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Selection decisions in Thoroughbred broodmares

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ABSTRACT

Using retrospective racing and breeding records the hypothesis was tested that in the last two generations there has been a significant increase in the proportion of race tested fillies entering breeding. During the 1998/99 breeding season there were 146 sires at stud, 92 had a Low cost service fee (<\$5,000), 28 had a Medium cost service fee (\$5,001-\$10,000), 9 had an Expensive cost service fee (>\$10,000) and 17 were Shuttle stallions. Of the 6,768 mares covered 46% were covered by Low cost, 22% by Medium cost, 12% by Expensive cost and 19% by Shuttle stallions. Three stallions from each of these four service fee categories were randomly selected and the opportunity for the female progeny sired by these stallions to enter yearling sales, race and enter the broodmare herd were examined. Significantly more 1999 born female progeny by Expensive (37%) and Shuttle stallions (34%) were presented for sale than those by Medium (1%) and Low cost sires (0%), and were more likely to race (85% and 82%) than those by Medium or Low cost sires (64% and 50%). Female progeny born in 1999 by Expensive sires were more likely to enter breeding (80%) than those by Shuttle (49%), Medium (43%) or Low cost sires (25%). The proportion of broodmares with race records decreased with each retrospective generation.

Keywords: horse, Thoroughbred, breeding, reproduction, selection, mare.

INTRODUCTION

The Thoroughbred industry is the largest of New Zealand's equine industries and has a long tradition of horse exports (Fennessy, 2010). During the last 10 years approximately 1,500 Thoroughbred horses have been exported annually, many of which are exported as yearlings or young racehorses. These exports and the domestic racing industry generate approximately 1.5% of the country's gross domestic product (IER, 2004; C.F. Bolwell, Unpublished data). However, despite strong overseas demand for the New Zealand Thoroughbred, the industry over the last 20 years has undergone what some refer to as "consolidation" (Rogers *et al.*, 2009). This consolidation has seen the national broodmare herd decrease from 10,176 in 1989 to 6,488 in 2004, a 36% reduction in the number of mares being bred and a 45% reduction in the annual foal crop. Similarly there has been a reduction in the number of Thoroughbred stallions at stud over this period. This reduction has been associated with greater sire efficiency within the industry with an annual increase in the number of mares covered by each stallion. This provides some support for the consolidation being associated with attempts to improve economic and reproductive performance (Rogers *et al.*, 2009).

Unlike other production systems the equine has a very limited imposed breeding season, is only capable producing one foal a year, and will have years off due to the industry demand for foals to be

born early in the season. These industry forces place a significant restriction on the economic life of the Thoroughbred broodmare due to significant costs to meet these demands. A recent report examining the economics of breeding Thoroughbred foals for sale as yearlings in Kentucky, identified that only mares valued over US\$150,000 generated a positive net cash flow and mares valued at US\$100,000 or less were not profitable (Bosh *et al.*, 2009a). This finding indicates that there may be differing selection pressures on broodmares dependent on their market value, which in turn may affect the retention of their progeny and their opportunity to race.

Mare age and parity may also contribute to the retention of the female progeny within the breeding population. There is a consistent trend reported for the foals from aged multiparous mares to have lower birth weight than younger mares (Platt, 1984; Wilsher & Allen, 2003), and to be less successful at racing (Barron, 1995). Smaller and lighter yearlings are also reported to achieve lower auction sales prices than yearlings of similar pedigree and type which are of median height and weight (MacCarthy & Mitchell, 1974; Pagan *et al.*, 2006; Morel *et al.*, 2007). Therefore, yearlings of greater weight and height are preferred by the market and so would be expected to receive greater opportunities to enter race training and race, obtaining a racing record and hence subsequent recruitment into the breeding population.

This paper utilises readily available industry production data to examine if there are differences in production and selection parameters in Thoroughbred broodmares that are associated with the perceived value of their sire and across generation changes in selection practices.

MATERIALS AND METHODS

Stallions

Stallions active in the 1998/99 breeding season that were listed in the "Register of Thoroughbred Stallions of New Zealand 1999" (New Zealand Thoroughbred Breeders' Association, 1999) and covered 10 mares or more were stratified according to their service fee into four categories. The categories were Low cost (<\$5,000), Medium cost (\$5,000-10,000), Expensive cost (>\$10,000) and Shuttle sires. Shuttle sires are stallions that serve mares in both the Northern and Southern Hemisphere over a period of 12 months, ranging in price from the Low cost to the Expensive category (Rogers *et al.*, 2009). Three stallions from each category were selected with the proviso they had produced a minimum of 20 foals from the 1998/99 breeding season (www.nzracing.co.nz).

