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Characteristics, socioeconomic benefits and household livelihoods of beef buffalo and beef cattle farming in Northeast Thailand

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Abstract

Since the Thai economy experiences rapid growth, agricultural systems, i.e. crop-livestock systems, are changing rapidly. On account of these changes, buffalo and cattle production has to be re-examined in terms of performance characteristics and roles of livestock for farm households in order to initiate suitable development programmes. Therefore, this study aimed to investigate the present characteristics of beef buffalo and beef cattle farms in Northeast Thailand. Using a semi-structured questionnaire, 121 randomly selected beef buffalo and beef cattle farms were interviewed in Nakhon Ratchasima province between October 2007 and May 2008. Both buffaloes and cattle were mostly integrated in mixed crop-livestock systems with medium to large farm sizes (7.9 ha), whereof less than half of the area was used for livestock. Family members were mainly responsible for the different activities of livestock farming and salaried labourers were only found on large-scale farms. The dominant roles of livestock were income generation to build up wealth or savings, the coverage of expected and unexpected expenses and earning of regular and additional income. Another important issue was the improvement of the social status, which increased with herd size. In order to improve farmers' livelihoods and develop sustainable farming systems in Northeast Thailand the changing economic circumstances of cattle and especially buffalo production should receive more attention of researchers, governmental institutions and stakeholders.

Keywords: agricultural activities, farm labour, household characteristics, Nakhon Ratchasima province, planned and unplanned expenses, roles of livestock, semi-structured questionnaire

1 Introduction

The agricultural sectors in Thailand have been shifting towards high-valued products during the last years. The production of chicken, pigs and ducks rapidly expanded. While the number of cattle gradually increased, the importance of buffaloes – mostly swamp type – continuously declined (FAO, 2002). Most of the buffaloes and cattle are kept by smallholder farmers in mixed crop-livestock systems. Such integrated farming systems are primarily practiced to generate adequate income, provide food security for family members as well as manage and conserve natural resources for a sustainable agricultural production (Devendra & Thomas, 2002c; Na-Chiangmai, 2002; Devendra, 2000). Most of the livestock farms are small-scale in terms of farmed area and herd size with an average number of 4.8 buffaloes and 6.8 beef cattle per household in 2008, respectively. Northeast Thailand hosts 74 % of the buffaloes and 54 % of the beef cattle of the country (DLD, 2008). These beef animals are mainly raised under extensive grazing and are fed with crop residues (Saisoong, 1989).

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Generally, farmers keep the animals in temporary housing in the backyard. Different studies demonstrated that cash inputs such as feed, drugs and housing systems are very low and tethering was predominantly done by women, children or older household members (Na-Chiangmai, 2002; Chantalakhana, 2001).

Buffaloes and cattle were commonly used as draught animals in crop fields, but nowadays animals are rather used for meat production and to some extent as part of their tradition than for draught purposes (Na-Chiangmai, 2002). Livestock manure has been used to maintain soil fertility in rice production, and excess animals were sold when necessary for extra household income and unexpected expenditures, thus the animals fulfilled the purpose of savings. There has been a trend of transition from buffalo to beef cattle farming resulting in a competition for farm resources between these two species (Nanda & Nakaon, 2003). Economic restraints of buffalo farming and especially the promotion of beef cattle enterprises by the Thai government has resulted in a substantial decline of the buffalo population (Khemsawat *et al.*, 2003; Nanda & Nakaon, 2003; Simaraks *et al.*, 2003). One of the projects initiated by the Department of Livestock Development (DLD) to improve the genetic quality of indigenous *Bos indicus* cattle is Thai BREEDPLAN (Intaratham, 2002). Chantalakhana (2001) stated that the buffalo population decreased at a rate of 3.8 % annually since 1984. Given the current changes in livestock production systems, there is a need to clarify the effects of such developments on farmers' livelihoods by inter-disciplinary and community-based participatory approaches (Devendra, 2002). Therefore, this study aimed at investigating present characteristics of beef buffalo and beef cattle farming systems in Northeast Thailand and its socioeconomic benefits for the local farming communities.

