Abstract M48

Genetic trends for dairy traits in the Holstein x Other Breeds multibreed dairy cattle population in tropical Central Thailand

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SUMMARY

Genetic variability and genetic trends for 305-d milk yield (**MY**), 305-d fat yield (**FY**), and average 305-d fat percent (**FP**) were evaluated using monthly test-day records from first-lactation cows collected from 1991 to 2005 in 92 farms located in Central Thailand. Estimates of variance and covariance components and breeding values (**EBV**) were obtained using a multiple-trait animal model. Fixed effects were contemporary group (herd-year-season), calving age, and additive genetic group as a function of Holstein fraction. Random effects were animal and residual. Program ASREML was used to perform computations. Estimates of heritabilities were 0.39 ± 0.10 for MY, 0.26 ± 0.10 for FY, and 0.21 ± 0.11 for FP. Although the difference between the mean MY for cows in 2005 and 1991 was 79.3 kg, the regression of mean cow EBV for MY on year was only 0.9 kg/yr. Differences between mean cow EBV for FY and FP in 1991 and 2005 and their corresponding regressions of mean FY and FP on year were all near zero. Similarly, mean EBV for sires and dams of cows also showed near zero trends during these years. The near complete absence of genetic trends suggests that high percent Holstein cows are not reaching their production potential under the management, nutrition, and hot and humid climate conditions in this tropical region.

INTRODUCTION

There has been concerted effort to increase milk production in Thailand for the past 35 years. This effort has been a combination of government policies, importation and widespread use of Holstein semen, and extensive use of high percent Holstein sires generated in Thailand. This mating strategy has resulted in a multibreed dairy population where 90% of animals are 75% Holstein or greater. Central Thailand is the most important dairy region. The Dairy Farming Promotion Organization of Thailand (DPO) has been collecting dairy production, breed composition, and pedigree records in this region since 1991. Kasetsart University has conducted annual dairy genetic evaluations in Central Thailand using the DPO dataset since 1996. The objective of this research was to assess genetic variability and genetic trends for 305-d milk yield (**MY**), 305-d fat yield (**FY**), and average 305-d fat percent (**FP**) in Central Thailand from 1991 to 2005.

MATERIALS AND METHODS

Animals and Data. The dataset consisted of 15,260 monthly test-day records from 1,377 first-lactation cows collected from 1991 to 2005 in 92 farms in Central Thailand. Test-day samples were measured for milk volume and analyzed for fat content (fat percentage) monthly. Monthly test-day samples were used to compute MY and FY using the test-interval method. Monthly production yields (milk and fat) were computed using two consecutive test-day production samples, and then added to obtain the accumulated 305-d productions.

Climate, Nutrition, and Management. Seasons were winter (November to February: cool and dry), summer (March to June: hot and dry), and rainy season (July to October: hot and humid). Feeding consisted of fresh grass (direct grazing or cut-and-carry; 30 to 40 kg/d) supplemented with concentrate (12 to 15 kg/d). In the dry season, when fresh grass is limited, rice straw, treated rice straw, crop residues, and agricultural byproducts were used as sources of fiber. A free-choice mineral supplement was available throughout the year. Cows were housed in open barns with less than 10% using fans to reduce heat stress. Almost all dairies milked their cows twice a day. Cows were bred all year round, mostly by artificial insemination. Sires were chosen primarily by semen availability, and secondarily by their genetic ability for economically important traits. Reasons for culling cows were mainly health and reproductive problems.

Breed Composition of the Population. Breeds represented in the multibreed dairy population of Central Thailand were Holstein, Brahman, Jersey, Red Dane, Red Sindhi, Sahiwal, and Thai Native. Most animals in the population were composed of a larger Holstein fraction, and smaller fractions of other breeds (Table 1). Consequently, for analytical purposes two breed groups were defined: Holstein (**H**) and Other breeds (**O**).

Table 1. Number of cows by breed group of sire x breed group of dam combination

Breed Group of Dam	Breed Group of Sire			
	Holstein (H) 338	0.00 < H < 1.00 35	Other Breeds (O) 5	Total 378
0.8H to 1.0H	538	81	7	626
0.6H to 0.8H	382	70	4	456
0.4H to 0.6H	197	25	2	224
0.2H to 0.4H	30	4	0	34
0.0H to 0.2H	36	1	0	37
Total	1,183	181	13	1,377

Genetic Parameters. Prediction of breeding values (**EBV**) and estimation of variance and covariance components were obtained using a multiple-trait animal model. Variance components were subsequently used to compute heritabilities for MY, FY, and FP. Fixed effects were contemporary group (herd-year-season), calving age, and additive genetic group as a function of Holstein fraction. Random effects were animal and residual. Program ASREML was used to perform computations.

Phenotypic and Genetic Trends. Weighted yearly means of Phenotypic Values (**PV**) and EBV of cows, and weighted yearly means of EBV of sires and dams were plotted against year. Weights for cows were equal to 1, and weights for sires and dams were equal to their respective numbers of daughters per year. Linear regressions for PV and EBV yearly means on years were also computed for each trait.

