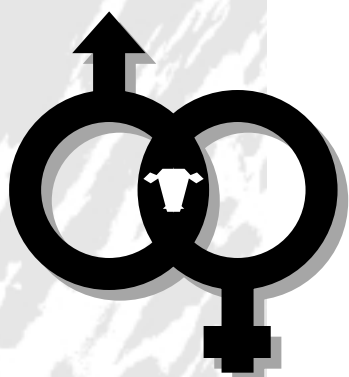


Determining Pregnancy in Cattle



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Determining Pregnancy in Cattle

John R. Beverly

Former Professor and Associate Vice Chancellor for the Agriculture Program

and

L. R. Sprott

Former Professor and Extension Beef Cattle Specialist

Determining pregnancy in cattle is an important management tool. The ability to determine pregnancy can allow you to make timely culling decisions, focusing the resources of your operation on sound, reliable breeders. With experience, you can determine the age of the fetus, which will allow you to predict expected calving dates and plan for the necessary labor at calving time. Pregnancy determination can also help you manage feeding to better meet the high nutritional demands of gestation, calving, lactation, and rebreeding.

Knowledge of expected calving dates can also be an advantage when marketing bred replacement heifers. Potential buyers often want to purchase females whose calving dates coincide with those of their present herd.

Increasing Herd Productivity

A cow-calf producer's economic returns depend largely on the percent calf crop and the weaning weight of the calves to be sold. You can compute your calf crop percentage by dividing the number of calves raised to weaning age (7 months) by the number of cows in your herd at the start of the breeding season.

Percent Calf Crop and Weaning Weight

Table 1 shows the cost per pound of calf produced for various production levels, with an operating cost of \$250 per cow per year. To determine the required level of production for this example, take an arbitrary selling price of 70 cents per pound and locate the break-even point in Table 1. You will find that, for this example, weanling calves weighing 400 pounds require a 90-percent calf crop to break even. If only a 60-percent calf crop is produced, then the cost per pound of calf is 34 cents higher than the 70 cents market value. Calves weighing 450 pounds break even at an 80-percent calf crop, and 500-pound calves break even at approximately a 70-percent calf crop.

You can see the economic importance of calf crop and its interaction with weaning weight even more clearly in Table 2.

Clearly, break-even prices decrease as calf crop and weaning weight increase. This is true under any annual operating cost per cow.

Management Practices to Improve Production

The challenge for cow-calf producers is to use management techniques that stimulate production without drastically increasing operating costs. You can improve weaning weight through a number of methods, including:

- Internal parasite control.
- Use of growth stimulants.
- Using sires with the genetic potential for increased growth.
- Providing adequate herd nutrition, which will also help optimize reproduction.

Another effective and inexpensive way to improve reproduction is through annual pregnancy testing and culling of subfertile cows. Not every open cow can be culled, because of market conditions and forage availability. When culling is possible, the repeat breeder cows, those that have never calved, and inconsistent calvers should go first. If you follow this practice annually and your cows are under otherwise good management, pregnancy rates will increase. Not only that, but Table 3 shows that the increases in the pregnancy rate in Texas test herds were sustained at an acceptable level.

Visual observation is also important in culling decisions. Some pregnant cows should be culled on the basis of age, or conditions of the udder, feet, legs, and teeth that make them poor breeding stock. The decision to cull an open cow may also depend on her reproductive history. A mature cow that has consistently calved throughout her life and is unexpectedly found open can be retained in the herd. Research indi-

Table 1. Production Cost Per Pound of Calf — \$250 Per Cow Operating Cost.

Weaning weight (lb.)	550	500	450	400	350
Calf Crop (%)	550 ¹	500	450	400	350
100	45.5 ²	50.0	55.6	62.5	71.4
90	495	450	405	360	315
	50.5	55.6	61.7	69.4	79.4
80	440	400	360	320	280
	56.8	62.5	69.4	78.1	89.3
70	385	350	315	280	245
	64.9	71.4	79.4	89.3	100.2
60	330	300	270	240	210
	75.8	83.3	92.6	104.1	119.0

¹Top figures indicate pounds of calf produced per cow.
²Bottom figures relate the cost per pound of calf, cents.

cates that this is an acceptable option, especially if replacement costs are higher than the cost of retaining the open cow. Nevertheless, if this same cow is again found open later in life, you should remove her from the herd.

Culling decisions may also depend on the animal's monetary value. You can retain highly valued registered females that fail to conceive until some or most of their initial cost is recovered. This strategy is prudent as long as these animals are free of abnormalities of the reproductive tract and have previously produced at an economically acceptable level.

Palpating to Determine Pregnancy

The following is a description of pregnancy determination. This determination, called palpation, is made by inserting the arm into the rectum and feeling the reproductive tract for pregnancy indications.

Table 2. Break-Even Prices at Various Levels of Production and Annual Costs of Production.

Calf crop (%)	Weaning weight (lb.)	Pounds of calf per cow	Annual costs per cow		
			\$250	\$275	\$300
90	500	450	\$.56 ¹	\$.61	\$.67
80	450	360	\$.69	\$.76	\$.83
70	400	280	\$.89	\$.98	\$1.07
60	375	225	\$1.11	\$1.22	\$1.33

¹Breakeven prices per pound of calf, dollars.

Table 3. Effects of Annual Pregnancy Testing and Culling of Subfertile Cows on Subsequent Herd Fertility.

	Percent Pregnant by Year				
	1	2	3	4	5
Herd					
1	75	97	96	93	98
2	64	56	84	89	--
3	59	66	79	92	85
4	85	90	94	--	--
5	82	94	93	93	--
6	74	76	86	94	98
7	49	89	92	89	89

Sprott and Carpenter, 1994; Unpublished data.

Equipment

Little equipment is needed in palpation. The individual doing the palpating should wear a protective plastic sleeve that covers the arm and hand up to the shoulder. The sleeve guards against disease and prevents irritation of the arm. Use a rubber band on your upper arm to hold the plastic sleeve in place. Use an obstetrical lubricant or mineral oil to make entry into the rectum easier. Don't use soap or detergents as a lubricant, since both are irritants. Plastic sleeves may tear after several uses, reducing protection. If the sleeve tears, replace it before palpating the next animal.

The chute for holding the animal during palpation should allow her to stand in a normal position. It should have a front wall or gate and

a bar just above the animal's hocks in the rear (Figure 1). This bar keeps the cow from kicking and protects the palpator. Include an entrance gate in the chute at the rear of the animal to allow the palpator to enter and exit easily. Provide a gate to swing across the crowding chute and fasten in front of other animals coming behind the palpator. You may use squeeze chutes, but catching the cow's head is not necessary for this procedure.

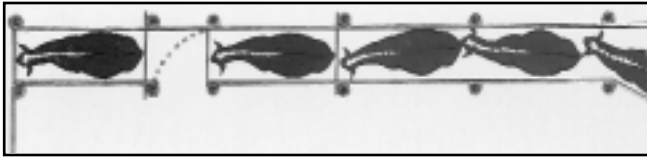


Figure 1. Chute arrangement for restraining cows.

Palpation alone takes only a few seconds. The speed of pregnancy determination depends on the management of the cows as they come through the chutes, the stage of pregnancy, and the palpator's experience. Under ideal conditions, an experienced palpator can examine several hundred head of cattle in a normal working day. However, the process is much slower if the palpator has to help bring the cattle into the chute or climb over the chute wall to get behind the animal to palpate her.

To ensure the safety of the animals and the palpator, you must practice certain precautions:

- Restrain the animal so she cannot jump over the side of the chute or kick the palpator.
- Prevent other cattle from coming up behind the palpator as he or she attempts to determine pregnancy.
- Replace broken boards in the chute that could injure the animal's legs, and check for exposed nails.
- Place cleats across the floor if it is slick to help stabilize the animals' footing.

These precautions make it much more likely that the cow will remain calm and stand quietly during palpation. This makes the process both safer for the cow and the palpator and more efficient as well.

