GENETIC PREDICTIONS OF RACING PERFORMANCE IN QUARTER HORSES

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ABSTRACT

Research on the racing performance of quarter horses has been used to develop genetic prediction summaries on all horses with at least one start on record at the American Quarter Horse Association. In the 1987 summary, records from a total of 212,665 horses were used to give genetic predictions on stallions, mares, geldings, fillies, and colts. A reduced animal model was used that incorporated the repeated records of individuals. The individual race was the contemporary group after the data were adjusted for distance, sex, and age. Estimates of heritability of .24 and repeatability of .32 suggest that increased racing performance can be achieved if the predictions are used by breeders. Continued research in variance component estimation includes the genetic covariances among the several distances, maternal influence, and genetic parameters for racing longevity.

Key Words: Quarter Horse, Genetic Analysis, Breeding, Racing Performance, Genetic Trend

Introduction

The breeding of horses for racing performance has yet to fully benefit from genetic predictions from the data base available on objective measures of racing speed. Such predictions are developed and await use by breeders of the racing quarter horse. Horse breeding is of economic importance, but it is not part of livestock agriculture.

The purpose of this paper is to describe what is currently available in the genetic prediction of racing performance for the breeders of racing quarter horses.

Project Results

In 1983, researchers at Iowa State University and Texas Tech University undertook a project supported by the American Quarter Horse Association (AQHA). The objective was to develop, through research of the AQHA data, optimum procedures to predict the breeding value of large numbers of horses for performance measures so that breeders will have sound selection criteria on which to develop breeding programs. The first study presented to the directors concerned the prediction of rank based on halter points using 1 yr of AQHA data. Results suggested strongly that the simple mixed-model methodology employed was capable of identifying the horses that won the halter classes at the national show held at the end of the showing season of 1980. Considerable knowledge about racing performance was learned as well.

A similar project that would concentrate on objective racing performance was started between Iowa State University and the AQHA in 1985. The results of this project were reported by Buttram et al. (1988a,b,c) and Wilson et al. (1988). What follows is a synopsis of the reported results.

Over one million racing records from the AQHA for five distances were studied. Finish time increased with distance almost linearly.
The distributions were similar, and all were skewed to longer finish times. Transformations to enhance normality were not considered to be necessary. Young horses raced together in the shorter races, whereas older horses and geldings ran in longer races. A sex × age interaction was interpreted to indicate differential selection rates among the sexes.

Racing records were used to develop correction factors for sex, which were multiplicative, for age, which were additive, and for handicap weight, which were not large enough to be considered. The analysis of variance was used to define the contemporary groups to be used. Individual races within tracks, years, and days accounted for 49.4 to 70.9% of the variation in racing time.

Several methods of variance component estimation were used to estimate heritability and repeatability for racing time after the records were adjusted for sex and age. Individual races were the contemporary groups. Weighted means for estimates of heritability and repeatability for finish time were .24 and .32, respectively.

A reduced animal model that used the repeated records of an individual was developed to give genetic predictions for racing performance on all horses with at least one racing record in the AQHA data base. The model included the race as the fixed contemporary group and horse breeding values and horse permanent environmental effects as random variables for racing performance. Sex- and age-adjusted finish time in seconds was the record. Stallions, mares, geldings, and nonparent horses were evaluated at three distances. The phenotypic, genetic, and environmental trends were computed using race effects and breeding values. Trends were reported for horses born between 1960 and 1983 for the 402-m distance. The phenotypic trend was for a .30-s improvement in performance over the 15 yr. The majority (.20 s) was accounted for by the environmental trend, contemporary group effects. A decrease in performance was found between 1976 and 1979. The genetic trend was consistent and resulted in an average decrease in racing time of .0067 s/yr. The genetic trends for all three distances were similar.

**Summaries**

A preliminary analysis resulting in genetic predictions was presented by Iowa State University to the executive board in December of 1985. Racing data provided by the AQHA included 1981 to 1983 starts at five distances. A reduced animal model that included repeated records was used.

