An Overview of Stallion Breeding Management

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Based on national and state surveys, approximately 100,000 horses are used for production in Oklahoma. Horse breeding enterprises are very diverse. Most people only own broodmares and contract breedings with stallion owners. Stallion owner enterprises range from those with a single stallion that may breed fewer than five mares per year to operations that stand several stallions and breed hundreds of mares annually. Breeding methods include pasture mating, in-hand natural mating and artificial insemination with fresh, cooled, or frozen semen. Those who manage stallions are concerned with maintaining a healthy horse that meets expectations as a breeding animal. This report provides an overview of management needs for breeding stallions.

Housing

Stallion housing facilities vary greatly between farms, partially because of facility constraints and partially because of differences in behaviors between stallions. Some stallions can be stalled in or around other horses with little concern for aggression or fighting. Others, especially during breeding season, can become quite aggressive, and require significant housing and facility construction to provide a safe environment for the stallion and surrounding horses. Stallions are normally housed next to geldings or other stallions, rather than mares. Housing stallions next to cycling mares is not recommended, unless using the mare for a short teasing period prior to collection.

Farms with several stallions will usually contain a stallion barn or stalling area that is separated from the general horse population. Separate housing decreases the chance of contracting infectious diseases inadvertently brought to the farm from horses that routinely travel off farm. Moreover, many owners invest in esthetically appealing stallion housing to increase the interest of visiting mare owners who are contemplating the purchase of a stallion's service.

Breeding stallions may be handled less frequently than other horses, and spend more time in stalls. As such, many farm designs expand the industry standard for stalling average-sized stock horses of 12 feet by 12 feet to larger dimensions.

Stalls should be of strong construction that is free from objects that can injure a stallion. Wood is the most commonly used material for stall walls, although concrete block and metal sheeting are also frequently and successively used. Wood allows for a solid barrier, yet it is more forgiving than concrete if a stallion paws or kicks the walls and is less noisy than metal. Wall heights should be a minimum of 8 feet, although taller sides may be required when housing aggressive stallions in adjoining stalls.

Stall fronts typically are solid in heights of 4 to 4 1/2 feet from the floor, with metal bars or a sturdy wire mesh extending above to the top of the stall front. The bars or mesh on the top of the stall front allow for ventilation into stalls and visual contact with other horses and activities in the area.

Stallions housed beside one another should not have physical access to each another since biting, kicking, and fighting are natural behaviors with many stallions. As such, common walls to adjoining stalls should be solid to barn eve heights (8 to 10 feet is typical).

Although exercise has not been shown to increase stallion semen production, most stallions will respond behaviorally and appear healthier when allowed daily access to mild exercise. Stalls are commonly connected

to a turnout area to provide self-exercise and visual contact with other horses. Stallions in stalls without a connected turnout should be routinely allowed access to an individual turnout paddock or mild exercise such as hand walking.

Turnouts should be fenced with sturdy construction. Minimum fence height recommendations for typical pasture fences of farms of 4 to 5 feet are increased to a minimum of 6 feet or higher to lessen the desire of stallions to rear and challenge enclosures. Double fencing turnouts that directly contact other horses is also recommended, so stallions have limited physical access to surrounding horses.

Nutritional Needs of the Stallion

Stallions will need more energy during the breeding season, as most will increase their daily voluntary exercise, such as walking paddock fences, in anticipation of breeding. Forage, usually in the form of hay, should be provided at minimums of 1% of body weight per day (10 pounds of hay for 1000 pounds of weight). Grain should supplement the forage at levels to maintain a moderate body condition. Body condition can be estimated visually by the level of fat cover on the stallion's neck, back, ribs, shoulder, and croup. Typically, condition level should allow for enough fat cover so that individual ribs are not seen, the croup appears rounded, and the neck and shoulder blend smoothly into the body. See OSU Extension Fact Sheet ANSI-3920, "Body Condition of Horses" for more information on assessing a stallion's level of condition.

