



Reproductive Management of the Mare

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A large portion of the equine industry is involved with the breeding and care of mares. Economic considerations of the equine breeding business make it necessary for owners to understand the reproductive cycle and how it can be managed. This knowledge is important for all mare owners, regardless of whether they are involved with breeding in their own operations, or whether they send their mares to a breeding facility.

Understanding Mare Reproductive Physiology

The mare has a seasonally polyestrous type of estrous cycle (Figure 1). This means that she typically is receptive to the stallion and ovulates only during certain times of the year. During the anestrus period, most mares show no behavioral signs of sexual receptivity and fail to develop follicles that ovulate. In the northern hemisphere, the anestrus period of the mare occurs most frequently during the winter (mid-Nov. to mid-Feb.). There are exceptions in that some mares will show behavioral signs of sexual receptivity throughout the year, even though they usually do not ovulate in the winter. Also, there is a small percentage of mares that do not express a seasonal pattern in that they stay both

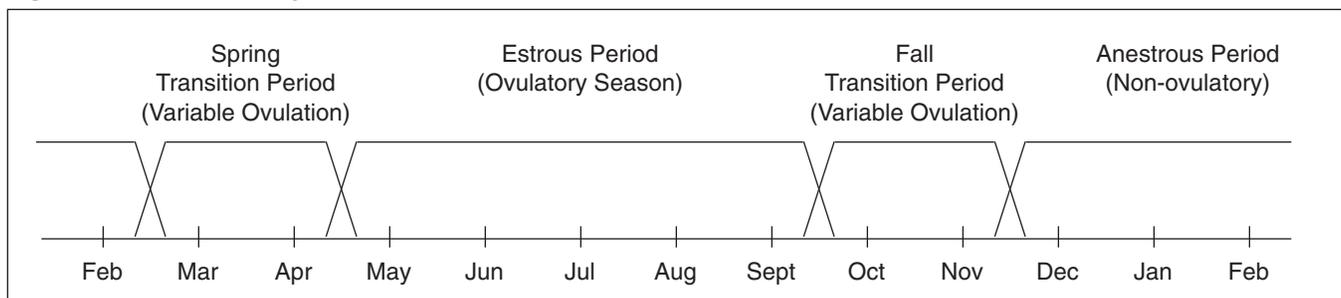
behaviorally and physiologically receptive to stallions throughout the year.

The transition periods' hallmark is a longer than expected time of receptivity to the stallion (Figure 1). The mare's ovaries contain small follicles that as yet do not have the ability to ovulate. After a time, one of the follicles matures and ovulates, and the regularity of estrous cycles begins.

During the ovulatory season, the mare is cycling, thereby exhibiting sexual receptivity to the stallion on a regular basis and is producing follicles that ovulate. Generally, the ovulatory season starts in mid-April and continues through mid-September, unless the mare becomes pregnant. During this time, the mare undergoes a series of cycles, each approximately 22 days in length. The estrous cycle is divided into two physiological parts—estrus and diestrus. Estrus is typically referred to as the time the mare is in heat. This is the time of follicular maturation and ovulation. During diestrus, the mare is not receptive to the stallion.

Ovulation most frequently occurs 24 to 48 hours prior to the end of estrus. Estrus duration is usually three to seven days. The mare enters diestrus following ovulation and the end of estrus. The follicle that ovulated at the end of estrus develops into a structure called the **corpus luteum (CL)**. If the mare is not pregnant, the corpus luteum will regress and follicular development

Figure 1. Mare seasonality.



