

Genetic progress in the horse population: what is it and how do we establish it?

Ane Visser, MSc.

Dutch Horses Unlimited, Ltd
93 Tangimoana Beach Road
RD3 Palmerston North
www.DutchHorsesUnlimited.com

There are different ways of assessing genetic progress depending on the focus of the study. An individual breeder with a limited number of mares, and a studbook which is responsible for an entire population, although on a different scale, are both trying to achieve the same goal: that is the improvement of the next generation of horses.



Figure 1. Each year the best stallions are selected to go into a Performance Test during the 'Stallion Selection' event at Den Bosch, Netherlands. The Performance Test is the last stage before approval. (Photo: Dirk Caremans, courtesy KWPN)

Most European studbooks have a method of scoring horses for their individual genetic potential in the different disciplines (dressage, and show jumping, and some also score for hunting). For now it is sufficient to

know that the method of identifying the suitability of individual horses for their sport is based on scientific principles, and that it is currently the best way of adjusting for biasing factors like nutrition, training method, rider and other factors that affect the actual performance, but which are non-hereditary. The end result is a number assigned to each individual animal, which tells how good the horse is relative to the rest of the population. As an example, the KWPN (Royal Dutch Warmblood Studbook) has set the average for jumping ability and for dressage ability of all registered horses to 100. Any horse that is genetically better than the average has a value higher than 100; any horse that is below average gets value less than 100. This number is called the breeding value (sometimes also a 'breeding index') and the value tells us how far the horse deviates genetically from the population average. So if a horse in this studbook has a value below 80 for dressage ability, it means that this horse is not a natural dressage talent, and it is unlikely to produce foals that are. But this does not necessarily make the horse undesirable. The same horse may have a breeding value for show jumping of 130, meaning that it is far above

average for show-jumping ability and is more likely to produce foals that have similar ability. As a breeder we have a goal: we want to breed an excellent dressage horse, or an excellent show-jumper, or maybe both. Therefore, we want to pick a stallion that has a high probability of passing that ability on to the next generation.



Figure 2. Champion of three-year old show jumpers 2008 at the Stallion Selection at Den Bosch, Netherlands: A.Adermie, sired by Namelus R (Concorde x Joost), a potential candidate to improve jumping ability. (Photo: Dirk Caremans, courtesy KWPN)

This implies that we should use a stallion that has a high breeding value in the discipline we are interested in. At the same time, we may be trying to correct for conformational and/or movement traits in the mare as well. But if you follow these principles it is more likely that genetic progress will be made on the trait that is important to you, and your foal will have a better ability to perform in your discipline of choice than its parent, your mare. The studbook is trying to achieve the same thing but on a much larger scale. It

strives for a generation of horses that are better at what they are bred for, than their ancestors; so the studbook is also seeking genetic progress.

Let's have a closer look at the methods that the studbooks use to achieve genetic progress. We consider the 'population' as all horses that are registered with a studbook- the principle is generic so this could be any studbook, like KWPN, Holsteiner Verband, Hanoveraner Verband, Oldenburg etc. All horses within the population have one breeding value for jumping ability and one for dressage ability. For each breeding value, the population can be subdivided into different classes of ability, let's say 'average', 'very good', 'superb', 'poor' and 'very poor'. For the KWPN we could create classes for the range below 60 (very poor), 60 to 80 (poor), 80 to 120 (average), 120 to 140 (very good), 140 and higher (superb). As you may expect, most horses will fall in the category of 'average' (68.3% of the population are in this category). A much smaller number falls in the category of poor and very good (13.6% each) and an even smaller number in the categories of very poor and superb (2.3% each). This distribution pattern is identical for the male and female horses in the population. If we graph this, we see a pattern like in figure 3.