A second analysis resulting in genetic predictions of racing performance that used all available data from 1971 through Labor Day in 1986 was conducted in 1986. This analysis presented listings of stallions with 15 or more progeny for 402-m and 320-m races, mares with four or more progeny for 402-m and 320-m races, young stallions foaled in 1979 or later with six or more races for the two distances, and young mares foaled in 1979 with six or more races for the two distances. For the 402-m listing, there were 373 stallions, 754 mares, 195 young stallions, and 133 young mares. The horses were listed in breeding value order from the most negative (faster) value down to the slowest. The information on each horse included the following: 1) name, 2) registration number, 3) birth year, 4) number of races run, 5) number of progeny, 6) number of progeny races, 7) the horse value, and 8) the breeding value. The horse value was the sum of the breeding value and the permanent environmental effect. These latter effects probably represent an excellent method for handicapping horses after their first season. Only horses that raced themselves had horse values. The stallion listing really was the recent history of the quarter horse industry. There were few surprises in the ranking of the stallions, which suggests that the several schemes in place currently to rank stallions did reasonable jobs of identifying the truly superior stallions. The exciting listing was that of the young stallions and mares. These listings represent the future of the quarter horse industry.

A third and similar analysis was conducted in 1987. It was presented in similar format. The data used in the 1987 evaluation included official racing starts beginning in 1971 and running through the All-American Futurity held on Labor Day, September 7, 1987, at Ruidoso Downs, NM. This data base included starts from more than 100 tracks located around the country and races distances of 300, 400, and 440 yards.

To reduce some of the confusion caused by multiple EPD per horse for racing performance, it was decided to adjust all finish times to a constant distance. The 300- and
440-yard finish times were adjusted to the intermediate 400-yard distance. There were 1,098,233 racing starts in the data base. The racing records were from a total of 212,065 horses that included aged stallions and mares, geldings, colts, and fillies. There were 23,323 colts and 53,170 fillies in this data base, horses that had individual performance records but no progeny with records. Stallions evaluated had an average of 8.3 progeny with an average of 62 racing starts per progeny. There is a genetic trend starting in 1964 that indicates that genetic merit is increasing.

Current Research

Considerable study remains to be done to enhance and refine the genetic predictions of racing performance in the quarter horse breed. But the basic ground work to make accurate genetic predictions for racing performance has been laid.

As the area of variance component estimation matures and computing programs to handle large data sets are developed, new estimates of the heritability and repeatability of racing performance need to be made. As with most field data, these estimates will probably be lower than expected. Much unexplained variation exists in most field data.

Examples of additional research that could be done on the racing data include estimating genetic correlations for racing performance at various distances to determine which records can be adjusted to an equivalent distance, analysis of the records to determine whether maternal effects have a significant effect on racing performance, and, most importantly, analysis of the data base to determine whether there are genetic effects on racing longevity. It could very well be that the real potential for mixed-model methodology in the horse industry lies in the area of identifying genetically superior horses for withstanding the rigors of the race track over a lifetime of racing.

Wilson (1990) has examined the data to determine whether finish time should also be adjusted for jockey weight, which includes rider, tack, and any assigned handicap. Three distances were studied and four race types (allowance, stakes, handicap, and others) were considered. Results found finish time to be affected by jockey weight for all types except handicap. Linear and sometimes quadratic regressions on the covariate were highly significant. Adjustments need to be made for this effect in subsequent analyses of genetic prediction.

There have been no updates of the summary for 1988 or 1989.

Discussion

There is a mystique that exists in the horse breeding fraternity. Today, it seems to remain an art form. The presentation by the AQHA of a genetic prediction summary for the racing quarter horses of the breed will create some social change within the breeding fraternity.

The association will produce a description of all individuals that have raced and will make these descriptions available to all breeders. It is but one more service by the association for its membership. Yet, it stands to be one of the most important in terms of enhancing the excitement of the sport enjoyed by many outside the confines of the association.

If the association can produce such descriptions of germ plasm, it will circumvent many ill-conceived computer programs touted as ones that can best evaluate genetic merit. The prevention of this alone would enhance horse breeding greatly.

Genetic predictions for racing speed alone is but part of the ongoing research project. It was chosen initially because of the objective records. However, the quarter horse is evaluated in other forms of competition. The study of other measures may well be the key in the publication of genetic summaries for the AQHA.

Implications

Genetic predictions of racing performance are available for use by breeders. Their use awaits approval by the board of directors of the American Quarter Horse Association.

Literature Cited


