factsheet
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Pregnancy Diagnosis in Swine

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Introduction

Non-pregnant, non-lactating females decrease the reproductive efficiency of swine operations. They generate production costs and occupy space in breeding and gestation facilities, yet they do not participate actively in the production of piglets. As a result, producers invest time and money with essentially no opportunity for return each day that these females remain in the herd.

The most common reason for keeping non-pregnant, non-lactating females in swine operations is the failure to identify sows and gilts that do not conceive soon after breeding. Consequently, the development and implementation of effective pregnancy diagnostic procedures is an important component of an efficient reproductive management program. This publication provides objective information concerning several methods used for pregnancy diagnosis in swine.

Techniques Used for Pregnancy Diagnosis in Swine

Most techniques used for the identification of pregnant swine are based on physiological or behavioral changes that normally occur following conception. The extent of their use by producers depends upon several factors including:

- the magnitude of the physiological or behavioral change being measured;
- the time period during which it occurs;
- the type and cost of equipment and technical skills required to measure the changes; and
- the amount of labor required to perform the evaluation.

Each aspect has important implications in terms of evaluating and implementing pregnancy detection programs for swine operations. For example, a technique may be judged ineffective if it is used during the wrong time interval or done by an inadequately trained technician. Conversely, an effective technique may not be used routinely due to financial or practical limitations. In order to make informed decisions, a thorough understanding of the characteristics of each technique is important. A brief summary of the key points associated with each of the techniques is outlined in Table 1 (see page 6).

technique may not be used routinely due to financial or practical limitations. In order to make informed decisions, a thorough understanding of the characteristics of each technique is important. A brief summary of the key points associated with each of the techniques is outlined in Table 1 (see page 6). Detection of Estrus (Heat) Observation of physiological and behavioral signs of estrus after breeding is the most common method used for pregnancy diagnosis. If a sow or gilt becomes pregnant after breeding, the production of a hormone called progesterone is maintained until farrowing. High progesterone levels prevent the normalsequence of events that lead to estrus. Conversely, if pregnancy does not occur or is terminated prematurely, the progesterone levels decrease and physiological changes are initiated that eventually result in estrus. In essence, with this technique, it is the lack of estrus that signifies pregnancy.

Figure 1. Daily detection of estrus with a mature boar as a formof pregnancy diagnosis. Note: the erect ears or "ear popping"response of sow in estrus. Courtesy of B. Belstra, North Carolina State University

Reddening and swelling of the vulva, increased activity and vocalizations, and a change in the consistency of the vaginal mucus are all signs of an approaching estrus and can be observed one to two days prior to its occurrence. Females are classified as being in estrus or heat when they exhibit immobilization, or the standing reflex, in response to pressure placed on their backs (PIH-64). In many animals the ears also become erect when pressure is applied to the back (Figure 1). The physiological and behavioral signs and, thus, the accuracy of estrus detection, are enhanced considerably by short periods of daily exposure to a mature boar. Daily boar exposure beginning 17 days after breeding is the most common regimen used for determining pregnancy with this method.

Daily estrus detection with a mature boar is an accurate means of predicting farrowing rate. Studies on commercial farms have reported an accuracy of 98% when this strategy was initiated during the second week of pregnancy and was continued daily until the last three weeks of gestation. False negatives (diagnosis of a pregnant sow as non-pregnant) are rarely observed and occur when sows exhibit a spontaneous estrus during pregnancy. False positives (diagnosis of a nonpregnant sow as pregnant) are more common. False positives occur as a result of pseudopregnancy; group housing in which the number of females per pen is too large to allow for accurate observation of estrus in individual animals; continuous, uninterrupted exposure to boars, which reduces the intensity of estrus; and inadequately trained personnel.

If conducted properly, detection of estrus If conducted properly, detection of estrus allows for identification of pregnancy between 17 and 24 days after breeding. This ability for early detection is coupled with a high degree of accuracy because it is based on the observation of behaviors associated with sexual receptivity. It is naturally linked to breeding management and results in the shortest interval between the identification of non-pregnant animals and subsequent attempts to rebreed them. In other words, when estrual females are identified, they can be bred immediately. Finally, recognition of the standing reflex (and other signs of estrus) is a skill that is relatively easy to master in a short period of time without a significant amount of specialized training or equipment. It is important to recognize that visual detection skills improve with experience.