Structures of the Reproductive Tract

Thorough knowledge of the structures associated with the female reproductive system is essential for successful palpation. Only the reproductive tract and the associated organs will be discussed here, but you should be aware

that endocrine glands located in other parts of the body, particularly the brain, are also involved in the sexual cycle. Figure 2 is a general diagram of the reproductive tract.

The **vulva** is the external portion of the reproductive tract and can be seen as two prominent lips. The size of the vulva may vary with age of the animal and between breeds. Brahman-influenced females usually have a larger vulva than do cattle of English and European breeds.

The next portion of the tract (moving right to left, as shown in Figure 2) is the **vagina**, and it serves as a receptacle for semen during natural mating. It is a thin-walled structure and is not easily felt during palpation.

The **urinary bladder** (not shown in Figure 2) is located underneath the vagina and may extend beyond the pelvic brim and slightly into the body cavity, particularly when it is full of urine. During urination, the bladder empties through a small opening (urethral orifice) on the floor of the vagina, eventually exiting the body through the vulva.

The **cervix** is a thick-walled structure attached to the vagina. It is composed of connective tissue, which feels much like gristle. Because of its thickness and firm feel, the cervix is a good landmark for orientation while you are palpating. The internal walls of the cervix are folded and protrude toward the exterior of the reproductive tract. These folds are sometimes called cervical rings. The surface of these rings is lined with special mucus-secreting cells. This mucus is often seen smeared on the rumps or flowing out of the vulva of cows in estrus. During pregnancy, the mucus is much thicker than at estrus and plugs the cervix, protecting the developing embryo from foreign debris in the vagina. The cervix may also act as a sperm sieve, trapping some abnormal sperm cells and allowing normal sperm cells to travel into the uterus and oviducts.

The **uterus** is Y-shaped, with a right and a left horn. The horns share a connecting region known as the body. During artificial insemination, semen is deposited in the uterine body. The walls of the uterus are lined with special glands that secrete "uterine milk," the substance that nourishes an early embryo. By about 16 to 18 days of gestation, the placental membranes are well developed and extend into both horns of the uterus. About 38 days into gestation, these membranes begin attaching to the uterine

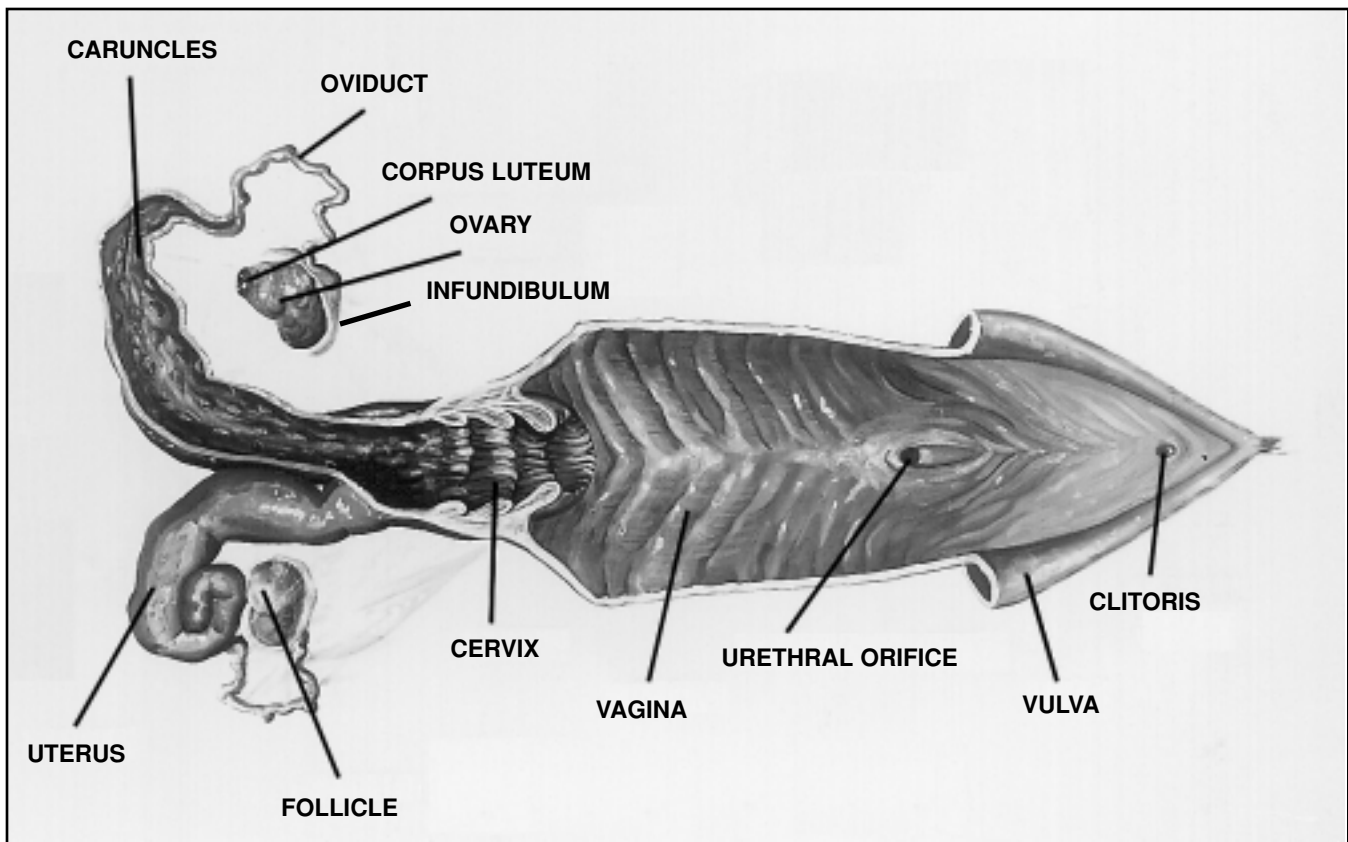


Figure 2. Anatomy of the reproductive tract.

wall at special, raised areas known as caruncles. These are located throughout the uterus and are the exchange points for nutrients coming from the dam. The placental side of these attachment points are called cotyledons, and together the cotyledon-caruncle combination is known as a placentome or "button." In mid- and later gestation, these buttons become firm and are easy to detect when you are palpating the uterine surface.

The end of each uterine horn is attached to an **oviduct**, also known as a fallopian tube. The oviducts are small, tube-like structures and, because they are very small, are difficult to feel. They transport sperm cells to the site of fertilization (the upper third of the oviduct) and an embryo back to the uterus, if conception occurs. At the end of each oviduct is a thin, cup-like membrane (difficult to feel) called the infundibulum. Its purpose is to catch the egg, or ovum, as it is expelled from an ovarian follicle during ovulation, and to transport the egg into the oviduct for eventual fertilization. For obvious reasons, each ovary is located close to the infundibulum.

The entire reproductive tract is attached to a thin suspensory membrane known as the **broad ligament**. This elastic-like ligament will stretch and move within the pelvic and body cavities to allow the reproductive tract to move. This movement is necessary because of the weight of the fetus and the crowding of the tract by other internal organs. The broad ligament acts as a cradle for the tract and is attached to the upper pelvic and body cavities. It also contains arteries and veins that supply the tract with blood to nourish the tissues.

An interior view of the reproductive tract and broad ligaments of an open (non-pregnant) cow is shown in Figure 7. Table 4 gives a general size description of the various parts of the tract in an open cow. The complete tract with all its parts varies in size and feel, depending on the stage of the estrous cycle and the breed, size, and reproductive history of the animal. Generally, the size of the entire open tract is 12 to 18 inches in length. In young heifers that have just reached puberty, the tract may be only 8 inches long. The tract of mature cows that have had several calves may extend to 24 inches.

