Dealing With Inbreeding, part 2

With which stallion does my mare have to offer the most?

Breedings with related ancestors can have a negative effect on vitality, life expectancy, and fertility of the offspring. Too large of an increase of the total inbreeding within the population causes a decrease in fitness of the Friesian breed. This makes it that the highest performer, the stallion with the highest index or the champion of the inspection, is not always the best choice. Especially for owners of the better brood mares within the population there is a responsibility and a challenge to responsibly deal with inbreeding.

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Feitse 293 pref is very popular and was/is much used for breeding Friesian horses. The same goes for his sire Jochem 259 Pref. and the Feitse sons approved for breeding. These three factors, however, gave Feitse the highest kinship percentage, namely 19.6%.

In part 1 of "Dealing with Inbreeding" (Phryso March 2007) it was shown that inbreeding is a tested method to increase the breeding purity. The other side of the coin is the negative influence it can have on the fitness characteristics vitality, life expectancy, and fertility. For breeders dealing with inbreeding means trying to find a balance between these two aspects of inbreeding. To make it a bit more complicated there is a certain amount of correlation between the pros and cons of inbreeding in the short term and in the long term.

Compensation breeding

A vital foal that matches the breeding goal as closely as possible is what every breeder envisions when searching for a suitable sire. The most logical choice is then a stallion that itself matches the breeding goal closely, that can compensate for the weaker points of the mare, and differs as much as possible in blood lines from the mare. An unrelated blood line means after all little inbreeding and thus the least chance of loss of fitness. To breed a good utility horse that is indeed a fine method. It does, however, produce a breeding product that has variation in blood lines and is relatively unpure in breeding. Unpure in breeding because there are several characteristics in which the sire and the dam differentiate from each other. If the breeding product itself then needs to produce offspring part of that offspring will not show that which based on the qualities of the sire and dam could be expected. Striving for little inbreeding also leads to the fact that for every next generation it is harder to find a stallion that is relatively unrelated and with that again lead to little inbreeding. For the generation of new breeding animals with different blood and exceptional qualities compensation breeding is therefore not the best method. Compensation breeding leads to more animals with average qualities and an average blood lines and less animals with extreme qualities and special blood. You should therefore make a distinction based on bloodlines and quality between breeding animals that are suitable for producing good utility horses and breeding animals that are suitable for producing new breeding animals.

The terms kinship and inbreeding are often mixed up

Besides quality, in the form of a functional exterior and usability qualities the value for breeding is thus also determined by the blood lines.

Blood lines

When is a certain blood line valuable for top breeding? First of all the chance of a successful breeding result will increase if the breeding animal has many ancestors in its pedigree that have distinguished themselves positively in quality and achievements. In addition a blood line becomes more interesting when there are many ancestors that have had but a minor influence on the population. Normally these two aspects work against each other. Top stallions are after all often used because they distinguish themselves in quality and achievement. Breeding animals with different blood have therefore by definition few top stallions in their pedigree.
Yet breeding animals with different blood will become more and more important for breeding Friesians. If breeding focuses too much on the winners in a population this will lead to a too large of an increase of total inbreeding with as a result an irreversible decrease of the fitness of the Friesian breed and the danger that genetic variation is lost forever. In the last part of "Dealing with Inbreeding" this will be further explained. At this moment the level of increase in inbreeding of the whole population is well above the limit that is considered allowable in science.

Kinship percentage

The degree to which a stallion contributes to the increase of total inbreeding is determined by the degree to which his blood lines match the mares in the population. To quantify this level of matching the kinship percentage was introduced. In practice the terms kinship and inbreeding are often mixed up. The kinship percentage, as we know it as an index number for the available stallions in the catalogue of the stallion inspection is actually not a kinship percentage but an inbreeding percentage. On paper the stallion in question is paired with all mares born during the last two completed birth years (now 2005 and 2006). The kinship percentage is subsequently calculated as the average of the inbreeding percentages of all fictitious foals that come from those matches. The stallion Feitse 293 pref is currently the leader with a kinship percentage of 19.6%. This means that the fictitious foals have an average inbreeding percentage of 19.6%. This percentage indicates the inbreeding over all registered generations of the pedigree and is thus of a different value than the well-known inbreeding percentage over the last five generations. The upcoming average brood mare has thus 39.2% (because that is what a foal with an inbreeding percentage of 19.6% produces) of her gene package in common with the stallion Feitse. The fact that Feitse's bloodlines, of all currently available stallions, matches the upcoming average brood mare the most has three causes.