Daily observation during gestation is labor intensive compared with other techniques. The amount of time is related to the size of the operation, the relative location of the boars and sows within the facility, the type of housing, and the ease with which animals can be moved.

The feasibility of using visual detection of estrus for pregnancy diagnosis, at least from a labor perspective, is likely to differ among operations. In facilities with pens or individual crates located on either side of a common alleyway, daily boar exposure probably is a viable option for pregnancy diagnosis because boars can be moved through the alleyways to provide adequate contact for estrus detection without relocating females. In addition, by having boars in a central location relative to sows, simultaneous exposure is provided to more than one female. In contrast, labor requirements are likely to become limiting in facilities that require movement of both the sows and boars to a separate location for estrus detection, unless only a small number of sows have to be diagnosed in this manner. Daily movement of pregnant sows is a significant disadvantage for estrus detection in these types of buildings.

Ultrasonography

Mechanical devices that use ultrasound technology have been developed for use in pregnancy diagnosis. In general, all ultrasound machines have a probe (or transducer) attached to a receiving unit. The most popular probes are those that can be placed against the skin and used externally (transcutaneous probes).

Oil or another type of viscous gel or fluid is placed on the probe before it is placed on the animal's skin. This helps the sound waves penetrate the skin and prevents them from being deflected off the skin at wide angles. The probe is placed in the flank above a point between the last two nipples on the female's right underline and oriented towards the uterus (Figure 2). It sends out and receives ultrasound waves that are relayed to the receiving unit. The receiving unit, in turn, translates the waves into either light, sounds, or pictures. Pregnancy is determined by the interpretation of the light, sound patterns, or pictures by the technician. There are three general types of ultrasound machines currently in use in the swine industry–amplitude depth, Doppler, and real-time. Each is perceived as being accurate but the methods are based upon slightly different principles.

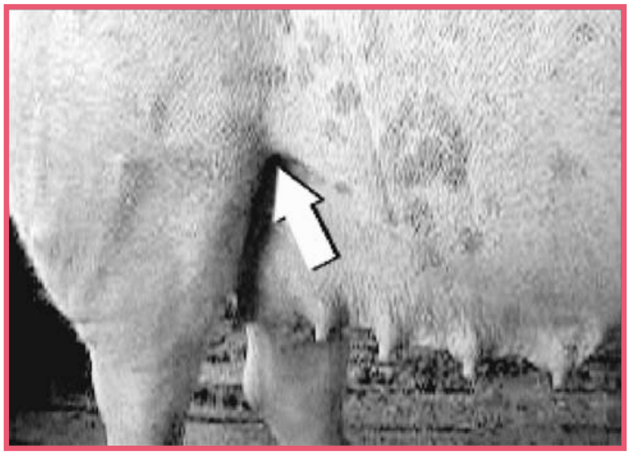

Figure 2. Placement of ultrasound probe between the last two nipples along the right underline of sows. Courtesy of B. Belstra, North Carolina State University

Amplitude Depth (A-Mode or Pulse Echo) Machines

Amplitude depth ultrasonography uses sound waves to detect the accumulation of fluids in the uterus. Sound waves travel through solid structures at a different rate compared with fluid-filled objects. The non-pregnant uterus resembles a solid object because of its thick muscle layers and small lumen, while the pregnant uterus is filled with pockets of fluid associated with the developing embryos. Consequently, the waves return to the probe with a different pattern in pregnant and non-pregnant females. This difference is converted to an audible signal, a display of lights, or a deflection on an oscilloscope screen by the receiving unit (Figure 3). Depending on the machine, a continuous tone or a constant illumination of a series of lights is displayed when an animal is pregnant, whereas a series of short, interrupted beeps or blinking lights occur when a female is not pregnant.