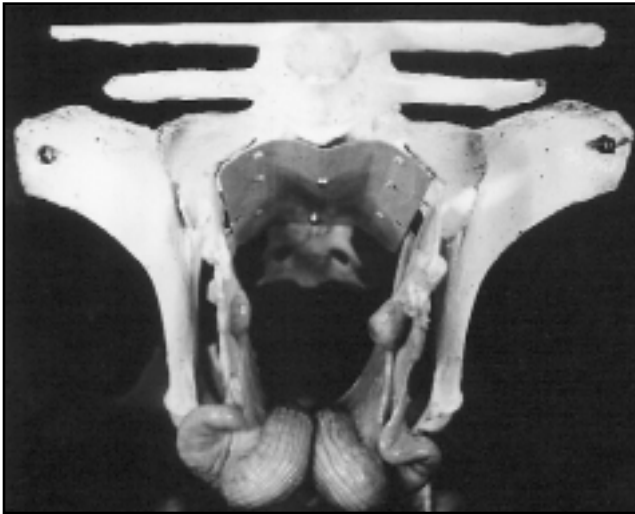


Figure 7. Reproductive tract of mature cow on the floor of pelvis.

Changes Associated with Pregnancy

The sexual cycle of a normal cow is characterized by estrus (heat) periods that occur at 21-day intervals. Figure 3 is a diagram showing the estrous cycle and some of its associated events.

At estrus, the cow is under the influence of estrogen being produced by follicles on the ovaries. This hormone causes her to display estrus. Within 24 hours after the initial stages of estrus, one of the follicles ruptures, releasing a single ovum, or egg. This is ovulation. The egg moves into the infundibulum and eventually down into the oviduct. The cavity on the ovary left by the ruptured follicle develops into a new structure known as a corpus luteum (Figure 2). The corpus luteum produces progesterone, the hormone responsible for maintaining pregnancy. If conception does not occur

Organ	Size	Shape	Remarks
Vagina*	Varies with position of tract	Thin-walled, hollow tube	Difficult to feel during palpation.
Cervix	2 to 12 inches long, $\frac{3}{4}$ to 8 inches in diameter. Average diameter $1\frac{1}{2}$ inch.	Tube-like and thick-walled	Cervix is tube-shaped, but may be funnel-shaped in some cows or bent and crooked. Firm, gristle-like feel. Good landmark.
Uterine body	Interior: $\frac{1}{4}$ to $\frac{3}{4}$ inch long. Exterior: 1 to 3 inches long.	Intersecting region of the two horns	Feels like soft, flat muscle. Not as firm as the cervix.
Uterine horns	5 to 12 inches long, $\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter.	Tube-like and sometimes coiled. See Figures 4 and 7.	Feels meaty and soft to slightly firm, depending on stage of the estrous cycle.
Oviducts*	$\frac{1}{16}$ to $\frac{1}{8}$ inch diameter	Long, crooked tube	Difficult to feel because of the small diameter and soft texture.
Ovaries*	$\frac{1}{2}$ inch wide, $\frac{3}{4}$ inch thick, 1 inch long	rounded or elliptical shape	Feels firm and distinct, as if you were holding a grape or plum.

*It is not necessary to feel the vagina, oviducts, and ovaries when palpating for pregnancy.

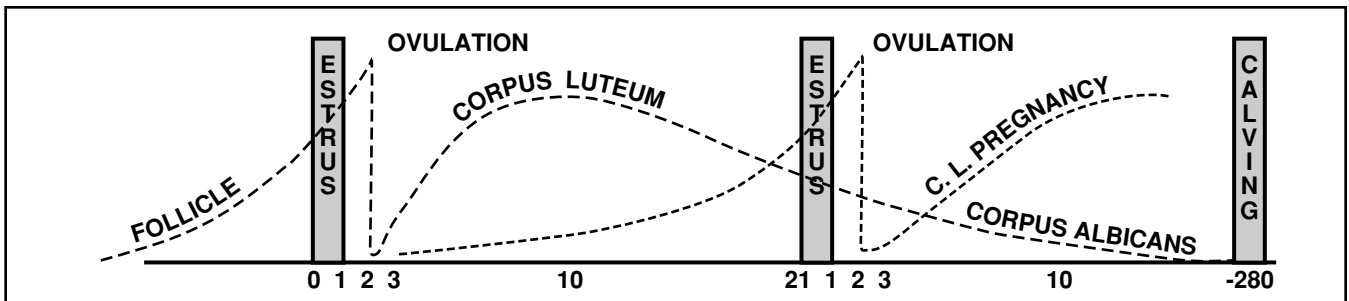


Figure 3. Note the cycle pattern is followed at approximately 21-day intervals.

with this ovulation, the uterus releases a hormone called prostaglandin, which regresses, or destroys, the corpus luteum. Regression is complete by about 16 to 17 days into the cycle. Meanwhile, follicles continue to grow on the ovary and, since the corpus luteum has regressed and is no longer producing progesterone, a new ovulatory follicle is recruited, and within 4 to 5 days the cow returns to estrus. The process of development and regression of a normal corpus luteum causes a cow to have her characteristic 21-day sexual cycle.

If the cow is mated during estrus, the sperm cells will travel from the site of deposition (the vagina) to the site of fertilization (upper third of the oviduct) within a matter of only minutes. While there, the sperm cells undergo a 6- to 8-hour maturation period called capacitation. Then and only then are the sperm cells capable of fertilizing an egg. So, when the egg arrives at the fertilization site, the sperm cells are already there and probably have undergone capacitation. The chances of fertilization and pregnancy average about 50 to 70 percent.

When fertilization occurs, the cow's physiological cycle begins a dramatic change, which leads to the development of a full-term fetus. About 8 days after fertilization, the embryo is transported to the uterus, and, at 16 to 17 days after fertilization, the embryo and its placental membranes begin to release a hormonal signal that prevents the usual release of prostaglandin from the uterus. As a result, the corpus luteum does not regress and continues to release progesterone to maintain the pregnancy. The embryo houses itself in the uterine horn nearest the ovary that produced the ovulating follicle. Therefore, an embryo found in the right horn came from an egg produced by the right ovary and vice versa. For this reason, both uterine horns must be palpated, particularly in cows that are open or may be in the early period of gestation.

The major changes in the structure of the reproductive tract after conception occur mainly in the uterus. Its shape, size, texture or feel, and location will change. These changes are described in more detail later in this publication. Also, the embryo will grow, and its growth is directly responsible for changes noted in the uterus. Figure 5 shows embryo or fetal growth by month and stage of gestation.

Developmental Stages

There three main periods of development in a young calf's life. The period of the ovum is that time from fertilization until the egg has divided enough times to take on a particular form. This occurs on about the thirtieth day, when there is an enfolding of the layers of the developing egg. At this stage, the newly developing animal is called an embryo. The period of the embryo lasts until the fetal membranes begin to attach to the lining of the uterus, approximately 38 days. During the embryonic stage, various organs and systems are laid down. These include the respiratory system, nervous system, digestive system, circulatory system, and reproductive system. The embryo, as it develops, floats freely in the uterine cavity, bathed by a secretion called uterine milk.

When the embryo is about 38 days old, the fetus period begins. This term is used until the newborn is expelled at parturition (birth). During the fetus stage, continued attachment takes place at the numerous caruncles lining the uterus. These attachments provide transfer of nutrients and waste materials for the developing fetus. Birth occurs about 280 days after fertilization.

Technique for Palpation

You may use either hand in palpation. With one hand, you may grasp the cow's tail as a handle, while you palpate with the other. The hand used for palpation should be well lubricated and shaped into a wedge by bringing the fingers together as closely as possible.

The Rectum

Push through the anus into the rectum with one continuous thrust. As your hand enters the rectum, fold your fingers into a modified fist by tucking the fingertips under (Figure 4).

