

## **The influence of the types of cross-breeding of the parental generation on the final results of stationary performance tests of Polish half-bred mares**

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**Abstract:** *The influence of the types of cross-breeding of the parental generation on the final results of stationary performance tests of Polish half-bred mares.* An analysis was made of the pedigrees of Polish half-bred mares that underwent a stationary performance test in Polish training stations in order to isolate the types of applied cross-breeding schemes of the parental generation. An attempt was made to determine the influence of particular cross-breeding schemes on the diversity of the value of the final results of the performance test, which is an indicator of the utility value of the mare. The research material consisted of the results of stationary saddle performance tests of 994 mares, obtained at training stations between a period of 2007–2012. The highest least squares means of the final results of the test were achieved by mares whose parents were representatives of foreign breeds, and the lowest by mares deriving from Małopolska breed parents. The largest group among mares taking the stationary saddle test consisted of daughters of one foreign breed parent and the second a Polish Warmblood. The greatest diversity among the schemes for selecting pairs for reproduction was found in the Polish Warmblood mare group. Mares deriving from both parents of the Małopolska breed, as well as from one parent of the Małopolska breed refined with Thoroughbred blood, showed the largest variability of the achieved results in the performance test.

*Key words:* half-bred mares, performance tests, parentage, utility value

### **INTRODUCTION**

Many authors (Nowicka-Posłuszna 1998, Cuber 2008) emphasize the importance and significance of the influence of the

female material on the utility value of the offspring, and at the same time on the growth of progress and the improvement of breeding. Breeding programs focus their selection and breeding goal on the obtaining of horses for modern equestrian sport. Intended for reproduction purposes should be such individuals, both stallions and mares, with the highest utility potential assessed during performance tests at training stations (Lawin 2008). The selection of parents is dictated by their having certain traits, which their offspring should also exhibit. This aspect justifies the carrying out of an evaluation of mares, equivalent to the evaluation of stallions, and the need to test their potential in terms of “rideability”. Rideability, being a very highly heritable trait, reflects the suitability of a horse for saddle use and the possessing of traits which allow the animal to cooperate with the rider.

The performance control of mares became obligatory starting from 2010 and a condition for obtaining registration in the stud book of a given breed. This was particularly significant in view of the changes in Polish breeding trends, which moved away from a multipurpose type of horse in favor of a sport and saddle horse. A change of the breeding goal is obviously carried out by mares as producers and this fact indicates that they should

absolutely be evaluated in performance tests (Byszewski 2009). A breeding which is mainly “led” by the evaluation of the utility value of stallions, excluding the results of mare performance tests, does not bode well for quick breeding progress (Jończyk 2001). If one observes an incorrect technique in a mare already while clearing short fences, then the increasing of their height will definitely not stimulate a spontaneous reduction of the problem and cause an improvement in the jumping technique. The covering of a poorly talented mare even with an excellent stallion in terms of performance rarely results in a jumping-talented foal (Wiszwoty 2004).

According to Barry et al. (2002a, 2002b), performance tests facilitate the selection of mares for breeding, because they create an opportunity to compare the future dams with each other.

The aim of the study is to evaluate the influence of the types of cross-breeding of the parental generation in the population of Polish half-bred mares on the diversity of the value of the final results of the performance tests, which are a reflection of the utility value of the mares.

## MATERIAL AND METHODS

The research material consisted of the results of stationary saddle performance tests of 994 mares obtained in training stations during a period of 2007–2012. The source of the numerical data to conduct the statistic calculations were materials made available by the Polish Horse Breeding Association (PZHK).

An analysis of the construction of the pedigrees was made, based on which

each of the mares of the study was assigned to one of 14 groups, according to the type of cross-breeding that occurred in the parental generation. The number of individuals forming each group was determined with the use of the MEANS procedure of the SAS package. The possessed data were statistically analyzed with the use of the GLM procedure of the SAS package. Levels of LSM were determined for the end result achieved by a mare in the training station. Significances of differences between results achieved by mares forming each of the 14 isolated groups were evaluated according to the following formula:

$$y_n = \mu + \text{Mating}_n + e_n$$

where:

$y_n$  – value of the result for horse  $n$  ( $n = 1, \dots, 994$ );

$\mu$  – average result;

$\text{Mating}_n$  – fixed effect of mating horse  $n$ ;

$e_n$  – sampling error.