Hay species used in feed rations vary; some managers prefer the added nutritional content of legumes, such as alfalfa, because legumes reduce the need for grain nutrients. Others choose high-quality grass hay such as bermudagrass to avoid potential blister beetle poisoning from alfalfa. A 70/30 hay-to-grain ratio (by weight of ration) is a typical benchmark for feeding stallions. However, there is enough individual variation between stallions and management routines that rations range from all-forage diets to diets higher in grain than hay.

Recommendations for grain mixes will partially depend on the type of hay fed, as stallions consuming alfalfa will need less supplementation than those consuming a less-nutritious hay. The typical commercially prepared grain mixes intended for breeding stallions contain 12% to 14% crude protein. These concentrations will more than adequately meet daily protein needs when the grain is combined with high-quality grass hay.

The amount of ration needed per day will vary; larger stallions require more ration per day because of higher maintenance needs. More active stallions will need more ration per day. Also, the energy content of the feed will influence how much ration is needed per day. It is becoming more and more popular to feed grain mixes with added fat because these mixes supply energy in concentrated, highly digestible amounts. Fat-added feeds are especially beneficial for those stallions that do not maintain adequate weight with traditional grain mixes.

Most commercially prepared grain mixes designed for stallions will have enough minerals and vitamins added to the formulation to more than meet daily needs for these nutrients. As such, additional supplementation of minerals and vitamins is unwarranted unless the stallion is fed low-quality hay and a grain without added minerals. The exception is the need for trace-mineralized salt, which is recommended to be supplied free choice in blocks in addition to the amounts provided in commercially prepared rations.

Water is the most important, and perhaps most unthought of, nutrient. Many stallions are watered with automatic waterers because of their convenience. However, automatic waterers should be cleaned and checked daily to ensure proper function. Using buckets instead of automatic waterers has the advantage of making it easy to monitor the animal's intake and note any changes that might relate to health problems.

Health Care

Managers who stand stallions for income emphasize all programs that influence the appearance and health of the stallion. As such, stallions are typically kept in top condition, hair coats are groomed, long hair is clipped, and manes and tails are maintained according to current industry trends. Stallions should have hooves trimmed every four to eight weeks. Some owners prefer shoeing stallions, while others prefer leaving them unshod.

Health programs include deworming and vaccination of stallions with similar routines as those conducted on other mature horses on the farm. The attending veterinarian will prescribe vaccinations against diseases such as tetanus, rabies, encephalitis, rhinopneumonitis, influenza, and equine viral arteritis. Parasite programs should include routine deworming and general sanitation practices, such as daily cleaning of stalls.

Breeding Management

Factors affecting daily spermatozoa output.

Basically, the role of a breeding stallion is to impregnate mares. This means producing semen containing adequate quality and numbers of spermatozoa to fertilize a mare's ovum. Spermatozoa are produced daily in the seminiferous tubules of the stallion's testes. The testes are housed in the protective covering of the scrotum, which functions to regulate the temperature of the testes.

Temperature regulation is important because abnormal rises in temperature — such as those caused by injury or infection — will decrease spermatozoa production. Since stallions need about 57 days to produce mature spermatozoa, injuries and infection can have long-term effects on the breeding season.

Testicular size is a good indicator of sperm production capability; stallions with larger testicles will normally have larger daily spermatozoa output. As such, measurement of scrotal circumference is one of the procedures that veterinarians conduct as part of a breeding soundness exam.

Total scrotal width is smaller in 2- to 3-year-old stallions than in their older counterparts. Stallions that are 2 or 3 years old are expected to have smaller daily sperm outputs and spermatozoa reserves.

Because of this sexual immaturity, 2-year-old stallions should be limited to breeding a small number of mares, if any at all. Otherwise, conception rates will be undesirable because of low spermatozoa numbers, and the stallion may develop a low sex drive from overuse. Even though spermatozoa production begins as early as 12 to 14 months of age in most colts, results of numerous research trials recommend waiting until the stallion is 3 years old before using him as a breeding stallion.