RESULTS AND DISCUSSION

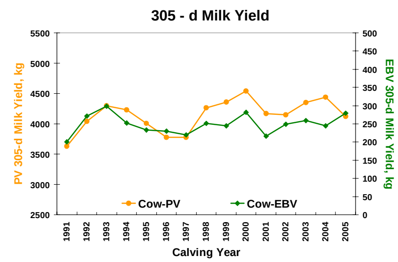
Means, Variances, and Genetic Parameters. Trait means were 3,968 kg for MY, 158 kg for FY, and 3.8 % for FP. Least squares mean differences between Holstein and Other Breeds were 298.9 kg for MY, -1.6 kg for FY, and -0.07 % for FP. Phenotypic variances were 663,678 kg^2 for MY, 1764 kg^2 for FY, and 0.2 $\%^2$ for FP. Heritability estimates were 0.39 ± 0.10 for MY, 0.26 ± 0.10 for FY, and 0.21 ± 0.11 for FP.

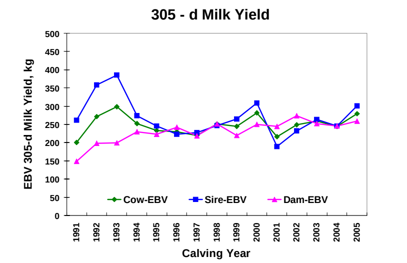
Phenotypic and Genetic Trends. Differences between MY yearly means for cows calving in 2005 and 1991 was 490.9 kg for PV and 79.3 kg for EBV. The corresponding regression of phenotypic and genetic means for MY was 17.9 and 0.9 kg/yr, respectively (Table 2). Differences between means of cow PV and EBV for FY and FP in 2005 and 1991, and their corresponding regressions of mean FY and FP on year were all near zero. Furthermore, mean EBV for sires and dams of cows also showed near zero trends during these years (Figures).

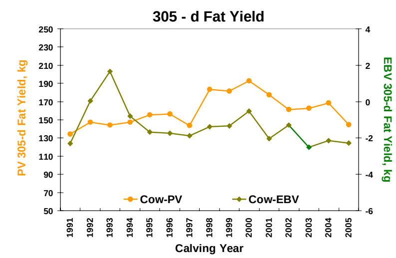
Weighted sire yearly means for MY EBV were higher than for dams in the first five years (1991 to 1995), and similar to dams afterwards (1996 to 2005). In contrast, sire weighted yearly means for FP EBV were lower than those for dams across all years (1991 to 2005). This was likely due to the upgrading of local *Bos indicus* and crossbred cattle to Holstein that was promoted by the Thai government.

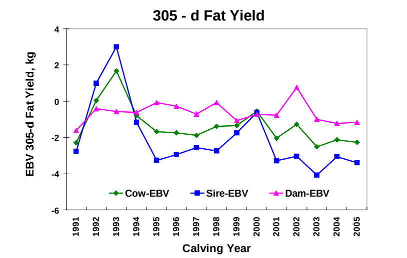
The small phenotypic and genetic trends for MY, FY, and FP suggest that sires and dams were chosen based on considerations other than their EBV for these production traits. Most Thai dairy farmers may have considered information on cost, health, reproductive ability, pedigree, and production when selecting dairy cattle. Further, EBV for imported sires under Thai conditions is limited and based on small numbers of progeny. This suggests the need for a comprehensive national dairy genetic evaluation to increase accuracy of genetic evaluation and the availability of Thai and imported sires for artificial insemination.

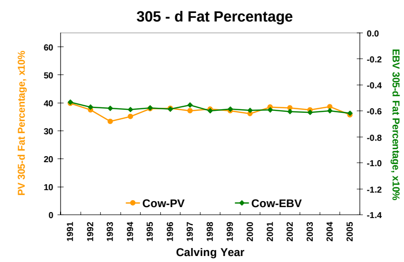
Another factor for the low genetic trends may have been genotype by environment interaction. The Thai dairy population has been under a steady upgrading process towards Holstein. The absence of strong genetic trends may be an indication that high-percent Holstein cows are not reaching their production potential under the management, nutrition, and hot and humid climate conditions in this tropical region.











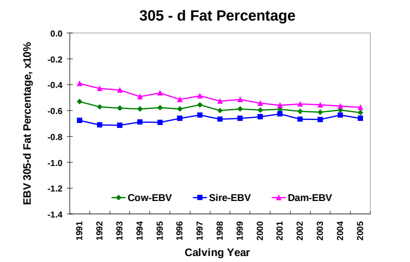


Table 2. Genetic Trends for MY, FY and FP

Parameter	Milk Yield	Fat Yield	Fat Percentage
Cow Phenotypic Trend	17.9 ± 7.8 kg/yr	0.7 ± 0.4 kg/yr	0.12 ± 0.04 %/yr
Cow Genetic Trend	0.9 ± 2.0 kg/yr	-0.12 ± 0.07 kg/yr	0.003 ± 0.001 %/yr
Sire Genetic Trend	-3.0 ± 1.9 kg/yr	-0.2 ± 0.1 kg/yr	0.004 ± 0.001 %/yr
Dam Genetic Trend	4.6 ± 1.5 kg/yr	-0.03 ± 0.05 kg/yr	-0.01 ± 0.001 %/yr

FINAL REMARKS

- **Genetic trends in the Holstein x Other Breeds dairy cattle population in Central Thailand from 1991 to 2005 were small for MY, and near zero for FY and FP.**
- **A National Sire Evaluation needs to be implemented to improve the accuracy of genetic evaluation and to increase the availability of Thai and imported sires for Artificial Insemination.**
- **The pricing system for milk needs to be changed to stimulate herd size growth and to increase the number of dairy farms willing to participate in genetic improvement programs in Thailand.**