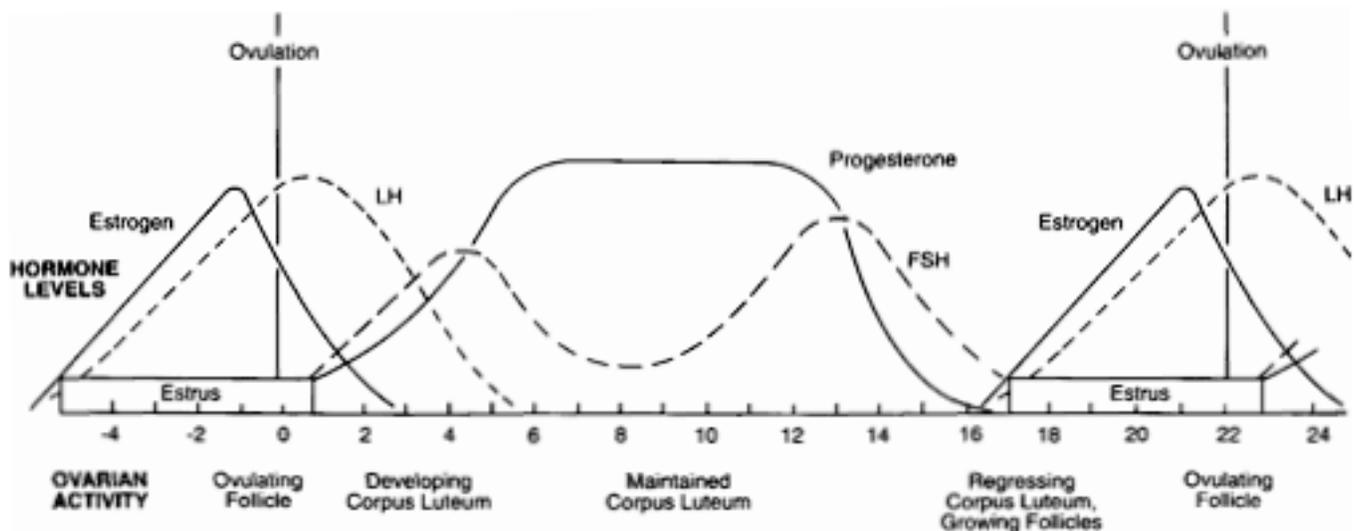


Figure 2. Hormone levels and corresponding ovarian activity in the estrous period.

will proceed at the end of diestrus. Diestrus usually lasts for 15 to 19 days. Some mares may ovulate two follicles during estrus or a second follicle during early diestrus. The occurrence of a second ovulation during or immediately following estrus may lead to twins, an undesirable event in the equine species. However, the mare's reproductive system (oviduct and uterus) usually eliminates embryos other than the primary one.

Management of the ovulatory season requires the mare owner to understand some of the physiological controls of the mare's reproductive status. Follicular development and ovulation are controlled by various hormones. An understanding of normal hormonal patterns is important, because many management practices used to increase conception rates involve action upon these patterns. Normal hormonal patterns are shown in Figure 2.

Blood levels of estrogen are highest when the mare is in estrus. **Estrogen** is responsible for causing the mare to show the behavioral signs of receptivity to a stallion. The primary hormone that is responsible for ovulation has been identified as **luteinizing hormone (LH)**. Another hormone, termed **follicle stimulating hormone (FSH)**, is mainly responsible for ovarian follicular development. **Progesterone**, which is produced by the corpus luteum, is the primary hormone that is responsible for the recognition and maintenance of early pregnancy up to about 150 days. From approximately 150 days until term, the source of progestins for pregnancy maintenance is the placenta. Figure 2 compares the normal circulating levels of these hormones with corresponding ovarian activity. Ovulation (day 0) occurs in response to increased levels of LH. If the mare is not pregnant, the CL begin to regress in response to prostaglandin (about day 13). This regression is complete by approximately day 18. Progesterone levels decrease when the CL regresses. At about the same time (day 13), FSH levels will increase

causing the follicle to grow in preparation for ovulation of the following estrus (day 19 to 22).

As with the different phases of the estrous cycle, the transition from the anestrus period to the estrous period is due to the changes in hormonal patterns. Little research has been done concerning hormonal patterns during anestrus, but it is understood that the changes in hormonal patterns necessary for transition into the estrous period are in response to longer days. Mares are long-day breeders.

The percentage of ovulating mares increases significantly as the daily photoperiod increases above the 12-hour vernal equinox (March 21), and decreases when daylight decreases in the fall below the 12-hour autumnal equinox (Sept. 21). Generally, the maximum number of naturally ovulating mares are during the maximum daylight periods of June.

Management of the Mare's Estrous Period

Breeding managers are generally concerned with four aspects of reproductive management during the ovulatory period—detection of estrus, mating management, pregnancy determination, and estrous cycle manipulation.

Detection of Estrus

Palpation and teasing are the two most common management tools used in the detection of heat. Rectal palpation and ultrasonography will help define the time of ovulation, and thus aid in mating management. Parameters of follicular size, follicular consistency, cervical size and consistency, and uterine tone can be monitored through rectal palpation. A mare with a large, very soft follicle that has an open cervix is a prime candidate for breeding. On the other hand, a mare that has no or

very small turgid follicles and a closed cervix would be a poor candidate for breeding. Most managers use a combination of teasing and palpation for estrus detection and breeding determination. Mares are teased and those showing signs of estrus are palpated to better define reproductive status. Mares can be individually teased or placed in teasing pens which are constructed to allow for group teasing. Most farms utilize some form of teasing code for recordkeeping which defines mare receptivity to a teaser stallion. The behavioral signs of estrus include winking of the vulva, urination, squatting, and seeking the stallion.