Progeny of the selected stallions

Using the online breeding database maintained by New Zealand Thoroughbred Racing Inc (www.nzracing.co.nz) data were extracted from all New Zealand resident foals that were the female progeny of the selected sires during the 1989/99 breeding season. The data collected were entered at least one race (yes or no), entered breeding (yes or no), age at start of breeding (years), number of years recorded as being reproductively active, number of positive 42 day pregnancy tests, number of full-term foals born, and the relative parity of the foals. Foals that were exported were recorded and excluded from analysis. Sales data were obtained from the online database of New Zealand Bloodstock Ltd (www.nzb.co.nz).

Data manipulation and statistical analysis

Data were downloaded or transcribed from the respective online industry databases and entered into a customised MS Access database. Data were checked for validity and outliers using descriptive statistics and plots. Parametric data were examined using a general linear model. Differences between proportions were tested using chi-squared tests. Age at entering breeding and parity were tested using Kaplan-Meier survival curves with the log rank test. All analysis were performed using SPSS v17 (SPSS Inc, Chicago, IL, USA) with a significance level set at P <0.05.

RESULTS

During the 1989/99 breeding season there were 146 sires at stud which could be categorised as Low cost service fee (63%), Medium cost (19%), Expensive cost (6%) and Shuttle sires (12%). Approximately half of all mares in the study were bred to stallions with a Low cost service fee (Table 1). However, these Low cost service fee sires bred the lowest mean number of mares per sire compared to other categories, with sires in the Expensive cost category breeding the greatest mean number of mares per sire.

Generally the 1999 born female progeny sired by Low cost sires had different production parameters than fillies by other sire categories. The 1999 born female progeny by Expensive and Shuttle sires had similar production characteristics for the proportion exported, offered for sale at the premier sale and entering race training (Table 2). However, there were significant differences between female progeny by Expensive sires and Shuttle sires in the proportion that entered breeding (P = 0.001). Across all sire categories the median parity of the 1999 born female progeny was 3 (3-3) and the median age when starting breeding was 6 (6-6) years.

There was a consistent pattern for more recent generations to have significantly higher proportions of the mares entering the breeding population with a race record (Table 3). However, this did not appear to alter the median age at which the mares entered the breeding herd. The 1999 born female progeny achieved greater parities compared to their dams and grand dams.

DISCUSSION

This analysis used a small sample of sires and their respective subpopulation of filly foals representing 945 of the estimated 2,199 filly foals born in 1999. As such caution should be used not to over generalise the findings presented. However, the consolidation in the breeding herd has been remarkably consistent over the last 20 years and so it is unlikely that the year chosen for the current analysis differed from this consistent trend.

The majority of mares bred in 1989 were bred to Low cost sires (~50%). However, there was a low proportion of 1999 born filly foals by Low cost sires offered at the premier yearling sales, which supports other work examining variables influencing yearling sales price (Waldron *et al.*, 2011). Fillies historically do not sell as well as colts with similar pedigree and conformation, so vendors often find it difficult to have fillies by Low cost sires included in the premier yearling sales. In stark contrast to the 1999 born females sired by Low cost and Medium stallions approximately a third of the 1999 born females sired by Expensive and Shuttle sires were

TABLE 1: Number of Thoroughbred sires covering 10 or more mares at stud in the 1998/99 season grouped according to service fee and their mean \pm standard error of breeding performance. Low = \$0-\$5,000, Medium = \$5,000-\$10,000, Expensive = >\$10,000 and Shuttle sires.

Parameter	Service fee			Shuttle sires	Total
	Low	Medium	Expensive		
Number of sires in service fee category	92	28	9	17	146
Mean number of mares covered per sire	34 ± 3^a	54 ± 6^b	93 ± 15^c	76 ± 7^b	46 ± 3
Total number of mares covered in 1998/99	3,117	1,518	834	1,299	6,768
Total number live foals born in 1999/00	1,916	1,024	520	891	4,351

Different superscripts within rows indicate that values differ significantly ($P < 0.05$).

TABLE 2: Production data on the 1999 born female progeny grouped according to sire service fee category. Low = \$0 - \$5,000, Medium = \$5,000 - \$10,000, Expensive = >\$10,000 and Shuttle sires. The 95% confidence interval is given in parenthesis.