The main aim of carrying out stationary saddle tests is to obtain an evaluation of the mare’s suitability for this type of use, as well as an analysis of her excitability and stability of her nervous system. Stationary saddle performance tests were carried out in accordance with the rules of the PZHK, which is that after a 60 day training period each mare was evaluated by the director of the training station, together with a group of mares which underwent training in the same conditions. This created the opportunity to evaluate the individual in comparison to the rest of the group. The traits that underwent evaluation were: character, temperament and suitability for training. In the next phase the committee assessed the mare’s behaviour under a rider in walk, trot and

canter, as well as the technique of clearing fences in the corridor (in free jumping): the style and readiness of clearing the fence, courage and respecting the fences, self-control and determination in moving forward. In order to increase the objectiveness of the evaluation and to eliminate the so-called “effect of the rider”, a test of outside riders was used, which is an anonymous evaluation of all horses by experienced competitors. The test rider assessed the riding level of the horse, its reaction towards riding aids and the ability to quickly establish contact with the horse. The summing up of points awarded by the committee, the director and the outside rider together formed the value of the final evaluation of the mare (Świstowska 2011).

## RESULTS AND DISCUSSION

The most numerous group among the 994 mares undergoing the stationary saddle performance test in the researched period were females deriving from one foreign breed parent and the second a Polish Warmblood (Table 1). The size of this group amounted to 183 individuals, which made up 18.41% of the analyzed population. In Poland a tendency can be observed in the increase of the Polish Warmblood population, which resulted from the cross-breeding of Polish breeds with foreign breed individuals. Łojek (2003), as well as Łojek and Nowak (2003) consider this breed to be predestined to obtain horses used in various equestrian disciplines. The results of the junior horse championships show that horses of the Polish Half-Bred and Wielkopolska breeds are among the

TABLE 1. Isolated types of cross-breeding of the parental generation of 994 mares undergoing the stationary performance test in training stations during 2007–2012

No	Type of cross-breeding	<i>n</i>	%
1	imp × imp*	23	2.31
2	imp × wlkp	141	14.19
3	imp × sp	183	18.41
4	imp × xx	19	1.91
5	imp × m	60	6.04
6	sp × sp	113	11.37
7	sp × xx	20	2.01
8	sp × wlkp	113	11.37
9	m × m	164	16.5
10	m × sp	24	2.41
11	m × xx	18	1.81
12	m × wlkp	36	3.63
13	wlkp × wlkp	57	5.73
14	wlkp × xx	23	2.31

\*imp – imported foreign breeds, wlkp – Wielkopolska breed, sp – Polish Warmblood, xx – Thoroughbred, m – Małopolska breed.

leading competitors in both show jumping and dressage (Pikuła et al. 2006).

The next two groups dominant in terms of size (164 individuals – 16.5% and 141 individuals – 14.19%, respectively), consisted of mares deriving from both parents of the Małopolska breed, as well as one parent of a foreign breed and the other of the Wielkopolska breed.

Among mares of the Małopolska breed the largest percentage (72.77%) consisted of individuals whose both parents were also representatives of this breed (Table 2). A small number of Małopolska breed mares had in their parental generation, apart from representatives of the Małopolska breed, individuals of foreign breeds (14.73%) and Thoroughbreds

TABLE 2. Distribution of cross-breedings from which mares of Polish breeds, that underwent the stationary saddle test in training stations during 2007–2012 (%), derived

Type of cross-breeding	Małopolska breed	Polish Warmblood breed	Wielkopolska breed
imp × imp*	–	4.69	0.32
imp × wlkp	–	3.41	39.81
imp × sp	–	38.81	0.32
imp × xx	–	4.05	–
imp × m	14.73	5.76	–
sp × sp	–	24.09	–
sp × xx	–	4.05	0.32
sp × wlkp	–	7.89	24.2
m × m	72.77	0.21	–
m × xx	8.04	–	–
m × sp	0.89	4.69	–
m × wlkp	–	1.07	9.87
wlkp × wlkp	–	–	18.15
wlkp × xx	–	0.21	7.01
other × m	3.57	–	–
other × sp	–	0.64	–
other × wlkp	–	0.43	–

\*imp – imported foreign breeds, wlkp – Wielkopolska breed, sp – Polish Warmblood, xx – Thoroughbred, m – Małopolska breed.

(8.04%), allowed by the rules of their breeding program. The largest diversity of schemes used for selecting pairs for reproduction was observed in the group of Polish Warmbloods. The largest percentage of Polish Warmblood mares in the evaluated population derived from parents of foreign breeds and Polish Warmbloods (38.81%), as well as from both parents of the Polish Warmblood breed (24.09%). Exactly 39.81% mares of the Wielkopolska breed were the offspring of one parent of the Wielkopolska breed and the other of a foreign breed, whereas in the case of 24.2% of mares of this breed one of the parents was a representative of the Wielkopolska breed and the other of the Polish Warmblood breed.

Stallions of the Małopolska breed were present in the father generation both in the case of Polish Warmblood mares and Wielkopolska breed mares.