Daily spermatozoa production is also influenced by season. Lowest production, a decline of about 50% from peak values, is expected from September through February. Production of spermatozoa increases as daylight grows longer in March, peaks in May and June, and then declines significantly in July and August. Artificially extending the length of the day by using lighting programs will enhance a stallion's semen production.

Lighting programs should start around the first of December to advance the breeding season for February and March. The perceived daylight should be lengthened to 16 hours of light per day. Lighting programs must be routinely applied every day. Avoid housing situations that supply 24 hours of light since stallions may respond by decreasing production of semen to levels characteristic of short days.

Stallions will typically remain fertile beyond their 20th year of age. The age that stallions stop producing spermatozoa will vary between stallions. It is important that semen is routinely evaluated on all stallions, especially when using older stallions because of the expected decrease of semen production with age.

Semen collection schedules

Collecting or breeding once per week decreases the weekly sperm output compared with breeding or collecting daily or every other day. Sperm output per week is similar whether collecting every other day or daily. Therefore, for maximum amounts of sperm collection and minimum labor, stallions should be collected every other day. The every-other-day schedule is typical for farms using artificial insemination.

Managers breeding stallions by natural cover may need them to cover mares more frequently than every other day. More frequent collection intervals will not result in a significant increase in weekly sperm output. Rather, individual collections will have fewer spermatozoa. Whether or not these decreases are significant enough to lessen fertility when breeding every day or twice daily will depend on the stallion's spermatozoa production capability.

The stallion's sex drive and his ability to produce spermatozoa will place limits on how often he can successfully breed mares. Sex drive, as monitored by reaction time and number of mounts necessary before ejaculation, usually will not be affected by increasing the breeding frequency from every other day to daily collections. However, managers must treat stallions as individuals and regulate collection intervals appropriately. Overuse can cause decreases in sex drive, observed by the stallion's disinterest in breeding, longer mounting times required before breeding, or lack of ejaculation during breeding.

Estimating the Time to Inseminate

Once in the breeding season, a mare will cycle every 22 days until she is bred or enters the anestrous or noncycling season. Each cycle will have a 5- to 7-day estrus period. During this period, a mare will build follicles on her ovaries, of which one will eventually ovulate a day to two before she goes out of estrus. Highest conception rates are most likely when mares are inseminated 1 or 2 days prior to ovulation up to the time of ovulation. Insemination outside that time frame reduces the chance of conception.

As follicles grow, so will the mare's acceptance to a stallion's sexual advances (See OSU Extension Fact Sheet ANSI-3974, "Reproductive Management of the Mare" for more information). Because of this nature, teasing a mare is the most common detection tool for determining timing of insemination (see Table 1).

Table 1. Teasing Scores for Estrus Detection.

One	Mare visibly resistant to stallion
Two	Mare is indifferent to stallion
Three	Mare is slightly interested in stallion: may urinate, may show winking of vulva
Four	Mare is greatly interested in stallion: occasional urination, profuse vulva activity
Five	Mare is greatly interested in stallion: frequent urination, squatting, backing into stallion

When in the presence of a stallion, the majority of mares in estrus will exhibit one or more of the signs characteristic of a teasing score of 3 or greater. Mares showing a teasing score of 3 or greater are covered. However, relying on this behavior alone may require mares to be serviced multiple times in one estrus because mares may show interest in stallions without being within one or two days of ovulation. Or a mare with a lack of estrus behavior may not be bred, even though she does ovulate.

Because of the variations between estrus behavior and time of ovulation, efficient use of stallions requires that teasing is combined with palpation and use of ultrasound. This is especially important when servicing a large number of mares, as limits to semen production or sex drive will place limits on how often the stallion can be collected. When approaching ovulation, palpation and ultrasound can detect changes in the tone of the cervix and uterus, and level of follicular activity and ovulatory follicle size, all signs that increase the accuracy of estimating the day of ovulation.

Teasing also influences the stallion's behavior and the composition of semen. The need to tease a stallion to increase sex drive will depend on the individual nature of the stallion. Teasing influences total volume of the ejaculate more than the number of spermatozoa per ejaculate. This increase in volume results from increases in accessory sex gland fluid that does not contain spermatozoa.

