

SELECTION PATTERNS FOR HOLSTEIN SIRES IN PRODUCTION-RECORDED HOLSTEIN HERDS WITH DIFFERING FEEDING SYSTEMS

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SUMMARY

The dataset created for the Feeding the Genes Project (Morton *et al.* 2013) was used to estimate the extent of phenotypic responses from Holstein daughters of Holstein sires in milk yield and composition variables associated with a 50 unit increase in the cow's sires' Australian Profit Ranking (APR). A subset from that dataset comprising 77,144 cows born from 2005 to 2009 was used to compare sire selection patterns in herds with different feeding systems. Australian Profit Ranking values of the cows' sires' varied widely from -303 to +430, including 20% of cows that were daughters of sires with negative APR values. Australian Profit Ranking values of the sires of the enrolled cows were low, with an average of 68 and an average annual rate of increase of 10.1 APR units. The cows in the herds with the greatest reliance on pasture and feeding <1,000kg grain supplement in the bail had the highest average APR of 77 and the highest average annual rate of increase of 13 APR units, whereas the cows in the herds feeding total mixed rations with minimal reliance on pasture had the lowest average APR of 48 and an annual average increase of 7.8 APR units. These results indicate that there are broad ranges in average APR values and in annual average increases in APR, across the different feeding systems. Major differences in sire selection patterns were also observed among the different feeding systems.

BACKGROUND

The APR is a selection index that estimates the relative profitability of different animals and enables ranking of bulls based on the estimated relative profitability of their daughters. Australian Profit Ranking values are calculated using Australian Breeding Values (ABVs); these are based on data derived from herds using a diverse range of feeding systems. Some farmers question the relevance of the APR to herds that have limited or no reliance on pasture grazing, such as those using feedlot systems and feeding total mixed rations. These questions were addressed in the Feeding the Genes Project (Morton *et al.* 2013). The phenotypic changes in yields and milk composition associated with a 50 unit increase in the cow's sires' APR were compared between cows in herds with each of 5 feeding systems.

Although sire selection patterns were known to differ among feeding systems, across herds differing in average yield levels, and in different states and regions, none of these differences have been quantified. Most of the 505 herds enrolled in the Feeding the Genes Project used feeding systems that combined grazing improved pastures with varied amounts of grain supplements fed in the bail during milking.

The objective of the current study was to utilise the dataset created for the Feeding the Genes Project to assess whether Holstein sire selection patterns varied by feeding system, and to measure any differences in genetic trends associated with these systems.

MATERIAL AND METHODS

All herds in which at least 50 Holstein cows calved in 2011 were selected from the Australian Dairy Herd Improvement Scheme (ADHIS) database. Letters were sent to herd managers asking them to complete a simple herd data questionnaire to identify their feeding system. In total, 505 herds provided data suitable for analysis, and cow and lactation data for these herds were obtained from ADHIS. The original dataset included 250,857 lactations for Holstein cows born from 2002 to 2009. The 77,144 Holstein cows, with identified sires, that had at least one enrolled lactation commencing between 2008 and 2011 were selected for the current study. Each cow's sires' APR was as estimated on 20th August, 2012. These cows were in 438 herds and were born from 2005 to 2009. Each herd was classified into one of five feeding systems for each year from 2008 to 2010 (Table 1).

Table 1. Details of five feeding systems used to classify 438 Holstein herds enrolled in the Feeding the Genes Project.

System name	System no.	System description	% of cows
Low bail feeding	1	≤1000kg grain supplement/cow/lactation	11.6
Moderate to high bail feeding	2	>1000kg grain supplement/cow but did not use feed pad or mixer wagon	59.0
Partial mixed ration (PMR)	3	Part of the ration was fed on a feed pad using a mixer wagon with pasture for at least 9 months /year	17.1
Hybrid	4	Pasture for 2-8 months of the year and entirely on a feed pad with a mixer wagon for some periods	6.3
Total mixed ration (TMR)	5	Cows are usually fed a total mixed ration with less than 1month/year on pasture	6.1

RESULTS

The most common feed management system was moderate to high bail feeding. It included 66% of the 1885 herd-years enrolled in the current study and 59% of the enrolled cows (Table 1).

Sires that each had at least 300 daughters had APR values ranging from -303 to +430, and 96% of study cows were daughters of sires with APR values between -200 and +200. The distribution of these cows by sire APR is shown in Figure 1. Overall, 20% of cows were by sires with negative APR values. This varied from 16% for cows in low bail feeding herds (System 1; see Table 1) to 26% of cows in TMR herds (System 5). By comparison, 34% of all cows were from sires with APR values of at least 120, varying from 34% in low bail feeding herds to only 20% in TMR herds. While 22% of cows born from 2005 to 2007 had sires with negative APRs, 16% and 14%, respectively, of cows born in 2008 and 2009 had sires with negative APR values. Mean APR values and selected ABVs within each feed management system are shown in Table 2. Daughters in low bail feeding herds had a sire average APR of 77 compared to only 48 for cows in TMR herds. Similarly, the average annual change in sire APR increased by 13.0 units per year for cows in the low bail feeding herds, but by only 7.8 units per year for cows in the TMR herds (Table 2).

Sire ABVs also reflected differences in sire selection criteria between feeding systems. Whereas the mean of sire milk volume ABV was only 259 litres for cows in the low bail feeding herds, this increased to an average of 311 litres for cows in the TMR herds. This was in contrast to the declining trends (from low bail feeding to TMR) in means of sire ABVs for protein and milk

fat yields (Table 1).

