

ARTIFICIAL INSEMINATION

What's New?

Precise timing and specialized tools are the mainstays of successful equine insemination

With artificial insemination, more mares can be bred by stallions from afar.

ANNE M. EBERHARDT PHOTOS

Thanks to ever-improving technology, breeders can rest assured there's a good chance their artificially inseminated mares will have foals by their sides come spring. In addition to the fact that conception rates with artificial insemination (AI, as opposed to natural cover) have risen, more mares can be bred by stallions from afar and an increasing number of mares and/or stallions with marginal fertility are capable of producing offspring.

HEATHER SMITH THOMAS

In this article we will explore the different AI breeding techniques (using fresh, cooled, and frozen semen) as well as new and existing methods to improve both mare and stallion fertility.

Forms of Semen

Fresh semen implies that semen was collected from the stallion, processed, and deposited in the mare immediately. "We

presume that sperm from most stallions will remain viable in the mare's reproductive tract for approximately 48 hours," says Pat McCue, DVM, PhD, Dipl. ACT, associate professor of equine science at Colorado State University's Equine Reproduction Laboratory. "Therefore, if we're using freshly collected semen, we'd want the mare to ovulate within 48 hours after insemination. If she hasn't ovulated within

that interval, we collect semen again and reinseminate the mare."

Administering an ovulation-inducing agent such as human chorionic gonadotropin (hCG) or deslorelin acetate (SuroMate) helps ensure the mare ovulates within this 48-hour window.

Cooled semen use typically involves collecting semen at one site and diluting it in semen extender. The semen is then packaged and shipped in containers within a special passive cooling device to the facility where the mare is located. Shipment might be via overnight courier or a same-day service, the latter usually meaning counter-to-counter airline service.

"The difference in selection of the two options (overnight courier versus same-day shipment) usually depends on one of two factors," McCue explains. "One is how soon the mare is anticipated to ovulate. If

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administering deslorelin acetate. “The common dose is 1.5 milligrams, given as an intramuscular injection,” McCue explains. “We use deslorelin in a similar manner as hCG, but the timing is slightly different (the mare ovulates within 40 hours instead of 35).”

Deslorelin is a synthetic hormone that mimics the natural gonadotropin-releasing hormone (GnRH). “Deslorelin stimulates release of LH from the mare’s own pituitary, and her own LH will travel to her ovaries to stimulate follicle maturation and ovulation,” explains McCue. “Consequently there’s a little delay in the interval from hormone administration to ovulation with deslorelin as compared to hCG. We expect a predictable timed ovulation in approximately 90% of mares that receive hCG. However, in a few mares hCG will not induce ovulation in a consistent time interval. Fortunately, deslorelin seems to work on those mares.”

James Bailey, DVM, veterinarian at Royal Vista Southwest, an assisted equine reproductive service center in Purcell, Okla., explains that another ovulation-inducing product similar to deslorelin, called histrelin, is currently offered in compounded form. Veterinarians have used it experimentally to stimulate follicular development in anestrus (noncycling) mares and to induce ovulation with positive results, but histrelin is not yet FDA-approved.

Semen Quality

Along with hormonal treatments for mares, new techniques for handling stallion semen also help increase AI fertility and pregnancy rates. Dickson Varner, DVM, MS, Dipl. ACT, a professor of the rriogenology at Texas A&M University, has been at the forefront of stallion research and is involved in developing methods for improving semen quality. His laboratory has investigated various techniques for centrifugation of stallion semen (when ejaculate is spun to separate the semen from seminal plasma). Varner says semen is generally subjected to centrifugation prior to freezing and also in certain instances for cool-shipped semen—if sperm must be concentrated or if all the seminal plasma must be removed because of toxic properties. “Cushioned centrifugation (in which a dense liquid at the bottom of the tube prevents excessive compaction of the

sperm during centrifugation) allows for improved sperm recovery rate with little or no harm to the sperm,” says Varner.

Density-gradient centrifugation is another relatively new technique used to separate good from bad sperm in a semen sample. “This technique involves centrifuging sperm through a special medium with a specific density,” he explains. “The density of this medium is generally controlled by incorporation of coated silica particles. This mineral substance is cell-impermeable, exerts no osmotic effects, has a high specific gravity and low viscosity.”