2 Materials and methods

2.1 Study area

This research was conducted in the province Nakhon Ratchasima, located in the lower part of Northeast Thailand (15°N; 102°E). The province consists of 32 districts with a total area of 20,494 km^2 (Fig. 1). Annual average daily temperature is 27.4°C with an average humidity of 71 % and an annual average rainfall of 1,019 mm. A cool season (November to February), hot season (March to May) and rainy season (June to October) can be distinguished. The area is traditionally known as a beef buffalo and beef cattle production region due to large areas with unfertile soils and a low water availability that impedes crop production (Simaraks *et al.*, 2003; Nakhon Ratchasima, 2008).

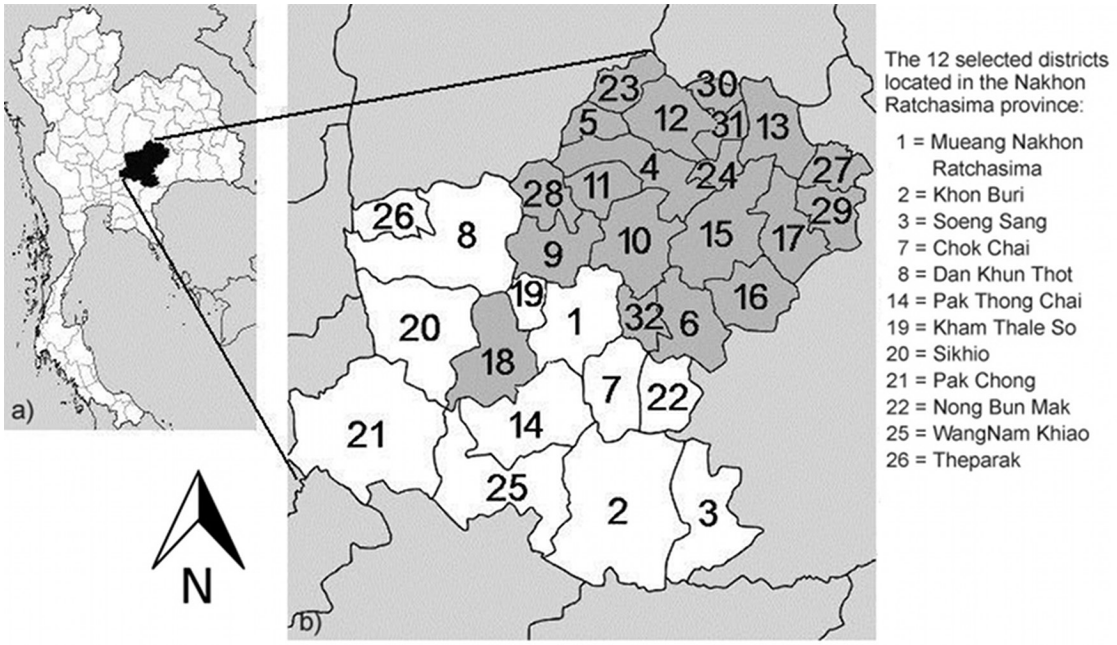

Fig. 1: *Map of the study area in Nakhon Ratchasima province (b), Northeast Thailand (a), showing in white the 12 selected districts (modified after Nakhon Ratchasima, 2008).*

2.2 Farm selection

The farms for the study were chosen according to data of the national census of the livestock sector in 2006 from the Nakhon Ratchasima Provincial Livestock Office, DLD. These data were used to characterize the production systems of beef buffalo and beef cattle farms in the study area. In 12 out of the 32 districts of Nakhon Ratchasima province farms with a traditional production system were selected. The 12 selected districts were Mueang Nakhon Ratchasima, Khon Buri, Soeng Sang, Chok Chai, Dan Khun Thot, Pak Thong Chai, Kham Thale So, Sikhio, Pak Chong, Nong Bun Mak, Wang Nam Khiao and Thepharak (Fig. 1). The farms were classified based on the number of cows: (1) < 6 as small-scale, (2) 6 to 20 as medium-scale and (3) > 20 as large-scale. Another prerequisite was that livestock had been kept on the farm for at least 5 years preceding the study. Farms were selected randomly by asking residents. In total 121 farms were selected and each of the farm size classes contained 19 to 22 farms.

2.3 Study methods

A single-visit, multiple-subject survey was carried out using face-to-face interviews between October 2007 and May 2008. The recall, observation and measurement method was used to complete a pre-tested, semi-structured questionnaire. Information on farmers' and farms' characteristics, roles of livestock and sources of money were collected. The farmers' characteristics included gender, age, level of education, livestock inheritance, farm experience and household size. Characteristics of farms were land size and use as well as livestock and crop production. The importance of beef buffalo and beef cattle farming was determined by asking for the roles of livestock for farm households and the coverage of unplanned and planned expenses during the last 5 years.