Figure 3. A-mode ultrasound machine. Courtesy of K. Rozeboom, North Carolina State University

It is difficult to determine pregnancies accurately with Amode machines prior to day 28 and after day 80 of gestation. However, between days 28-80 of pregnancy, it is not unusual for their accuracy to be greater than 95%. Prior to day 28 of gestation, the amount of fluid that accumulates in the uterus is variable among animals. After day 80 of pregnancy, the developing fetuses occupy the majority of the uterine lumen and deflect ultrasound waves. Consequently, the low accuracy prior to day 28 most likely is the result of insufficient accumulation of fluids for detection with A-mode machines and the reduced accuracy after day 80 is due to the presence of solid objects (fetuses) in the uterus.

The most common cause of false positives is the improper placement of the ultrasound probe such that the urinary bladder is scanned instead of the uterus. When the bladder is full of urine, it resembles a fluid filled structure similar to a pregnant uterus. Females that are pseudopregnant or have accumulation of fluids in the uterus due to pathological (uterine infection) or environmental reasons (mycotoxin ingestion) also produce false positive readings. False negatives occur when ultrasound scans are performed before day 28 and after day 80 of gestation.

Of the three ultrasound machines commonly used on swine operations, A-mode machines generally tend to be the least expensive and easiest to use. This is because the receiving unit only displays one of two signals—a continuous tone or display of lights for a positive test and a series of beeps or blinking lights for a negative test. The technology required to accomplish this is less expensive and the technicians have only two options from which to choose as they interpret the signals from the receiving unit.

Females are examined individually when A-mode ultrasonography is used for pregnancy diagnosis. Therefore, individual housing and crates or stalls that provide easy access to the sow's underline are physical features of breeding and gestation barns that facilitate the use of this form of pregnancy detection, with most pregnant sows scanned and diagnosed in 15-20 seconds. Diagnosis of non-pregnant sows usually takes 20-30 seconds, with the additional time being spent scanning the sow. Consequently, labor requirements for pregnancy diagnosis with A-mode machines are low compared with other methods including detection of estrus.

It is important to recognize that A-mode ultrasonography is one of the least flexible techniques in terms of the time interval because its accuracy is compromised before day 28 and after day 80. As a result, females that did not conceive at breeding or became non-pregnant during the first month following breeding cannot be identified accurately until 28 days after mating and cannot be rebred until they display estrus in the new cycle. Similarly, a high percentage of sows and gilts that lose their pregnancy during the final month of gestation remain undetected with A-mode units.

Doppler Machines

Figure 4. Doppler ultrasound machine.
Courtesy of W. Singleton, Purdue University

The ultrasound waves from Doppler machines are used to distinguish the movement of objects such as the fetal heart and the pulsation of blood through umbilical vessels or uterine arteries in pregnant sows and gilts. Once the ultrasound waves from the Doppler probes encounter moving objects, they are reflected back to the probe with a similar frequency and converted to an audible signal by the receiving unit (Figure 4).

Some Doppler machines have a headset that the technician wears during diagnosis to facilitate the identification and interpretation of the audible signals. In pregnant females, blood flow through the uterine artery increases and occurs in pulses at regular intervals 50-100 times per minute. Similarly, the frequency of blood flow through the umbilical arteries is 150-250 beats per minute and the fetal heart rate usually is between 100-150 beats per minute. A female with an audible pattern consisting of a regular series of rapid sounds or beats is interpreted as being pregnant. Often times, the beats or sounds occur at a frequency of one to three per second. Contrary to popular belief, the sound patterns in pregnant females are predominantly those from either the uterine or umbilical arteries and not from the fetal heart. In non-pregnant females, there are no umbilical arteries because no fetuses are present and uterine blood flow, for the most part, is reduced. Therefore, the audible signals from non-pregnant females consist of an irregular series of beats at a reduced frequency (less than 50 per minute) or the complete lack of any discernable pattern.

The accuracy of pregnancy diagnosis with Doppler ultrasonography is greater than 95% when conducted after day 29 of gestation. Prior to day 29, the ability to detect pregnant animals is usually between 70% and 85%, which is considered to be better than results that can be obtained with A-mode ultrasonography (prior to day 28). The final stages of implantation in swine are completed around day 30 of gestation and coincide with the establishment of a regular pattern of blood flow in uterine and umbilical arteries. This is most likely the reason for the reduced accuracy of Doppler ultrasonography during the first month of pregnancy.

