RELATIONSHIP BETWEEN PARENT AVERAGE AND FIRST OFFICIAL PROOF IN A COMMERCIAL DAIRY SIRE SAMPLING PROGRAM

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INTRODUCTION

In dairy cattle, most of the genetic progress is being generated by the progeny testing of a large number of young bulls per year. Currently, artificial insemination (AI) organizations select young bulls on the basis of some parent average (PA) before progeny testing them in order to measure their genetic merit accurately (Meinert *et al*., 1997 ; Veirhout *et al*., 1998).
Several studies have looked at the optimization of progeny-testing programs in terms of the number of bulls to sample and the size of daughter groups in order to maximize genetic gain and/or economic returns (Dekkers *et al.,* 1996). However, each additional young sire being sampled leads to a substantial increase in investment (among others, purchase, housing, semen collection and storage and testing program costs). As suggested by Lohuis *et al*. (1992), it might be appropriate to look at better strategies to manage semen collection and culling of young sires before the release of their first official proof. The objective of this paper is to report on the relationship found between PA and first official proofs for three major traits as well as the observed probability of success.

MATERIAL AND METHODS

Data selection. All young Holstein bulls which started in the Semex Alliance progeny test program between November 1, 1993 and October 31, 1997 were included in this study. However, Red Holstein bulls were excluded as they were more likely to return to service than other Holstein bulls (black and red carriers) even if their first official proof was often of inferior genetic merit. For each bull, the closest available PA estimate to its start on the sampling program was retrieved. For each young bull, a PA was calculated using domestic proofs on each parent for three traits. If proofs on one or both parents were not available from the Canadian Dairy Network (CDN) results, a search was made for a MACE proof or a converted proof was calculated. In this study, three traits were considered : the Lifetime Profit Index (LPI) as published by CDN (2001) and its two major components, protein yield (PROT) and conformation (CONF). First official proofs were calculated by CDN and released when bulls met minimum requirements regarding their number of daughters with production and type performance records. On average, a young bull obtains its first official proof 3.5 years after being sampled e.g. bulls sampled in 1993 got their first official proofs in 1997.

Statistical analyses. Results were analyzed on a within-year basis. Product-moment correlations were calculated between the parent average and first official proof of each bull. For each trait, the percentile rank of each bull was determined using its PA estimate. Then, bulls were grouped in seven exclusive categories according to their percentile ranking for each proof : 1-10, 11-20, 21-30, 31-40, 41-50, 51-75 and 76-99. Sales of semen (doses and revenues) were also related to the percentile rankings.

RESULTS AND DISCUSSION

The number of bulls sampled and returned to service each year in this particular commercial testing program appears in table 1. Each year, there was an average of 345 bulls. Some sires were returned to service only until the next proof-round, 3 months later, while others were returned for service for several years. The return percentage after progeny testing was 14.5 % (199/1376), however the proportion of bulls returned to service and utilized heavily after their progeny test decreased to 9.6 % beyond one year only.

Correlations between PA and first official proofs were consistently higher for PROT than for either CONF or LPI with a weighted average of 0.37 in comparison to 0.29 and 0.31, respectively. These correlations are lower than their expectation ($\sqrt{.5}$ = .707) as well as the correlations reported by Lohuis and Stuhmer (1998) on another set of Canadian bulls born from 1988 to 1992 (0.62 for PROT and 0.52 for CONF). Unlike the latter study, our PA's were all estimated in the same year as bulls began their progeny test. Lower correlations in this study could be explained since proofs of some sires of sons might change substantially when their second daughter crop arrives. In addition, biases in bull dams EBVs would also decrease the magnitude of these correlations (Lohuis and Stuhmer, 1998). Finally, we should point out that CDN changed its computation methodology of production EBVs at the start of 1999 by moving from a single trait repeatability model using all available lactations to the current multitrait test-day model which is using all test-day records from the first three lactations (Jamrozik *et al*., 1997).

