

# A survey of decision making practices, educational experiences, and economic performance of two dairy farm populations in Central Thailand

J. A. Rhone · S. Koonawootrittriron · M. A. Elzo

Accepted: 11 December 2007 / Published online: 19 January 2008  
© Springer Science + Business Media B.V. 2007

**Abstract** A survey was performed to characterize the dairy production, educational experiences, decision making practices, and income and expenses of dairy farms and to determine any differences of these practices among two dairy farm populations. Farm groups were identified as farms from the Muaklek dairy cooperative (Muaklek farms) and farms from other dairy cooperatives (Non-Muaklek farms). In April, 2006 questionnaires were distributed to 500 dairy farms located in Lopburi, Nakhon Ratchisima, and Saraburi provinces. A total of 85 farms completed and returned questionnaires. Means and frequencies were calculated for questions across categories and Chi-square tests were performed to determine differences among Muaklek and Non-Muaklek farms. Results showed that most farms from both groups had a primary or high school educational level, used a combination confinement and pasture production system, gave a mineral supplement, raised their own replacement females, milked approximately 16 cows/day, used crossbred Holstein cows (75% Holstein or more), and mated purebred Holstein sires to their cows. More Non-Muaklek farms ( $P < 0.05$ ; 80%) used

a combination of genetic and phenotypic information when selecting sires than Muaklek farms (54%). Monthly profit per lactating cow, were 1,641 and 1,029 baht for Muaklek and Non-Muaklek farms, respectively. Overall, information from the study should be useful for dairy cooperatives and other dairy organizations when training farmers in the future and furthering dairy production research in Thailand.

**Keywords** Decision making · Education · Economic · Dairy farms · Thailand

## Abbreviations

EBV estimated breeding value

## Introduction

Dairy data set analysis at the farm level is often available through dairy cooperatives, private firms, and other government organizations in Thailand. However in many instances these data only contain records of production traits and may be represented as a farm unit with few or no records on individual animals. As a result, detailed farm management, decision making and economic practices are not fully understood at the farm level in many developing dairy organizations. One commonly used method of obtaining this information is through the use of a survey, by

---

J. A. Rhone (✉) · M. A. Elzo  
Department of Animal Sciences, University of Florida,  
Gainesville, FL 32611, USA  
e-mail: jrhone\_1@msn.com

S. Koonawootrittriron  
Department of Animal Science, Kasetsart University,  
Bangkok 10900, Thailand

administration of a questionnaire, typically done through a personal visit, interview or by mail through the postal service. Since dairy farming technology, methods, and some other decision making and management practices may change over long periods of time, using questionnaires to obtain information from farmers is a good method of staying updated on what is taking place at the farm level. For example, in a previously performed survey in Thailand, Leeuw et al. (1998) reported that most dairy farms were raising high percentage Holstein cattle, with average herd sizes ranging from 20 to 29 animals, and were producing 2,000 kg/milk/cow/yr. Additionally, these farms were feeding 5–6 kg/d of concentrate to lactating cows and allocating 70% of operating costs towards the purchase of feed (Leeuw et al. 1998). In a more recent survey, Garcia et al. (2005) reported that most dairy farms in the Chiang Mai area of Thailand were raising cattle of 75–80% Holstein Friesian and yielding 3,152 to 3,385 kg/milk/cow/yr. Additionally, most of these farms raised their own replacement females, and typically had a second source of off-farm income other than dairy farming (Garcia et al. 2005).

Despite surveys that have been performed throughout Thailand, few if any have focused on obtaining and reporting information from many different areas such as educational experiences, management and decision making practices, and economics of farms. Since farm analysis involve people as well as animals, it is important to look at the cognitive process of farmers and their educational experiences, in addition to animal production information in order to grasp an entire picture of how farmers make decisions and how these decisions affect the performance of their animals.