In this position, your hand will push the fecal material aside and straighten the rectum. Folds in the rectum do not straighten as easily if the fingers are held in a pointed position. The modified fist also eliminates the risk of puncturing the rectal wall with the sharper pointed fingers. However, puncturing is rare, as the rectum is thick-walled and resistant. Cleaning the cow's rectum of fecal material usually is not necessary. However, in early stages of learning, cleaning the rectum will increase your ability to feel other structures.

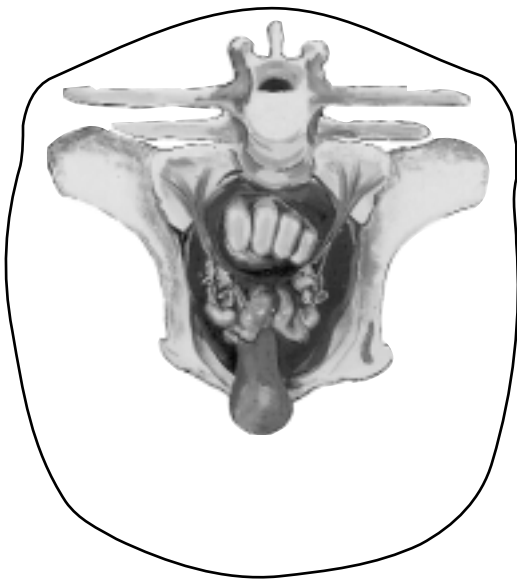


Figure 4. Reproductive system of young cow, viewed from inside of animal. Note the position of the hand (fingers folded into a modified fist) inside the rectum directly above the uterine horns.

Rectal straining may occur in response to the entry of your hand. This is a reflex response by the cow. Straining can be alleviated by simply moving your hand back and forth in a gentle massaging motion. If straining reoccurs, massage the rectal wall again.

Usually, the longer the examination, the more rectal straining you will encounter. Do not be upset by a small amount of bleeding; this occurs occasionally and is not necessarily a sign of damage to the rectum. An indication of rectal damage is a sandpaper or gritty feeling, which means that the mucosa lining of the rectum has been rubbed off in the palpation process. If this occurs, it is best to stop palpating immediately.

Feeling through the rectal wall is similar to feeling through a layer or two of thin rubber. Most cattle are cooperative. It should be possible to detect and pick up the reproductive the organs without difficulty.

Experienced palpators usually follow a consistent routine which should be adopted in the learning process. Upon initial entry into the rectum, thrust the arm beyond the elbow and deep

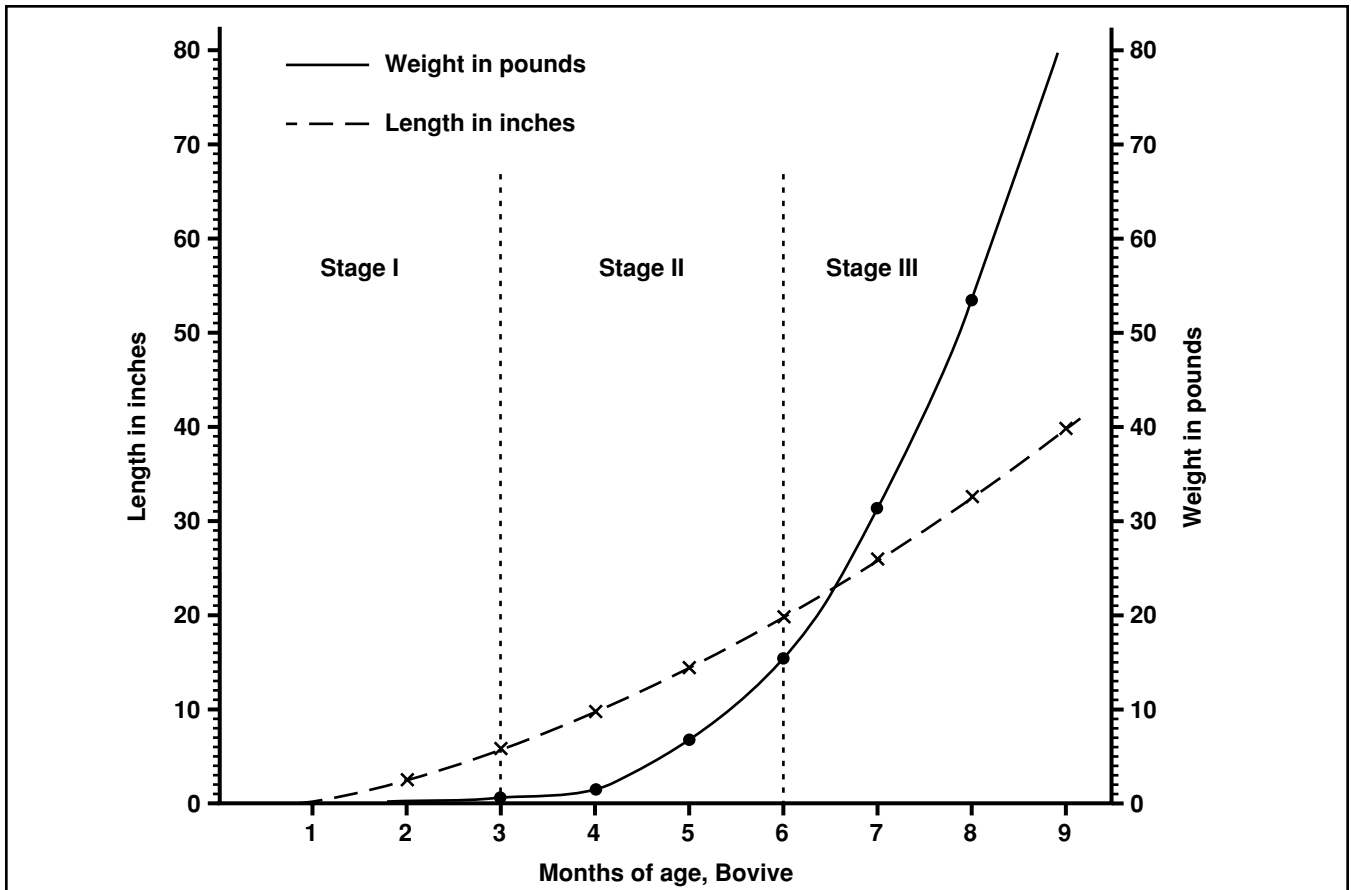


Figure 5. Growth of fetus. Parturition occurs approximately 280 days after fertilization.

into the abdominal cavity. Feel in a downward direction toward the udder. Late-term fetuses will be located in this region. For this reason, initial deep entry allows palpators to quickly determine pregnancy and reduces the time spent in the cow. If a fetus or other indications of pregnancy are not found in the abdominal cavity, palpators should move back toward the pelvic cavity. Most open tracts and early pregnancies will be located here. While feeling in or near the pelvic cavity, locate the pelvic brim. This is a good landmark for orientation. Most importantly, find the cervix and move forward to the uterus to determine pregnancy. Following this simple routine will help reduce palpating errors.

The Paunch

Upon entry into the rectum and just past the pelvic brim, palpators may encounter the paunch or rumen, which is the first and largest of the cow's four stomachs (Figure 6). It has a dorsal (upper) and ventral (lower) sac. The dorsal sac is located forward of the pelvic brim and to the left. It may feel like the end of a football and be mushy or gritty. This protruding end of the dorsal sac may even extend into the pelvic cavity. In such cases you might mistake it for an enlarged uterus or late-term fetus. By mashing the paunch, you will notice an indentation which gradually smoothes back to its original

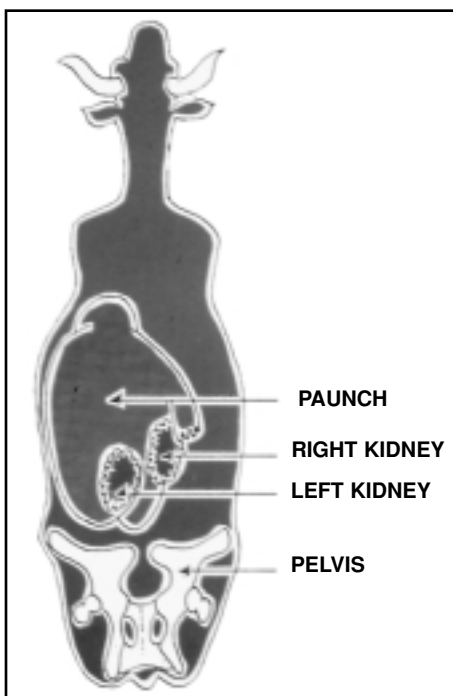


Figure 6. Position of the paunch and kidneys.

shape, indicating that the paunch is full of feed. The paunch does not have the watery feel that a pregnant uterus has.