The highest level of performance ability during the evaluated period of 2007–2012 belonged to mares deriving from both parents of foreign breeds (Table 3), which is confirmed by results achieved during stationary performance tests in training stations. The results of this group were significantly better than the results of mares deriving from other types of parental generation cross-breeding. The significant influence of foreign breed sires on the state of Polish breeding has been visible for years. The advantage of using foreign breed sires

TABLE 3. Least squares means of the final results of mares undergoing stationary performance tests in training stations in 2007–2012 for the isolated types of cross-breedings of the parental generation from which they derived

No	Type of cross-breeding	<i>n</i>	<i>LSM</i> **	<i>SD</i>
1	imp × imp*	23	60.80 <sup>A</sup>	4.96
2	imp × sp	183	57.88 <sup>B</sup>	4.97
3	imp × wlkp	141	57.33 <sup>BC</sup>	4.52
4	imp × xx	19	56.64 <sup>BCDF</sup>	4.98
5	imp × m	60	55.93 <sup>CD</sup>	4.65
6	sp × sp	113	56.14 <sup>CD</sup>	4.75
7	sp × xx	20	56.45 <sup>BCDE</sup>	4.65
8	sp × wlkp	113	55.38 <sup>DE</sup>	4.59
9	m × m	164	54.33 <sup>E</sup>	5.27
10	m × xx	18	53.75 <sup>DE</sup>	5.54
11	m × sp	24	55.70 <sup>CDE</sup>	4.09
12	m × wlkp	36	54.98 <sup>DE</sup>	5.17
13	wlkp × wlkp	57	54.36 <sup>EF</sup>	3.82
14	wlkp × xx	23	54.42 <sup>DE</sup>	4.58

\*imp – imported foreign breeds, wlkp – Wielkopolska breed, sp – Polish Warmblood, xx – Thoroughbred, m – Małopolska breed.

\*\*Means in columns marked with the same big letters are not significantly different.

compared to domestic breed sires is confirmed by the studies of Pietrzak (2003). Chrzanowski et al. (1997) claim that the need for using imported sires stems from the small suitability of Polish breeds for the production of sport horses. Kaproń (2007) points out the large diversity of performance predispositions of the Polish half-bred population, in which he sees the reason for trying to improve them by cross-breeding with horses of foreign origin. Drewka (2012), as well as Geringer et al. (2004) emphasize the decisive dominance of the performance ability of offspring of foreign breed sires in comparison to the offspring of Polish sires.

Slightly lower least squares means were achieved by the largest group of

mares (183 individuals), being the offspring of parents of foreign breeds and Polish Warmbloods. Its results were significantly higher than those of mares deriving from the following cross-breedings: sp × sp (Polish Warmblood × Polish Warmblood), all types of cross-breedings in which there were both or one parent of the Małopolska breed and all (except imp × wlkp – imported foreign breed × Wielkopolska breed) types of cross-breedings in which both parents or one of the parents was of the Wielkopolska breed. Mares from groups that had representatives of foreign breeds or Polish Warmbloods in their parental generation achieved better results of their evaluation in comparison to mares by both parents of Polish half-bred breeds.

The lowest LSM values were achieved by the second in terms of size (164 individuals) group of mares deriving from both parents of the Małopolska breed and Małopolska mares deriving from a parent of the Małopolska breed refined with Thoroughbred blood. For mares of both of the above mentioned groups also the largest variability of the achieved performance test results was determined, expressed as standard deviation value.

The achieved results point to the justness of using imported breeding material in reproduction, which in a significant manner influences the increase of the utility value of Polish half-bred mares. Lower average results of mares without foreign breed individuals in their parental generation attest to the small effectiveness of carried out breeding programs and the fact of achieving breeding progress in terms of improving saddle traits in the Polish half-bred population only by using sires from abroad for reproduction. The existence of this tendency is confirmed by the results of Chrzanowski and Maśko (2012, 2013), as well as Chrzanowski et al. (2012).

Stachurska et al. (2006) suggest the justness of using sires of German breeds in Polish breeding in order to improve the jumping and movement predispositions of our population. As stated by Borowska (2011), the parameters of the majority of the analyzed traits evaluated during the performance test were the highest in horses of foreign breeds, especially the Dutch Warmblood breed (KWPN), characterizing itself with the highest suitability for show jumping. The studies of Lewczuk (2004) also point to a greater suitability for sport use and therefore a greater performance ability of horses of

foreign breeds or deriving from sires of imported breeds.

As stated by Jończyk (2002) the basic factors in horse selection are the utility value and correct conformation (assessed both during field and stationary tests), whose appropriately high level results in achieving breeding progress from generation to generation. According to Geringer et al. (2006) the general variability of sport horses is influenced in a significant manner by such factors as: the breed of the horse, the breed of the sire and the trainer. The author suggests the improvement of utility traits both by breeding procedures, as well as environmental factors, for example the individualization of training methods.