2.4 Data analysis

Descriptive statistical analysis was applied to describe the characteristics of beef buffalo and beef cattle production systems. The analysis of variance (ANOVA) was used to analyze the metric data and to determine differences between beef buffalo and beef cattle farms as well as differences between small-, medium- and large-scale herds, whereas the Fisher's Exact and Chi-square tests were applied for the categorical data. The Pearson correlation analysis was used to describe the relationship between variables. The data were analyzed using the Statistic Package for Social Sciences SPSS-PC (SPSS Inc., 1999).

3 Results

3.1 Farmers' characteristics

The households were mainly headed by men (89.1 %) with an average age of 56.3 years (range 28–80 years) (Table 1). In comparison to cattle farmers buffalo farmers were older ($p < 0.05$). The level of education was mainly primary school. Almost half of the farmers had inherited the animals from their ancestors. The proportion of farmers who inherited the livestock increased with increasing herd size for both cattle and buffalo farmers ($p < 0.05$), whereas the proportion was lower for cattle than for buffalo farmers. Furthermore, large-scale farmers had a longer experience in livestock farming than small-scale and medium-scale farmers ($p < 0.05$). Due to the fact that livestock raising is a traditional activity, a certain level of experience is provided through informal education. Nevertheless, livestock farmers in the present study showed a high farm experience. The family size in the study ranged between 1 and 10 family members and averaged 4.4 persons, whereas the average number of family members working on the farm was 2.8 and ranged from 1 to 6. A difference for both variables was neither found between livestock species nor between farm sizes.

3.2 Farm characteristics

The average farm size determined in this study was 7.9 ha including 6.6 ha own land and 1.3 ha leased land (Table 2). The land holding of the farmers varied strongly, ranging from 0.4 to 181.6 ha for the total land, from 0 to 181.6 ha for the own land and from 0 to 32 ha for the leased land. Farmers allocated on average 3.66 ha (3.10 ha own, 0.56 ha leased) for crop production and 3.15 ha (2.4 ha own, 0.75 ha leased) for livestock production including housing, grazing land and fodder cultivation. The remaining land was used for homestead and non-agricultural activities.

Buffalo farmers with large herds cultivated more land than large-scale cattle farmers, whereas the land size of the buffalo farmers with small- and medium-sized herds were lower than the respective land size of the cattle farmers. The number of animals raised was positively correlated to the total land size (r=0.40, $p < 0.0001$) and the land used for livestock farming (r=0.35, $p < 0.001$). However, the correlations between animal species or between herd sizes and the land sizes were not significant, whereas the area of cropped land was positively correlated to the number of family members (r=0.29, $p = 0.001$).

More than one third of the medium- and large-scale buffalo farmers also kept beef cattle, whereas only 20 % of the large-scale cattle farmers raised buffaloes (Table 2). Pigs were kept by 5 to 10 % of the buffalo and cattle

farmers independent of the herd size, whereas the proportion of farmers raising waterfowls ranged between 5 and 20 %. The majority of farmers raised chicken, but the proportion was significantly higher for small-scale herds than for medium- and large-scale herds ($p < 0.05$).

Various crops were grown by the rural farm households in the studied area for food supply and income generation (Table 2). Rice was cultivated on the majority of the farms. Additionally, farmers cultivated several cash crops including cassava (28.9 %), maize (11.6 %), sugar cane (4.1 %) and vegetables (8.3 %). Vegetables were more frequently grown by small-scale households than by medium- and large-scale households ($p < 0.05$).

Beside the male household head, spouses had responsibilities for livestock activities in most of the households (61.9 %), followed by their children, other relatives, grandchildren and parents (Table 3). Household members were responsible for livestock herding (59.3 % of households), the main activity in this production system. However, large-scale farmers depended less frequently (48.4 % of households) on family members for livestock activities than small- (57.3 %) and medium-scale farmers (77.5 %, $p < 0.05$). On large-scale farms farm labourers were common.