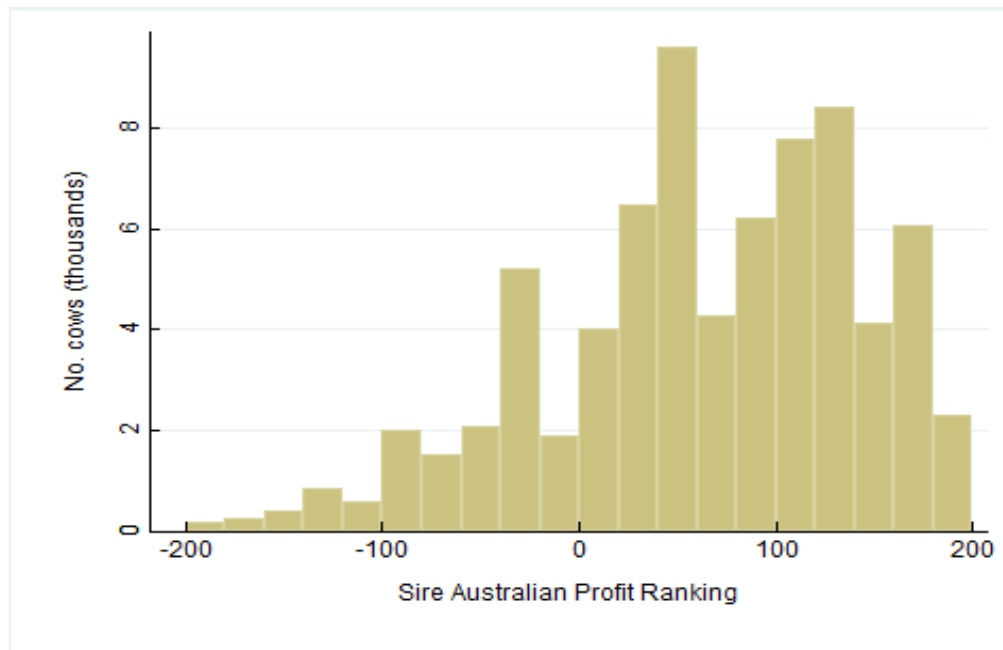


Figure 1. Distribution of Holstein cows by APR of their sire for cows with sires with APRs between -200 and +200.

Table 2. Mean (\pm SD) sire APRs and annual increases in sire APR and their mean sire ABVs among cows in herds with differing feeding systems.

Genetic variable	Low bail	Mod/high bail	PMR	Hybrid	TMR	Pooled
APR						
Mean	77(85)	71(85)	62(84)	62(89)	48(86)	68(86)
Change/year	13.0	10.0	8.8	12.1	7.8	10.1
ABV						
Milk volume (l)	259(461)	289(472)	302(470)	296(482)	311(459)	289(470)
Protein yield (kg)	9(17)	8(18)	7(18)	7(19)	6(19)	8(18)
Milk fat yield (kg)	9(12)	8(12)	5(12)	7(12)	2(12)	7(12)

DISCUSSION AND CONCLUSION

There was a wide range in cow's sires' APR values and almost 20% of the cows were daughters of sires with negative APR value. This pattern of sire selection indicated that there had been limited emphasis on sire APR by many herd owners; this consequently contributed to an average APR of only 68 and an annual average APR increase of 10.1.

Sires with high APR values were sometimes selected, as 14% of cows were daughters of sires with APR values greater than 160. However, the overall average of 68 could have been expected to be twice as high if herd owners had only selected sires with high APR values. Mean sire APR values differed markedly between feeding systems. The lower APR values for cows in the TMR herds may partly reflect the greater emphasis on milk volume ABV and less emphasis on milk fat and protein yield ABVs in herds with this feeding system, as the APR is negatively influenced by milk volume ABV and positively influenced by protein yield ABV. This may also have contributed to the slower annual rate of increase in the average APR of cows in these herds.

A key finding from the Feeding the Genes Project was that a 50 unit increase in cow's sires' APR is associated with increases in phenotypic protein and milk fat yields as well as profitability in all feeding systems (Morton *et al.* 2013). The average increases in the yields of milk volume, protein and milk fat measured in cows in the TMR herds was approximately double the APR associated increases for cows in the low bail feeding herds (110 versus 56 litres; 5.1 versus 2.6 kg protein; and 5.7 versus 2.6 kg milk fat/cow/lactation for TMR versus low bail feeding, respectively; Morton *et al.* 2013). These yield improvements were calculated to increase milk profit by \$46/cow/lactation for a 50 unit increase in APR for cows in the TMR herds compared to \$22 for cows in the low bail feeding herds (Morton *et al.* 2013). If greater use had been made of sires that had APR values greater than 160 (as was the case with 14% of cows) to achieve an average increase in APR of approximately 100 units higher than the pooled average of 68 units of APR (Table 2), the overall increase in milk profit would have averaged over \$50/cow/lactation across the herds enrolled in the study. It would have been slightly less for cows in low bail feeding herds (\$45), but almost double this for cows in TMR herds (\$92).

In conclusion, these results showed that greater use of sires with higher APR values could increase milk profit for herds in each of the 5 feeding systems with the greatest increases occurring in herds that relied less on pasture as the major source of nutrients.

REFERENCES

Morton J., Brightling P. and Little S. (2013) Feeding the Genes – Interactions between feeding system and APR and ABVs in dairy cows, pp 1-107. Australian Dairy Herd Improvement Scheme, Melbourne.