

Abstract W133

Dairy farm milk quantity, quality and revenue within a private organization in Central Thailand

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SUMMARY

Monthly farm records (34,133 records) collected from September 2003 to December 2007 in 1,101 dairy farms supported by a private organization in Central Thailand were used to determine factors affecting milk quantity, quality, and revenue. Seasons were classified as winter, summer, and rainy. Farm locations were Muaklek (ML), Wang Muang (WM), Phattana Nikhom (PN), and Pak Chong (PC). Farm sizes were defined as small, medium, and large. The model for each trait had year-season and farm location-farm size as subclass fixed effects, and individual farm and residual as random effects. **Year-season, and farm location-farm size effects significantly affected all traits ($P < 0.05$), except for protein percentage.** Least squares means for farm location-farm size ($P < 0.0001$) ranged from 162.3 \pm 47.4 kg (small, PN) to 378.3 \pm 14.5 kg (medium, PC) for milk yield per cow, 3.36 \pm 0.04 % (medium, PC) to 3.60 \pm 0.10 % (large, PN) for fat percentage, 4.54 \pm 0.02 % (medium, PC) to 4.61 \pm 0.01 % (small, PN) for lactose percentage, 8.19 \pm 0.03 % (medium, PC) to 8.33 \pm 0.07 % (large, PN) for solid not fat percentage, 11.64 \pm 0.05 % (medium, PC) to 12.01 \pm 0.14 % (large, PN) for total solid percentage, 536,450 \pm 48,500 cells/ml (small, PN) to 1,062,780 \pm 114,030 cells/ml for somatic cell count and 2,015.3 \pm 549.3 baht (large, PN) to 4,483.7 \pm 168.3 baht (medium, PC) for milk revenue per cow. **Positive trends across year-seasons (YS) existed for fat percentage (0.015 \pm 0.006 %/YS; $P < 0.04$), somatic cell count (11,309 \pm 3,067 cells/ml/YS; $P < 0.004$), and milk revenue per farm (622.51 \pm 249.09 baht/YS; $P < 0.03$), whereas a negative trend existed for milk yield per cow (-6.2 \pm 1.4 kg/YS; $P < 0.001$).**

INTRODUCTION

Survival of dairy farming in Thailand depends on the ability of dairy farmers to increase profitability and efficiency of their dairy operations. Revenues are directly related to amount of milk produced. In addition, milk quality (fat percentage, bacterial contamination, and somatic cell count) is also being considered for determination of the purchasing price of raw milk. Thus, in addition to amount of milk, variation in milk quality also plays an important role in the revenue of dairy farmers. Under the current social conditions and high level of economic competition in Thailand, increasing efficiency and lowering production costs of high quality milk would increase farmer profitability. Determination of important factors affecting milk quantity and quality would help dairy farmers manage their limited resources and opportunities to improve the efficiency of their dairy operations. This information would also help dairy organizations to provide more appropriate and effective support to their members. Thus, **the objective of this research was to determine factors affecting milk quantity, quality, and revenue in dairy farms supported by a private organization in Central Thailand.**

MATERIALS AND METHODS

Data, traits and farms. The dataset was composed of 34,133 farm records for 2 monthly milk production traits, i.e., milk yield per farm (MF; kg) and milk yield per cow (MC; kg), 2 monthly milk revenue traits, i.e., milk revenue per farm (RF; baht) and milk revenue per cow (RC; baht), and 6 monthly milk quality traits, i.e., fat percentage (FP; %), protein percentage (PP; %), lactose percentage (LP; %), solid-not-fat percentage (SP; %), total-solids percentage (TP; %), and somatic cell count (SC; $\times 10^3$ cells/ml). These records were from 1,101 farms supported by a private dairy organization (Midland Dairy Limited Partnership, Saraburi, Thailand) and collected from September 2003 to December 2007. No records were taken from individual animals.