3.3 Roles of livestock

The roles of beef buffaloes and beef cattle for farm households in Northeast Thailand are presented in Table 4. On almost two thirds of the medium- and large-scale buffalo farms the main income was generated by the sale of animals, while livestock represented the main source of income in only one third of the small-scale households ($p < 0.05$). On the beef cattle farms livestock provided the main income on 50 % and 75 % of the medium- and large-scale farms, respectively ($p < 0.05$). For the purpose of generating supplementary income, animals were raised on up to 45 % of the buffalo farms, whereas the corresponding proportion for beef cattle farms was 25 % among large-scale farms and 65 % among small-scale farms. Livestock also played a major role in covering unexpected and expected expenses. Furthermore, animals served as savings and granted social status, whereby the latter aspect was more important for large-scale farmers. Other aspects, such as provision of draught power and manure, inheritance as well as livestock production as a traditional activity, did not play a considerable role.

Table 1: *Characteristics of 121 beef buffalo and beef cattle farmers in 12 selected districts of Nakhon Ratchasima province, Northeast Thailand.*

Variable	*Beef buffalo herds*			*Beef cattle herds*		
	Small (*n*=22)	*Medium* (*n*=20)	*Large* (*n*=19)	*Small* (*n*=20)	*Medium* (*n*=20)	*Large* (*n*=20)
Household head, %						
Male	95.5	90.0	84.2	75.0	90.0	100.0
Female	4.5	10.0	15.8	25.0	10.0	0
Farmers' age, years (SE) *	59.4 (2.3)	59.4 (2.4)	57.5 (2.5)	54.1 (2.4)	53.6 (2.4)	53.5 (2.4)
Farmers' education, %						
Illiterate	9.1	5.0	5.3	5.0	5.0	10.0
Literate, but no school	4.5	0	0	5.0	5.0	0
Primary school	86.4	90.0	89.5	80.0	90.0	80.0
Middle school	0	5.0	0	5.0	0	5.0
High school	0	0	5.3	5.0	0	5.0
Livestock inherited, % †	31.8	50.0	63.2	35.0	20.0	57.9
Farm experience, years (SE) ‡	24.3 (3.1)	19.8 (3.2)	31.1 (3.3)	17.5 (3.2)	20.0 (3.2)	24.3 (3.3)
Family members, *n* (SE) §	3.9 (0.4)	4.0 (0.4)	4.6 (0.4)	4.4 (0.4)	4.7 (0.4)	4.7 (0.4)
Working on farm, *n* (SE) §	2.8 (0.2)	2.7 (0.2)	2.9 (0.3)	2.7 (0.2)	2.6 (0.2)	3.1 (0.2)

* Difference significant between beef buffalo and beef cattle farms at $p \leq 0.05$ (Tukey-test)
† Difference significant between herd sizes at $p \leq 0.05$ (χ^2 test)
‡ Difference significant between herd sizes at $p \leq 0.05$ (Tukey-test)
§ Does not include family members who are absent for more than 2 months per year

Table 2: *Characteristics of 121 beef buffalo and beef cattle farms in 12 selected districts of Nakhon Ratchasima province, Northeast Thailand.*

Variable	*Beef buffalo herds*			*Beef cattle herds*		
	Small (*n*=22)	*Medium* (*n*=20)	*Large* (*n*=19)	*Small* (*n*=20)	*Medium* (*n*=20)	*Large* (*n*=20)
Land size and use, ha (SE)						
Own *	3.1 (3.7)	3.0 (3.9)	21.3 (4.0)	3.7 (3.9)	3.5 (3.9)	6.0 (3.9)
Crop production	2.2 (0.8)	2.2 (0.8)	4.6 (0.9)	3.3 (0.9)	2.8 (0.9)	3.7 (0.9)
Livestock production	0.4 (3.3)	0.3 (3.4)	13.2 (3.5)	0.2 (3.4)	0.4 (3.4)	0.7 (3.4)
Leased	0.6 (0.8)	2.2 (0.9)	0.7 (.8)	0.6 (0.8)	1.9 (0.8)	1.8 (0.8)
Crop production	0.6 (0.2)	0.6 (0.3)	0.4 (0.3)	0.6 (0.3)	0.5 (0.3)	0.6 (0.3)
Livestock production	0.1 (0.7)	1.6 (0.8)	0.3 (0.8)	0.3 (0.8)	1.4 (0.8)	1.1 (0.8)
Livestock production, %						
Buffaloes	–	–	–	0	0	20.0
Beef cattle	0	35.0	47.4	–	–	–
Pigs	9.1	5.0	10.5	5.0	5.0	5.0
Goats	0	5.0	0	0	0	0
Waterfowls	4.5	10.0	10.5	5.0	20.0	15.0
Chicken *	86.4	60.0	68.4	95.0	80.0	75.0
Crop production, %						
Rice	73.3	70.0	73.7	70.0	70.0	80.0
Cassava	22.7	30.0	26.3	35.0	25.0	35.0
Corn	13.6	15.0	0	25.0	10.0	5.0
Sugar cane	9.1	0	0	5.0	10.0	0
Vegetables *	13.6	5.0	5.3	20.0	5.0	0
Forest	0	5.0	5.3	0	0	0
Tree fruits	0	0	10.5	5.0	10.0	5.0