The number of mares that can be booked successfully to a stallion depends on the stallion's spermatozoa output, the stallion's sex drive, and the number of times each mare must be bred. A common booking limit is 30 to 40 mares per season with natural mating. This number can be larger if the manager utilizes palpation and ultrasound to accurately determine ovulation time in mares.

Breeding Methods

The vast majority of stallions are hand-mated naturally or collected for artificial insemination. While total conception rates are no less with pasture breeding, most mare owners require specific breeding dates so that expected foaling dates can be accurately calculated.

Some breed registries, most notably The Jockey Club, require natural cover. In addition to requirements imposed by registries, some managers prefer natural service because of lower investments in labor and equipment. Conversely, natural matings can be more dangerous because of the differences in mares' acceptance to a stallion and the stallion's conduct around them. Additionally, natural matings can also spread infectious diseases that move from horse to horse by physical contact.

Artificial insemination allows individual collections to be divided to inseminate multiple mares, so the bookings can be larger or the stallion use lessened. In addition, semen evaluation becomes more routine because ejaculates are evaluated as a normal part of the collection and insemination procedure. Those owners interested in shipping cooled or frozen semen must, of course, use artificial insemination. These factors, combined with the decreased chance of spreading infectious diseases, make artificial insemination the desired method with breeds whose registries allow for it.

Artificial insemination requires investment in additional equipment and requires additional skilled labor. Breeding artificially requires collection of semen with an artificial vagina (A.V.). Two models, the Colorado and the Missouri, are the most commonly used. The Colorado has the advantage of maintaining a more constant temperature, while the Missouri (Figure 1) is lighter.

A.V.'s are composed of inner and outer rubber liners encased in a plastic or leather casing. The liners are filled with water, and a nonspermicidal lubricant is applied to the surface that contacts the stallion's genitalia. The amount and temperature of the water and lubricant are closely regulated to promote the sex

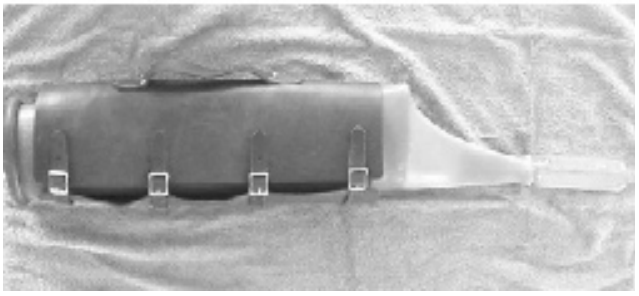

Figure 1. Missouri Model A.V.

drive of the particular stallion and to avoid cold shock of the semen.

Stallions are usually trained to jump a phantom or 'dummy' mare, so the need to have a jump mare for collections is avoided. Once the stallion services the A.V., the semen is evaluated for volume, concentration and motility, so accurate insemination dosages can be calculated. Minimum accepted insemination dosages are 400 to 500 million live, motile spermatozoa per insemination.

Semen extenders are used before the semen is used. Extenders include a food source for the spermatozoa, buffers, and antibiotics, all of which prolong survival of the spermatozoa and protect them from unfavorable environmental conditions. Semen must be extended unless the mare is inseminated within a few minutes after collection.

There are many different commercial sources for A.V.'s, extenders, and equipment for semen evaluation and insemination. Readers are encouraged to contact veterinarians and breeding farms for contacts, or simply search the World Wide Web for suppliers.

Use of Cooled and Frozen Semen.

Great care is taken during collection to ensure the spermatozoa are in an environment that guards against cold shock and contamination of spermicidal agents. For most stallions, A.V.'s are typically prepared for inner temperatures between 110^0 to 120^0 Fahrenheit at the time of collection. Stallions are sensitive to pressure and temperature changes, and accurate monitoring is essential for promoting sex drive.