Similar tendencies to the ones described in the study, referring to the influence of the mares' parentage on the results achieved in stationary performance tests, are described by authors analyzing the influence of stallion parentage on the results achieved in training stations. As Kamieniak et al. (2016) states, sires of foreign breeding statistically had a significantly higher score of almost all traits evaluated during the performance test in comparison to sires of Polish breeding. The author had also proven the existence of statistically significant differences between average scores achieved by stallions of Polish half-bred breeds regarding marks awarded by the director of the training station and outside riders. Polish Warmblood stallions received higher scores than Małopolska and Wielkopolska breed stallions for a majority of traits evaluated at the training station. Małopolska breed stallions received the lowest evaluation during the test with outside riders. Also Lew-

czuk (2005) determined that the highest marks during performance tests were received by stallions deriving from sires of foreign breeds.

Pietrzak et al. (2001 and 2006), having analyzed the predispositions of young stallions for use in sport as part of the independent rider test, showed the existence of statistically significant differences between the results of Wielkopolska and Małopolska breed stallions compared to stallions of the Polish Half-Bred breed. The Polish Half-Bred horses dominated not only in the assessment of their predisposition for use in sport, but also in possessing a potential allowing to specialize in show jumping.

The high utility value of stallions of foreign breeds, confirmed by results achieved in training stations, translates to their popularity as breeding sires.

The developing of a modern system of carrying out performance tests is one of the priority tasks necessary to be implemented by Polish breeding organizations. This procedure is vital if the goal of Polish breeding is to match world standards in terms of producing horses that are able to meet the requirements currently posed by professional disciplines of equestrian sports (Kapron et al. 1996, Kapron 2001).

## CONCLUSIONS

1. The analysis of the construction of pedigrees of Polish half-bred mares, undergoing stationary performance tests, has proven the existence of a numerical superiority of mares deriving from one or two parents of foreign breeds or one or two parents of the Polish Warmblood breed.

2. Mares deriving from both parents of foreign breeds, as well as from one parent of foreign breed and the second of the Polish Warmblood breed achieved significantly higher least square means of final results of stationary tests in comparison to the other mares. This fact indicates the justness of using imported breeding material in reproduction.
3. The small suitability of Polish breeds for the production of sport horses and the large diversity of their performance predispositions creates the need to improve the domestic population by way of cross-breeding with horses of foreign breeds.
4. Significantly lower mean values of final results of performance tests of Polish half-bred mares suggest the small effectiveness of the carried out breeding programs and that the improvement of saddle traits is mainly achieved by using foreign breeding material in reproduction.
5. A complete reorganization of the rules of carrying out stationary tests seems to be the basis of all future actions aimed at matching world standards in terms of producing horses for professional equestrian sports.

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- półkrewi zdających stacjonarną próbę dzielności w zakładach treningowych pod kątem wyodrębnienia typów zastosowanych schematów krzyżowań pokolenia rodzicielskiego. Podjęto próbę określenia wpływu poszczególnych schematów krzyżowań na zróżnicowanie wartości wyniku końcowego próby dzielności, będącego miarą wartości użytkowej klaczy. Materiał badawczy stanowiły wyniki stacjonarnych wierzchowych prób dzielności 994 klaczy, uzyskane w zakładach treningowych (SPW) w latach 2007–2012. Największe średnie najmniejszych kwadratów wyniku końcowego próby uzyskały klacze, których rodzice byli przedstawicielami ras zagranicznych, a najmniejsze klacze pochodzące po rodzicach rasy małopolskiej. Najliczniejszą grupę spośród klaczy zdających stacjonarną próbę wierzchową tworzyły córki jednego z rodziców rasy zagranicznej i drugiego szlachetnego półkrewi. Największe zróżnicowanie zastosowanych schematów doboru par do rozrodu stwierdzono w grupie klaczy rasy polski koń szlachetny półkrewi. Zarówno klacze mające oboje rodziców rasy małopolskiej, jak i te, które miały jednego z rodziców rasy małopolskiej uszlachetnionego rasą pełnej krwi angielskiej, charakteryzowały się największą zmiennością uzyskanych wyników próby dzielności.

*Słowa kluczowe:* klacze ras półkrewi, próby dzielności, pochodzenie, wartość użytkowa

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**Streszczenie:** *Wpływ typu krzyżowania pokolenia rodzicielskiego na wyniki końcowe stacjonarnych prób dzielności klaczy polskich ras półkrewi. Dokonano analizy rodowodów klaczy polskich ras*