* Significant difference between herd sizes at $p \leq 0.05$ (Tukey-test)

Table 3: *Farm labour of 121 beef buffalo and beef cattle farms in 12 selected districts of Nakhon Ratchasima province, Northeast Thailand. Numbers express the proportion of farms within each column using the distinct type of farm labour.*

Variable	*Beef buffalo herds*			*Beef cattle herds*		
	Small (*n*=22)	*Medium* (*n*=20)	*Large* (*n*=19)	*Small* (*n*=20)	*Medium* (*n*=20)	*Large* (*n*=20)
Family members						
Spouse (831) *	59.1	60.0	63.2	80.0	80.0	70.0
Children (31)	22.7	15.0	26.3	20.0	35.0	35.0
Other relatives (11)	4.5	15.0	10.5	0	20.0	5.0
Grandchild (5)	9.1	0	5.3	10.0	0	0
Parents (4)	0	10.0	0	10.0	0	0
Family labour						
Temporary (73) †	68.2	50.0	52.6	70.0	80.0	40.0
Permanent (30) †	4.5	25.0	31.6	15.0	25.0	50.0
Specific season (7)	0	5.0	10.5	5.0	0	15.0
Hired labour						
Temporary (43)	27.3	70.0	21.1	15.0	45.0	35.0
Permanent (12) †	0	0	36.8	0	0	25.0
Seasonal (3)	0	5.0	5.3	0	0	5.0

* Number of responses
† Significant difference between herd sizes with χ^2 test ($p < 0.05$)

Table 4: *Roles of livestock in 121 beef buffalo and beef cattle farms in 12 selected districts of Nakhon Ratchasima province, Northeast Thailand. Numbers express the proportion of farms within each column using the distinct type of farm labour.*

Variable	*Beef buffalo herds*			*Beef cattle herds*		
	Small (*n*=22)	*Medium* (*n*=20)	*Large* (*n*=19)	*Small* (*n*=20)	*Medium* (*n*=20)	*Large* (*n*=20)
Main income (59 *) †	31.8	65.0	57.9	5.0	50.0	75.0
Supplementary income (50)	31.8	45.0	36.8	65.0	45.0	25.0
Unexpected expenses (101)	95.5	85.0	63.2	90.0	80.0	85.0
Expected expenses (104) †	81.8	80.0	100.0	70.0	90.0	95.0
Savings (115) †,‡	77.3	95.0	100.0	100.0	100.0	100.0
Social status (98)	77.3	80.0	94.7	65.0	90.0	80.0

* Number of responses
† Significant difference between herd sizes with χ^2 test (p <0.05)
‡ Significant difference between beef buffalo and beef cattle farms with Fisher's Exact test ($p \leq 0.05$)

Independent of the animal species and the herd size, selling livestock was the major source for covering planned as well as unplanned expenses. Unplanned expenses during the last 5 years arose mainly due to health costs, emergency debts, unplanned ceremonies, agricultural inputs and crop failures (Fig. 2). For 60 % of the respondents these expenses were covered by selling livestock and about 20 % of the farmers stated to sell other agricultural products. One third of the respondents paid unplanned ceremonies with their savings.

Planned expenses during the last 5 years included costs for assets, dwelling, ceremonies, education, debts, replacement of stock and land (Fig. 3). More than half of the respondents covered the respective expenses by sales of livestock. Another major source, especially for paying planned debts and education costs, was the sale of other agricultural products. Costs for replacement stock were commonly covered by selling livestock (78 % of responses). Savings (12 % of responses) and off-farm income (8 % of responses) were other sources for planned household expenses.