Non-spermicidal lubricants are used, and spermicides such as water and light are not allowed to come in contact with the ejaculate. Any equipment or materials that come in contact with the spermatozoa are warmed to about 100^0 Fahrenheit. Once extended, semen is housed in an incubator at 100^0 Fahrenheit until inseminated. Insemination should follow within the hour or as quickly as possible since the longer semen is stored, the greater the loss of live, motile spermatozoa cells.

Recent changes in several major breed registries have allowed for increased use of cooled and frozen semen. Cooling or freezing semen allows for semen to remain viable longer. As such, semen can be shipped to mares, eliminating the cost and stress of shipping a mare and foal. Freshly collected extended semen can be cooled to 40^0 Fahrenheit, transported in containers specially designed to maintain the cool temperature, and inseminated in mares 24 to 48 hours after collection. The success of using cooled semen depends on how well a particular stallion's spermatozoa respond to cooling, the synchronization of the mare's estrus to the time of insemination, and how well proper semen collection and handling techniques are followed.

Although frozen semen is routinely used in other species of livestock, it has not been as well researched in horses because of breed registry restrictions on its use. However, it will become more common because of recent changes adopted by many registries for legalization of its use. Frozen semen is packaged in pellets, plastic straws or glass ampules and stored in liquid nitrogen at temperatures below -320^0 Fahrenheit.

Breeding Shed Equipment

Most farms using artificial insemination will have at least two pieces of equipment: a phantom and insemination chute.

Phantom. The use of a mare phantom or "collection dummy" removes the need for a mare during semen collection. Once trained, stallions will serve the A.V. while mounted on the phantom. Phantoms are padded cylindrical tubes positioned above the ground with one or two pipe legs.

Phantom dimensions vary between farms; however, most are between 5 and 8 feet long and 4 to 5 feet in circumference (see Figure 2). A commonly expressed disadvantage with the smaller circumference phantoms is that the stallions have difficulty stabilizing on the phantom when serving the A.V. Phantoms with diameters on the larger end of the range may be difficult for some stallions to grasp with the front legs.

One modification on the smaller cylindrical tube design has been to increase the circumference on the rear two feet of the cylinder. This design allows for the

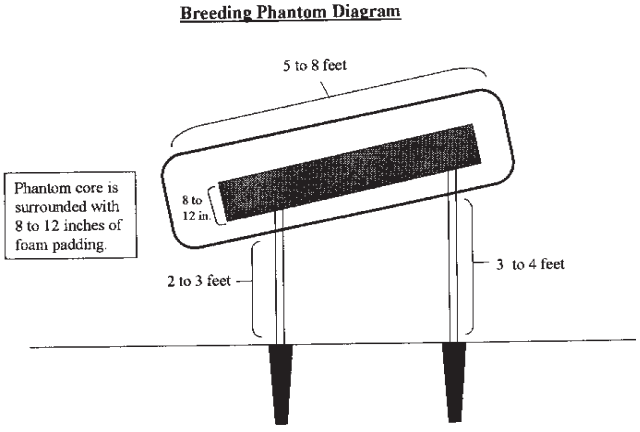

Figure 2. Breeding Phantom Diagram.

stallion's front legs to grasp a small diameter cylinder while allowing his body to rest on the larger portion. Another modification involves a cutaway along the side or under the rear of the cylinder to allow for positioning of the A.V.

Phantom cylinder construction commonly uses an 8- to 10-inch diameter metal core constructed from pipe or heavy gauge sheet metal frames. The phantom is positioned above the ground on 3- to 4-inch pipe legs that are anchored securely in the ground. The legs need to be designed to allow for height adjustment on rear and front. Heights will vary depending on the stallion. The top of the front of the phantom is commonly raised about 5 feet from the ground. Rear heights typically are about a foot lower.

An added feature for height adjustment uses an upper pipe of small diameter designed to slide inside a lower pipe, which is anchored into the ground. To secure heights, aligned holes are drilled in each pipe every 6 inches to allow a metal pin to be inserted through both pipes. Use of a 1/2- to 1-inch set screw housed in the lower portion of the lower leg provides further stabilization of the phantom.