Increasingly, ultrasonography is being utilized for estrus detection and determination of ovulation. With real-time ultrasonography, veterinarians can determine follicular size, early ovulation, uterine changes characteristic of estrus, and abnormalities of the reproductive tract. Ultrasonography is a significant contributor to reduction of the number of breedings or inseminations required per estrus.

Each mare responds and acts differently during estrus. Thus, day to day monitoring of teasing status and reproductive tract parameters is essential.

Mating Management

Conception rates are highest when mares with reasonably good fertility are mated to stallions which meet high fertility standards (semen volume, sperm concentration, and percentage of live sperm). Mares with unknown or poor reproductive histories should be evaluated by using the standard practices of palpation, ultrasonography, intrauterine culture, cytology, and biopsy well ahead of the breeding season (i.e., late summer or early fall of the previous season) or as problems appear during the current breeding season. A "clean culture" by itself may not reveal the reproductive problems of an individual mare. Early detection of reproductive abnormalities, followed by proper therapy and management changes, usually results in more consistent and acceptable conception and foaling rates.

Conception rates are highest when mares are inseminated 36 hours before and up to the time of ovulation. As previously stated, ovulation most frequently occurs 24 to 48 hours prior to the end of estrus. Ovulation can be easily missed unless managers are precise in estrus detection and maintain accurate records. Managers often start breeding mares the second or third day of estrus (heat) and continue every other day until the mares goes out of estrus. However, palpation and ultrasonography can aid significantly in calculating the proper breeding time.

Pregnancy Determination

Several management techniques are used for pregnancy determination. One of the simplest ways is to watch for signs of heat. A mare may be pregnant if she exhibits no signs of heat 18 to 20 days after her last ovulation. However, some mares may not cycle

Related Terms

Anestrus - The period when most mares show no signs of reproductive activity at all. Anestrus begins in the fall and peaks around December. This should not be confused with the term "diestrus."

Diestrus - The period when the mare is not receptive to the stallion (usually lasts about 17 to 19 days).

Estrous - Refers to the entire reproductive cycle. The average length of the estrous cycle is 21 to 23 days (from one ovulation to the next).

Estrus - Refers to "heat," the period when the mare is receptive to the stallion (usually lasts about five to six days).

Palpation - The procedure of reaching in through the rectum and feeling the ovaries through the rectal wall to detect the presence of a follicle.

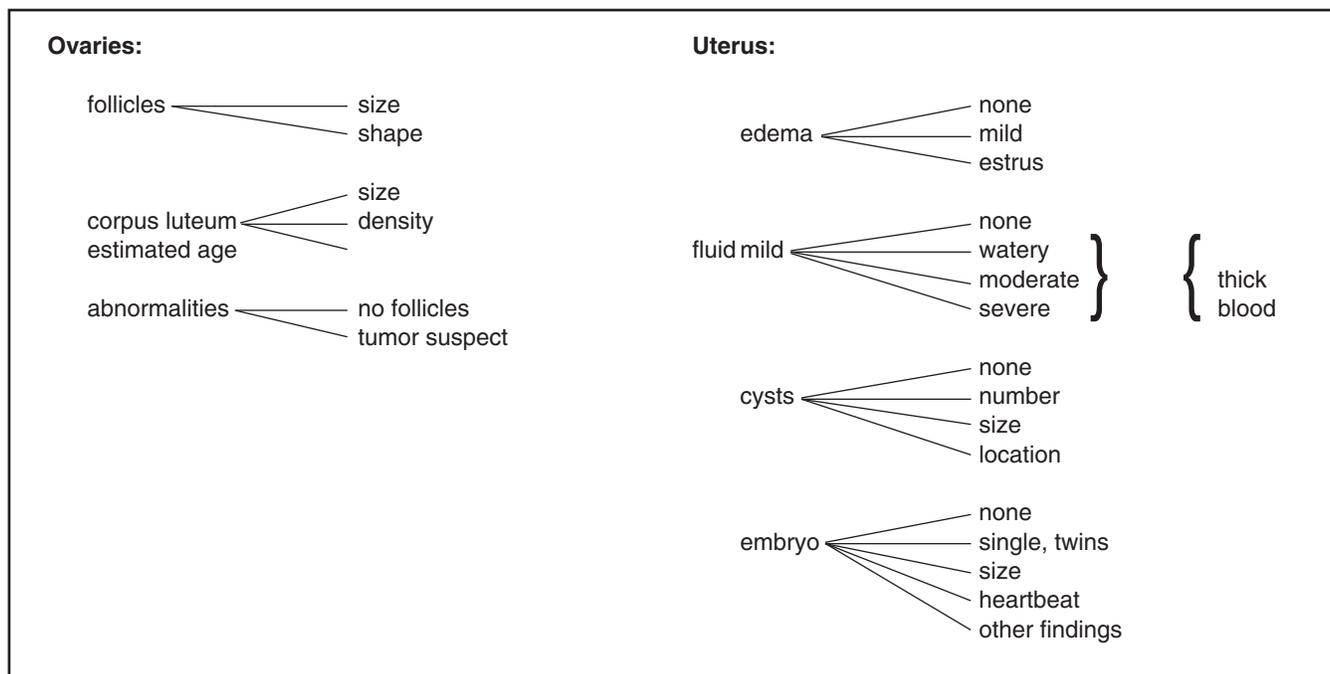
because of follicular or corpora luteal abnormalities, or they may have silent heat periods in which external signs of estrus are not evident. These problem mares would not be bred again if absence of heat was the only factor used to determine pregnancy. Because of these situations, other methods for pregnancy determination are commonly used.

