Some Factors Associated With Fertility of Thoroughbred Stallions

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ABSTRACT

The results of 3 years (2005–2007) of observations and mating (5,646 estrous cycles of 3,788 mares bred to 1 of 15 stallions) at one Thoroughbred breeding farm in central Kentucky were analyzed by a multiple logistic regression model using Bayesian statistics to evaluate the relationship between data entries (factors) and pregnancy outcomes. Factors found to be significantly ($P < .05$) associated with pregnancy outcome included stallion (one stallion had lower OR for pregnancy higher odds ratio [OR] for pregnancy, and one had, than other stallions), date of mating (OR for pregnancy declined slightly in May – July), mare age (OR for pregnancy were higher for mares <13 years old, and lower for mares >18 years old), mare beginning status (foaling mares had a higher OR for pregnancy), mating on foal heat (lowered OR for pregnancy), mating of the day for the stallion (OR for pregnancy was 4.16 times lower for fifth compared with first mating of day), reinforcement breeding (increased OR for pregnancy), dismount semen neutrophil score (lowered OR for pregnancy when neutrophils were present in dismount semen samples), and tranquilization before breeding (lowered OR for pregnancy in foaling and barren mares). The influence of dismount sample sperm motility scores on OR for pregnancy was weak, so motility scores were not included in the final logistic regression model. The majority of variation in pregnancy outcome was because of mare factors, with only approximately one-third of the variation in fertility explained by stallion.

Keywords: Fertility; Equine; Stallion; Thoroughbred; Dismount sample

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Several factors have been shown to affect fertility of stallions used in natural service mating programs. Some factors are difficult to alter managerially, such as individual stallion variation in fertility,[1–5] age of stallion,[1,5] season,[6,7] semen quality,[7–10] quality of mares bred including age and/or beginning status (maiden, foaling, barren, etc),[4,5,11–16] and whether mares are bred on foal heat.[11,15,17,18] Factors affecting stallion fertility that can be managed to some extent include number of mares bred in a season,[19,20] daily mating frequency,[1] interval from breeding to ovulation,[21] and whether reinforcement breeding is used.[15] Another management practice that might explain variation in a stallion's fertility is tranquilization of mares to ensure matings are safely accomplished[22] (as opposed to rejecting mares without allowing mating).

Variation in quality of dismount samples evaluated might also explain differing fertility. Monitoring of dismount semen samples for the presence of sperm to confirm ejaculation is a common management practice on well-managed Thoroughbred breeding farms.[23,24] Drippings collected from the penis were reported to represent the quality of whole ejaculates in a study that used sperm head morphometric measures in entire ejaculates and drippings from the penis after removing the artificial vagina following ejaculation.[25] Evaluation of sperm motility and morphology in dismount semen samples was also reported to provide useful information for determining potential fertility of stallions.[8] Haag[8] reported that low sperm motility in raw dismount semen samples was coincident with low pregnancy rate in 87 Thoroughbred matings. Immediately mixing the dismount semen sample with a warm semen extender and promptly examining the specimen microscopically has been recommended as a useful procedure for monitoring potential changes in stallion fertility during the course of the breeding season.[23] By evaluating sperm morphology in dismount samples collected from 797 matings of 17 stallions, Love et al[9] found that specific sperm morphologic features in dismount semen samples were predictive of pregnancy outcome for each particular breeding. Whether sperm motility of dismount samples has predictive value for determining pregnancy outcome for each mating has not been studied.

Because endometritis remains a significant cause of infertility in mares,[26,27] evaluating dismount semen samples for the presence of neutrophils might be useful for identifying mated mares with inflammatory conditions of the tubular reproductive tract that could lower overall fertility of a stallion. If a mare has an active endometritis, neutrophils could be expelled during breeding and be collected in the dismount sample, and resultant fertility of that breeding could be compromised.