In one version of this technique, “a product called EquiPure is used to filter semen, then it is centrifuged to concentrate it,” Bailey says. “Through use of EquiPure and low-dose insemination (also known as deep horn insemination, which involves placing semen directly into the uterine horn containing the follicle), some of the mares that react adversely to seminal plasma, etc., and produce a lot of fluid in the uterus (basically, an inflammatory response to foreign material that can impede conception) will become pregnant.”

Veterinarians and breeding managers typically use this low-dose insemination technique when inseminating mares with frozen-thawed semen, but they also apply it to help separate out motile sperm for fresh-semen insemination. The process also helps reduce mares’ uterine inflammatory response to insemination, because veterinarians can use concentrated semen doses as low as 1-1.5 mL.



Semen samples are often obtained and processed to count the number of sperm cells per milliliter and to determine accurate semen doses for cooled artificial insemination.



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“Although this centrifugation technique can be somewhat time-consuming and requires experienced laboratory personnel, the results can be impressive for some stallions, improving their semen quality and fertility,” Varner adds.

Another tool Bailey recommends is a NucleoCounter, which he instituted in his practice two years ago (learn more at TheHorse.com/13745). “This new machine enables us to count the sperm and also lets us know about viability—we can determine what percentage of sperm cells have intact membranes,” he says. “This enables us to do a much better job of evaluating shipped-in semen. Since we are breeding mares and doing embryo transfers, it is imperative to know whether a failure is the fault of the mare or due to poor-quality semen, so we can advise our mare owners.”

Intracytoplasmic Sperm Injection

Another insemination technique that has become commercially applicable in recent years is intracytoplasmic sperm injection (ICSI). The process involves injecting a single sperm into a mature egg that was previously aspirated from a mare's ovarian follicle as a means of fertilization.

“A developing embryo (in a preblastocyst stage) can then be surgically transferred into the oviduct of a recipient mare,” explains Varner. “Advances in some labs allow the embryo to be grown to a blastocyst stage (embryos that are big enough to transfer to mares with standard embryo transfer methods) in a Petri dish so it can be transferred nonsurgically into the uterus of a recipient mare.”

This procedure has applications for use in some subfertile mares and stallions. “In addition, ICSI can be used for establishment of pregnancies from mares that have died, by harvesting their ovaries (immediately after death) and transporting them to a lab that offers this service,” Varner says. “Similarly, limited banks of frozen semen can be thawed and refrozen in more dilute forms so more straws (dozens to thousands) can be available for ICSI purposes. This technique has been used to establish pregnancies from stallions that are no longer living.”

Optimizing Fertility

Fertility varies greatly from one stallion to another, so it is important to evaluate

semen quality and per-cycle pregnancy rates of stallions to help determine optimal insemination techniques or management changes that could maximize fertility.

Pregnancy rates vary among fresh, cooled, and frozen semen, but industry average—all mares and stallions—reports highest success rates with fresh semen, followed by cooled and then frozen.

It's important to conduct a test freeze on any stallion whose semen has never been frozen to determine if it freezes well (i.e., has good post-thaw motility). However, “The bottom line is pregnancy rates in mares bred with that frozen semen,” McCue cautions. “Until you breed some mares, you really don't know the pregnancy potential of that frozen semen.”

“Cushioned centrifugation allows for improved sperm recovery rate with little to no harm to sperm.”

DR. DICKSON VARNER

Bailey explains that despite potential subfertility challenges, “there are some pedigree crosses that some people want very badly, and they are willing to take risks with certain stallions and work harder at getting a pregnancy. They may have to flush their mare two or three times to get an embryo, using one of those stallions. But using our NucleoCounter, looking at a mare's (and the stallion's) track record, and having the software (to calculate and track fertility rates) ... enables us to counsel our clients appropriately.”

Take-Home Message

Owners or breeders that desire a foal from a certain mare and stallion despite fertility challenges have a much better chance of breeding success due to the above-described AI methods and technologies. Always work with an equine reproductive specialist who is experienced with these techniques to determine the best approaches for your particular animal. 🐾

ABOUT THE AUTHOR

Heather Smith Thomas ranches with her husband near Salmon, Idaho, raising cattle and a few horses. She has raised and trained horses for 50 years, and she has been writing freelance articles and books nearly that long.