Réseau laitier canadien
Canadian Dairy Network

Genetic Superiority of A.I. Sires Compared to Herd Sires

A recent analysis at Canadian Dairy Network (CDN) found that approximately 90% of all heifers registered in the breed association herdbook each year are the result of artificial insemination with the remaining ten percent being daughters of herd sires. Other surveys done in the past suggest that 25 to 35 percent of all dairy enterprises in Canada have a herd sire on the farm even though most see very limited use. In general, herd sires are used to breed groups of heifers and cows to reduce the effort of heat detection and when trying to get problem breeders back in calf. These underlying reasons relate to herd management options but one should also consider the impact on the genetic potential of the resulting progeny.

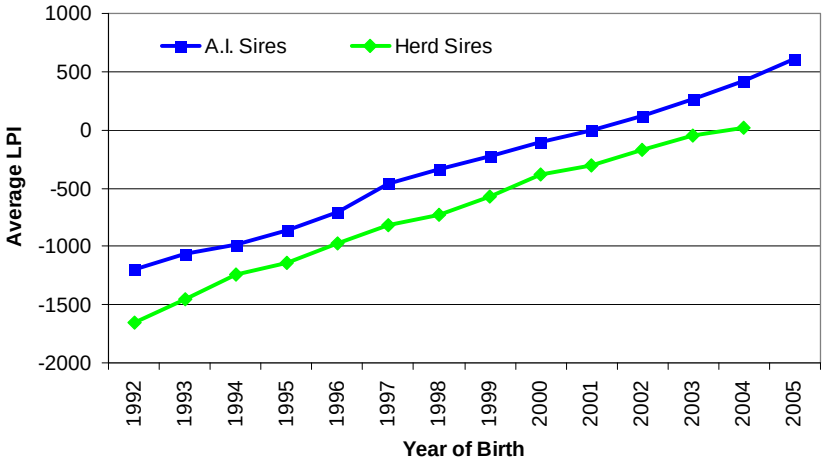
Genetic Evaluations

Genetic evaluation systems at CDN include recorded information on all herdbook registered females. Requirements for publication of official bull proofs include minimum counts on daughters and herds (at least 5 or 10) for each sire, which therefore prevents most herd sires from receiving official genetic evaluations. Daughters of herd sires, however, do receive official genetic indexes assuming they meet the other requirements such as supervised milk recording and official type classification.

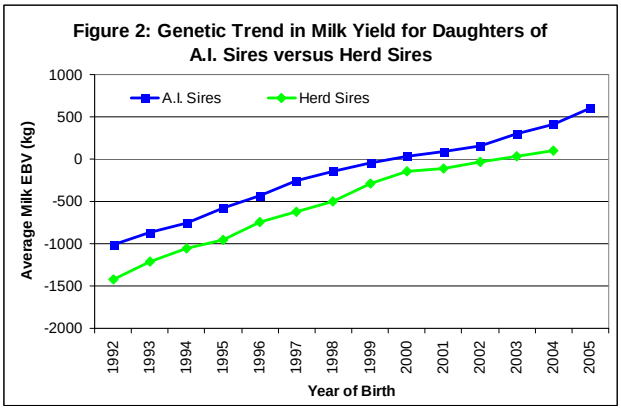
Genetic Trends

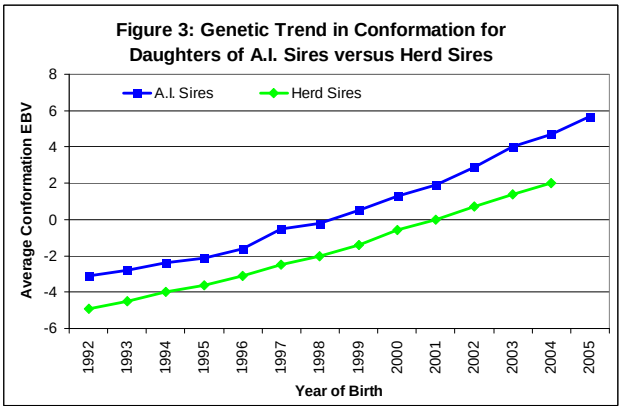
Since all cows included in genetic evaluations have a genetic index calculated it was possible for CDN to examine the difference in genetic potential of daughters of A.I. sires compared to daughters of herd sires for various traits. Figure 1 shows the genetic trend realized in each sub-group of the Canadian Holstein population born since 1992 and the consistent advantage of the daughters of A.I. sires is evident. In fact, a closer look at these two trend lines shows that the average genetic level of herd sire daughters lags almost exactly three years behind the average genetic level of the daughters of A.I. sires. This point is quickly confirmed by noting that the average LPI of herd sire daughters born in 2004 is very close to zero, which is also the same average LPI of A.I. sire daughters born in 2001, three years earlier.

Figure 1: Genetic Trend in LPI for Daughters of A.I. Sires versus Herd Sires



Similar to Figure 1, Figures 2 and 3 show the genetic trends since 1992 for A.I sire daughters and herd sire daughters for Milk Yield and Conformation, respectively. As with LPI, the genetic merit of herd sire daughters consistently lags about three years behind that of A.I. sire daughters. This lag is primarily due to the fact that herd sires are usually sons of elite A.I. proven sires and the daughters of the resulting herd sires are born, on average, about three years after the birth of the herd sire's paternal sisters produced through artificial insemination.





Daughter Comparisons

In numerical terms, Table 1 shows the average genetic superiority of A.I. sire daughters for LPI, production and key type traits based on daughters born between 1992 and 2004 and for daughters born in 2004 only. For this latter group, daughters of A.I. sires have an LPI that is nearly 400 points higher than the herd sire daughters born during the same year. Extrapolating the results of a previous CDN analysis linking genetics and profit (see CDN web site, http://www.cdn.ca/articles.php, *"Genetics and Profit"*, June 2006), this 400-point LPI advantage translates to an increase in profit per cow of $200 per year in favour of A.I. sire daughters over herd sire daughters. It is important for those considering the use of herd sires, instead on A.I. sires, to understand this "cost" in genetic potential and the impact on future herd profitability.

Table 1: Genetic Superiority of Daughters of A.I. Sires versus Herd Sires

	Average Genetic Difference (A.I. - Herd Sire)	
Daughters' Birth Year:	**1992-2004**	**2004**
Lifetime Profit Index (LPI)	332	397
Milk Yield (kg)	296	315
Fat Yield (kg)	9.6	9.0
Protein Yield (kg)	9.7	10.0
Conformation	1.9	2.7
Mammary System	1.5	2.5
Feet & Legs	0.9	1.4
Dairy Strength	2.0	2.3
Rump	1.0	0.9

For production traits, the genetic superiority of A.I. sire daughters born in 2004 compared to their counterparts produced by herd sires was 315 kg Milk, 9 kg Fat and 10 kg Protein (Table 1), which is an important genetic advantage that is expressed each lactation and is passed on from generation to generation. This advantage was also important for type traits, exemplified by the 2.7-point advance for Conformation in A.I. sire daughters, expressed on the genetic evaluation

publication scale. Mammary System and Dairy Strength show a similar magnitude of genetic superiority for A.I. sire daughters while the advantage is slightly less for Feet & Legs and Rump.

Summary

While most herd owners that choose to keep a herd sire on the farm use them only in specific management situations, greater consideration of the impact on genetic improvement and herd profitability is warranted. On average, the genetic merit of herd sire daughters lags three years behind that of A.I sire daughters, which translates to an estimated cost of $200 per daughter per year based on the 400-point LPI advantage for A.I. sire daughters found in a recent analysis at CDN.

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Date: July 2007