Mares are most often rectally palpated 18 to 45 days following the last day of insemination. In recent years, real-time ultrasonography has gained attention for use in pregnancy determination. Ultrasonography can be used to obtain a visual image of the mare's reproductive tract, and thus to detect pregnancy before palpation is normally performed. Ultrasonography is normally used following the 14th day post-breeding, but it can detect pregnancies as early as 10 days post-ovulation. As mentioned earlier, the ultrasound can also be used to detect estrus and follicular development, and it can be used with mares that have reproductive tract abnormalities or abnormal cycles (Figure 3).

Manipulation of the Estrous Cycle

There are several management tools used to bring about the onset of the breeding season or to alter the estrous cycle itself. The most reliable method used to induce the ovulatory season is the use of artificial lights to alter the mare's perception of day length. The easiest light management program is to use lights at the end of the day to extend the perceived day length (or photoperiod) to 16 hours. This practice entails turning on an artificial light source 30 minutes before sundown. The light source should be turned on to supply enough additional light to produce a total 16 hours of daylight

Figure 3. Ultrasound examination.



(natural and artificial). There is a lag period of 60 to 90 days between the onset of daylight extension and first ovulation. Therefore, if February-March ovulations are desired, mares should be started on the lighting program before December 15.

Perception of day length must be constant from day to day; the use of automatic timers is of benefit. Also, using too much light can cause adverse effects. Mares that are exposed to continuous light will not cycle properly. Light intensity should be a minimum of two foot-candles, which is comparable to one 200-watt bulb for a 12 x 12-foot stall. Floodlights can be used on outside pens. A general rule is that lighting is sufficient if a newspaper can be easily read in any corner of the stall or pen. One side note is that mares in light inducement programs will also shed hair, so those housed outside will need protection from bad weather.

While the use of artificial lights has the greatest benefit on dry or open mares, recent studies have shown that early foaling mares will also respond to added light. Gestation lengths have been decreased by as much as 10 days when using lights for open mares, with no effect on foal weight and size. Artificial lighting enhances proper cycling in these mares after foaling.

Artificially advancing the ovulatory season in open and bred mares will help maintain a yearly foaling interval, produce older foals at the breed association's January 1 universal birth date, and make better use of available semen across the entire breeding season.

Several pharmaceutical products are used in the horse industry to maximize conception rates once mares are cycling. **Prostaglandin** is responsible for regression of the corpus luteum during normal cycles. Mares can

be "short cycled" by treatment with prostaglandin $F_2\alpha$ or one of its synthetic analogues, if there is a viable corpus luteum present. Prostaglandins are most effective when used on days 6 through 8 after ovulation, potentially reducing the interval from one heat to the next by as much as eight days. Prostaglandin treatment is most often used on mares that were not bred on the previous cycle and that have a viable corpus luteum suppressing the estrous cycle. Use of prostaglandin should be under the direct supervision of a licensed veterinarian, both for determination of usage and because of occasional adverse side effects. Pregnant women should avoid contact with the drug because it has been proven to cause abortions.

Progesterone can be used to suppress heat during transition into the ovulatory season in mares that have histories of long and erratic estrous cycles during this time. Progesterone has also been used with less consistent results to maintain pregnancy in mares with abortion history.

