we can schedule a pregnancy diagnosis as early as 28–30 days after removing the bull. However, if we are using rectal palpation, it is recommended that we schedule the pregnancy diagnosis at least 40 days after bull removal (Figure 3a). Producers also may plan to vaccinate or perform other management procedures on calves at this time since calves are sorted from cows.

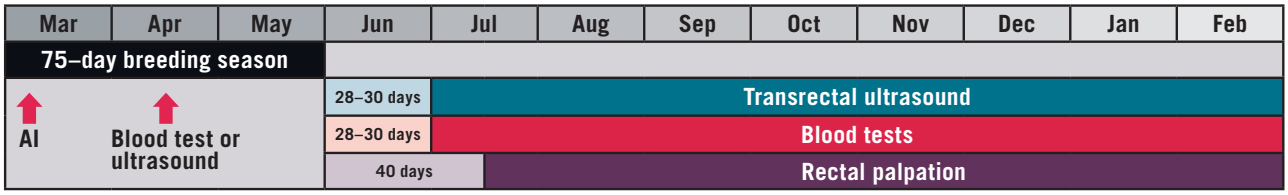
Figure 3. Three examples of when to schedule pregnancy diagnosis, based on testing method.

A



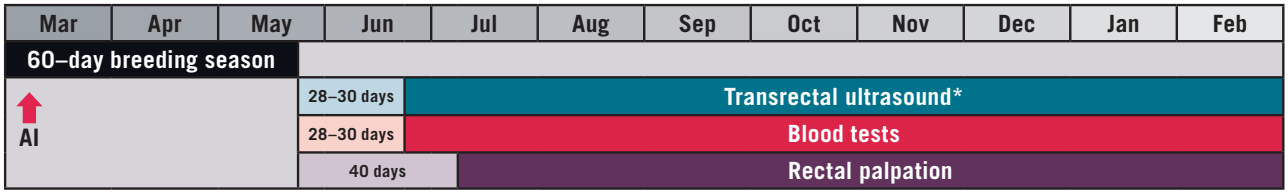
A 75–day breeding season with natural service.

B



A 75–day breeding season with fixed–time artificial insemination (AI) in the first day. Two pregnancy diagnoses are required in order to obtain a final pregnancy diagnosis and distinguish AI from natural–service pregnancies.

C



A 60–day breeding season. In this case, a single ultrasound examination can be performed 28–30 days after breeding and provide the final pregnancy diagnosis while distinguishing AI from natural–service pregnancies.

**Can differentiate AI from natural service pregnancies in a single ultrasound.*

The utilization of reproductive technologies, such as AI, has increased considerably over the last few decades. Pregnant heifers that are confirmed pregnant via AI usually have a marketing advantage compared to those bred by natural service. Similarly, AI–sired calves often are heavier at weaning and consequently sell for a greater price than calves produced through natural service. Producers can schedule a pregnancy diagnosis strategically to differentiate between females that became pregnant via AI versus females that became pregnant via the bull or females that are open. For example, think about a group of females that have been exposed to one round of fixed–time AI, followed by a 75–day breeding season where bulls were turned in with cows 10–14 days after AI (Figure 3b). Pregnancy diagnoses can be scheduled 30 days after AI and determine the females that successfully became pregnant via AI using TUS or blood tests. For both tests, the females that became pregnant by a cleanup bull would be too early in gestation to be recognized as pregnant at this point. Performing a final pregnancy diagnosis at least 30 days after the bulls are removed from the herd allows us to determine all the females that became pregnant throughout the breeding season. In a herd with a breeding season of 60 days or less, we can use a single pregnancy diagnosis to determine the females that became pregnant via AI and the females that became pregnant via the cleanup bull. This pregnancy diagnosis needs to be performed 30 days after the end of the breeding season (90 days after AI) using TUS in order to distinguish AI and natural–service pregnancies (Figure 3c). If the pregnancy check is scheduled more than 90 days after the AI, it can be challenging to differentiate cows that became pregnant via AI from bull–bred cows. It is important to emphasize that bulls should not be introduced until 10–14 days after AI in order to accurately distinguish pregnancies via AI and natural service.

Conclusions

Identifying and culling less fertile females through the use of pregnancy diagnosis is paramount for optimizing profitability in both commercial and seedstock operations. Failing to recognize these females will increase production costs, reduce reproductive performance over time, and decrease the ability of nutritional programs to adequately meet the nutritional requirements of the herd. Several methods are available to accurately detect pregnancy, and choosing a method is entirely dependent on what is the best fit for each operation. Encouraging producers to take action and detect less productive females can substantially impact beef production efficiency in the United States.

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