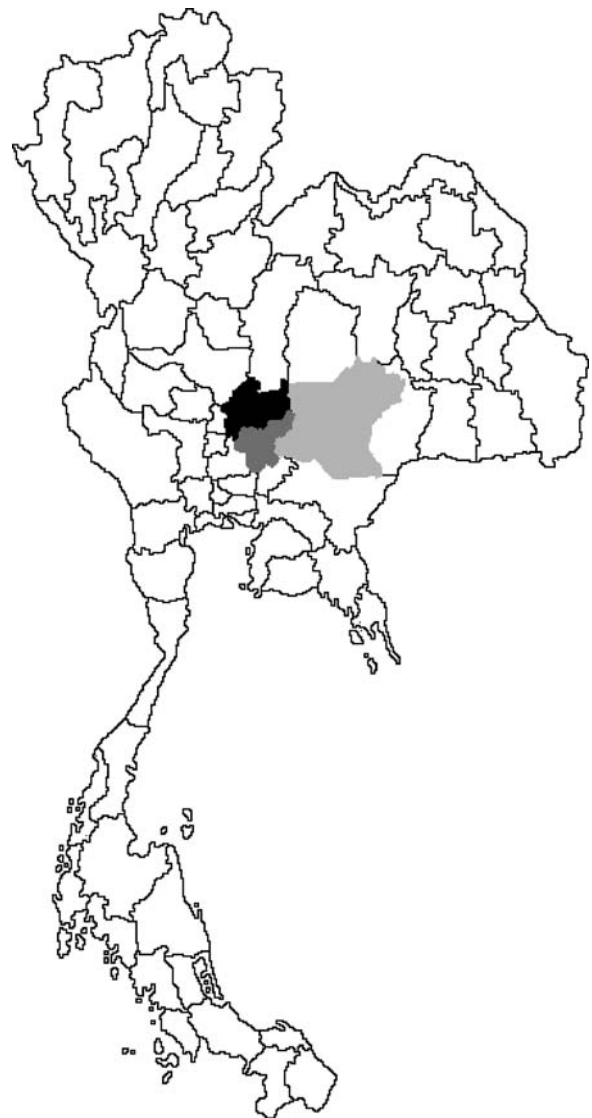
The objectives of this study were to 1) characterize the dairy production, educational experiences, decision making practices, and income and expenses of dairy farms and to 2) determine if there are any differences of these practices between Muaklek and Non-Muaklek farms located in central Thailand.

## Material and methods

### Farms

Thailand is located in the south eastern part of Asia, between 5° 35' to 20° 30' North latitude and 97° 20'

to 105° 40' East longitude (Fig. 1). A total of 85 dairy farms from the central region of Thailand were included in this study. Farms were located in the provinces of Saraburi ( $n=63$ ), Nakhon Ratchisima ( $n=10$ ), and Lopburi ( $n=12$ ). Within these provinces farms were in the districts of Muaklek, Wang Muang, Pak Chong, and Pattana Nikhom. All farms were members of dairy cooperatives and were classified into two groups, farms belonging to the Muaklek dairy cooperative (Muaklek farms) and farms belong to other dairy cooperatives (Non-Muaklek farms).



**Fig. 1** Provincial map of Thailand with location of farms in Lopburi (black), Saraburi (dark grey), and Nakhon Ratchisima (light grey)

## Questionnaire data and methodology

A questionnaire covering the areas of dairy production, reproduction and selection of mates, feeding and nutrition of animals, educational experiences, and income and expenses of farms was written by faculty at Kasetsart University, Bangkok and the University of Florida, Gainesville in February - March of 2006. The questionnaire contained questions from the four categories of 1) dairy production, 2) educational experience (formal and informal education, and dairy farming experience), 3) decision making practices and 4) income and expenses. The dairy production category included sub- categories of number of cattle, dairy production, reproduction and selection of mates, feeding and nutrition, and animal health care of farms. The questionnaire contained four types of questions of 1) multiple choice, 2) fill in the blank, 3) choose all that apply, and 4) Likert scale (Likert 1932). Only multiple choice, fill in the blank, and choose all apply questions were used in this study.

Questionnaires were originally to be mailed out to all Muaklek dairy cooperative farms (~1,000 farms). Following a pilot questionnaire performed on 40 farmers and a review from other dairy experts in Thailand, it was determined that approximately half of Muaklek dairy cooperative farms (~500 farms) may be unable to understand and complete the questionnaire. Additionally due to the uncertainty of farmer addresses, the questionnaire was to be handed out to farmers at dairy production seminars. In April of 2006, the questionnaires were distributed to 250 Muaklek dairy cooperative farmers attending two dairy production seminars given by Kasetsart University faculty and administered by the Muaklek dairy cooperative. Because only 250 Muaklek dairy farmers attended the two seminars, the additional 250 questionnaires were distributed to farms belonging to other dairy cooperatives by the Dairy Farming Promotion Organization. A cover letter and postage paid self addressed return envelope were included with each questionnaire. Farms mailed questionnaires to Kasetsart University upon completion. A total of 85 farms completed and returned questionnaires (17% response rate). Questions that were filled out improperly were followed up by phone calls to farmers. Data from the questionnaires were then recorded and edited in an Excel spreadsheet.