Livestock manure produced on the 121 livestock farms studied was mainly used for fertilizing cash crops (34 % of responses), followed by the use as a gift (32 % of responses) and sale (27 % of responses; not shown in the table). The application of manure to the pasture (5 % of responses) and the use for other purposes, such as biogas production, exchange for crop residues and disposal (3 % of responses) was not common. Among the beef cattle farmers 68 % sold manure to generate additional income, compared to 50 % of the beef buffalo farmers ($p < 0.05$). Moreover, large- and medium-scale farmers (72 % and 65 %) more frequently sold manure than small-scale farmers (41 %; $p < 0.05$).

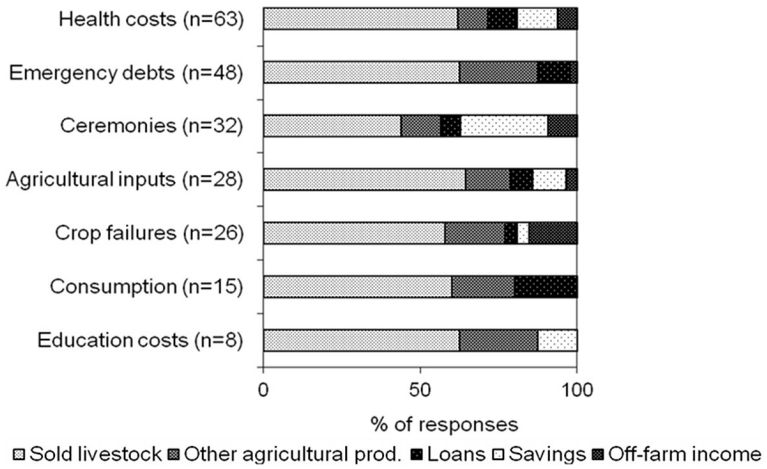

Fig. 2: *Sources of money for unplanned expenses during the last 5 years of beef buffalo and beef cattle farms (not differentiated) in 12 selected districts of Nakhon Ratchasima province, Northeast Thailand (Number of responses is given in parenthesis).*

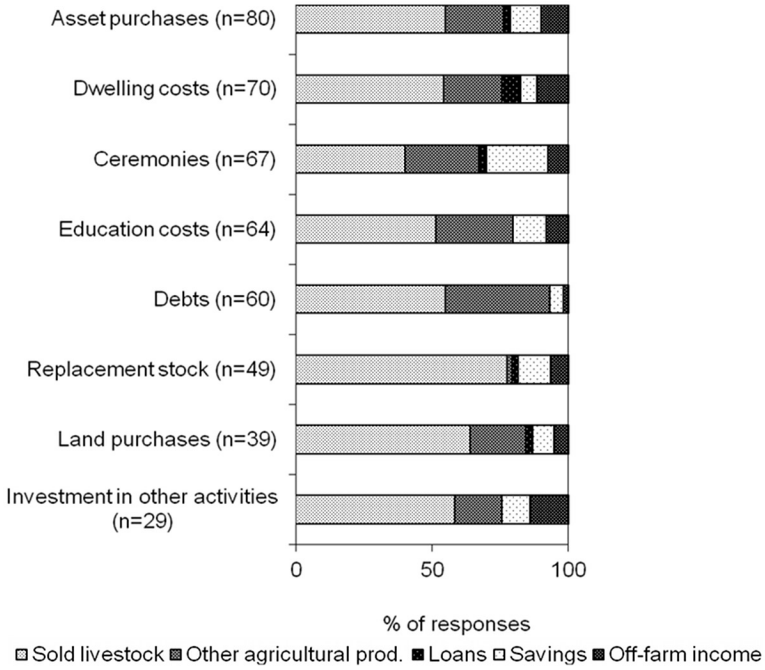

Fig. 3: *Sources of money for planned expenses during the last 5 years of 121 beef buffalo and beef cattle farms (not differentiated) in 12 selected districts of Nakhon Ratchasima province, Northeast Thailand (Number of responses is given in parenthesis).*