In case of doubt whether a given mare will stand safely for mating, tranquilizing agent(s) may be administered to it before exposure to the teaser stallion. In some cases, the mare is tranquilized after it has rejected mounting by the teaser stallion. Tranquilization of a nervous mare will often quiet the mare sufficiently to allow mounting by the teaser stallion, and then the intended breeding can be safely accomplished. Fertility could be adversely affected if administration of tranquilizing agent(s) interferes with sperm transport and colonization of the uterotubal junction, or with timing of ovulation (by inhibiting luteinizing hormone release). Some mares may have objected to the teaser stallion because they were not in an optimal stage of estrus. In such cases, tranquilization may have facilitated mating at a time not near to ovulation, in which case fertility would be reduced.

The purpose of this study was to evaluate the influence of various factors (stallion, mare, management procedures) on fertility of Thoroughbred stallions on one Kentucky farm. In addition, the relationship of observations of dismount semen samples to pregnancy outcome of a given mating was examined.

MATERIALS AND METHODS

A manual record system was developed before the 2005 breeding season at a Thoroughbred breeding farm in central Kentucky for recording of dismount semen sample observations and data from each mating, including pregnancy outcome. Data from the manual record system that were tabulated for analysis included date of mating, stallion used for mating, session of the day for the stallion (first, second,… fifth session, etc), mare identification, mare age, beginning mare status (maiden, foaling, barren, not bred [in the previous year], slipped [aborted]), boarding farm for the mare, cycle of breeding (first, second, third cycle, etc), whether the mare was mated twice during the same estrus (double), whether the mating was on foal heat, number of mounts required to accomplish the mating, mating of the day for the stallion (first, second,… fifth), sperm concentration in the dismount sample (after correction for dilution factor with extender), the dismount sample progressive sperm motility score, the dismount sample neutrophil score, whether the mare was administered a tranquilizer cocktail before breeding, whether it was reinforcement bred on that cycle, estimated number of sperm (concentration × volume) infused into the uterus after cover if the mare was reinforcement bred, and pregnancy outcome for that cycle of mating. Mating and pregnancy results obtained from 5,646 estrous cycles of 3,788 mares bred to one of 15 stallions (2005–2007; 34 stallion years) were analyzed. Data on pregnancy rates in tranquilized maiden mares used in this study have been reported.[22]

The observations recorded from each mating are discussed in the following sections.

Breeding Shed Procedures

Mares presented for breeding were first identified and tagged, then placed in a stall next to a teaser stallion. A window was opened that allowed the mare exposure to a teaser stallion, thus encouraging the mare to exhibit behavioral signs of estrus. The mare was taken to a preparation area where the tail was wrapped and the perineum cleaned. If necessary, vulvar sutures were removed to permit safe penile intromission. It was then taken to the breeding shed where padded leather boots were placed on the hind feet before moving it to the location for mating. The teaser stallion, with a breeding shield attached to prevent inadvertent intromission, was brought to the shed and allowed to mount the mare to determine whether the mare would stand safely for mating. If the mare allowed mounting by the teaser stallion, mating to the intended stallion to which the mare was booked was then permitted.

Tranquilization

If there was a doubt whether the mare would stand safely for mating, a tranquilizer cocktail (20 mg acepromazine, 100 mg xylazine, and 10 mg butorphanol) was administered intravenously. In some cases, it was administered after the mare initially rejected mounting by the teaser stallion. After allowing the tranquilizing agents to take effect, mounting with the teaser stallion was attempted. If the tranquilized mare allowed mounting by the teaser stallion, mating to the intended stallion to which the mare was booked was then permitted.

Dismount Samples

Attempts were made to collect dismount samples (drippings of semen) from the penis of the stallion into a noninsulated, nonwarmed disposable plastic cup immediately after each mating for confirmation of ejaculation. The dismount sample was either mixed in a ratio of 1:2 with warm (35°C) semen extender (INRA-96; IMV, Maple Grove, MN) containing gentamycin or, if reinforcement breeding was to be performed, the entire raw dismount sample was mixed with 10 to 30 mL of warm extender. Extended samples were poured through a nylon mesh filter (Disposable Nylon Mesh Gel Filter, Animal Reproduction Systems, Chino, CA) into a clean warm cup to remove debris, and