Table 1. Correlations between parent average and first official proof for three traits

Period[A]	# Sampled	# Returned	PROT[B]	CONF[B]	LPI[B]
1994-1998	358	40	0.40	0.20	0.27
1995-1999	356	49	0.34	0.27	0.34
1996-2000	336	70	0.34	0.31	0.28
1997-2001	326	40	0.42	0.40	0.36
Overall	1376	199	0.37	0.29	0.31

[A] The first number is the year in which a bull crop was put on the sampling program while the second number indicates the year in which their first official proof was released.
[B] PROT = Protein Yield, CONF = Conformation and LPI = Lifetime Profit Index.

The distribution of bulls returned to service per percentile category of LPI is shown in table 2. Most of the bulls successfully progeny tested are found in the first and second quartiles. However, the five lowest percentile categories contributed a similar proportion of bulls with 5.5 to 8.0 % of the bulls returned to service. This is not totally unexpected as the choice of bulls to be retained is not solely based on genetic merit but also on some other characteristics such as pedigree uniqueness, balance of proof profile and market niche, among others. Cumulative frequencies are given in table 3. Overall, the best 25 % and 50 % of bulls on the basis of their PA accounted for 39.2 % and 64.3 % of the bulls returned to service, respectively.

Table 2. Distribution of bulls returned to service per percentile category of LPI

	Percentile category						
Period [A]	75-99	50-74	40-49	30-39	20-29	10-19	0-9
1994-1998	11	13	3	5	3	2	3
1995-1999	17	13	5	3	2	3	6
1996-2000	30	13	5	8	4	7	3
1997-2001	20	11	2	0	2	3	2
Overall	39.2	25.1	7.5	8.0	5.5	7.5	7.0

[A] The first number is the year in which a bull crop was put on the sampling program while the second number indicates the year in which their first official proof was released.

Table 3. Cumulative frequency of bulls returned to service per percentile category of LPI

	Percentile category						
Period [A]	75-99	50-74	40-49	30-39	20-29	10-19	0-9
1994-1998	27.5	60.0	67.5	80.0	87.5	92.5	100.0
1995-1999	34.7	61.2	71.4	77.6	81.6	87.8	100.0
1996-2000	42.9	61.4	68.6	80.0	85.7	95.7	100.0
1997-2001	50.0	77.5	82.5	82.5	87.5	95.0	100.0
Overall	39.2	64.3	71.9	79.9	85.4	93.0	100.0

[A] The first number is the year in which a bull crop was put on the sampling program while the second number indicates the year in which their first official proof was released.

Table 4. Cumulative frequency of doses and value of semen per percentile category

	Percentile category						
	75-99	50-74	40-49	30-39	20-29	10-19	0-9
LPI							
Doses	38.7	75.8	82.9	87.1	90.8	94.2	100.0
Value	37.8	80.8	85.4	87.7	91.5	94.6	100.0
PROT							
Doses	38.6	62.7	80.8	86.5	95.8	96.8	100.0
Value	38.8	57.5	81.9	87.7	97.2	97.7	100.0
CONF							
Doses	38.1	78.9	82.7	89.5	93.3	99.1	100.0
Value	42.3	84.8	87.3	91.4	93.2	99.5	100.0

Deciding to return a proven sire to service does not mean instant sales. To more clearly understand the impact of PA on volume and value of semen sold, these data were also related to LPI, PROT and CONF PA's (table 4). Sires ranked in the top 90 % on PA's for CONF accounted for 99 % of doses sold and revenues which is not surprising since Semex standards on type traits are relatively higher than in the rest of the AI industry. As well, a lesser proportion of the sales were related to LPI than to PROT in the lowest percentile categories (bottom 30 %). By looking closely at these sales results, it might be possible to optimize the economic and genetic returns achieved under this progeny testing program.

CONCLUSION

Results from this study show that there is a good relationship between the parent averages of a bull being sampled in a progeny-test program and its probability of returning to service. Lower correlations between PA and first official proof than expected were found which might be related to several factors including the impact of second crop daughter on sire's proofs, the possible bias in the dam's proofs as well as the recent move to the Canadian test-day model from a typical repeatability lactation evaluation. The probability of success of bulls in the lower percentiles did not differ very much which might be related to the competitive nature of the dairy AI industry. Results from this study might be used to optimize progeny testing resources in this specific commercial AI organization.

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