4 Discussion

4.1 Farmers' characteristics

Understanding production systems, management and roles of buffaloes and cattle are an essential basis for any initiative aiming at an improvement of the livelihoods of beef buffalo and beef cattle farmers in Northeast Thailand, which has the highest cattle and buffalo population of Thailand. Characteristics of beef cattle and especially of beef buffalo farmers in Thailand are rarely reported in the literature. Most of the buffaloes and cattle are integrated in smallholder mixed crop-livestock systems, which are geared towards income generation, food security for family members and the management and conservation of natural resources for a sustainable agricultural production (Devendra & Thomas, 2002c; Na-Chiangmai, 2002; Devendra, 2000). Beef buffaloes and beef cattle are considered as a long-term investment and an asset of inheritance from one generation to the next (Simaraks *et al.*, 2003; Chantalakhana, 2001). The purpose of these livestock species changed dramatically in recent years. There is less use of the animals as draught power for cropping. Nowadays, buffaloes and cattle are rather used for meat production and to some extent as tradition (Na-Chiangmai, 2002). The gradual replacement of buffaloes by cattle resulted in a competition for farm resources between these two species. Moreover, the promotion of beef cattle enterprises by the Thai government intensified this transition (Khemsawat *et al.*, 2003; Nanda & Nakaon, 2003; Simaraks *et al.*, 2003; Chantalakhana, 2001). Initiated by the Department of Livestock Development (DLD) the Thai BREEDPLAN was developed and promoted with the aim to improve the genetic quality of indigenous *Bos indicus* cattle (Intaratham, 2002). Overall, the replacement of buffaloes by cattle results in an intensified crop-livestock production system as buffaloes are generally raised more extensively than cattle and their diet is mainly based on rice straw and rice stubble (Na-Chiangmai, 2002).

As shown in this study, households were primarily headed by men aged close to 60 years; in most cases the household head was responsible for livestock farming. According to a farm household survey in northern Thailand in 1994, men constituted a significantly higher proportion of the workforce (64 %) than women (36 %), and men were predominantly responsible for the livestock (Kehren, 1999). Grünbühel *et al.* (2003) mentioned that the head of the family in Northeast Thailand is usually the oldest and most respectable person with the priority being given to male family members. NSO (2008) reported that women were usually not nominated as household head unless they were unmarried or no adult men lived in the household. Studying the multifunctionality of integrated farming systems in one com-

munity in Khon Kaen province in Northeast Thailand, Tipraqsa *et al.* (2007) determined an average household size of 5 and 4 persons for integrated farms (multiple objectives) and commercial farms (market-oriented rice production), with the labour force (persons aged 15–65 years) being 4 and 2 persons, respectively.

The educational level found in this study is widely in agreement with the fact that Thai people generally receive only formal education, especially in rural areas (ONEC, 2001). According to data of the official population and household census, people aged older than 6 years with a primary level of education constituted 68 %, 72 % and 70 % of the population in 1970, 1980 and 1990, respectively (NSO, 2008). Nevertheless, it has to be mentioned here, that livestock raising is a traditional activity and a certain level of experience is provided through informal education. Though, livestock farmers in the present study showed a high farm experience.

4.2 Farm characteristics

According to Tipraqsa *et al.* (2007) the size of land holdings of farmers in Thailand depends on the farming system. For a community of Khon Kaen province in Northeast Thailand, these authors reported an average farm size of 3.9 and 2.7 ha for integrated and commercial farms, respectively. Kehren (1999) found an average size of land holdings of 5.6 ha in Thai farms, whereas a considerable number of small-scale farmers owned less than 1.6 ha. These values are similar to the values found in the present study, particularly for the small-scale farms. Chantalakhana (2001) mentioned that in Northeast Thailand village farmers, generally raising 2 to 5 beef buffaloes, used small plots sized 0.2 to 1 ha for ruminant grazing. These complemented other available grazing areas, e.g. paddy fields. According to Grünbühel *et al.* (2003), buffaloes and beef cattle in Northeast Thailand grazed freely on the harvested fields during the dry season with the fertilization of the harvested fields by the manure being an integral part in the crop-livestock systems. At night and during most of the vegetation period, the animals were kept in stables and fed with straw and grass. Faeces were mixed with straw bedding and were brought to the fields once every year before the planting season. Although farmers were aware of its value, large parts of the manure were wasted (Grünbühel *et al.*, 2003). This could be reflected to some degree in the present survey, as none of the farmers mentioned the production of manure as a role of the livestock.