## Data analysis

The Proc Means procedure of SAS (SAS 2004) was used to calculate means, standard deviations, and number of farms for dairy production and income and expenses of farms. Descriptive statistics for income and expenses of farms included average monthly expenses, milk revenue, and profit, on a per lactating cow basis. Expenses and revenues per lactating cow were calculated by dividing the average monthly expenses and milk revenue of farms by their total number of lactating cows. Average monthly expenses included the categories of feed, semen, health and veterinary, milk transportation, and equipment. Profit per lactating cow was calculated by subtracting average total monthly expenses per lactating cow from the farm milk revenue per lactating cow.

The Frequency procedure of SAS (SAS 2004) was used to calculate frequencies of educational experience and decision making practices of farms. Frequencies for educational experience included level of formal education and training experiences. Descriptive statistics for decision making practice included breed of animal and type of sires used, method of selecting cows and raising replacement heifers, milking method, production system used, mineral supplementation, type of information used to select sires and dams, and organization of influence. Breed of animal was defined on a farm herd basis. Farms with herds containing two-thirds or greater total dairy animals within a breed group were assigned to that breed group (Table 3).

For each frequency analysis, a Chi-square test was performed to determine differences of proportions for multiple choices and choose all that apply questions between farm groups (Muaklek and Non-Muaklek). Significant levels for Chi-square tests were at a  $P=0.05$  level.

## Results

### Dairy production and educational experience

Number of animals, dairy experience and length of dairy cooperative membership by farm group are in Table 1. The total number of lactating dairy cows in Muaklek farms ( $16.58 \pm 11.75$ ) was similar to that of Non-Muaklek farms ( $16.59 \pm 11.24$ ). Muaklek dairy

**Table 1** Means and standard deviations (SD) for number of animals, dairy farming experience and dairy cooperative membership of Muaklek and Non-Muaklek dairy farms

Item	Muaklek farms			Non-Muaklek farms		
	N	Mean	SD	N	Mean	SD
Number of Animals						
Total animals	58	39.43	24.68	27	41.29	23.27
Heifers	58	10.41	3.45	27	8.93	4.50
Dry cows	58	4.46	2.90	27	4.22	2.44
1st lactation cows	58	4.78	5.89	27	3.70	3.26
2nd and later lactation cows	58	11.81	8.39	27	12.88	9.45
Total lactating cows	58	16.58	11.75	27	16.59	11.24
Dairy experience (yrs)	56	14.23	10.81	27	10.57	5.89
Cooperative membership (yrs)	56	10.29	7.30	27	7.98	5.39

farms had more dairy farming experience (14.23 vs. 10.57 yrs) and longer dairy cooperative membership (10.29 vs. 7.98 yrs) than Non-Muaklek farms. The majority of farmers had a primary or high school level of education in both farm groups and received most of their information on dairy production through training from a dairy cooperative (Table 2). Results for breed of animals and type of sire used, methods of selecting cows and replacement heifers of Muaklek and Non-Muaklek farms are in Table 3.

Farms of both groups primarily used a combination confinement and pasture production system (Muaklek = 71% and Non-Muaklek = 77%) and milked their cows using a single unit milking machine (Table 4). While there was no difference in which climatic season (summer, rainy, winter) cows were in their best body condition ( $P=0.76$ ), climatic season where cows were in their worst body condition approached a significant difference ( $P=0.06$ ) between Muaklek and Non-Muaklek farms (Table 4).

