

The effects of race track surface condition on the racing time of Orlov trotters

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Abstract. Race speed is one of the main indicators by which trotting horses are estimated. In addition to the horse genotype, race speed is also determined by the influence of environmental factors, such as feeding, keeping, training, and testing conditions. These conditions include of race track surface condition, the rider's qualifications, season of the year, weather conditions. In this paper the influence of race track surface condition on the accuracy of assessing race time is considered. The data of horse trials of Orlov trotters at the Moscow hippodrome were used. The race time of 256 horses at a distance of 1600 m was assessed. Depending on the weather conditions and the track surface, 9 different track conditions were identified. For the analysis we used data on stallions and mares aged 4 years and older without disaggregation by sex, since there were no significant differences between the average race speed of stallions and mares and it was shown that it was the horses of the older age group that were reliably characterized by the highest average race time with minimal races per horse. It was found that the strength of the influence of the variety of race tracks on the variety of assessments of race time is reliable and amounted to 23.5%. When analyzing the group of the fastest horses, this indicator turned out to be higher and amounts to 43.8%. It is also shown that the selection of horses for breeding work is more expedient and accurate to carry out according to the average race time of the horse for a number of races, and not according to its best result, since in this case the stability of performances is not taken into account.

1 Introduction

Race is one of the main (if not the most important) trait by which horses of trotting breeds could be evaluated. The assessment of racing time is carried out mainly at the racecourses. Usually Orlov trotters are tested from the age of two and, based on the results of racecourses trials, a conclusion is made about the breeding value of this horse and its further use, including for breeding purposes.

Breeders obtain data on this trait as a result of regular tests over several years at the racecourse. That is why racecourses are an integral part of the horse breeding industry as a kind of laboratory for testing of horse breeding products. According to the Russian

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«Livestock Breeding Law», the racecourse is an organization for accounting, control, assessment of the level of productivity and product quality. It takes into account the genotypic and phenotypic characteristics of breeding animals to use of these traits in animal breeding.

When evaluating the race time of horses, the accuracy of this assessment is very important, which depends on many factors: both on the quality of the horse itself and on the totality of trial conditions, which can both be favorable for the manifestation of the maximum possible race speed under these conditions, and, conversely, not let the horse show its capabilities.

Therefore, the determination of the strength and reliability of the influence of factors on the accuracy of evaluation of trotting horses by race speed seems to us relevant, both from a theoretical and practical point of view.

We found it is necessary to analyze how the trial conditions, and, first of all, race track surface condition, affect the accuracy of the race time evaluation. A certain number of studies have been carried out on this issue, but mainly the object was Thoroughbred horses or Arabian breeds [1-7].

All scientists agreed that the track distance, track surface condition and even the temperature of track could affect the racing time it takes for a horse to cover a distance. In our investigation we considered only one factor - the quality of the track surface, and its influence on the racing time of the Orlov trotters in the conditions of the Moscow Hippodrome.

2 Material and methods

The material for our investigation was programs with the results of horse trials of the Moscow Hippodrome in 1931 from the library of Dmitry A. Kislovsky in the amount of 45 books.

More than 1000 horses of the Orlov trotter breed aged 2 years or more, mares and stallions were selected. The number of effective races per one horse is ranged from 5 to 14, but there were no horses with less than 5 data. Estimated trait is race time at 1600 m.

Qualifying races were not taken into account, because the horse does not show their high results, but are only proved to have the right to participate in trials with other horses.

In two-round races, each round was treated as a separate round. Race time at a distance of 2400 m and 3200 m was recalculated to 1600 m.

All horses came from the same stud farms and were trained from the age of 2 at the Moscow Hippodrome in the same conditions.

Trials' results and weather conditions were official data, which were recorded by the panel of judges.

To process the data, we used the methods of one-way layout variance analysis and rank correlation.

The results were analyzed statistically with Microsoft Excel. The significance of the differences was calculated by the Student's test with the following significance levels: * – $P < 0,05$; ** – $P < 0,01$; *** – $P < 0,001$.

3 Results and discussion

Before studying the influence of various factors on the variety of horses in terms of racing time, it was necessary to establish how much different horses of different age and sex can be differentiated in this trait (Table 1).

We divided all horses by sex: into mares and stallions, and each of these groups - into horses aged 3 years, 4 years old and over 4 years old. This division is due to the fact that this system is adopted at the Russian racetracks.

Table 1. Characteristics of the racing time of stallions and mares depending on their age

Sex	Age	Race time		
		M, c	m, c	Cv, %
Mare	3 years old	143.1 *	1.1	2.95
	4 years old	134.2	0.5	0.98
	over 4 years old	139.1	-	-
Stallions	3 years old	141.3 *	1	3.79
	4 years old	135.6	0.9	2.15
	over 4 years old	130.6	0.8	1.88

* $P < 0,05$, ** $P < 0,01$, *** $P < 0,01$

A significant superiority of both older mares and stallions over younger mares and stallions was found. There were no significant differences in average race time between mares and stallions of the same age. Therefore, to study the influence of factor, we considered as one group of horses of the same age - 4 years and older, both mares and stallions, a total of 256 heads.