Rice is the primary agricultural product in Northeast Thailand and provided the basis of the traditional subsistence economy (Saisoong, 1989). People produce rice mainly for home consumption but also sell a portion of the harvest on the market (Grünbühel *et al.*, 2003). This high dependency on crop – in particular rice – production was reflected by the large proportion of buffalo as well as cattle farms integrating crop and livestock. The correlations between the number of livestock raised and the land size emphasize the dependence of the animals on grazing areas, but also indicate the wealth of farmers with large animal herds.

Regarding the labour management on the farms, a shortage of labour force is a major problem and constraint of small-scale livestock farms nowadays. This is mainly caused by the migration of employees to peri-urban and urban areas, especially of the young generations. Therefore, the different household activities on livestock farms are widely carried out by women, children and older people (Skunmun *et al.*, 2001).

4.3 Roles of livestock

Devendra & Thomas (2002b,c,a) and Kehren (1999) agreed that small-scale farm households in Thailand, mostly living at the subsistence level, frequently integrated crop and animal husbandry activities, namely cultivation of field crops, horticulture, aquaculture and livestock farming. Livestock including buffaloes, beef cattle, pigs and poultry were of high importance for these farms and played multi-purpose roles in both monoculture and multiple cropping systems. In these systems outputs from one sector were used as inputs for other sectors. By Grünbühel *et al.* (2003) and Chantalakhana (2001) it was mentioned that livestock in Thailand is generally utilized for many different purposes by the farmers: small-sized animals such as chickens, ducks and pigs constitute short-term savings and food sources, while buffaloes and cattle supply draught power, long-term savings and income resources. During the past decades the roles of buffaloes and cattle in Northeast Thailand have changed fundamentally and animals are no longer raised for draught purposes (Simaraks *et al.*, 2003; Chantalakhana, 2001). Although the rapid growth of the Thai economy during the last decades has generated various alternatives to the use of livestock as savings, keeping animals as savings is still common. A similar importance as found in the present study, was observed in two villages of Surin province, Northeast Thailand, where more than 90 % of the farmers kept buffaloes as savings (Skunmun *et al.*, 2001). In Sang Saeng village, Northeast Thailand, villagers owned an average number of 0.65 buffaloes and cattle (Grünbühel *et al.*, 2003). In these farms animals were raised for draught purposes only in 4 % of the small-scale farms.

In the present study livestock was kept as the main source of income on almost two thirds of the medium- and large-scale buffalo farms, whereas livestock consti-

tuted the main income in around 30 % and 5 % of the small-scale buffalo and cattle farms. Farmers in the studied region primarily kept livestock in order to cover expected as well as unexpected expenses and to generate supplementary rather than main income. This was particularly illustrated for small-scale farms. Furthermore, animals played a role for sustaining or improving the farmers' livelihoods and the social status and as savings.

Chantalakhana (2001) stated that in case of crop failures due to drought or flood, buffaloes or cattle are sold in order to obtain sufficient cash income to purchase enough rice for year-round family consumption. In the case of traditional ceremonies such as weddings or religious rites, rural farmers sold buffaloes or cattle for cash or slaughtered them for meat consumption in the household.

Due to changes of the agricultural production systems in Thailand towards more intensive farms, raising livestock for purposes such as draught power, manure production, inheritance and livestock farming as a traditional activity is becoming of less interest. As stated by Simaraks *et al.* (2003), the role livestock played as savings and in bartering systems in Northeast Thailand has been mostly replaced by a buy-and-sale system, and other roles related to inheritance, rituals etc. have declined dramatically and been replaced mainly by consumer goods. Regardless of these other opportunities, the present study indicated that keeping livestock as savings is still common for small-, medium-, as well as large-scale farmers.

5 Conclusions

The present survey undertaken in 12 selected districts of Northeast Thailand clearly demonstrated that beef buffaloes and beef cattle are an essential part of the integrated crop-livestock farming systems in terms of cash income, savings and social status, whereby increasing herd sizes are associated with improved livelihoods and social status. However, the animals' roles vary between small-, medium- and large-scale farms. Family members play a major role for different activities of livestock farming with work force being hired mainly by medium- and large-scale farms. Due to the strong competition between livestock and crop production farmers depend largely on the availability of communal grazing areas to feed their beef animals. In order to improve farmers' livelihoods and develop sustainable farming systems in Northeast Thailand, the changing economic circumstances of cattle and especially buffalo production should receive more attention of researchers, governmental institutions and stakeholders.

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