From left to right: Wander 352, Ielke 382, Fabe 348, and Erik 351 are currently the stallions with the lowest kinship percentage, namely 15.6%.

1. The pedigree: Feitse's sire Jochem 259 has put a considerable gene stamp on the population with 368 registered daughters and five approved sons.
2. The use of Feitse himself: Feitse 292 pref is up to now good for 613 registered daughters that are all for 50% or more related to their sire Feitse.
3. The number and use of his approved sons: Feitse already has six approved sons: Rypke 321 with 339 registered daughters and one son, Tsjerk 328 with 476 registered daughters and four sons, Fetse 349 with 308 daughters and also four sons, Folkert 353 with 284 daughters and two sons, the "American" Feike 395 with six daughters, and Ait 410 still without registered daughters. The majority is very popular with the breeders so the distribution of Feitse blood will continue for a while.

The fact that Feitse currently is the most related with the mare population is a logical consequence of his qualities as a breeding stallion and that of his sire and his sons. Based on these qualities the popularity is very understandable and the use very much defendable, but it does lead to a negative contribution to the decrease of the increase in inbreeding. Ielke 382, Fabe 348, Erik 351, and Wander 352 are with a percentage of 15.6% currently the least related with the mare population. Still with these stallions 31.2% (two times the average inbreeding percentage of the fictitious foals) of their blood lines matches the average mare. The margin of kinship with the mares between the highest and the lowest is relatively small and everyone would like it to be higher. Still there are possibilities to as a breeder do something against the increase in total inbreeding within the population. The striving is also not to get the total number of inbreeding down but to slow down the increase. A decrease of total inbreeding would almost certainly be at the expense of every form of genetic progress and would possibly only deviate the Friesian breed from the breeding goal. Especially if the personal breeding goal of a breeder is not as much focused on creating new breeding animals but rather on good utility horses, a well matching stallion with which a high kinship percentage is tolerated, is a fine choice. For the better brood mares the emphasis will more be on producing new breeding animals. The degree to which the intended breeding product can contribute to diminishing the increase in inbreeding and the variation in blood lines within the breeding population then deserves considerable more attention in choosing a suitable stallion.

Diminishing the increase in inbreeding

With the calculation of the kinship percentage as an aid it will become quite a bit simpler to incorporate diminishing the increase in inbreeding when choosing a stallion. The degree to which the brood mare is related to the overall population is a steady piece of information and determines for 50% the possible gain. The kinship percentage of the mare therefore also determines the breeding value next to exterior and performance. The stallion determines the other half. A mare with a low kinship percentage combined with a stallion with also a low percentage can produce a filly that as a brood mare contributes to diminishing the increase in inbreeding. A stud colt from such a combination only gets added value if he is approved for breeding. At the same level of quality a stallion with a low kinship percentage is therefore better suited for the production of young breeding animals than one with a

higher percentage. There is, however, a snake under the grass. At the time that a top stallion with a low kinship percentage starts to be used widely, his kinship percentage will rise and thus also that of his offspring. Even better suited is, therefore, a top stallion with a low kinship percentage that is not recognized as a top stallion by the main stream.

The 20 least related stallions of this moment.