The farm identification number created by the private dairy organization was used for the analyses and also to link all related information. The address of individual farms was used to assign farms to 4 locations: Muaklek (ML), Wang Muang (WM) in Saraburi province, Phattana Nikhom (PN) in Lop Buri province, and Pak Chong (PC) in Nakhon Ratchasima province. The average number of milking cows per farm that was recorded every 4 months was used to classify farms into 3 sizes: small = less than 10 milking cows per day, medium = between 10 and 19 milking cows per day, and large = 20 or more milking cows per day. Seasons were winter (cool and dry; November to February), summer (hot and dry; March to June), and rainy (hot and humid; July to October).

Cattle, feeding, and Management practices. The majority of dairy cattle raised at the farms were over 75% Holstein. Farms primarily used artificial insemination (AI) to breed cows. Most farms used Holstein bulls. Farmers used their own experience, sire information (EBV and daughters' production), and suggestions from the government and private organization advisors to choose sires. The private organization provided veterinary services to farms including AI and healthcare for animals.

Farm feeding and nutritional management varied among seasons. Grasses that farmers fed to dairy cattle were *Brachiaria mutica* (para grass), *Brachiaria ruziziensis* (ruzi grass), *Pennisetum purpureum* (napier grass), and *Paricutum maximum* (guerni grass). However, during the dry seasons (cold and hot) grasses were usually insufficient because of lack of irrigation. Thus, rice straw, hay, and silage were used as supplements. All farmers milked their dairy cattle twice a day, once in the morning and once in the afternoon. Almost all dairy farms used machine rather than hand milking. After each milking, either the farmer or a private carrier took the raw milk to the private milk collection center.



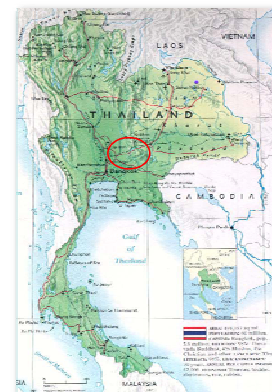
Statistical Analysis. Single-trait mixed models were used to analyze MF, MC, RF, RC, FP, PP, LP, SP, TP, and SC. Computations were carried out using the mixed procedure of the SAS software package. The mixed model used for all traits contained the subclasses of year-season and farm location-farm size as fixed effects. Random effects were farm and residual. Random farm effects were assumed to have mean zero, a common variance σ^2 and uncorrelated. Similarly, random residual effects were assumed to have mean zero, common variance σ^2 and uncorrelated. Variances for random effects were estimated using restricted maximum likelihood using option REML in the mixed procedure of SAS. Year-season and farm location-farm size least squares means (LSM) were estimated for all traits, and then compared using t-tests.

RESULTS AND DISCUSSION

Dairy farms in this study produced an average of 3,232 \pm 2,553.25 kg for MF and 366.90 \pm 163.39 kg for MC. Farms received 37,521.88 \pm 29,849.50 baht for RF and 4,256.12 \pm 1,885.08 baht for RC. Raw milk produced by these farms had a mean of 3.40 \pm 0.46% for FP, 3.01 \pm 0.22% for PP, 4.57 \pm 0.28% for LP, 8.25 \pm 0.36% for SP, 11.74 \pm 0.67% for TP, and 656.52 \pm 678.73 $\times 10^3$ cells/ml for SC.

Year-season subclass effects

Year-season LSM for MF tended to increase from 2003 to 2007 (4.57 \pm 17.03 kg/year-season; $P > 0.05$). In contrast, year-season LSM for MC tended to decrease over this same period (-6.23 \pm 1.42 kg/year-season; $P < 0.001$). The direction of the RF (622.51 \pm 249.09 baht/year-season; $P < 0.03$) and RC (-14.96 \pm 23.19 baht/year-season; $P > 0.05$) trends were the same as those for MF and MC. **The decreasing trend in MC may have been a consequence of the deterioration of the economic situation of dairy farmers during that period.** Higher costs may have forced farmers to decrease quantity and quality of feed supplied to cows, and perhaps to lower the level of management and health care. Lower levels of nutrition, management, and health care may, in turn, have caused stress on dairy cows resulting in lower MC.

