Abstract T23

Lactation patterns for dairy cattle in a multibreed dairy population in Central Thailand

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SUMMARY

Lactation patterns of 5 lactation traits: initial yield (IY), peak yield (PY), days to peak (DTP), persistency (PST), and 305-d milk yield (MY) in a Holstein-Other breeds (HO) multibreed population in Central Thailand were studied using monthly test-day records from first-lactation cows collected from 1998 to 2006 in 108 farms. Breeds groups were BG1 (purebred H), BG2 (0.9687 ≤ H < 1.00), BG3 (0.9375 ≤ H < 0.9687), BG4 (0.875 ≤ H < 0.9375), and BG5 (0.50 ≤ H < 0.875). Seasons were 1 = winter (November to February), 2 = summer (March to June), and 3 = rainy (July to October). The model for each trait included the fixed effects of herd-year-season, calving age, and breed group. Random effects were sire of cow and residual. Procedure Mixed of SAS was used for computations. Least squares means ranged from 14.16 ± 0.71 kg (BG5) to 16.04 ± 0.66 kg (BG4) for IY, from 18.23 ± 0.55 kg (BG5) to 19.84 ± 0.51 kg (BG4) for PY, from 36.51 ± 3.78 d (BG4) to 52.04 ± 9.74 d (BG1) for DTP, from 6.45 ± 0.24 (BG1) to 6.71 ± 0.11 (BG3) for PST, and from 4,083.74 ± 103.50 kg (BG5) to 4,317.15 ± 111.56 kg (BG3) for MY. Breed group differences were non-significant. However, BG3 performed better than BG1 and BG2 suggesting that nutrition, management, and tropical conditions in Thailand may have prevented them from reaching their production potential.

INTRODUCTION

Milk production in Thailand is based on a dairy population composed of Holstein (**H**) and fractions of various other *Bos taurus* and *Bos indicus* breeds (**O**). This population structure is the result of a national effort encouraged by the Thai government to increase milk production. Genetic evaluations have been conducted by Kasetsart University and the Dairy Farming Promotion Organization (DPO) for milk yield, fat yield, and fat percentage since 1996. Dairy cows that have higher IY, higher PY, and more ability to continue to produce milk at near peak levels throughout the lactation are expected to have higher milk yield per lactation. To further improve management and the ability to select animals suitable for Thai tropical conditions, a more complete understanding of lactation characteristics and their association with milk production is needed. Thus, the objective of this research was to study the patterns of 5 lactation traits: initial yield (IY), peak yield (PY), days to peak (DTP), persistency (PST), and 305-d milk yield (MY) in 5 breed groups in a Holstein-Other breeds (HO) multibreed population in Central Thailand.

MATERIALS AND METHODS

Animals and Data. The dataset consisted of 5,713 monthly test-day records from 520 first-lactation cows collected from 1998 to 2006 in 108 farms in Central Thailand. The gamma model of Wood ($y_t = at^b e^{-ct}$; Wood, 1967) was transformed logarithmically into a linear form, and then fitted to monthly test-day milk records for individual cows. The log-linear model was:

$$Ln(y_t) = ln(a) + b\ ln(t) - ct$$

where

y_t = monthly test-day milk on day t
a = variable related to milk at $t = 5$
b = variable related to increase in milk before peak yield
c = variable related to decrease in milk after peak yield

The IY was defined as a, PY was calculated as $a(b/c)^b e^{-b}$, DTP was defined as b/c, and PST was calculated as $c^{-(b+1)}$. Sum of monthly test-day milk estimates (y_t) of individual cow represents MY.

Climate. Central Thailand has daily temperatures ranging from 19° to 36° Celsius, relative humidity ranging from 48 to 94 %, and rainfall is approximately 1,232 mm per year. 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).

Nutrition and Management. Grasses used in dairy farm pastures in Central Thailand were Guinea (*Penicum maximum*), Ruzi (*Brachiaria ruziziensis*), Napier (*Pennisetum parpureum*), and Para (*Brachiaria mutica*). Some farmers planted mixtures of grasses and legumes to increase the nutritional value of pastures. Concentrate feed for cows was either produced by the farmers themselves, or purchased from dairy cooperatives and local companies. Feeding was based on concentrate (12 to 15 kg/d, or considering 1 kg of concentrate for 2 kg of milk), and fresh grass (direct grazing or cut and carry; 30 to 40 kg/d) from famers own land (90% of farmers) or from public areas (small holders). In the dry season, when fresh grass was limited, rice straw, urea-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. Less than 10% of farmers used fans to reduce heat stress. Almost all dairies milked their cows twice a day. Cows were bred year round by artificial insemination. Sires were chosen primarily based on semen availability, and secondarily by their genetic ability for economically important traits. Reasons for culling cows were mainly health and reproductive problems.

Table 1. Descriptive statistics for initial yield, peak yield, day to peak, persistency, and milk yield of first lactation cows

Trait	No	Mean	SD	Minimum	Maximum
Initial yield (kg)	520	14.90	6.22	1,017.00	44.90
Peak yield (kg)	520	18.58	5.67	5.00	44.90
Days to peak (day)	520	40.75	32.93	8.00	228.00
Persistency	520	6.62	0.88	2.76	12.31
Milk yield (kg)	520	3,588.31	1,183.98	3.30	8,141.00

Breed Composition of the Population. Breed groups in this multibreed dairy population of Central Thailand were classified by considering fraction of Holstein (H) and Other breeds (O) as BG1 (Holstein; H), BG2 (0.9687 ≤ H < 1.00), BG3 (0.9375 ≤ H < 0.9687), BG4 (0.875 ≤ H < 0.9375), and BG5 (0.50 ≤ H < 0.875).