**Table 2** Educational levels, sources of dairy information, and record keeping practices of Muaklek and Non-Muaklek farms

Item	Muaklek farms		Non-Muaklek farms		Chi-square	
	N	Freq (%)	N	Freq (%)	Value	P value
Level of formal education						
Primary school	20	43	8	33	2.65	0.26
High school	17	36	7	29		
University degree	9	19	9	37		
Sources of information for dairy production/technology						
Dairy magazine, newsletter, and book	4	8	2	8	0.34	0.95
Seminar	8	16	5	21		
Training from business firm	3	6	1	4		
Training from dairy cooperative	33	68	15	65		
Record amount of milk sent to cooperative						
Do not record	15	28	5	21	0.76	0.68
Sometimes record	16	30	6	26		
Record every time	22	41	12	52		
Record milk production for individual cows						
No	29	55	11	47	0.40	0.52
Yes	23	44	12	52		
If record, how often recorded						
Every milking time	6	24	1	7	2.17	0.33
Once a week	11	44	9	64		
Once a month	8	32	4	28		

**Table 3** Breed of animals and type of sires used, methods of selecting cows and replacement heifers of Muaklek and Non-Muaklek farms

Item	Muaklek farms		Non-Muaklek farms		Chi-square	
	N	Freq (%)	N	Freq (%)	Value	P value
Breed used by farm					3.50	0.32
Purebred Holstein	9	20	7	35		
Crossbred Holstein (> 75% Holstein)	22	48	9	45		
Crossbred Holstein (50–75% Holstein)	5	11	3	15		
Mixed breeds and Holstein	9	20	1	5		
Type of sire mated to cows					3.35	0.34
Purebred Holstein	22	53	12	60		
Crossbred Holstein	7	17	6	30		
Other dairy breeds	7	17	1	5		
Crossbred Holstein and beef breeds	5	12	1	5		
Selection of cows					2.72	0.09
Own decision	38	86	16	69		
Own decision and advice from Coop or vet	6	13	7	30		
Replacement females					0.90	0.63
Raise on own farm	44	80	21	87		
Buy	2	3	1	4		
Raise own and buy	9	16	2	8		

Decision making practices and income and expenses

Record keeping practices were similar for both farm groups ( $P \geq 0.33$ ) with 52 % and 41% of Non-

Muaklek and Muaklek farms recording the amount of milk sent to their respective dairy cooperative following every milking time. In the Non-Muaklek farm group, 52% of farms recorded milk production

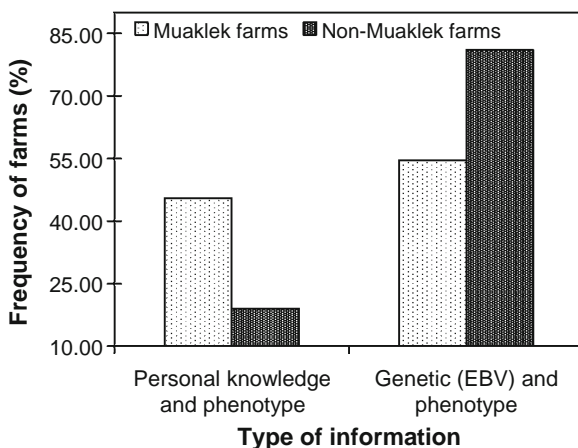
**Table 4** Milking method, type of production system (confinement or pasture), mineral supplementation, and body condition of cows of Muaklek and Non-Muaklek farms

Item	Muaklek farms		Non-Muaklek farms		Chi-square	
	N	Freq (%)	N	Freq (%)	Value	P value
Milking method					2.94	0.22
Single unit milking machine	47	85	24	96		
Multi-unit milking machine	2	3	1	4		
Single Unit milking machine and by hand	6	10	0	0		
Production system					0.26	0.67
Confinement	14	28	5	22		
Confinement and pasture	35	71	17	77		
Mineral supplementation					0.01	0.88
Only salt	34	72	17	73		
Salt and minerals	13	27	6	26		
Season of best body condition of cows					0.08	0.76
Winter (Nov. - Feb.)	19	55	12	60		
Summer (Mar. - Jun.)	0	0	0	0		
Rainy (Jul. - Oct.)	15	44	8	40		
Season of worst body condition of cows					5.5	0.06
Winter (Nov. - Feb.)	3	8	3	15		
Summer (Mar. - Jun.)	22	62	6	30		
Rainy (Jul. - Oct.)	10	28	11	55		

