

Is Your Stud A Dud?

Dr. Janet F. Roser, associate professor in the Department of Animal Science, University of California-Davis.

- * Introduction
- * Fertility Evaluation
- * What Causes Subfertility or Infertility?
- * Treating the Subfertile/Infertile Stallion
- * References
- * About the Author

Introduction

Many stallions are being retired from racing, showing and performance to enter the breeding shed. Their value as potential breeding animals is based more on exceptional performance than on their ability to sire foals. Reports indicate that at least 11 percent of breeding stallions are subfertile or infertile (Rossdale and Ricketts, 1980), contributing to the low conception rate of 60 to 65% generally observed in the horse industry today.

When is a stallion fertile, subfertile or infertile? According to Dr. Robert Kinney and co-workers (1983), a stallion is considered fertile if his conception rate is around 75% of 40 or more mares covered naturally or 75% of 120 mares covered by artificial insemination in one breeding season when given reasonably good management and mares of reasonably good fertility. A subfertile stallion's conception rate would be lower and an infertile stallion's would be almost zero.

How does one measure fertility? The best measurement of a stallion's fertility is the foaling rate of a large group of fertile mares mated by him under optimal conditions of management. However, it is not always possible to 'try out' the stallion in such ideal conditions prior to standing him at stud. Therefore, the potential buyer or owner is left with having to use other, sometimes less reliable, methods of testing for fertility. Generally, the most commonly used predictor of fertility is the stallion breeding soundness exam or fertility evaluation. During this evaluation, the veterinarian will perform a series of observations, procedures and tests which should be in accordance with the recommendations of the Society for Theriogenology (Kinney et al., 1983).

Fertility Evaluation

Breeding soundness exam. The prospective buyer or owner of the stallion should try to be present during the exam. Observing the evaluation assures good quality control practices and allows for the opportunity to evaluate the stallion prospect's performance in the breeding shed or to observe the problem stallion in a different situation. First, the stallion should be identified (color, markings, registration number, etc.) and a complete history should be obtained, including age, previous management, use, and if appropriate, frequency of ejaculation, present level of fertility, and previous fertility evaluation findings. In addition, information should be obtained on factors that could effect libido and semen quality such as severity and duration of illness or injury, types of medications received and nutrition, parasite and vaccination programs.

Once the identification and history are recorded, the stallion should be given a general physical examination. Any defects, such as blindness, severe lameness or faulty conformation, which interfere with the desire and ability of the stallion to cover a mare should be recorded. Next a blood sample should be taken for evaluation of blood hormone levels such as luteinizing hormone (LH), follicle stimulating hormone (FSH), testosterone and estrogens to test for testicular degeneration; T3 and T4 to test for thyroid dysfunction and cortisol to check for adrenal-gland pathology. The blood sample should also be checked for evidence of Equine Infectious Anemia (EIA) unless this has been done in the last 3 months.

Following the physical exam, the stallion should be taken to an estrous mare in a teasing chute where his behavior is noted and recorded. Intense interest in the mare is a sign of normal healthy libido. Normal behavior includes restlessness, pawing, whinnying, nudging, nuzzling, smelling nipping, and the Flehmen reflex. Erection usually occurs shortly after sighting the mare but can occur anytime during teasing. After washing and examining the penis for any abrasions or lesions, the veterinarian should swab the urethra for bacteriologic examination.

The next step involves collection of semen for evaluation. The jump-mare should be prepared by wrapping her tail, then washing the perineal area with mild detergent, followed by thoroughly rinsing with clean water. The jump-mare must be in good standing heat, preferably gentle and appropriately restrained. The stallion is led into the breeding area and introduced to the mare. The manner in which the stallion approaches, his reaction time (time between first sighting the mare and erection), and the number of mounts before intromission and ejaculation should be noted. Reaction time varies between seasons and ranges from a

low of 3 to 4 min in August to a high of 13 to 14 min in January. The number of mounts also varies between seasons ranging from 1 to 2 in April to 2 to 3 in October. Any abnormal sexual behavior, such as biting, striking and savaging mares should be recorded. Once the stallion has mounted, the penis should be deflected into an artificial vagina for collection of semen. Upon dismount, a post-ejaculatory swab for bacteriological examination should be taken while the urethra is dilated.

While the semen is being evaluated in the laboratory, the external and internal genital organs should be given a thorough physical examination by the veterinarian. The scrotum is checked for inflammation or edema; the penis and sheath are examined for summer sores, melanomas, warts, lesions or abrasions; the testicles and epididymis are palpated for size, consistency and texture. Testicular diameter has been shown to be correlated to daily sperm production and daily sperm output. Testicular size varies with season and age of the stallion. Scrotal width for a mature stallion averages between 10 to 13 cm. It is measured by using a ruler or an instrument called calipers.