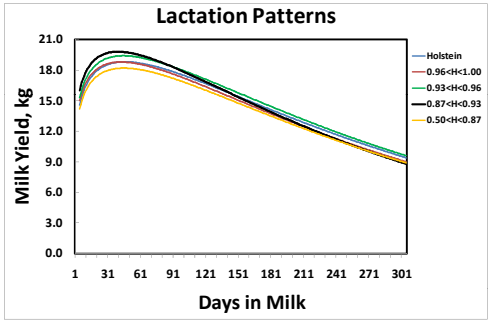
Data Analyses. The model for IY, PY, DTP, PST, and MY included the fixed effects of herd-year-season, calving age, and breed group. Random effects were sire of cow and residual. Procedure Mixed of SAS was used for computations. Lactation curves for breed groups (BG1 to BG5) were created using least square means of predicted daily test-day milk yields. Procedure Corr of SAS was used to compute phenotypic correlations between MY and IY, PY, DTP, and PST.

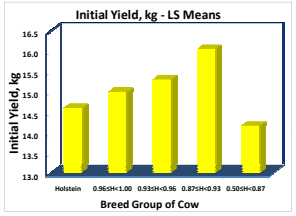
RESULTS AND DISCUSSION

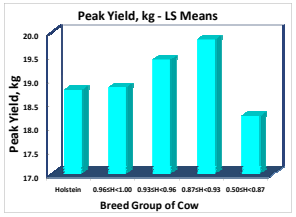
Least squares means ranged from 14.16 ± 0.71 kg (BG5; 0.50 ≤ H < 0.875) to 16.04 ± 0.66 kg (BG4; 0.875 ≤ H < 0.9375) for IY, from 18.23 ± 0.55 kg (BG5) to 19.84 ± 0.51 kg (BG4) for PY, from 36.51 ± 3.78 d (BG4) to 52.04 ± 9.74 d (BG1; purebred H) for DTP, from 6.45 ± 0.24 (BG1) to 6.71 ± 0.11 (BG3; 0.9375 ≤ H < 0.9687) for PST, and from 4,083.74 ± 103.50 kg (BG5) to 4,317.15 ± 111.56 kg (BG3) for MY.

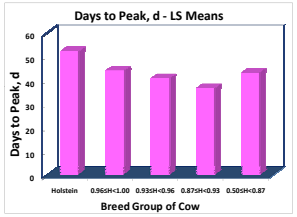
Breed group differences were non-significant for all traits. However, there was a general trend for crossbred cows to outperform H cows. Cows in BG3 had higher MY and PST than any other group, including H (BG1) and 97% H (BG2), whereas crossbred group, BG4 showed the largest least square means for IY, PY, and DTP. These results suggest that cows in BG1 and BG2 were less able to cope with the management, nutrition, and climatic conditions in Central Thailand. Thus, for cows in these 2 groups to reach their production potential, changes in management (e.g., active cooling) and nutrition (e.g., more concentrate) may be needed. Some of these changes may, however, prove to be unprofitable under Thai economic conditions.

Phenotypic correlation estimates between MY and IY, PY, DTP, and PST were 0.39, 0.69, 0.27, and 0.25 respectively. These results suggest that selection for higher INT and PEK may also help increase milk production in this population.









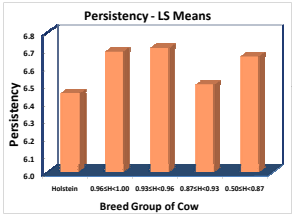


Table 2. Least squares means and standard errors for initial yield, peak yield, days to peak, persistency, and milk yield by breed group of first lactation cows

BG	Breed Group of Cow	No	Initial yield (kg)	Peak yield (kg)	Days to peak (day)	Persistency	Milk yield (kg)
1	Holstein	22	14.60 ± 1.71	18.78 ± 1.32	52.04 ± 9.74	6.45 ± 0.24	4,170.43 ± 249.77
2	0.9687 ≤ H < 1.00	81	14.99 ± 0.91	18.83 ± 0.71	43.86 ± 5.21	6.69 ± 0.13	4,195.80 ± 133.49
3	0.9375 ≤ H < 0.9687	118	15.30 ± 0.76	19.42 ± 0.59	40.61 ± 4.36	6.71 ± 0.11	4,317.15 ± 111.56
4	0.875 ≤ H < 0.9375	160	16.04 ± 0.66	19.84 ± 0.51	36.51 ± 3.78	6.50 ± 0.09	4,112.28 ± 97.01
5	0.50 ≤ H < 0.875	139	14.16 ± 0.71	18.23 ± 0.55	42.92 ± 4.04	6.66 ± 0.10	4,083.74 ± 103.50

FINAL REMARKS

- Breed group differences for IY, PY, DTP, PST, and MY in first lactation Holstein and Crossbred cows were non-significant
- Environmental conditions in Central Thailand may have prevented Holstein and high percent Holstein cows from reaching their milk production potential