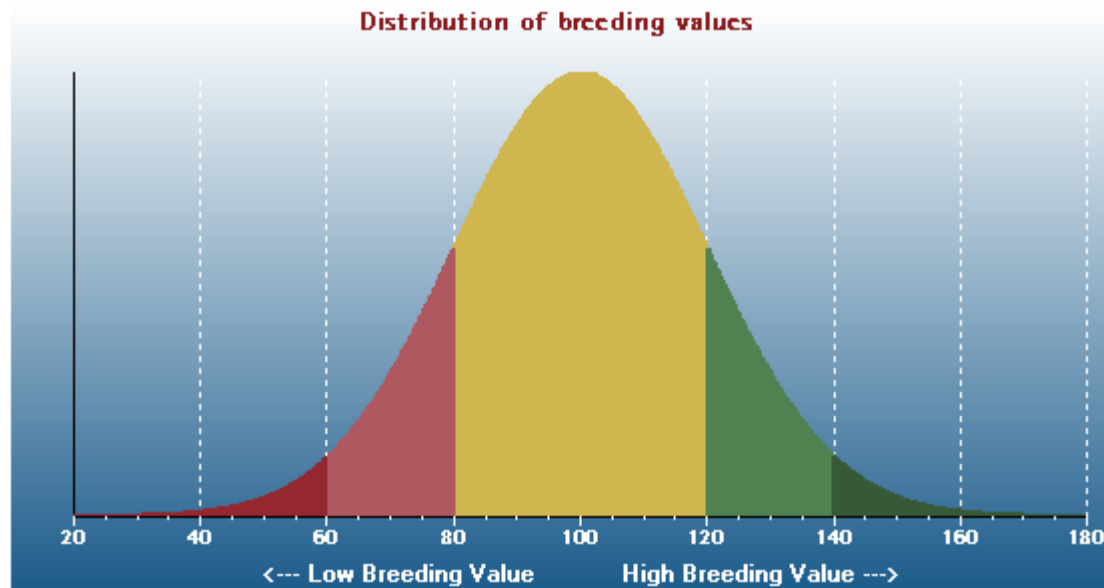


Figure 3. Sizes of the groups with a low to high genetic merit within the population.

In order to be able to improve the next generation, the studbook has to follow a number of guiding principles. The most important one is to select within the population of stallions, those that are above average, and preferably as far above average as possible. The system of stallion-approval into the studbook represents their policy to select stallions that have a breeding value that is higher than the population average or that have a high probability of being so. Depending on the number of stallions required to maintain the desired population size (there being a maximum number of mares that can be bred by one stallion), and to avoid problems associated with inbreeding, the studbook may have a policy of only approving stallions that have a breeding

value of higher than 110, or higher than 120. In the case of the KWPN, the average breeding value for dressage and jumping of approved stallions is 110, with extremes up to 170 and higher. By using the best stallions in the population, breeders can make genetic progress.

Let's assume breeders choose stallions with a breeding value of 120. This would mean that the average breeding value of the next generation will be 110 (the average of the parents) and the genetic progress in one generation is 10 points. In figure 4 you can see how the whole population has moved to a higher average. The difference between the old peak and the new one shows genetic progress.

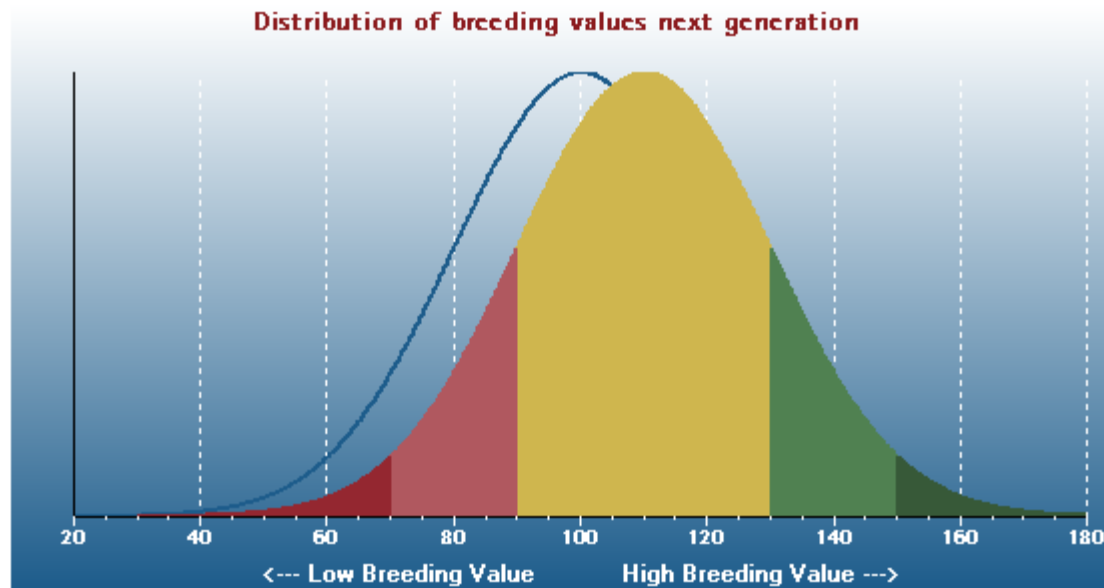


Figure 4. Breeding values of the offspring (coloured) compared to the original mare population (blue line), when stallions of a high genetic merit are used.

The studbooks work continuously on selecting the best stallions within their respective populations, so each generation of horses improves over the previous one. They keep track of individual performances of the stallions,

and equally important, of their progeny. By following the principle of selecting the best parents to produce the following generation, the studbooks have achieved enormous results for their members.

About the author

Responsible for the formation and running of Dutch Horses Unlimited, alongside his wife, horse trainer and instructor Nicole Bours. Ane Visser's extensive experience in setting up breeding programmes for horses has gained a high visibility in The Netherlands. Now in New Zealand, he hopes to contribute to the genetic progress in the population of NZ sport horses. To this end, he and his wife have imported their breeding stock into NZ.