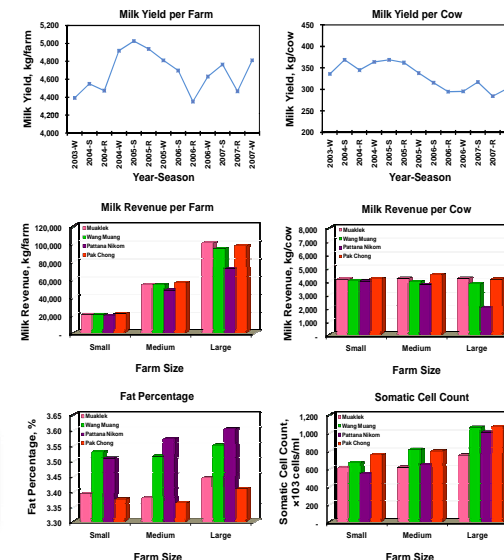


Year-season LSM trends for milk quality traits were low but favorable (FP: 0.015 \pm 0.006%/year-season, $P < 0.04$; PP: 0.003 \pm 0.006%/year-season, $P > 0.05$; LP: 0.024 \pm 0.013%/year-season, $P > 0.05$; SP: 0.021 \pm 0.016%/year-season, $P > 0.05$; TP: 0.033 \pm 0.021%/year-season; $P > 0.05$), except for SC (11,311 \pm 3,073 cells/ml/year-season; $P < 0.004$). Year-season LSM for SC were all above the recommended maximum of 500,000 cells/ml. **Thus, improving management and health care of dairy cows to reduce and maintain SC below the recommended maximum should be a priority for farmers in this private organization.** This will likely result not only in lower SC, but it may also increase milk production.

Farm location-farm size subclass effects

Farm location-farm size subclass was important for all traits ($P < 0.05$). The low LSM values for MF and MC in large farms in Phattana Nikhom were likely due to low quality and quantity of feed provided to dairy cows. The RF and RC patterns across farm location-farm size subclasses were related to MF and MC. Low milk revenues (RF and RC) were due to low milk production (MF and MC) rather than low milk quality (FP, PP, LP, SP, TP and SC). Thus, factors that affected milk production (e.g., feed and management) had a direct impact on milk revenues. As with MF and MC, low LSM values for RF and RC in large farms in Phattana Nikhom were likely due to low quality and quantity of feed given to cows. **Thus, feeding and management strategies, especially during the dry season, must be improved to increase milk production and revenues in this region.**

All farm sizes in Muaklek had LSM for FP similar to those in Pak Chong, and both of them were lower than FP values of farms in Phattana Nikhom and Wang Muang. Variability of FP across farm location-farm size subclasses could be associated with weather patterns, availability of roughage, agricultural activities, irrigation of pastures, and the ability of farmers to manage and utilize local feed resources.



Large farms in all locations tended to have higher SC than the smaller size farms. This may be related to lack of training of employees in large farms. Owners of small and medium farms may be more directly involved in their dairies, thus providing a higher quality of management than personnel in large farms.

Individual farm effect

Variation associated with differences among individual farms explained from 25% (FP) to 52% (MF and RF) of the total variation for these traits. Thus, to improve revenues per farm and per cow, increasing the level of training, dairying ability, and commercial opportunities for farmers should be considered together with improvements in feeding, management, health care, and genetics of dairy cattle.

FINAL REMARKS

- Monthly milk yield and revenue per cow was similar across farm location-farm size subclasses, except for Phattana Nikhom.
- Monthly milk yield per cow decreased from 2003 to 2007 likely due to insufficient feeding levels determined by lower farm revenues.
- Monthly milk revenue per farm increased from 2003 to 2007 likely due to an increase in milk yield per farm due to higher number of cows milked per day.
- Monthly milk quality traits had small, but favorable increases from 2003 to 2007.
- Improving management and health care of dairy cows to reduce and maintain SC below the recommended maximum should be a priority for farmers in this private organization.