Rectal palpation should be completed in a chute to evaluate the internal genitalia; the prostate, ampulla and seminal vesicles. These organs are palpated for size, consistency and texture. The stallion should not show any pain or discomfort upon palpation. A second semen collection and evaluation should be carried out one hour later for complete examination of the quality and quantity of sperm production.

Semen Evaluation. Semen characteristics that are commonly measured include the following: 1) volume (gel, gel-free, and total), 2) concentration of spermatozoa per milliliter of gel-free semen, 3) total spermatozoa (concentration x volume), 4) progressively motility (%), 5) morphology (normal and abnormal forms), 6) pH, 7) presence of white blood cells, 8) longevity of the motility of raw semen at 22°C and 9) bacteria. Most mature fertile stallions have semen with 1) sperm output that is 6×10^9 , 2) progressive motility of greater than 50%, 3) normal morphology of greater than 60% with less than 10% major defects affecting the head and midpiece, 4) pH of 7.2 to 7.6 and 5) gel-free volume of greater than 40 ml. The color and consistency of the semen should be creamy white without any tinges of red or yellow indicating blood or urine.

Effect of age, season and frequency of ejaculation on sperm production. Age significantly influences testicular size and seminal characteristics. Scrotal width of stallions that are 1) 2-4 years of age are about 9.0 cm, 2) 4-6 years of age are about 10.0 cm and 3) greater than 7 years of age are about 11.0 cm.

The increase in testicular size is closely correlated with an increase in total sperm per ejaculate: 2-3 years of age, 1.8 billion; 4-6 years of age, 3.6 billion and 9-16 years of age, 4.5 billion. Season also effects testicular size and sperm output and should be considered when evaluating a stallion. Scrotal width can change from 10.5 cm in December to 11.5 cm in June. Although motility is not effected by season, gel-free volume and concentration change dramatically. Total sperm output can be almost two fold greater in the breeding season than in the non-breeding season, i.e it can change from 6 billion in December to 10 billion in June. Frequency of ejaculation can dramatically effect sperm output. The total number of sperm found in the second ejaculate can be half the number found in the first if the ejaculates are taken one hour apart.

Overall stallion evaluation. No single physical characteristic or test of semen quality will accurately predict stallion fertility. The overall exam should serve as a guideline in determining the stallion's potential fertility. According to the Society for Theriogenology Manual for Clinical Fertility Evaluation of the Stallion (Kinney et al., 1983), to consider a stallion to have sufficient fertility to have a book of 40 mares, or 120 if artificial breeding is used, the stallion should have the following qualities as assessed by a fertility evaluation:

"1. The stallion should demonstrate good libido, as indicated by short reaction time, to move freely, to find and mount the mare, to make intromission and to promptly ejaculate semen free of urine and/or blood.

2. The penis should be of normal size and shape and be free of lesions of an inflammatory nature.

3. The bacteria recovered from the semen and 2 urethral swabs should be inconsistent in type and reduced in number after ejaculation. There should be no colonies of the organism of Contagious Equine Metritis. In addition, multiple pure cultures or an unexplained increase in colony count on the second ejaculate are considered suggestive of reproductive tract infection and necessitate further investigation and clarification.

4. There should be no indication of equine infectious anemia as indicated by a negative Coggins test.

5. There should be 2 scrotal testicles and epididymides of palpably normal size, shape and texture.

6. The stallion should have the potential ability to ejaculate at least 1×10^9 morphologically normal, progressively motile sperm in the second ejaculate each month of the year, (Sperm concentration \times semen volume \times 06 morphologically normal sperm \times % progressively motile sperm)."

If the stallion fails to meet these requirements, he should be re-examined in 60 days, the time it takes for one complete spermatogenic cycle (i.e., production of a new population of sperm). If the stallion fulfills all the requirements, he should be considered as a satisfactory prospective breeder for 40 (120) mares. Kinney and co-workers (1983) emphasize that the ultimate performance of the stallion depends not only on passing the fertility exam but on management factors, veterinary care and the number and fertility of mares mated.

What Causes Subfertility or Infertility?

There are many causes of subfertility or infertility in breeding stallions. For the last few years, researchers and veterinarians have been investigating factors such as poor management, behavior, injury, disease, genetic defects and hormonal imbalance (endocrine dysfunction) as they relate to subfertility and infertility. Progress in evaluating the importance of these factors has been slow as the research is expensive and time-consuming. Without an insight into the causes of subfertility or infertility, treatment is difficult and at present, very few therapeutic regimens are available for the subfertile/ infertile stallion.