The ventral sac of the paunch is deep into the body cavity and located toward the udder region. This sac lies either to the right or to the left side of the body, depending on gut fill. It has the same mushy or gritty feel as the dorsal sac and will indent if mashed with the hand.

The Reproductive Tract

The open reproductive tract normally lies on the pelvic floor or against either pelvic wall. The horns of this tract are usually coiled on their front edge, and in older cows may hang slightly into the abdominal cavity (Figure 7). When you palpate them, both uterine horns in the open cow will feel thick-walled and have a meaty texture. No fluid will be present in the horns, and these two characteristics confirm the absence of a pregnancy. As this stage you can hold the entire uterus in your hand and palpate it either from underneath or from the side. However, in the learning process, feeling the top surface may be easiest (Figures 8 and 9).

Tone, or firmness, of the open horns varies with the estrous cycle. Shortly before and after estrus (under estrogen influence), the uterus will be turgid or firm to the touch. During the period of the corpus luteum (progesterone influ-

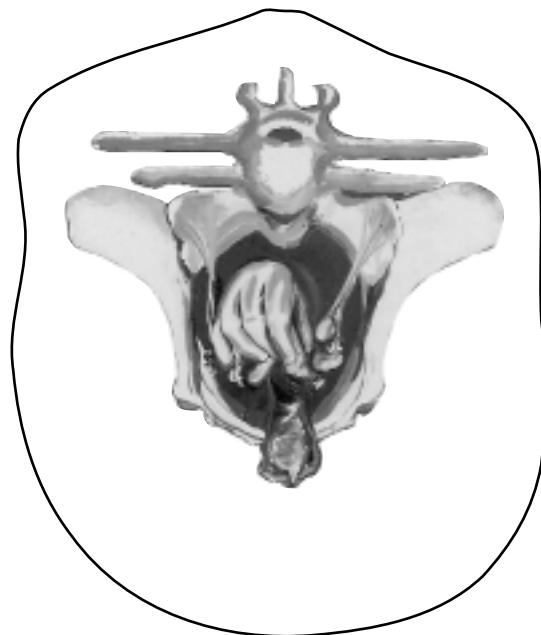


Figure 8. Separation of horns of the uterus.

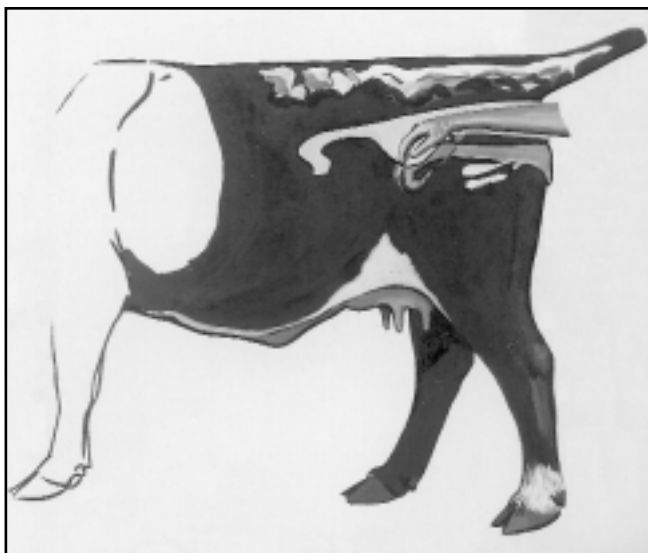


Figure 9. Position of hand in early pregnancy.

ence), the uterine horns will feel flaccid or soft. Slight pressure with the middle finger (Figure 8) will separate the horns, allowing you to palpate each horn. Both horns must be felt since a pregnancy may occur in either. Inexperienced palpators sometimes have difficulty grasping the uterine horns. To overcome this difficulty, move the uterus down against the pelvic floor or to either pelvic wall. Flatten your hand and apply gentle pressure against the uterus to separate the horns.

The ovaries are located in the broad ligament toward the end of the uterine horns or at their sides. However, it is not necessary to palpate the ovaries when determining pregnancy. The most important step is to feel the uterus for its texture and content.

Determining Stage of Pregnancy

Stage I: 30- to 35-day pregnancy

Embryos at this early stage are delicate, and beginning palpators should not try to feel them. But an experienced palpator, with skill and practice, can detect pregnancy as early as 30 days after breeding. Palpation at this early stage should be accompanied by good breeding herd records. These records let the palpator know the approximate breeding date of the animal.

In the early stage of pregnancy, the uterus, filled with a small amount of fluid, will feel slightly thin-walled. One horn is enlarged a little more than the other. At this stage you can determine the presence of the embryonic vesicle

by carefully running the horn between your fingers in a milking action; you can feel the vesicle slide through your fingers.

At this stage, the embryo is only about $\frac{1}{2}$ inch long. The vesicle surrounding it is about $\frac{3}{4}$ inch in diameter and filled with fluid, like a balloon filled tightly with water. However, the borders of this vesicle are indistinct, and what you actually feel is something slightly smaller than a marble as it slides through your fingers. The uterus, in much the same location as a non-pregnant uterus, has not been displaced because of size or weight at this time. The outer embryonic vesicle, which occupies both horns, is rather thin with little fluid, and may be 18 to 24 inches long. By pinching the horn of the uterus carefully, you can feel the membranes of this vesicle as they slip between your fingers.

Stage I: 45-day pregnancy

Most palpators prefer that bulls be separated from cows at least 45 days before pregnancy determination. At 45 days, the horn of the uterus containing the fetus is somewhat enlarged and thinner-walled compared to the other. The fetus at this stage is about 1 inch long. The vesicle around it is egg-shaped and measures about 1 to $1\frac{1}{2}$ inches long. You can feel the outer membrane, which contains fluid, through the uterine wall. The attachment of the membranes to the uterus has just taken place at about 38 to 40 days. Therefore, avoid moving the fetus about in the uterus. The caruncles on the uterus join the cotyledons on the fetal membranes for nutrient exchange.

Slipping of the fetal membranes is a valuable aid to early pregnancy determination. Although the membranes can be slipped at any stage of gestation, it is easiest to perform and of the most value between 40 to 90 days of pregnancy. The procedure involves picking up and gently pinching together the walls of either uterine horn and feeling the fetal membranes as they slip between the thumb and fingers. Palpators should be gentle when using this technique since the embryo and membranes are rather delicate in pregnancies under 45 days.

Stage I: 60-day pregnancy

The uterus has enlarged until one horn is about $2\frac{1}{2}$ to $3\frac{1}{2}$ inches in diameter, measuring 8 to 10 inches long. The weight of the contents may pull the uterus into the body cavity just over the pelvic brim (Figure 10). The fetus

has grown rapidly, and, at this stage, is about 2 1/2 inches long. The embryonic vesicles are still prominent and, at this stage, may be felt without feeling the fetus.

