(Note presented at WBFSH seminar, Budapest, November 5th. 2002)

Genetic evaluations for competition traits of warmblood sport horses

Erwin Koenen
NRS, P.O. Box 454, 6800 AL Arnhem, The Netherlands

Introduction

Estimated breeding values can be used to rank potential breeding animals for one or more traits of interest. Over the past few decades, several genetic evaluation systems have been implemented in sport horse breeding. Although breeding values can be used to increase performance ability by genetic selection, breeding values are not always well accepted by practical breeders. The use of breeding values becomes even more complicated if breeders want to interpret foreign breeding values. The increased availability of background information on the genetic evaluation systems in the different countries may be a first step to enhance the understanding and subsequent use of the available breeding values in sport horse breeding. This note therefore summarises some characteristics of the different systems of genetic evaluations for sport performance.

Present evaluations

Table 1 lists seven countries that run a genetic evaluation for one or more sport traits. Genetic evaluations for sport horses presently include evaluations for jumping (7 countries), dressage (5) and eventing (1).

Table 1. Genetic evaluation systems for sport disciplines in seven countries

Country	Sport discipline	Observations
Belgium	jumping	ranks in competition
Denmark	dressage	performance test results
	jumping	
France	dressage	earnings in competition
	eventing	ranks in competition
	jumping	
Germany	dressage	ranks in competition
	jumping	performance test results
Ireland	jumping	ranks in competition
Sweden	dressage	performance test results
	jumping	
The Netherlands	dressage	highest level in competition
	jumping	performance test results

Each genetic evaluation procedure basically includes three consecutive steps: (1) data recording, (2) estimation of the breeding values using a statistical model and (3) publication of the estimation breeding values.

Data recording

Countries use various types of observations as the basis for their genetic evaluation. The two main types are competition data and performance test data. Competition data are mostly recorded as the ranking of a horse within an individual event. As an alternative, the French record earnings and the Dutch record the highest level a horse has ever reached in his career. Four countries (D, DK, S and NL) include performance test results in their genetic evaluation. The definition and number of the traits recorded at such tests vary largely between countries but observations often include scores for basic gaits and/or scores for performance ability.

While most countries only use one type of observations, the Germans and the Dutch consider competition and performance results simultaneously.

Breeding value estimation
The essence of this procedure is to estimate breeding values using phenotypic data (recorded observations) and pedigree data (genetic relations between horses with observations and their relatives). All seven countries apply a BLUP-animal model but variation in the number of traits and the non-genetic effects to adjust for is large. Several countries use more information sources simultaneously. For example, KWPN combines two traits: competition results (highest level) and station performance results (e.g. score for riding ability). The German model is the most extensive: it considers results from competition (4 traits), stallion performance tests (6) and mare performance tests (5) simultaneously.
The main non-genetic effects in the statistical models are the effects of age and sex: performance results increase on average with age and stallions perform on average better than mares. Other statistical models also adjust the recorded observations for the effects of location, rider and permanent environment.

Publication of breeding values
In many other livestock species, breeding values are easy to interpret as they are expressed on the same scale as the observations. For example, in dairy cattle both observations and breeding values can be expressed in kilograms of milk production. In horse breeding, estimated breeding values on the underlying scale (ranks, earnings, highest level etc.) are transformed to a relative scale (low ability - high ability) to facilitate interpretation. Breeding values for performance traits are commonly transformed to a scale with a mean of 0 (France) or 100 (other countries) and a standard deviation of 20. However, countries use different groups of horses to define their genetic base population: some countries (NL and IRL) include all horses in the base population whereas other countries (D, F, and S) only include horses of a specific age and sex.
Breeding values are often estimated at yearly intervals and are published in magazines and/or on the Internet as single trait breeding values. Some countries such as Germany and Sweden also combine breeding values into an index.

Discussion and recommendations for further studies
This note shows that variation in the genetic evaluation systems regarding input data, statistical evaluation models and publication is large. To facilitate the correct use of the breeding values, both nationally and internationally, several aspects may need additional attention.

Although breeding objectives of the various organisations include similar definitions of sport traits (a sport horse that can compete at the highest international level), information on the genetic similarities of analysed traits is not available. International variation in the genetic background of the defined traits may explain that stallions tested in different countries can rank differently. Studies on the genetic variations in traits in the various countries are recommended.

Up to now, most countries only consider national data in their genetic evaluation, i.e. observations on exported stallions and/or their offspring are ignored. Also the observations at the highest sport levels such World Championships, Olympic Games are almost never considered even if breeding objectives include performance at these levels. Studies on the possibilities and relevance of the use of these data may be another step to increase the quality and the credibility of the genetic evaluation systems.

Finally, breeding organisations may discuss consider harmonisation of the way breeding values are published. Harmonisation of the defined genetic bases makes it easier to interpret the relative position of a breeding horse within his own population.

Acknowledgements
Financial support provided by KWPN, EAAP, WBFSH and ICAR is gratefully acknowledged.