Management factors. Management practices have a profound influence on a stallion's breeding performance. The basic care and management that applies to all horses should be strictly adhered to with the breeding stallion. A good parasite and vaccination program should be carried out under the supervision of a veterinarian. The stallion should be dewormed every two months and vaccinated periodically against the common diseases such as influenza, tetanus and encephalomyelitis. A good nutrition program is critical. Underfeeding the stallion during the breeding season will cause physical deterioration which will adversely affect sexual performance. Emaciation will cause testicular atrophy and poor seminal quality. Overfeeding the stallion during the season can lead to physical deterioration and poor, slow sexual performance. Incorrect feeding can lead to laminitis which can have a serious influence on sexual performance. The stallion should be fed a nutritionally balanced ration as recommended by the National Research Council (NRC) in their publication, Nutrient Requirements of the Horse, 1989. Additional mineral, vitamin and protein supplementation is not

necessary for the adult stallion if a normal balanced ration is being fed. During the breeding season, there is an additional energy requirement as recommended by the NRC. The teeth should be floated at least once a year to prevent hooks from forming and lacerating the cheeks and tongue making it difficult to chew and swallow. A good exercise program is not only important to maintain body condition but to prevent boredom, vices and in some cases poor libido.

Those working with the stallion should be aware of the effects of age, season and frequency of ejaculation on sperm output as indicated above. Generally, a 2 year old stallion should breed only 2 times per week, a 3 year old stallion can breed 4-6 times per week, a 4 year old can breed once per day and a mature stallion can breed 1-2 times per day. At least one to two days of sexual rest should be incorporated into the program of those stallions that are 4 years or older who are breeding every day. Overuse of the stallion, particularly the young stallion, will have a detrimental effect on breeding performance. Those working with the stallion should evaluate his daily sperm output (DSO) at the beginning of the breeding season. The stallion should be allowed to sexually rest for 4-7 days after which two ejaculates are collected and examined one hour apart on the first day followed by collection and examination of single ejaculates every day for the next six days. This technique will deplete extragonadal sperm reserves and will determine daily sperm output. The stud manager will then be able to determine just how many mares to book the stallion to so that the horse is not overworked. For many breeds the breeding season starts around February 15th, a time when the stallion is not at his peak performance. In this situation, the number of service per day may be significant and particular stallions may suffer from overwork if called upon to mate two or three times in 12 hours for several consecutive days and weeks. This may result not only in loss of libido but depletion of sperm output. In order to gear up the stallion for this unnatural breeding season, the stallion can be exposed to an increased artificial daylength. Exposure of stallions to 16 hr of light and 8 hr of dark starting in mid to late December in northern hemisphere, and maintaining them on this photoperiod until early June should maximize reproductive efficiency early in the breeding season. However, it should be kept in mind that exposing stallions to an artificial photoperiod in late winter and early spring will result in early burnout, ie, a decline in breeding performance prior to the end of the breeding season, July-August.

Failure to recognize ejaculation is a serious mismanagement situation in the breeding shed and can be a substantial cause of subfertility. Some stallions show signs of ejaculation by

tail flagging but others are quite deceptive. A couple of methods to determine if the stallion has ejaculated is to 1) feel for the ejaculatory pulses by placing a hand at the base of the penis after intromission or 2) after dismount, allow the stallion to remain in the presence of the mare; a stallion who has not ejaculated will usually remount and try again.

Sexual behavior. By domesticating the stallion, we have interfered with his natural mating behavior. In fact the most common cause of abnormal sexual behavior is mismanagement. The young maiden stallion, retired from the race tract or show ring, should not be expected to carry a full book of mares his first season. Most likely these stallions have been previously trained to suppress normal sexual behavior. Some maiden stallions present no problems while others need a great deal of patience and retraining. A traumatic first experience may cause long lasting psychological problems. Many times putting a young inexperienced stallion in an arena to freely mate with a gentle, quiet, experienced estrous mare provides the optimal sexual environment for a positive experience that has lasting effects. Thereafter, the new breeding stallion should be introduced to the breeding program over a period of several weeks during which time he can be trained to the washing, teasing and breeding procedures.

Impotence and abnormal sexual behavior can be induced by pain and fear. Detrimental handling by an aggressive stallion handler or adverse changes in the stallion's environment can decrease libido. Obviously a change in personnel and a change in surroundings may increase breeding performance. The stallion who has been injured by a mare in the breeding shed will need plenty of sexual rest and retraining. Even when the injury has healed and the pain is gone, the stallion will remember the experience and be reluctant to mount another mare. A phantom or dummy mare may be useful in overcoming "mare shyness" after an injury.

