Performance Rates of Thoroughbreds as a Criterion of Racing Ability

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Abstract: Performance Rates as the criterion of racing ability which was recently developed in U.S.A. have been calculated according to the number of lengths that each horse finished behind the first place horse in all the races in which he ran. All of the three-year-old thoroughbreds having four or more starts for the entire racing year of 1972 in the Japan Racing Association were used to estimate Performance Rate. Performance Rate is useful in breeding program because of its high heritability estimate (0.64 ± 0.23)

For a long time, I have looked for the way of evaluating racing performance.^{1,2,3)} Recently a new method to evaluate that of thoroughbreds called Performance Rate was investigated by R. A. PORTER⁴⁾ and R. H. GILLESPIE⁵⁾ under partial sponsorship of the Thoroughbred Record and has been applied to practical breeding.

The basic input to obtain the measure of "goodness" of a horse in whom he beat or who beat him and how good. Performance Rate in U.S.A. is based on the number of lengths ahead of or behind an average horse in an average race. The author has used the number of lengths that each horse finished behind the first place horse.

Materials and Methods

In determining Performance Rate the three-year-old thoroughbreds with at least four starts for the entire racing year of 1972 in the Japan Racing Association were used. The performance was the number of lengths that each horse finished behind the first place horse in all the races in which he ran. Additional factors such as sex of a horse, length of race, weight carried, post position, jockey, track condition, and the like were not taken into account.

S. K. WINSTANDLEY⁶⁾ has utilized this system to rate courses and students in the university environment and assembled two brief descriptions. The method was used to estimate Performance Rate.

Suppose P represents as the performance received, H as the horse factors, and R as the race variables, then we have the equation:

$$P = H + R$$

We can isolate what effect the race has on the performance by:

$$R = P - H$$

and we can determine what the horse would have received in the race after the effect of the race was removed by:

$$H = P - R$$

Performance Rates of Thoroughbreds

In our original equation we have one dependent variable P , caused by two independent variables, H and R .

We can calculate averages for every H and R by setting the problem as a two dimensional matrix, the horses as the rows, and races as the columns.

An element in the matrix has data in it only if the horse represented by the row has taken the race represented by the column. This matrix approach provides links throughout the system so that it will converge to the correct answers. The H for each horse is:

$$H_i = \frac{\sum (P_{ij} - \bar{R}_j)}{m}$$

and the final R for each race will be the average:

$$\bar{R}_j = \frac{\sum (P_{ij} - \bar{H}_i)}{n}$$

where m is the number of races taken, and n is the number of horses in the race. An iterative process must be used to arrive at the final answer.

Results and discussion

Data of all of the three-year-old thoroughbreds were represented. Horses are considered to be more superior as the Performance Rate decreases. The number of horses was limited when only those stallions who had four or more racing offsprings were used to obtain heritability estimate (Table 1).

Table 1. Performance Rates of stallions by the means of their offsprings

Stallion	Performance rates	Stallion	Performance rates
Atan	7.21	Meutieur	6.80
Atrax	9.84	Mincio	6.49
Barbieri	7.60	Nadir	4.15
Beau Prince II	8.73	Never Beat	6.03
Berber	4.94	Nyrcos	7.89
Blanc Bleu	9.99	Only for Life	10.84
Canadian Champ	8.93	Our Babu	6.08
China Rock	6.76	Panaslipper	8.32
Darannor	4.35	Partholon	5.93
Dicta Drake	6.68	Pharamond	5.82
Die Hard	4.29	Royal Record	7.59
Ferriol	7.93	Sammy Davis	5.77
Gilles de Retz	8.99	Sedan	7.16
Gold Arrow	5.60	Shinzan	8.31
Grey Monarch	9.40	Sound Track	4.19
Guersant	4.38	Sunproof	9.90
Hard Ridden	7.91	Tamanar	8.09
Indiana	9.53	Tesco Boy	3.74
Iron Liege	7.43	Tetsunochikara	10.56
Kodama	8.98	Tin Whistle	6.05
Larkspur	5.41	Tudor Period	6.53
Lavandin	9.62	Turquin	8.74
Marino	3.38	Vimy	12.13
Matador	7.29	Wordpam	11.19

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Table 2. Analysis of variance of Performance Rates according to stallions

Source of Variation	Degrees of Freedom	Mean Square	Expected Value of Mean Square	Variance Components
Total	292	17.90		
Stallions	47	32.47	6.09 S + W	2.85
Within Stallions	245	15.10	W	15.10

$$h^2 = 0.64$$

Table 3. Heritability estimates of racing performance in the thoroughbreds

Investigator	Heritability (%)	Criterion of Racing Performance	Age of Horse
PIERRE and STEELE USA (1952)	60.0	Lifetime earnings	
ARTZ, W. Germ. (1961)	19.3 (females)	Time ?	-
BORMANN, W. Germ. (1964)	17.3	Time	2
	8.7	Time	3
	16.6	Time	4
DUSEK, Czech (1965)	19.5 (males)	Time ?	3
	25.0 (females)	Time ?	3
BORMAN, W. Germ. (1966)	6.0	Time	2
	14.0	Time	3
WATANABE, Jap (1969)	11.6	Time	4
SCHWARK and NEISSER, W. Germ. (1971)	60.6	Handicap weight	2
	60.2	Handicap weight	3
Foye, <i>et al.</i> , USA (1972)	36.0	Performance Rate Mixed	
	68.0	Performance Rate	3

As was expected, the larger heritability estimate (0.64) was obtained (Table 2). Nat M. KIEFFER⁷⁾ suggested some selected heritability estimates of racing performance in the thoroughbreds (Table 3). As seen in the table, Performance Rate is better than any other systems and useful for a breeding program.

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サラブレッドの競走能力の基準としての Performance Rates

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著者は長年競走能力の評価の方法について模索してきた。最近アメリカで所謂 Performance Rates と称される性能評価の新しい方法が開発された。著者はこれの変法として 1972 年, 中央競馬に出走した全 3 歳馬について, ゴールに於ける一着馬からの馬身差を基にして, レースごと, 個体ごとの平均値から補正して Reformance

Rates を計算した。ヘリタビリティはかなり高く (0.64), これまでの指標に比べて性能評価に於てより有用であることがわかった。この方法は選択コースの異なる学生の評点に応用されているが, 家畜の色々な性能評価にも適用される可能性が考えられる。