There are several situations in which blood flow to the reproductive tract increases without fetuses being present and, as a result, lead to false positive readings with Doppler ultrasonography. These include estrus, pseudopregnancy, and inflammation of the uterus. In cases of pseudopregnancy and uterine inflammation, blood flow increases to the same extent as that observed in pregnant females and, thus, the sound pattern detected from the uterine artery is similar to that heard during pregnancy. Attempts to use the sound patterns characteristic of the umbilical artery or fetal heat beat for identification of these conditions in sows have not proven to be useful because the sound patterns from both vessels are nearly identical. In the case of estrus, blood flow increases to the ovaries and other parts of the sow's reproductive tract. Due to the close anatomical proximity of the ovaries and uterus, it is not possible to determine whether the sound pattern is originating from the ovary during estrus or from the uterus during pregnancy. False negatives with Doppler ultrasonography occur when examinations are conducted prior to day 29 of gestation or perormed in a noisy environment.

Compared with other ultrasound devices, the accuracy of the results obtained with Doppler machines is viewed as being the most dependent upon the skill and experience of the technician performing the diagnosis. Additional time and practice usually are required for the consistent identification and accurate interpretation of the sound patterns associated with pregnancy. As a result, the training period required for use of Doppler ultrasonography often is longer and more intensive than it is with other techniques used for pregnancy detection. Doppler machines tend to be more expensive than A-mode machines, but less expensive than their real-time counterparts. They are more flexible than A-mode machines because they can be used beyond day 80 of gestation. In contrast, because the technician has to identify and interpret sound patterns, the time required for testing individual sows is longer compared with A-mode machines. Facility requirements for Doppler and Amode ultrasonography are similar. Buildings in which sows are housed individually in crates or stalls that allow easy access to their rear flanks facilitate its use. A low level of background noise is important for Doppler users to prevent a high incidence of false negatives.

Figure 5. Real-time ultrasound machine.
Courtesy of K. Rozeboom, North Carolina State University

Figure 6. Real-time ultrasound image from a pregnant sow onday 21 of gestation. Note the series of small, solid, dark circlesthat represent fluid-filled pockets in the uterus.

Figure 7. Real-time ultrasound image from a non-pregnant sowon day 21 after breeding. Note the lack of dark circles in the areacontaining the uterus. The large dark circle located in the lowerleft-hand corner of the image is the bladder.

Real-time (B-mode) Machines

Real-time ultrasonography consists of sound waves emitted from a probe that travel in different patterns. Upon contact with tissues, the waves are reflected back to the probe, converted into electrical signals, and displayed on a monitor in the receiving unit as a two-dimensional image (Figure 5). Gray areas on the screen represent tissues such as bone and muscle, while black structures correspond to fluid-filled structures such as the pregnant uterus or bladder. During early pregnancy, the uterus begins to accumulate fluid. This accumulation is represented by a series of small, dark circles on the ultrasound screen (Figure 6). In the non-pregnant animal, with no fluid retention in the uterus, the image consists of a solid gray mass without the small, dark circles (Figure 7). As pregnancy progresses, the activity of the fetal heart and the skeletons (Figure 8) of developing fetuses can be visualized with real-time ultrasound.

Both controlled and field studies have demonstrated that use of real-time ultrasonography is a highly precise method of pregnancy detection in swine. On day 21 of gestation, the pregnancy status of 96% of the sows was diagnosed correctly in a research setting and greater than 93% accuracy was achieved when sows were scanned between 21 and 23 days after breeding on commercial swine operations. In contrast, attempts to diagnose pregnancy prior to day 21 of gestation resulted in an accuracy of less than 70%. The volume of fluid that accumulates in the uterus increases nearly 70-fold between days 17-28 of pregnancy. As a result, the low accuracy before day 21 probably is because there is not enough fluid in the uterus to consistently visualize the differences between a high percentage of pregnant and on-pregnant females.

False positives and negatives both occur most often when females are scanned during the first three weeks after breeding. In contrast to A-mode and Doppler ultrasonography, many of the situations that result in a misdiagnosis of pregnancy are eliminated with real-time machines because various aspects of the developing fetuses can be seen and more detailed images are provided for interpretation by the technician.