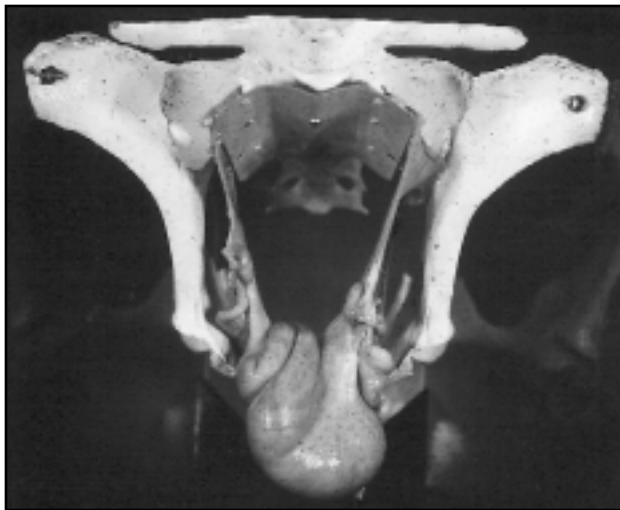


Figure 10. 60-day pregnancy. Uterus may hang over pelvic brim.

The uterine walls have thinned considerably. The best method of feeling the fetus is to bobble it with your hand so that, if you gently tap the uterus, the fetus swings like a pendulum and hits against the wall of the uterus and vesicle. The cervix remains on top of the pelvic cradle with the uterine horns moving toward, and possibly beyond, the brim.

Stage I: 90-day pregnancy

The uterus will have enlarged considerably by this time, filled with fluid and increased growth of the fetus (Figure 11). The fetus now is about 6 1/2 inches long and may have displaced itself into the abdominal cavity, indicating that the uterus has stretched. The cervix may be pulled over the pelvic brim, but the cervix, body, and horns of the uterus are within reach. In larger animals, this is a difficult stage for pregnancy determination because of displacement and the distance from the anus to the developing fetus.

You may have to consider factors other than the presence of the fetus itself at this stage. Displacement of the uterus, a possible indication of pregnancy, should be considered. Another indication of pregnancy is enlargement of the uterine arteries with their characteristic pulsation. These arteries (one for each uterine horn) are located in the forward fold of the

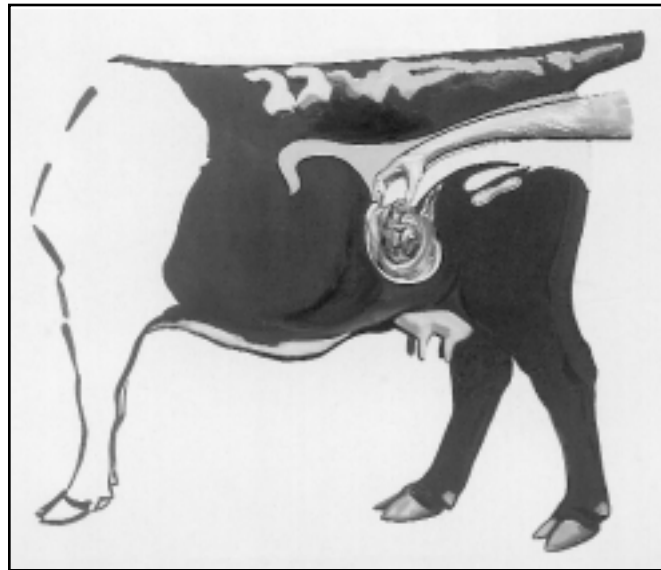


Figure 11. Position of 90-day fetus. The fetus is now about 6 1/2 inches long and has displaced itself over the pelvic brim and down into the abdominal cavity.

broad ligament (Figure 13) which supports the uterus. In a 3-month pregnancy, the artery supplying blood to the pregnant uterine horn is about 1/8 to 3/16 inch in diameter. The artery feeding the non-pregnant horn is only half that size. When you grasp the artery, you can easily feel the pulse of the heartbeat as blood is carried into the uterus to nourish the developing fetus. Do not confuse the uterine artery with the femoral artery lying on the inside of the thigh which supplies the hind legs. The femoral artery is located in the muscle but may be palpated. Remember that the uterine artery is in the broad ligament and can be moved 4 to 6 inches, while the femoral cannot.

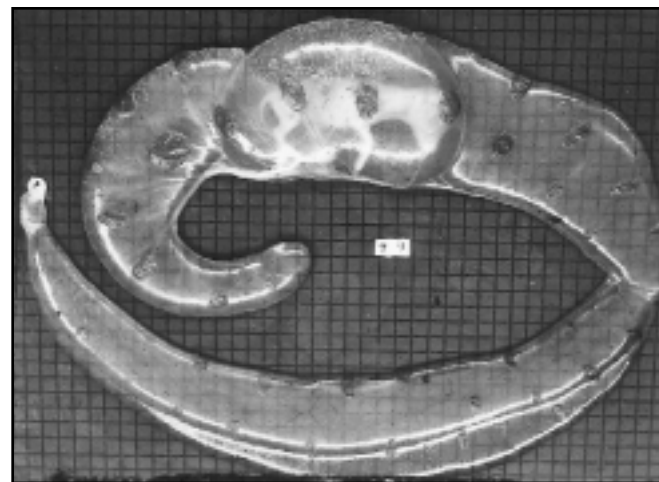


Figure 12. 79-day fetus, with surrounding membranes filled tightly with fluid. Grid scale 1/2 inch.

The best indication of pregnancy, if you cannot reach the fetus, is the presence of buttons. In a 3-month pregnancy the buttons are flattened and egg-shaped and measure $\frac{3}{4}$ to 1 inch across. Although rather soft to the touch, they are firmer than the thin-walled uterus. The membranes still are filled tightly with fluid.

Stage II: 120-day pregnancy

At this stage, the fetus is displaced similarly to the 90-day fetus. However, it has grown to approximately 10 to 12 inches long. The head is about the size of a lemon. Often, the palpator can detect the head of the developing fetus before any other body part.

The enlarged fetus fills a greater portion of the abdominal cavity and is easier to feel than the 3-month fetus (Figure 13). All other characteristics have changed some. The buttons are more noticeable, since they have developed to about 1 $\frac{1}{2}$ inches in length and have a much firmer feel. The pulsating uterine artery may be palpated, and the displacement of the entire reproductive tract.

Stage III: Over-5-month pregnancy

Because of their weight and size, these pregnancies will fall deep into the body cavity (Figure 14). Remember to reach deep into the cavity and toward the stomach floor.

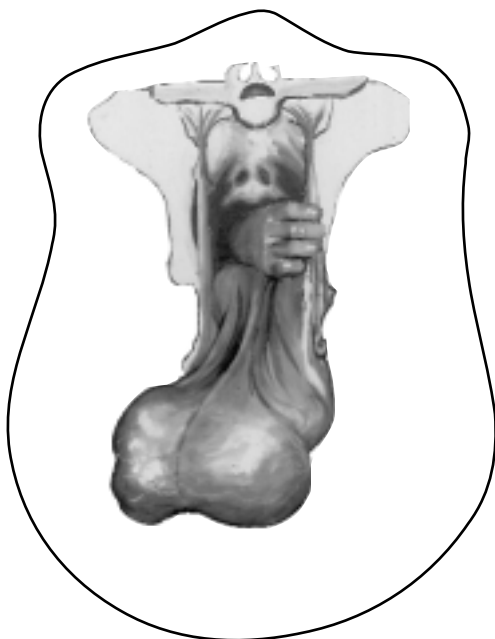


Figure 13. 4-month pregnancy. Tract lies on floor of abdominal cavity. Palpation of uterine artery.