Disease and bacterial infections. A high fever associated with a systemic disease can have a deleterious effect on sperm output. Good veterinary care and management along with both physical and sexual rest for 60 days should allow for a full recovery. Equine viral arteritis, a contagious, communicable viral disease, can be passed to the mare by infected semen. The disease is characterized by fever, conjunctivitis, depression, anorexia and abortion. Certain bacteria such as some strains of *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and the contagious equine metritis organism, *Taylorella equigenitalis*, that are isolated from the external genitalia of the stallion can be passed on to the mare and cause acute uterine infections. Although these

bacteria do not cause lesions or systemic disease in the stallion, they can cause earlier embryonic loss in the mare.

Genetic factors. Genetic abnormalities in the stallion are not usually a common cause of subfertility or infertility. However, an infertile or subfertile stallion with no history of injury, infectious disease, or managerial problems are often considered to have genetic inadequacies. These may be associated with semen abnormalities or, in rarer cases, chromosomal abnormalities. There have been a few case reports of hermaphrodites (both male and female reproductive organs) and genetic mosaics but these conditions are usually associated with obvious genitalia abnormalities. **Cryptorchidism, when one or both testes do not descend into the scrotum, is considered a heritable condition that is surgically treated by castration.**

Hormonal factors. Although there are very few case reports in the literature that associate stallion subfertility or infertility with endocrine dysfunction, the presence of this disorder should not be overlooked. Anabolic steroids, given to performance horses in an attempt to promote growth and physical ability, do suppress sperm output. Recovery rate can be slow and incomplete after the stallion is taken off these steroids. Normal breeding stallions demonstrate a seasonal increase in levels of luteinizing hormone (LH), follicle stimulating hormone (FSH) and testosterone. In a subset of stallions with poor fertility, LH and FSH levels are elevated throughout the year in the presence of normal to low unchanging levels of testosterone. Further research must be carried out on the role of hormones in controlling reproduction in the normal stallion in order to understand the relationship between endocrine dysfunction and subfertility/ infertility.

Treating the Subfertile/ Infertile Stallion

The first step in treating the subfertile/ infertile stallion is to determine the cause by carrying out the fertility evaluation as indicated above. A few treatment programs have already been discussed in terms of management practices that have an impact on body condition, behavior, disease and bacterial infections, hereditary conditions and hormonal imbalances. However, in many cases the cause is unknown and/or the course of treatment is uncertain. Around the country, researchers are starting to make some significant advances toward understanding the physiology and endocrinology involved in stallion reproduction. Information acquired from these studies will be helpful in developing diagnostic tools and therapeutic regimes for stallions with poor fertility. Treating the Subfertile/ Infertile Stallion The first step in treating the subfertile/ infertile stallion is to

determine the cause by carrying out the fertility evaluation as indicated above. A few treatment programs have already been discussed in terms of management practices that have an impact on body condition, behavior, disease and bacterial infections, hereditary conditions and hormonal imbalances. However, in many cases the cause is unknown and/or the course of treatment is uncertain. Around the country, researchers are starting to make some significant advances toward understanding the physiology and endocrinology involved in stallion reproduction. Information acquired from these studies will be helpful in developing diagnostic tools and therapeutic regimes for stallions with poor fertility.

References

Bowen, J. M. (1987) Venereal diseases of stallion. In: Current Therapy in Equine Medicine. Ed. N. E. Robinsonn. W. B. Saunders Co., Philadelphia. pp 567-570.

Hurtgen, J. P. (1987) Evaluation of stallion fertility. In: Current Therapy in Equine Medicine. Ed. N. E. Robinsonn. W. B. Saunders Co., Philadelphia. pp 555-558.

Kinney, R. M., Hurtgen, J., Pierson, H., Witherspoon, D. and Simons, J. (1983) Theriogenology and the Equine. Part II. The Stallion. J. Soc. Therio. Vol IX. Society for Theriogenology, Hastings, Nebraska.

Pickett, B.W., Amann, R. P., McKinnon, A. O., Squires, E. L. and Voss J. L. (1989) Management of the Stallion for Maximum Reproductive Efficiency, II. Colorado State Univ. Anim. Reprod. Lab. Bull. 5.

Rossdale, P. D. aand Ricketts, S. W. (1980) The Stallion. In: Equine Stud Farm Medicine. Eds. P. D. Rossdale and S. W. Ricketts. Bailliere Tindall, London. pp 120-164.

Nutrient Requirements for Horses. (1989) National Research Council, Washington, D. C.

About the Author

Dr. Janet F. Roser is an associate professor in the Department of Animal Science, University of California-Davis. Her primary research interest is endocrine regulation of reproduction in the stallion. She has done extensive research with normal, subfertile and infertile stallions