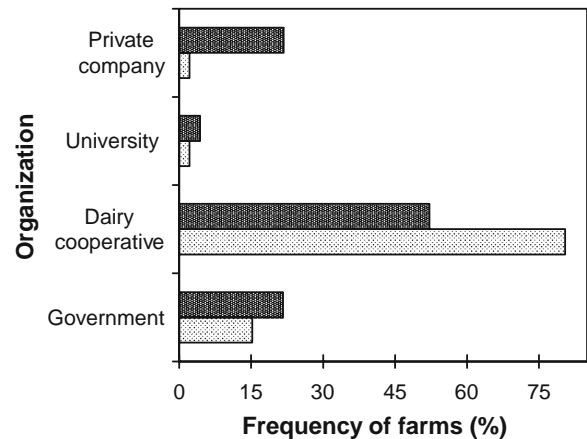
on individual cows, but were not different ( $P=0.52$ ) from the Muaklek farm group, where 44 % of farms collected records on milk production from individual cows (Table 2). Of the farms that collected records on milk production from individual cows, only 24% and 7% of Muaklek and Non-Muaklek farms recorded this information every milking time cows were milked.

Crossbred Holstein, containing at least 75% Holstein blood, was the largest represented breed of both Muaklek (48%) and Non-Muaklek farms (45%). When asked what type of sire farms mated to their cows, 53% of Muaklek and 60% of Non-Muaklek farms said they used Purebred Holstein (Table 3). Decision making on selection of cows approached significance ( $P=0.09$ ), where 13% of Muaklek farms used advice from a Coop or veterinarian in addition with their own decision, compared to 30% of Non-Muaklek farms. Conversely, a greater percentage ( $P<0.05$ ; 80%) of Non-Muaklek farms used both Genetic (EBV) and phenotypes for selecting sires, compared to 54% of Muaklek farms (Fig. 2). For selecting dams, 65% of Muaklek and 66% of Non-Muaklek farms used both genetic (EBV) and phenotypic information and were not different ( $P=0.91$ ) from one another. A higher percentage of Muaklek farms ( $P<0.05$ ; 80%) said their dairy cooperative had the largest influence on their dairy business, compared to 52% of Non-Muaklek farms (Fig. 3).

Average monthly expenses per lactating cow for Muaklek and Non-Muaklek farms are presented in Figs. 4 and 5, respectively. Feed costs were the highest related expense of both farm groups (Muaklek = 83% or 2,397.00 baht and Non-Muaklek = 88% or 2,659.92



**Fig. 2** Type of information used by Muaklek and Non-Muaklek farms to select sires



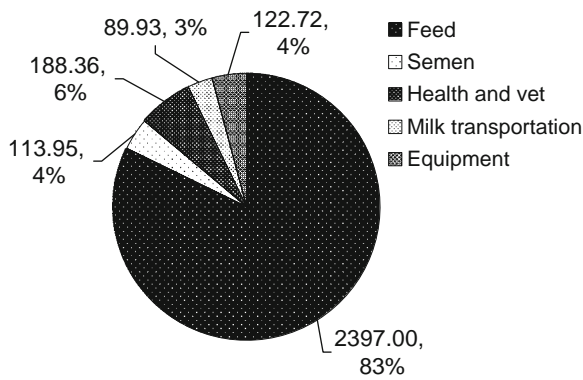
**Fig. 3** Type of organization with the largest influence on Muaklek (dotted) and Non-Muaklek (solid) farms

baht). Health and veterinarian costs were higher for Muaklek farms (188.36 baht) than Non-Muaklek farms (119.81 baht) and semen cost represented one of the smallest categories of expenses. Overall profit per lactating cow was higher in Muaklek farms (1,641 vs. 1,029 baht) compared to Non-Muaklek farms (Fig. 6).