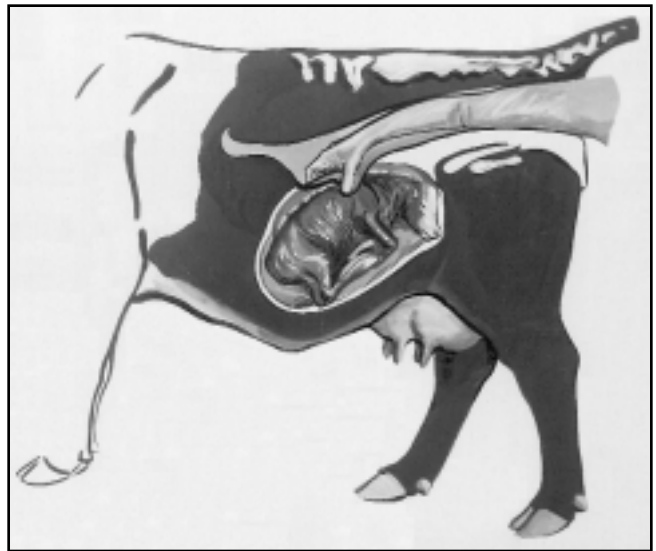


Figure 14. 5- to 6-month pregnancy. Enlarged calf now fills abdominal cavity.

Occasionally, these fetuses will be completely out of reach. To help confirm pregnancy, look for the presence of well-developed buttons or weight on the displaced cervix, or check the uterine arteries. The main change until parturition will be in size, as the fetus grows rapidly, using more of the abdominal cavity. Table 5 summarizes outstanding identifying characteristics.

A Word of Caution

One word of caution is necessary to help avoid errors in determining pregnancy. The position of the reproductive tract, in and of itself, is not a reliable way to determine pregnancy. Many 90-day (and shorter) pregnancies may be located entirely in the pelvic cavity and not be displaced beyond the pelvic brim. On the other hand, pregnancies beyond 90 days are big enough that they most often are displaced beyond the pelvic brim. Conversely, some open tracts are not always located entirely within the pelvic cavity. In large-frame, fat cows, the open uteri may fall beyond the pelvic brim. In all cases, the tract must be adequately traced to correctly determine pregnancy status. Simply stated, the location of the tract should be used as a roadmap to lead the hand to the uterus, whether it is displaced beyond the pelvic brim or not.

Other Factors

The paunch. Remember that the paunch (Figure 6) is often encountered when entering the rectum and feeling beyond the pelvic brim

Table 5. Fetal Size and Characteristics Used in Determining Pregnancy.

Stage	Days of Gestation	Fetal Size		Identifying Characteristics
		Weight	Length inches	
I	30	1/100 oz.	2/5	One uterine horn slightly enlarged and thin; embryonic vesicle size of small marble. Uterus in approximate position of nonpregnant uterus. Fetal membranes may be slipped between fingers from 30 to 90 days.
	45	1/8-1/4 oz.	1-1 1/4	Uterine horn somewhat enlarged, thinner walled and prominent. Embryonic vesicle size of small egg.
	60	1/4-1/2 oz.	2 1/2	Uterine horn 2 1/2 to 3 1/2" in diameter; fluid filled. Fetus size of mouse.
	90	3-6 oz.	5-6	Both uterine horns swollen (4 to 5" in diameter). Fetus is size of rat. Uterine artery 1/8 to 3/16" in diameter. Cotyledons 3/4 to 1" across, but very soft.
II	120	1-2 lb.	10-12	Similar to 90-day but fetus more easily palpated. Fetus is size of small cat with head the size of a lemon. Uterine artery 1/4" in diameter. Cotyledons more noticeable and 1 1/2 inches in length. Horns are 5 to 7" in diameter.
	150	4-6 lb.	12-16	Difficult to palpate fetus. Uterine horns are deep in body cavity with fetus size of large cat – horns 6 to 8" in diameter. Uterine artery 1/4 to 3/8" in diameter. Cotyledons 2 to 2 1/2" in diameter.
III	180	10-16 lb.	20-24	Horns with fetus still out of reach. Fetus size of small dog. Uterine artery 3/8 to 1/2" in diameter. Cotyledons more enlarged. From sixth month until calving a movement of fetus may be elicited by grasping the feet, legs or nose.
	210	20-30 lb.	24-32	From 7 months until parturition fetus may be felt. Age is largely determined by increase in fetal size. The uterine artery continues to increase in size— 210 days, 1/2" in diameter; 240 days, 1/2 to 5/8" in diameter; 270 days, 1/2 to 3/4" in diameter.
	240	40-60 lb.	28-36	
270	60-100 lb.	28-38		

and toward the left or very low in the body cavity. The shape of the dorsal and ventral sacs may be mistaken for the head or rear quarters of a calf. The difference can be determined by mashing on these large objects. The paunch will indent when mashed, while a well-developed calf may move away from the pressure of your touch. Also at these late stages of pregnancy, you can easily distinguish fetal features (ribs, hooves, ears, etc.) when you touch them.

The kidneys. The kidneys (Figure 6) are suspended directly under the spinal column at about a 30-degree downward angle. In cattle, the left kidney is located more toward the rear of the animal than is the right kidney. For this reason, the left kidney is often touched during palpation. It is elliptically shaped and is sometimes mistaken for a calf's nose. Practice will allow you to distinguish the difference, but inexperienced palpators can avoid the left kidney by feeling at a steeper angle into the abdominal cavity. It is usually at this steeper angle that large fetuses are located.

The buttons. Buttons may be mistaken for ovaries or vice versa. Buttons do not have the solid feel of an ovary but are rather soft. The best comparison is that they feel like dried apricots soaked in water. The ovaries are more rounded and egg-shaped with a firm feel. Only two are present.

Pyometra. In this condition, the uterus is filled with white blood cells attempting to clear up disease organisms. The uterus may be fluid to the touch or may be somewhat solidified, feeling rather plastic. This stage may be confused with early pregnancy stages if the uterus is in a fluid condition and only partly filled. In the latter stages of pyometra, the uterus becomes rather firm.

Large uteri. In older cows that have had many calves, the uterus may not return to its normal size, as it will in a younger cow. The enlarged uterus may be displaced over the brim of the pelvis as in a 3- to 4-month pregnancy. In the open cow, careful manipulation of the uterus will allow you to determine that no fluid and no developing buttons are present. Relaxation of the broad ligament tends to cause a similar condition.

The bladder. A full urinary bladder may be interpreted as a pregnancy in the 60- to 75-day stages. The full bladder feels similar to the uterus filled with fluid. Careful tracing should allow you to determine whether the structure is

the bladder, where there is only one body, or a pregnant horn of the uterus, where both horns can be palpated and traced back to the cervix.

Enlarged cervix. Some Brahman and Brahman-crossbred cattle have an enlarged cervix that is firm and has the feel of a developing fetus in the latter stages. Tracing the reproductive tract allows you to distinguish between the two.

Breed differences. Certain Brahman cross-breeds, Santa Gertrudis, Charolais, Holstein, and Brown Swiss cattle, because of their large size, are more difficult to palpate in certain stages of pregnancy than the smaller European breeds. In the 3- to 4-month stages, the uterus may have dropped so deeply into the body cavity that it is almost impossible to palpate. In these cases, pass your hand under the cervix and lift the uterus to feel the fetus itself. By lifting the uterus and quickly moving your hand down into the body cavity, you can determine the presence of the fetus by gently bobbing the fluid and the fetus through the wall of the uterus.

Brahman and Charolais breeds appear to have more tissue inside than smaller breeds. More folds of the omentum seem to cover the intestines, making it slightly more difficult to pick up the uterus. Charolais cattle seem to have less flexibility in the rectum. It is commonly harder to feel deep in the body cavity in these cattle, and lateral movement is somewhat restricted. In Holstein cows, the anal sphincter may be tight, limiting the deep entry into the body cavity necessary to determine the stage of pregnancy. In these cases, proficiency at mid-uterine artery palpation may be necessary (Figure 13).

The uteri of Brahman or Brahman-influence heifers vary considerably. It is not uncommon to find 1,000-pound heifers with uteri measuring only 4 to 6 inches in length, compared to a normal uterus, which would be 10 to 12 inches.

Highly finished cattle may be filled with fat, which interferes with movement and feel. These cattle may be difficult to palpate. If you are in doubt, repalpate at a later date.