Parameter	Service fee			Shuttle sires
	Low	Medium	Expensive	
Median parity of filly foal	2 (2-3) ^a	3 (2-4) ^b	4 (3-5) ^b	4 (3-5) ^b
Percentage offered at Premier yearling sales	0 ^a	1 ^a	37 ^b	34 ^b
Percentage exported	0 ^a	11 ^b	31 ^c	26 ^c
Percentage that raced	50 ^a	64 ^a	85 ^b	82 ^b
percentage entering breeding	25 ^a	43 ^{ab}	80 ^c	49 ^b
Median age started breeding (years)	8 (7-9)	5 (4-6)	6 (6-6)	6 (6-6)

Different superscripts within rows indicate that values differ significantly ($P < 0.05$).

TABLE 3: Between generation comparison of breeding and performance parameters for filly foals born in 1999 that entered breeding, and the breeding records for their dams and maternal grand dams. The fillies were sired by 12 selected sires. The 95% confidence interval is given in parenthesis.

Parameter	1999 born female progeny	Dams		Grand dams
Percentage that raced	81 ^a	69 ^b	45 ^c	
Age entered breeding (years)	6 (6-6)	6 (6-6)	6 (6-6)	
Parity	4 (3-5) ^a	4 (3-5) ^b	2 (2-3) ^c	

Different superscripts within rows indicate that values differ significantly ($P < 0.05$).

offered for sale as yearlings and the majority of these were exported. These data indicate that within New Zealand there may be two distinct populations of Thoroughbred horses bred; one group sired by the Low cost sires (and to a lesser extent the Medium priced sires) for domestic consumption, and female progeny sired by Expensive and Shuttle sires for the international markets.

Differences in the perceived merit of female offspring across sire categories were also evident in the proportion that raced. Within the New Zealand racing industry there is an export market for a colt or gelding with a lesser pedigree if it can win a race trial or maiden race (Bolwell *et al.*, 2010). However, this export market does not exist for fillies, so the primary reason for racing a filly by a Low cost sire is to obtain a successful race record to improve the horses' market value as a potential broodmare. The

later age of entry of fillies by Low cost sires into the breeding herd supports this hypothesis.

Female progeny by Shuttle and Expensive sires had similar production characteristics up to the point of recruitment into the breeding population. Fewer females sired by Shuttle stallions entered the breeding population compared to females sired by Expensive sires. This may reflect that Expensive sires tend to be the sires with a proven progeny performance record, while most Shuttle sires in contrast are younger sires, which have recently finished their racing career and do not yet have progeny old enough to race (Rogers *et al.*, 2009). As such Shuttle sires can represent a "bit of a gamble", with some proving to be very successful and others failing to produce progeny up to expectations. It is this variation that may drive the lower recruitment of females by Shuttle sires into breeding.

The age at entry to the breeding herd was similar to previous reports (Rogers *et al.*, 2009), however, the parity of 1999 born female progeny was lower than expected. This lower parity may reflect the commercial pressure on broodmares in New Zealand. Breeders are unwilling to continue to breed with a mare with increasing drift of foaling date from the industry standard with each subsequent foal. This reproductive loss in the Thoroughbred means that a mare is likely to be barren two years out of seven at stud (Bosh *et al.*, 2009b; van Rijssen *et al.*, 2010). The parity value for the Expensive sires may indicate that breeders delay sending a mare to an Expensive sire until they have bred a foal and know the mare produces a quality foal. A contributing factor may also be driven by the significant production constraints imposed by a short breeding season and natural service. These constraints often mean that mares are given a limited opportunity to conceive. Hence, stud masters with Expensive sires will pre select for mares of suitable quality which are good breeders to maximise breeding success of their stallions. The first foal is also known to be smaller and so mare owners may also send multi parity mares to Expensive sires so that they produce a larger foal, which in turn should generate a greater return when sold as a yearling.

Across generational comparisons indicated greater selection for mares with a race record, indicating a greater emphasis on performance with the 1999 born generation than was observed with their dams or their grand dams. This pattern, in association with the reduction in the number of national broodmare herd, supports the industry view that the production focus is increasingly orientated to the export and commercial sector.

The data examined indicate we have two distinct groups in New Zealand; mares covered by Low cost sires for domestic consumption and a group of horses specifically bred for sale as a commercial product for sale as a yearling. The across generation analysis supports the view that the industry has become more commercially focused due to the greater proportion of the 1999 born fillies that had a race record than previous generations. There was also a trend for fewer mares by Low cost sires to have their progeny remain in the breeding herd, further supporting this view.

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