Name	kinship percentage
Wander 352	15.6%
Ielke 382	15.6%
Fabe 348	15.6%
Erik 351	15.6%
Ouke 313	15.7%
Gjalt 426	15.8%
Doaitsen 420	15.8%
Beintse 418	15.9%
Jakob 302	16.0%
Olrik 383	16.1%
Winand 405	16.1%
Teade 392	16.2%
Loadewyk 431	16.2%
Sape 381	16.3%
Arjen 417	16.4%
Jorn 430	16.4%
Abe 346	16.5%
Aan 416	16.5%
Ludse 305	16.5%
Jisse 433	16.6%

Variation in blood lines

It is a deep-rooted misconception that the inbreeding percentage of the intended foal calculated over five generations is a measure for the contribution of that match to the total increase in inbreeding. When the inbreeding calculation over the last five generations was introduced it was a handy aid to minimize the chance that two carriers of birth defects would be matched up. Meanwhile it is clear that the defects dwarfism and hydrocephalus have been passed along almost without interruption over much more than five generations. The aid has, where that's concerned, thus lost much of its value. Tracing carriers in the current populations is a much more effective method to lower the number of defects and that is what the current policies are focused on. The striving for a low percentage of inbreeding over the last five generations did lead to the fact that the genetic material of the breeding stallions has been spread through the whole populations at a dizzying speed. The consequence of this is that in the current selection of breeding stallions there is hardly a stallion to be found that is free of Ritske, Age or Tetman blood and only one that is free from Mark blood.

Avoiding inbreeding from such staple stallions is therefore no longer possible. In the same manner striving for a foal with a low inbreeding percentage will lead to a situation that in a number of years every breeding stallion will to a larger or smaller degree carry blood of the staple stallions from the period after (think Jochem 259 and Hearke 254 pref). The variation in blood lines decreases as breeders continue to massively choose for a foal with a low inbreeding percentage. For the production of new breeding animals you could as the owner of a top mare with different blood take into consideration to search exactly for a stallion that compares to the different blood of your mare. That does render a foal with a high inbreeding percentage but in this way preserves and increases animals with different blood and that helps the breed. You open up more choices for the next generation. Especially stallions that have been bred in that fashion can be valuable for future breeding.•

In the next Phryso: Dealing with Inbreeding part 3: Selection and Breeding-Technical policies.

Stallion choice in ten steps

Step 1. The mare has an above average level of quality (registered ster).
- ○ Yes, go to no. 3.
- ○ No, go to no. 2.

Step 2. The mare scores exceptionally high for one or more selection characteristics.
- ○ Yes, go to no. 3.
- ○ No, go to no. 4b.

Step 3. The mare is very much related with the average mares of the total breeding population (kinship percentage over 18%, number available soon).
- ○ No, go on to 4a.
- ○ Yes, go on to 4b.

The A steps from 4a.

Step 4a. The mare is suitable for the production of new breeding animals. Check to see what her strongest and weaker selection characteristics are.

Step 5a. Select several stallions that score high for her strongest characteristics and not too low for her weaker characteristics.

Step 6a. Select from the stallions of step 5a several stallions with a low kinship percentage.

Step 7a. Compare the pedigree of the mare with that of the selected stallions. Check to see if the ancestors they have in common in their pedigrees score sufficiently on the characteristics of step 4a.

Step 8a. Check to what degree the common ancestors contribute to diminishing the increase in inbreeding (used little, a low kinship percentage).

Step 9a. Go back to step 5 if this does not produce acceptable stallions and adjust the requirements of step 5a.

Step 10a. Choose the best suited stallion based on the results of step 6a, 7a, and 8a.

The B steps of 4b.

Step 4b. Formulate the personal breeding goal with this mare. Do you want to breed a show-driving winner, a show horse, one that is suitable for dressage, etc.

Step 5b. Check which selection characteristics are important for this personal breeding goal.

Step 6b. Check what the mare scores for these characteristics.

Step 7b. Select several stallions that score high for the characteristics of step 5b; those that the mare should score better on.

Step 8b. Determine the inbreeding percentage of the matches with the stallions from step 7b. Below 5% is acceptable.

Step 9b. Compare the pedigree of the mare with that of the stallions you found. Check if the ancestors they have in common in the pedigrees score sufficiently for the characteristics of step 5b.

Step 10b. Make a choice from the stallions that are left on your list based on the results of step 7b, 8b, and 9b.

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