Systematic Determination

Once you understand the variations in location and size of the reproductive organs, your ability to accurately determine pregnancy depends upon a careful and logical check of the various reproductive and fetal structures. Using a systematic approach to checking each cow

will ensure that you determine critical changes and variations in the location, size, and feel of the reproductive organs. A systematic approach not only helps assure accuracy, but avoids an excessive expenditure of energy on the part of the palpator. The schematic shown in Figure 15 is a systematic approach to determining pregnancy. The system can be modified, but it has proven to be a very functional approach for both beginning and experienced palpators.

Figure 16 provides an outline of the important and critical factors that must be carefully checked and considered in determining the stage of pregnancy. If your pregnancy determination is to be accurate, you must consider all factors. The outline is basically an arbitrary division of pregnancy based upon the location of the reproductive organs and/or fetus. It is included to summarize the more important factors that indicate whether the cow is open or pregnant. Beginners should study carefully the outline and be familiar with the changes and variations that occur in each stage of pregnancy.

Even after following a systematic approach to palpation, some beginners will be unable to confirm pregnancy status on some cows. If this happens to you, simply wait 30 days and check these few again. If they are indeed pregnant, their uteri will have increased in size, making it easier to confirm their status. But never speculate on their status. Incorrect guesses can be costly.

Occasionally, cattle producers desire an anticipated calving date (or known date of conception) from pregnancy records. This is best accomplished by palpating in the early stages of pregnancy (90 to 100 days or less). These pregnancies are usually within the palpator's reach and are small enough to be sized, which allows a close estimate of anticipated calving date. In late pregnancies (120 days or more), fetal size can vary greatly among cows that actually conceived on or about the same day. Consequently, determining anticipated calving date (or day of conception) from records taken in late pregnancy is difficult and often inaccurate.

Recommendations

Practice! Experience is the key to palpation. In many instances, the ranch manager should not be the one to palpate but should supervise the operation and critically observe the cows. Unhealthy, unsound, and undesirable types should be eliminated, as should open cows.

Shorten the calving interval by reducing the time during the breeding season when the bulls are with the cows. Cows that settle first are most adapted to reproduction. Wait about 90 days after the bulls are removed before you palpate. Most cows should conceive at the beginning of the season, and only a few will be short-term pregnancies. Cull as critically as is feasible for your operation. If every open, unsound cow can be removed, cull immediately.

Remember, palpation is an art and a skill. It pays dividends to the person who uses it wisely.

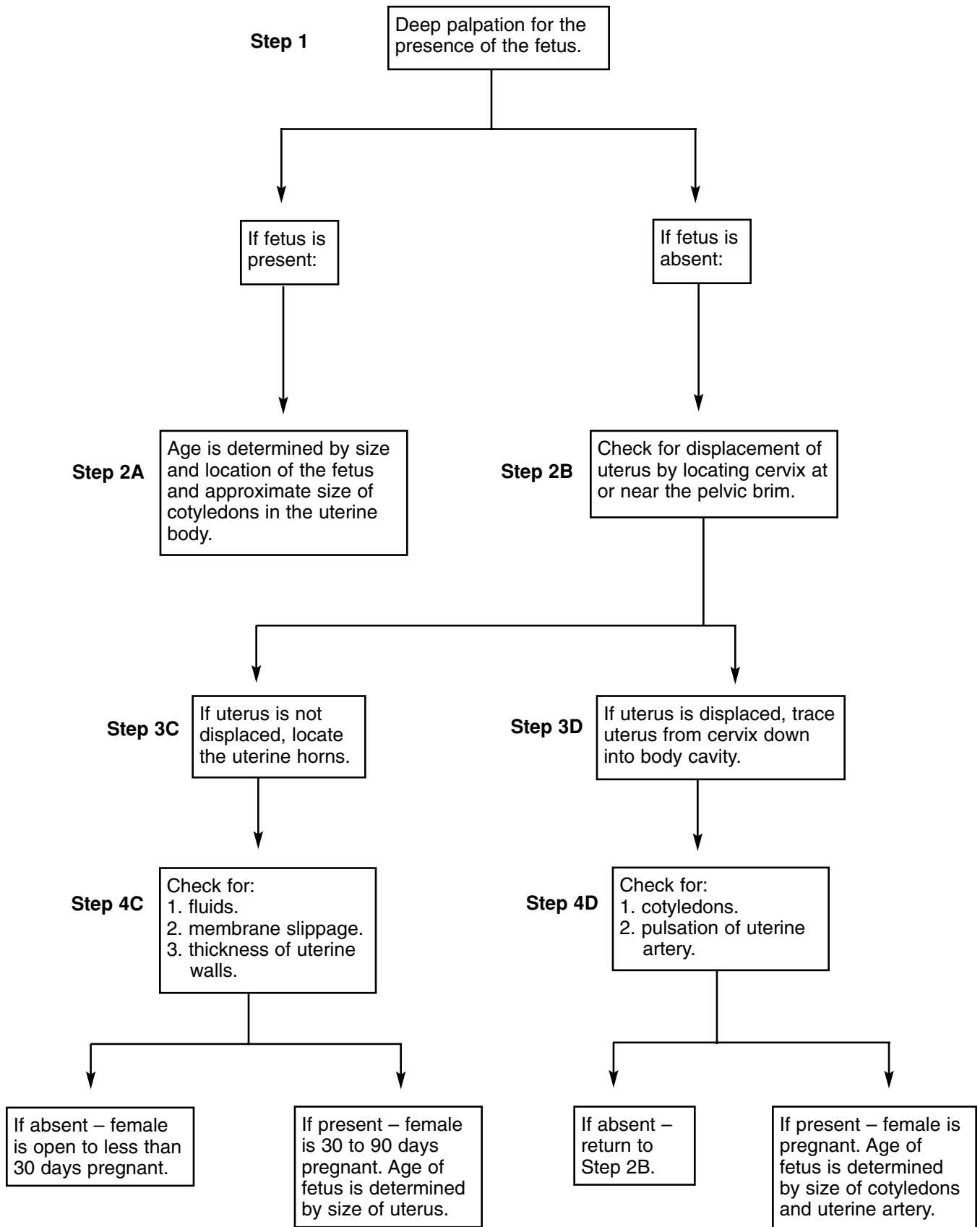


Figure 15. A systematic approach to pregnancy determination in the cow.

Open cows

In females that are nonpregnant or open, the entire reproductive tract is usually located within the pelvic cavity; however, in older cows and large-frame cows the cervix and uterine horns may be distended over the pelvic brim into the body cavity.

Determining Factors:

1. no fluids in uterus.
2. no membranes present upon slippage.
3. thick uterine wall with a meaty texture.
4. uterine tone
 - a. firm – at or near estrus.
 - b. flaccid – between estrous periods.

Stage 1 Pregnancy

Females in this stage vary from 40 days to 3 months of pregnancy. Cervix and uterine horns in pelvic cavity or perhaps moving over the pelvic brim into the body cavity as Stage 1 advances.

Determining Factors:

1. fluids in uterus and somewhat enlarged.
2. presence of membranes upon slippage.
3. thin uterine walls.
4. buttons indistinct to the touch.

Stage II Pregnancy

Females in this stage vary from 3 to 5¹/₂ months of pregnancy. Cervix normally located on pelvic brim with the uterine horns distended into the body cavity out of the normal reach.

*Determining Factors:**

1. displacement of uterus.
2. presence of buttons.
3. pulsation of middle uterine artery.

* Any two factors are considered sufficient evidence.

Stage III Pregnancy

Females in this stage vary from 5¹/₂ months pregnant to term. Cervix at or near pelvic brim. Developing calf has achieved sufficient size to be reached. Palpation of the calf becomes progressively easier as Stage III advances.

Determining Factors:

1. displacement of uterus.
2. palpation of large fetus.
3. presence of buttons.

Figure 16. An outline of factors that must be considered in determining pregnancy at different stages of gestation.

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