CHAPTER 4

RESULTS

4.1. Cattle production in northern Vietnam

4.1.1. Description of the study area

All of the three investigated villages are villages of the Thai ethnic group. Na Pan is the largest village with a total area of 1640.4 ha, considerably larger than Chieng Ban and Nam villages with 1121.0 ha and 803.8 ha, respectively. The population of Na Pan is also highest with 254 households comprising 1,252 inhabitants, followed by Chieng Ban with 169 households (697 inhabitants). Nam village has 92 households with 463 inhabitants. The average household size in the investigated villages was 4.68 persons, highest in Nam (5.0 persons) and lowest in Chieng Ban (4.1 persons). The cattle population was highest in Na Pan with 700 heads. The average number of cattle kept per household was less than three in all investigated villages.

Table 3: General information of investigated villages

Village	Chieng Ban	Na Pan	Nam
Total area, ha	1121.0	1640.4	803.8
Homestead, ha	6.4	3.2	1.8
Forest area, ha	969.0	1520.0	750.0
Rice field, ha	23.3	25.2	11.7
Slope land, ha	122.3	92.0	40.2
Population	697	1252	463
Number of households	169	254	92
Number of cattle	253	700	195
Number of buffaloes	180	320	93

(Source: key-person interviews)

4.1.2. General household information

4.1.2.1. Households size and information of household leaders in the investigated villages

The average family size in the investigated households was 5.2 persons per household, with the highest number in Nam village (5.8 persons/ household) in comparision with 5.1 person/

household in Na Pan village and 4.5 person/ household in Chieng Ban. The number of adult family members ranged between 2.9 to 3.4 people, accounting for 58.6% to 66.7% of the people in the investigated households. The number of children accounted for 22.2% in Chieng Ban, 27.5% in Na Pan and 19.0% in Nam village. The proportion of old people in Na Pan (about 7.8%) was lower than in Chieng Ban and Nam (about 13.3% and 15.5%, respectively).

Table 4: General information of respondents

Village	Chieng Ban			Na Pan			Nam		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Family size (people)	10	4.5	1.4	10	5.1	1.2	10	5.8	1
Children<16 years	6	1.7	0.5	8	1.75	0.7	7	1.6	1
Adults	9	3.2	1.5	10	3.4	1.1	10	3.4	1
Old people>60 years	3	2	-	3	1	1	5	1.8	0
King speaker (person)	10	4.5	1.4	10	5	1.2	10	5.3	1
Illiterate people (person)	1	2	-	3	1.3	0.6	4	1.75	1
Age of household heads (years)	10	47.9	11	10	44.7	11	10	41.3	10
Cattle keeping experience of household head (years)	10	16.9	11	10	16.5	8.3	10	12.7	9

(Source: Own questionnaire)

Almost all people speak King language[1] as their second language. The H'mong language is used to communicate with H'mong people. The illiteracy rate was lowest in Chieng Ban village (4.4%) and highest in Nam village (12.1%). The average age of the household heads in all villages ranged from 41.3 to 47.9 years in all villages. The cattle keeping experience of the household heads was highest in Chieng Ban (16.9 years), compared to 16.5 and 12.7 years in Na Pan and Nam, respectively.

4.1.2.2. Land ownership

Land in Vietnam is allocated by the government. According to the national law, the amount of land generally available for farmers with land use rights is up to 2 ha for annual crops (e.g. rice) or 10 ha for perennial crops and 5 ha for other farming activities, such as livestock production. However, in each province, this law is applied according to land availability (Drucker et al, 2006).

Table 5: Land tenure in the investigated households

Village	Chieng Ban		Na Pan		Nam	
	Mean	SD	Mean	SD	Mean	SD
Rice field (ha)*	0.24[a]	0.18	0.21[a]	0.10	0.18[a]	0.07
Slope land (ha)*	0.85[a]	0.32	1.57[a]	1.19	0.99[a]	0.21

[1] Kinh Languague is the language of Viet ethnic and also the national language in Vietnam.. There are total 54 ethnic groups in Vietnam. Even though some ethnic groups have their own language, Kinh language is used in administrative affairs and education system.