## Discussion

### Dairy production and educational experience

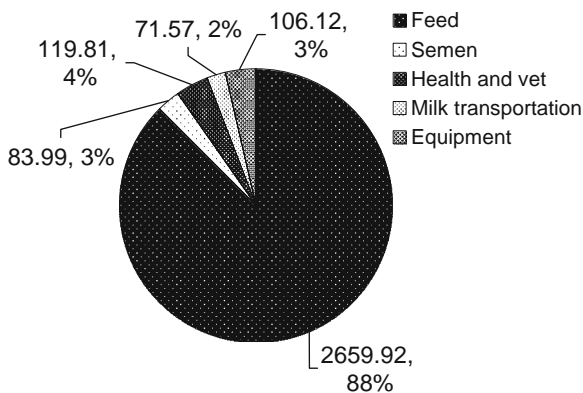
The number of total animals and lactating cows from all farms in this study were higher than Chantalakhana and Skunmun (2001) study that reported average number of lactating cows from farms in Saraburi and Lopburi provinces were 9.2 and 8.5 head, respectively. Additionally, cattle numbers were also higher than those reported in Rhone et al. (2007), which could suggest that, on the average, farms in this study may have been slightly larger than the average sized dairy farm in Thailand. Although there were no differences ( $P=0.26$ ) between the two farm groups for level of education, the majority of farms of both groups had a primary or high school education, which is important to understand when working with or training farmers. For example, in a previous study performed with fish farmers in Thailand, materials that used pictures to describe management practices were more readily adopted and used by farmers, than those that contained fewer pictures and were more verbose in nature (Turongruang and Demaine 2002).



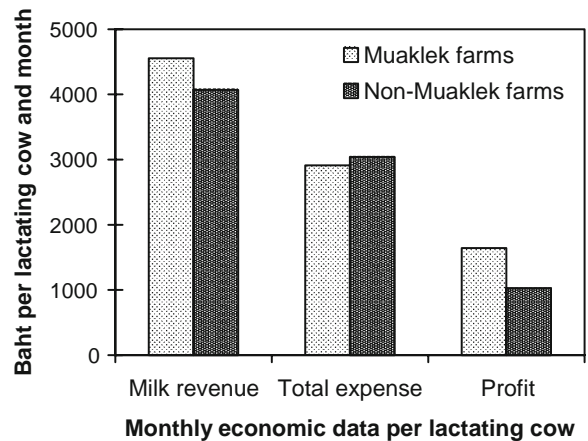
**Fig. 4** Average monthly feed, semen, health and veterinary (vet), milk transportation, and equipment expenses per lactating cow of Muaklek dairy farm in Thai baht and percent of total expenses

Educational level of farmers coupled with that fact that most farms identified dairy cooperatives as their main method of obtaining information on dairy production is critical for all organizations in the Thai dairy industry to understand. Thus, results from this study show that when reaching farms through training and extension activities, it should probably be through or in cooperation with their dairy cooperative.

The production system used by farms (confinement vs. combination of pasture and confinement) is likely dependant on the size of farm, availability of forages coupled with what type of labor is available or used by farms. Further information is needed to determine to what extent farmers are using pasture for the diet of their animals and how this is affecting animal performance. Although most farms gave a mineral supplement, it is unclear if the supplement contained



**Fig. 5** Average monthly feed, semen, health and veterinary (vet), milk transportation, and equipment expenses per lactating cow of Non-Muaklek dairy farm in Thai baht and percent of total expenses



**Fig. 6** Average milk revenue, total expense and profit per lactating cow of Muaklek and Non-Muaklek dairy farms

trace minerals, and if so, which ones and in what quantity. Proper mineral supplementation is important as it has shown to not only increase milk, fat, and protein levels, but also reproductive rates, and lower post partum interval of dairy cattle (Nocek et al. 2006). The body condition of cows from Non-Muaklek farms being the worst in the rainy season compared to Muaklek farms in the summer season may be due to difference in geographical climate and/or from lack of certain feedstuff during certain parts of the year of these two regions. Further research is needed in order to determine the effect of mineral supplementation and body condition of cows on animal performance in farms.

Decision making practices and income and expenses

Although approximately 50% of farms from both groups recorded milk production on individual cows, only 17–24% of these farms recorded it at every milking time (Table 2). Previous studies have shown farms that keep records on individual animal performance have higher milk yields than those that do not (Losinger and Heinrichs 1996). Thus, emphasis needs to be placed on encouraging and training farmers to record individual animal performance in order to track progress and improve production and efficiency of their animals. Breed of dairy cattle of both farm groups is consistent with government data that reports the majority of cattle in Thailand to be 75% Holstein or greater (MOAC 2005). However, there is little information in the literature about the decision making process of dairy farms when selecting sires

and cows for breeding. The results of this study showed a greater percentage ( $P < 0.05$ ) of Non-Muaklek farms used a combination of EBV and phenotypes when selecting sires, which could be due to these farmers having a higher level of education and the fact that they use advice from their cooperative or veterinarian as compared to Muaklek farms who placed less emphasis on genetic information (EBV) and used less advice from a dairy cooperative and/or a veterinarian (Table 3). Nonetheless, if farms are going to make improvements on milk production and other economically important traits, proper use of genetic information (EBV) must be encouraged through extension and training from dairy cooperatives, universities, and government organizations.