For example, by examining images for the presence of fetal skeletons from sows between days 65 and 75 of gestation, 115 out of 138 non-pregnant females were diagnosed correctly on a commercial swine farm with a history of a high incidence of pseudopregnancy.

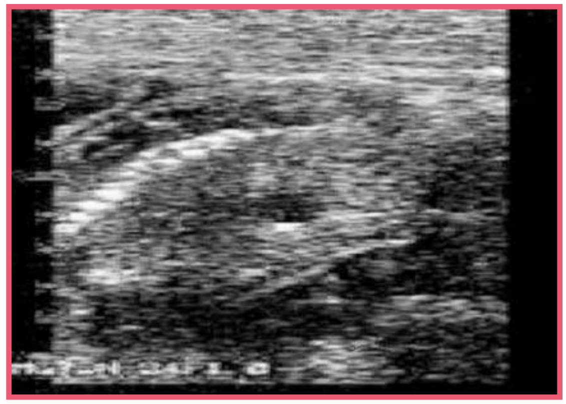

Figure 8. Real-time ultrasound image from a pregnant sow on day 75 of gestation. Note the outline of the spinal cord and ribcage of the fetus in the center of the image.

In this situation, sows without fetuses had ultrasound images consistent with the presence of fluid accumulation in the uterus (Figure 6), but the scans from pregnant sows revealed fetal skeletons (Figure 8) and heartbeats. In contrast to the situation with A-mode machines, false positives that result from misplacement of the probe and scanning of the bladder do not occur with real-time units because the bladder can be easily identified (Figure 7).

While use of real-time ultrasonography is the most versatile type of pregnancy detection, it also is the most expensive. However, as real-time technology improves, the cost of these units is expected to decrease. In terms of labor requirements, interpretation of the image on the ultrasound screen requires more time and expertise than the analysis of the signals from A-mode machines, but less labor and skill than the evaluation of sound patterns associated with Doppler units. With A-mode machines, technicians are only required to recognize two different signals which takes less time than evaluation of sound patterns or two-dimensional images. Interpretation of real-time pictures is easier than evaluation of the Doppler sound patterns because anatomical reference points within the images can be used to guide the technician during the scan. For example, the bladder is located posterior to the uterus and is easily identified as a large dark circle on the ultrasound screen (Figure 7). Therefore, once the bladder is located, the probe needs to be angled forward slightly to scan the uterus. There essentially is no equivalent reference point that can be used to guide movement of the probe with Doppler machines.

As with other ultrasound techniques, individual housing and crates with easy access to the rear flank of sows are characteristics of breeding and gestating buildings that facilitate the pregnancy detection with real-time ultrasonography. The monitor (receiving unit) on some models is too large to be carried by the technician during scans. Thus, a cart on which to place the monitor and an alleyway that allows movement of the cart are practical requirements for use of these models. Alternatively, on some operations, the monitor is placed on a board or holder situated on top of the rear portion of the crate during pregnancy detection. A current trend in real-time technology is to reduce the size of the monitor, thereby increasing the ease with which the unit can be handled. There are some models that can be carried by the technician with a belt harness and others in which the image is displayed in a special set of goggles that the technician wears like glasses.

Endocrine Tests

In addition to physiological and behavioral changes, progesterone, prostaglandin-$F_2\alpha$, and estrone sulfate are three hormones that differ between pregnant and non-pregnant females and have potential as pregnancy detection tests for swine. However, the time interval over which most of these endocrine differences occur is short, and there is sufficient variation among animals to make collection of samples at the correct time and their interpretation technically demanding. In addition, most require collection of blood or urine samples and transportation of samples to a diagnostic laboratory for analysis or performing the test with an on-farm kit. Consequently, additional labor, costs, and expertise are required for these tests compared to other forms of pregnancy diagnosis. These methods have not gained much popularity in the swine industry.

Prostaglandin-$F_2\alpha$ Concentrations

In females that fail to conceive or lose their pregnancy during the first 10 to 12 days following mating, prostaglandin- $F_2\alpha$ is released from the uterus between days 13 and 15 after breeding and blood concentrations are high. In pregnant females, prostaglandin-$F_2\alpha$ remains sequestered in the uterus and blood concentrations are low or undetectable. Monitoring blood levels of prostaglandin-$F_2\alpha$ between days 13 and

15 after breeding is a possible method for identifying pregnant animals. A level greater than 200 pg/ml is used as the decision boundary to define non-pregnant animals. Fortunately, concentrations considerably higher than 200 pg/ml are common in non-pregnant females.