Table 2 shows the different surfaces of the race tracks, which have been identified by the judges before the each trial. The condition of the tracks depends on a number of factors - weather conditions, coverage, etc.

Table 2. Classification of race track surface

concreted
tarmac
easy
hard
broken
medium
snowy
heavy
very heavy

Certainly, that it is much easier for a horse to run on a track surface that is qualified as «easy» than on a «very heavy» track surface.

Next, we evaluated the strength of the influence of the variety of track surfaces on the variety of assessments of the race time.

The analysis results are presented in Table 3.

Table 3. Results of one-way analysis of variance (n = 2094 races).

Track surface	n, races	M, c	σ , c	Cv, %	m, c
concreted (a)	126	148.3	6.188	4.2	0.55
tarmac (b)	80	149.1	8.708	5.8	0.97
hard (c)	228	151.4 * ab	6.460	4.3	0.43
easy (d)	868	151.5 * ab	7.752	5.1	0.26
very heavy (e)	186	163.5**	7.011	4.3	0.51
broken (f)	32	151. * ab	5.546	3.7	0.98
snowy (g)	99	154.1* k abcdf	6.910	4.5	0.69
medium (i)	145	153.7* k abcdf	8.208	5.3	0.68

very heavy (k)	330	158.6 * abcd	7.986	5.0	0.44
* $P < 0,05$, ** $P < 0,01$, *** $P < 0,01$					

Indicator	Variance		
	x	z	y
C_i	37030.8	120340	157370
$\eta_i^2 = C_i/C_y$	0.235	0.765	1
v_i	8	2085	2093
$\sigma_i^2 = C_i/v_i$	4628.85	57.72	75.19

$$F_{\text{fact.}} = 80.2 \quad v_1 = 8$$

$$F_{\text{st.}} = 1.9:2.5:3.4 \quad v_2 = 2086$$

It was found that the strength of the influence of different types of tracks surface on the variety of race time assessments is reliable and amounted to 23.5%.

In addition, the variety of results (coefficient of variation, C_v) shown by trotters on different surface types is approximately the same. It could mean that different horses equally reduced or increased the time to cover the distance, depending on the quality of the track surface.

All race tracks were reliably divided into four clusters: the first, with the easiest surface, included «concrete» and «tarmac» tracks, the second – «hard», «easy», «broken», the third – «snowy», «medium», «heavy», and the fourth cluster had only one type of track surface – «very heavy», on which all horses performed significantly low race speed and, therefore, highest race time.

We hypothesized that, perhaps, the influence of the race track surfaces was superimposed on the fact that horses of different race classes could run mainly or only on the tracks of the same surfaces.

To ensure that horses of different classes were randomly assigned to different track surface types, we compiled a distribution of horses for different track surfaces, an element of which is presented in Table 4.

Table 4. Distribution of horses of one and the same race class for different race track surfaces, %

Horse name	Track surfaces							
	concreted	tarmac	easy	hard	medium	snowy	heavy	very heavy
Agava			37.5		25		25	12.5
I		12.5	62.5	12.5			12.5	
Aliment	14.3		42.8			14.3	28.6	
Ametist	12.5	12.5	25	25			12.5	12.5
Burlak			57.1		28.6		14.3	
Vlastnaya			33.3			33.3	33.3	
Naslednitsa	11.1		44.4		11.1		22.2	11.1
Patriot	18.2	9.1	27.3	9.1	18.2		18.2	
Provincialka	16.7		50		16.7		16.7	
Scoba	20	40	20	20				

Vlastnaya	3	4
Aliment	4	9
Agava	5	8
Burlak	6	7
Patriot	7	6
Naslednitsa	8	10
I	9	5
Scoba	10	1

It was found that the rank of the horse for the best single result does not coincide with the rank for the average indicator of agility.

The calculated rank correlation coefficient was 0.16. There is a strong mixing of ranks, when evaluating a horse by the best shown result and by the average result over a number of races.

It means that when breeders select the horses based on their best race time, horses showing stable results are selected with a probability of 16%.

In practice breeders, on the other hand, are mainly guided by the best result that the horse has shown, without considering the favorable and unfavorable environmental factors.

We can assume that a horse shows its best race time when most of the factors affecting the variety of time to cover race distance, including the type of track surface, are relatively ideal, and when calculating the average result, those that the horse showed even with a less successful combination of factors are taken into account.

4 Conclusion

Thus, the quality of the track surface on which horses are tested affects the accuracy of assessing their breeding value based on race time, the power of influence is 23.5%.

This means that almost a quarter of the difference between the race time of even the same horse shown in a number of races may depend on what type of surface it was running on.

That is why it is necessary to carry out measures so that the influence of the quality of the track surface on the test results becomes minimal due to the use of modern materials for surface, careful maintenance of tracks, and testing on one special - prize - track.

This is especially actual for the group of the sharpest horses, in which the influence of the variety of track surfaces on the variety of the results of evaluating horses is almost twice higher as for all evaluated horses as a whole - 43.8%.

Also, to compare the results of Orlov trotters for breeding use, it should be borne in mind that there is a strong mixing of ranks (rank correlation coefficient 0.16) between data when we take in consideration the best race time of the horse and data, when we take the average indicator of race time for a number of races.

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