Feed expenses of farms from both groups were much higher than those reported by Suzuki (1998), which were approximately 50% of total farm expenses, but similar to values from Garcia et al. (2005) that were around 70%. Although profits from all farms were between 1,000 and 1,500 baht/lactating cow and similar to the study by Suzuki (1998), other expenses such as loan payments and hired labor were not included in the expenses of farms. Moreover, income from selling bull calves and cull cows were also not included in farm revenues, and as a result, the overall profit per lactating cow may not be entirely accurate. It is important to remember that because farmers in this study were not randomly selected, rather they were those that attended a dairy seminar, they may be more progressive in nature, and thus they may not entirely represent the entire dairy population in Thailand. In addition, because only 17% of farms completed and returned the questionnaires, possibly the farms in this study were biased towards having greater educational experience and herd management than those that did not reply. Despite this, results from this study provide important background information and decision making practices of farms that are useful in determining areas that need to be addressed by the respective dairy cooperatives. Lastly, knowledge of the educational level and experiences of farmers should help develop future teaching methods and materials for increasing the level of record keeping and their use to improve reproduction, production, genetic, health, and economic practices of Thai dairy farms.

**Acknowledgements** The authors highly appreciate support from the Muaklek Dairy Cooperative Limited for their cooperation in this study and funding from the Kasetsart University Research and Development Institute (KURDI) under project code number K-S (D) 9.50. Other contributors to the study came from faculty and graduate students at Kasetsart University and the Dairy Farming Promotion Organization.

## References

- Chantalakhana, C., and Skunmun P., 2001. Dairy development in Thailand and a case study on environmental impacts of peri-urban dairy colonies, Part I. Smallholder dairy development. Ch. 12 in Smallholder dairy production and marketing - opportunities and constraints. Proceedings of a South -South workshop held at national dairy development board, Anand, India, 13–16 March 2001
- Garcia, O., Hemme, T., Rojanasthien, S., and Younggad J., 2005. The economics of milk production in Chiang Mai, Thailand, with particular emphasis on small-scale producers, working paper, pro-poor livestock initiative, (Food and Agriculture Organization of the United Nations, Rome, Italy)
- Leeuw, P.N. de, Omere, A., Staal, S. and Thorpe W., 1998. Dairy production systems in the tropics: A review, (International Livestock Research Institute, Nairobi, Kenya)
- Likert, R, 1932. A Technique for the Measurement of Attitudes, *Archives of Psychology* 140: pp. 1–55
- Losinger, W. C., and Heinrichs A.J., 1996. Dairy operation management practices and herd milk production, *Journal of Dairy Science* 79:506–514
- Ministry of Agriculture and Cooperatives (MOAC), 2005. Thailand's Dairy Industry Modernization, <http://www.modernizethailand.com/conference/260149/data/agriculture/dairy.pdf>
- Nocek, J.E., Socha, M.T., and Tomlinson D.J., 2006. The effect of trace mineral fortification level and source on performance of dairy cattle, *Journal of Dairy Science* 89:2679–2693
- Rhone, J.A., S. Koonawootrittriron, and Elzo M.A., 2007. Factors affecting milk yield, milk fat, bacterial score, and bulk tank somatic cell count of dairy farms in the Central region of Thailand, *Tropical Animal Health and Production*, Online First (DOI 10.1007/s11250-007-9074-5)
- SAS, 2004. SAS 9.13 Help and documentation, (SAS Institute Inc., Cary, North Carolina)
- Suzuki, A., 1998. The present situation of dairy farming in Thailand - a case study from the dairy farming development project in the central region of Thailand, Japan International Cooperation Agency, Technology and Development, 11, 66–74
- Turongruang, D. and Demaine H., 2002. Participatory Development of Aquaculture Extension Materials and their Effectiveness in Transfer of Technology: the Case of the AIT Aqua Outreach Programme, Northeast Thailand. Ch. 22 in *Rural Aquaculture*, New York, CABI Publishing