The accuracy of using prostaglandin-$F_2\alpha$ for pregnancy diagnosis is 80% for animals that returned to estrus within 21 days after breeding. This was the result of a 90% accuracy rate of identifying pregnant animals, but only a 70% rate for nonpregnant females. The accuracy is considerably lower for animals that exhibited delayed returns to estrus (>28 days) or lost their pregnancy after the first month of gestation. Lack of a consistent reference point upon which sample collection can be based is the primary reason for the low accuracy of this test in these types of animals. Finally, it is not possible to distinguish pregnant from pseudopregnant females with techniques based on concentrations of prostaglandin-$F_2\alpha$.

Progesterone Concentrations

Maintenance of corpora lutea occurs in swine if embryos are present in the uterus 10 to 14 days after mating. This results in the continued secretion of progesterone, the hormone responsible for maintaining pregnancy. If embryos are not present in the uterus between days 10 to 14, prostaglandin-$F_2\alpha$. is released from the uterus and destroys the corpora lutea. In these females, progesterone levels decrease on day 15 after breeding and remain low until after the next estrus. As a result, measurement of progesterone levels between days 17 to 20 after breeding is a physiologically appropriate method of pregnancy diagnosis in swine. Due to the variation among animals in progesterone production, serum concentrations between 4 and 9 ng/ml have been used to assess pregnancy status. A concentration of 5 ng/ml is the most common value used. Females above and below this level are considered to be pregnant and non-pregnant, respectively.

The accuracy of monitoring progesterone concentrations between 17 and 20 days post-breeding for pregnancy diagnosis is 85% for females with normal inter-estrous intervals. As is the case with prostaglandin-$F_2\alpha$, a success rate of greater than 95% was achieved for identifying pregnant animals, while only 60% to 80% of non-pregnant females were diagnosed correctly. The normal individual variation in progesterone concentrations after luteal regression is the primary reason for the decreased ability of this test to identify non-pregnant females. As was the case with prostaglandin-$F_2\alpha$, the absence of a consistent reference point upon which to base sample collection hampers the identification of females whose pregnancy is terminated after the first month of gestation. In addition, pregnancy diagnosis with progesterone cannot discriminate between pregnant and pseudopregnant females.

Estrone Sulfate Concentrations

Developing fetuses produce elevated levels of a hormone called estrone sulfate during pregnancy. In pregnant animals, estrone sulfate initially increases between days 16 and 30 after breeding before decreasing to low levels between days 35 and 45. A second increase generally begins between days 70 and 80 of gestation and continues until farrowing. In non-pregnant animals, estrone sulfate production is low. Both urinary and serum concentrations of estrone sulfate have been used for pregnancy diagnosis in swine. Normally, there is a 10 to 100-fold increase of estrone sulfate between days 25 and 30 following breeding in pregnant compared with non-pregnant sows. Values over 0.5ng/ml are common in pregnant sows, while those less than this are associated with non-pregnant females.

The accuracy of pregnancy diagnosis by measuring estrone sulfate concentrations in samples collected 25 to 30 days after mating is greater than 93%. False positives are rare, and they are limited to some animals that are in the process of returning to estrus. False negatives are more frequent and occur mostly when sows or gilts are pregnant, but have four or less pigs in the litter. In contrast to other endocrine tests, measurement of estrone sulfate can be used to identify pseudopregnant females. There is a moderately strong positive correlation between urinary concentrations of estrone sulfate between days 70 and 80 of gestation and litter size at farrowing. Consequently, when applied during this period, it can be used to diagnose both qualitative and quantitative aspects of pregnancy.