Another hormone that has been used with some success in breeding management is **Human Chorionic Gonadotropin (HCG)**. HCG aids in stimulating ovulation in mares. It is most often given at the same time the mare is bred. HCG will normally lead to ovulation of a mature follicle within 48 hours, aiding in appointment breeding and helping mares that tend to develop a follicle and fail to ovulate. Estrogen, **gonadotropin releasing hormone (GnRH)**, and **FSH** have been used to alter reproductive function. Results of the use of these three hormones, by themselves, are usually poor when compared to their use in other large animal species.

Recordkeeping

It is extremely important to keep accurate records of each mare's reproductive status. Breeding, teasing, palpation, and health records are examples of some of the essential record types necessary to assist in attaining maximum productivity. Breeding records should include mare identification, breeding dates, health comments, and expected and actual foaling dates. Health records should identify the date and description of health care, including the person who administered it. An example of a teasing and palpation record is given in Figure 4. The teasing record includes identification of the mare, teasing dates, teasing codes corresponding to the teasing dates, and other information, such as treatment records and dates bred.

Palpation records include dates and remarks of each palpation, teasing scores, and information describing follicular and reproductive tract condition. The following codes correspond to the record in Figure 4:

Teasing Code

- 1 - Mare is visibly resistant to stallion
- 2 - Mare is indifferent to stallion

- 3 - Mare is slightly interested in stallion; may urinate, may wink vulva
- 4 - Mare is greatly interested in stallion; occasional urination, profuse vulva activity
- 5 - Mare is greatly interested in stallion; frequent urination, squatting, leans into stallion

Follicle Size

Commonly sized as <20, 30, 40, 50 millimeters or greater in diameter.

Follicular Consistency

- T - Turgid
- S - Soft or breedable
- O - Ovulated

Cervix Size

- 1 - ≤10 millimeters
- 2 - >10 but <30 millimeters
- 3 - ≥30 millimeters

Uterine Tone

Poor, fair, good, excellent, or pregnant

Figure 4. Teasing and palpation record for mares.

Tease Code	Mare _____	Color _____	Age _____	Farm number _____
1 - resistance	In 19 _____	Book to _____	Mare owner _____	
2 - indifferent	Results of last year's breeding _____			
3 - interested				
4 - winks vulva, urinates				
5 - profuse urination and vulvular activity				
Other Codes				
T - treated				
C - culture				
S - speculum				
P - palpate				
B - bred				
Pr - pregnant				
F - foaled				
A - arrived				
D - departed				
U - ultrasound				

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Dec.																															
Jan.																															
Feb.																															
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May																															
June																															
July																															

Palpation		
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Revised from a fact sheet written by Jerry Rains and David Freeman.

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Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
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15.4. Management of the Mare at Parturition. 15.4.1. Foaling kit. 15.4.2. First stage of labour. This chapter will deal with the reproductive anatomy of the mare, detailing the individual structures along with their function. Further accounts may be found in other texts, such as Ashdown and Done (1987), Frandson and Spurgen (1992), Ginther (1992), Kainer (1993), Dyce et al. (1996), Bone (1998), Senger (1999), Bergfelt (2000) and Hafez and Hafez (2000). The reproductive tract of the mare may be considered as a Y-shaped tubular organ with a series of constrictions along its length. The perineum, vulva, vagina and cervix can be considered as the outer protective structures, providing protection. The reproductive tract in the mare consists of the ovaries, uterine tubes, uterine horns, uterine body, cervix, vagina, vestibule, and vulva. These are the organs that produce the oocyte, facilitate its fertilization, provide an environment for embryonic and fetal development, and transport the fetus from the maternal to the external environment. They cannot perform these functions without interacting with other organ systems. The broad ligaments allow for functional as well as physical attachment of the reproductive tract to the rest of the body. They provide an avenue for arteries, veins, lymphatic vessels, and nerves, which supply the ovaries, uterine tubes, and uterus. A working knowledge of the mare's reproductive anatomy and physiology is essential in a horse breeding program. This knowledge provides the fundamental basis on which all other principles of horse breeding rest. The vulva is the exterior opening to the reproductive canal. It consists of the labia, clitoris and the vestibule. The construction of this region is important because it serves to protect the mare from the entrance of air and other contaminants into the vaginal vault. Vagina. Another negative aspect of human management is that we frequently attempt to breed mares outside of their natural reproductive season. Left to their own devices, mares normally mate during the longer, warmer days of spring and summer.