Metal cores and legs are covered with a minimum of 8 to 12 inches of foam padding and covered in nylon-reinforced vinyl or some other nonabrasive material, such as leather. The covering must be easily cleaned with water and disinfectant. Addition of a leather simulated "mane" positioned at the front third of the phantom allows the stallion to grip the "mane" with his teeth, further stabilizing himself while mounted.

Stanchions. Stanchions are used for many purposes on horse farms: washing, grooming, injury treatment, and breeding. Relative to the breeding activities, stantions are used for teasing, washing, palpation and examination of stallions and mares. Stanchion construction must consider the large potential for horse and handler injury in and around the stantion. Sharp edges and projecting structures should be avoided.

Stanchions used for mature horses typically are constructed from 3- to 4-inch pipe frames (see Figure 3). Length dimensions are approximately 5 1/2 to 6 feet, and internal widths range from 26 to 32 inches. Height from top of stanchion to the ground should be 7 to 8 feet. Sides are constructed with one or more side rails. Sides may also be solid metal or wood. Single-railed side bar heights should be approximately 3 1/2 feet from the ground. Double-railed side bar heights should be approximately 3 and 4 feet from the ground.

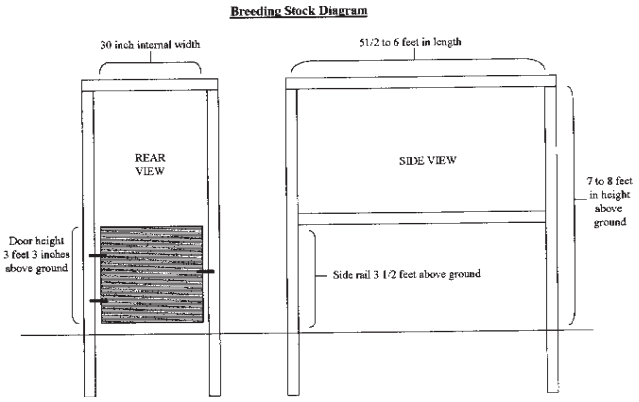

Figure 3. Breeding Stock Diagram.

Solid sides are also suitable. Sides can be hinged to swing out at the front or rear or have sliding or hinged windows to allow access to specific areas of the horse's body for examination. Foal stanchions designed to house foals along side mares should have solid sides that are at least 3 feet 6 inches in height. Taller sides may better deter any attempts of the foal to jump out of the stanchion.

Rear door heights should allow for ease of palpation and insemination, but should be tall enough to deter mares from kicking above the top of the door. The preference for the amount of clearance beneath the door and actual door height varies between individual managers. The top of the door should reach 3 feet to 3 feet, 3 inches above the floor. Bottom door clearance of 1 to 6 inches should protect the examiner from being kicked.

A front gate placed to a top height of 3 feet, 6 inches can assist in containing unruly mares. However, a cotton chest rope is routinely used instead of a front door. The use of a rope allows for adjustment forward and backward, thus allowing the mare's hindquarters to be positioned against the rear gate for palpation and insemination.

Stanchions used for palpation and insemination will need an accessible water source at the rear. Faucets and plumbing should be protected from horse traffic. Some stanchions are designed with plumbing along the top rail of the rear of the stanchion, with faucet placement on the side of the rear frame 6 to 7 feet above the floor.

Small brackets or shelves on the rear of the stanchions designed to house soaps, paper towels, and other

supplies provide easy access for the examiner. These structures should be positioned away from horse traffic in and out of the stanchion.

Breeding Laboratory

Semen collection and evaluation equipment is housed in a breeding laboratory. Laboratories should provide a dust-free, clean environment and be conveniently located near the breeding shed. The laboratory will need a hot and cold water source in addition to housing space for microscopes, semen incubators, and collection and insemination equipment. Many farms find it useful to house on-farm medication supplies requiring refrigeration or controlled dispensing in the breeding laboratory. A useful design of a laboratory allows for observation into the breeding shed area by a window so the laboratory technician can coordinate with the horse handlers and semen collection and insemination personnel.

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