Pregnancy Detection Programs

A pregnancy detection program is the application of one or more of the various techniques described previously (Table 1) in a systematic, repeatable pattern for identification and either removal or rebreeding of non-pregnant animals. Due to differences in size, physical facilities, labor and other management factors,

Technique	Physiological Basis	Period of Effective	Accuracy	Identifi-cation
Detection of estrus	Non-pregnant females exhibit estrus	Any time during gestation	> 98%	No
A-mode ultrasound	Identification of fluid in pregnant uterus viaspeed at which emitted sounds return to probe	Days 28 to 80 of gestation	> 95%	No
Doppler ultrasound	Identification of sound patterns of increased blood flow in uterine and umbilical arteries during pregnancy	After day 29 of gestation	> 95%	No
Real-time ultrasound	Visualization of fluid and fetal tissue in pregnant uterus	After day 21 of gestation	> 95%	No
Progesterone concentrations	Increased blood progesterone concentrations (>5.0ng/ml) in pregnant females	Days 17 to 20 of gestation	>85%	No
Prostaglandin-F2α concentrations	Increased blood prostaglandin concentrations in non-pregnant females (>200pg/ml)	Days 13 to 15 of gestation	> 80%	No
Estrone sulfate concentrations	Increased estrone sulfate concentrations in pregnant females (> 0.5 ng/ml)	Days 25 to 30 or after day 80 of gestation	> 93%	No

it is likely that the optimal program is not the same for all operations. Nevertheless, a good program accentuates the advantages and minimizes the disadvantages of the various techniques. Often, this is accomplished by using a technique during a specific phase of gestation or by using several techniques in a predetermined sequence.

A common pregnancy detection program is to use various combinations of estrus detection and ultrasonic evaluations. Daily detection of estrus has the advantage of identifying non-pregnant females early and reducing the number of days that they remain in the herd before they are bred or removed. It has the disadvantage of being labor intensive if conducted daily on every pregnant female. In contrast, ultrasonography is more flexible in terms of labor requirements because it can be used over an extended period during gestation and doesn't need to be conducted daily on every animal to achieve a high degree of accuracy. A program consisting of daily estrus detection for all bred animals during the first 28 days of gestation followed by an ultrasound examination only of females assumed to be pregnant is an effective program. The daily detection of estrus should begin on day 17 after breeding and continue for a week, while the ultrasound examination can be conducted anytime after day 28 of gestation. Because all three ultrasound machines have a high accuracy after day 28, the decision regarding the most appropriate machine depends upon factors other than accuracy.

This program's attractiveness is that estrus detection is used when it is more effective than ultrasound, days 17 to 24 after breeding, yet labor associated with this method is not prohibitive because it is only applied to a portion of the herd for a period of one week. In addition, it should identify all sows that either did not conceive or whose pregnancy was terminated during the first two weeks of gestation. Ultrasonography is applied when it is effective, after day 28, and is used to identify sows that lost their pregnancy after estrus detection or were non-pregnant at this time, but failed to show estrus. On most operations, the majority of pregnancies are lost during the first 30 to 40 days after breeding. It is reasonable to speculate that combining estrus detection with ultrasonography should permit identification of most of the non-pregnant, non-lactating sows in a herd. Additional ultrasound examinations can be applied later in gestation to add further precision to the program or confirm previous results.

Another effective pregnancy detection program is the use of real-time ultrasonography without daily detection of estrus. In this program, bred sows are scanned between days 21 and 23 of gestation and again one to two weeks later. Once identified, non-pregnant females are relocated and checked for estrus daily or culled. Under commercial conditions, the overall accuracy of pregnancy diagnosis with this program was 92%. This figure was comparable to estrus detection coupled with A-mode ultrasonography (on days 35 and 42 of gestation) that was conducted on a contemporary group of females on the same farm. In essence, labor costs associated with the daily estrus detection for one week is replaced by the cost of real-time technology that only has to be used once during the same time interval. As mentioned earlier, the practical feasibility of these types of decisions are best evaluated within the unique production environment of each operation.

Summary

Implementation of an effective pregnancy diagnosis program improves the efficiency of swine operations by limiting the amount of time, money, and space that is spent on non-pregnant, non-lactating females. The type of technique(s), the time frame over which it is used, and the frequency with which it is applied defines the pregnancy diagnosis program. The best programs are those that accentuate the advantages and minimize the disadvantages of the various techniques in use, and compliment the production facilities. With the technologies that are available, a reasonable goal for commercial farms is to maintain an accuracy of 95% for their pregnancy diagnosis programs.

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