Forest area (ha)*	3.49[a]	3.60	8.50[a]	7.16	-	-
Homestead (ha)**	0.15[a]	0.15	0.08[ab]	0.05	0.02[b]	-
Pond (ha)*	0.06[a]	0.04	0.06[a]	0.05	0.03[a]	0.01
Total land(ha)**	3.74[a]	3.44	10.41[b]	8.04	1.21[a]	0.25

Village differences insignificant for rice field (F=0.51, dfmodel=2, dferror=27), slope land (F=2.83, dfmodel=2, dferror=27), forest area (F=2.87, dfmodel=1, dferror=15) and pond (F=2.68, dfmodel=2, dferror=26). Village differences significant for homestead (F=5.75, dfmodel=2, dferror=27) and total area (F=8.85, dfmodel=2, dferror=27). Means in a row followed by a common letter are not significantly different at $p \leq 0.05$. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: Own survey)

Table 5 shows that the total land owned by the investigated households in Na Pan village was much higher than in the other villages and nearly reached the maximum land use described above. The average total land owned by the households in Na Pan was 10.41 ha, compared to 3.74 ha and 1.21 ha in Chieng Ban and Nam villages, respectively. The total land of a family consists of rice fields, slope land, forestland, land for the homestead, garden and pond.

The slope land area occupied around 78-88% of the total agricultural land (including rice fields and slope land) in the investigated households. In Chieng Ban, the homestead area was largest, about 0.15 ha in average. Area for house and garden of each family was very small with 0.02-0.04 ha in Nam and Na Pan, respectively. The homestead area in Nam was the same for every household (200 m² per household).

4.1.3. Crop production

4.1.3.1. Area and output of crops

As table 6 shows, no significant difference were found for cropping areas. Rice was grown in all investigated households. The planted rice area was smallest (0.30 ha) in Na Pan and higher in Chieng Ban and Nam villages (0.42 ha and 0.34 ha). Rice field area in Nam village was smallest among the investigated villages, but cultivated rice area was higher than in Na Pan. Yield of rice was lowest in Na Pan village (about 5.45 tons/ ha) and higher in Chieng Ban and Nam (about 5.94 and 5.87 tons/ ha, respectively).

Average maize area in Chieng Ban and Na Pan village was 0.85 ha and 1.53 ha, respectively. The maize area was smallest in Nam village (about 0.20 ha). Maize was grown by all the investigated households in Chieng Ban and Na Pan villages, but only by one household in Nam village. Yield of maize in Na Pan was (9.62 tons/ ha) and lower than in Chieng Ban (11.72 tons/ ha) and in Nam village (20.00 tons/ ha). Only a small amount (around 500 kg per year) was kept for animals.

Table 6: Planted crops and plot size per crop in the investigated households

	Chieng Ban			Na Pan			Nam		
	%hh	Mean	SD	%hh	mean	SD	%hh	mean	SD
Rice area/hh (ha)*	100	0.42[a]	0.29	100	0.30[a]	0.10	100	0.34[a]	0.13
Maize area/hh (ha)*	100	0.85[a]	0.32	100	1.53[a]	1.20	10	0.20[a]	-

Cassava area/hh (ha)*	10	0.10[a]	-	0	-	-	100	0.31[b]	0.07
Sugarcane area/hh (ha)*	0	-	-	20	0.25	0.21	0	-	-
Coffee area/hh (ha)*	0	-	-	0	-	-	90	0.29	0.06
Improve grass(ha)*	80	0.04[a]	0.016	40	0.11[a]	0.13	30	0.05[a]	0.01

Village differences insignificant for planted rice area (F=0.94*, dfmodel=2, dferror=27) and planted maize area (F=2.11*, dfmodel=2, dferror=18). Village differences significant for cassava area (F=7.24*, dfmodel=1, dferror=9). Means in a row followed by a common letter are not significantly different at $p \leq 0.05$. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: Own survey)

Table 7: Yield of main crops in the investigated households, harvested during the last 12 months (tons)

	Chieng Ban			Na Pan			Nam		
	N	Mean	SD	N	mean	SD	n	mean	SD
Rice (tons/ ha)	10	5.94[a]	3.02	10	5.45[a]	1.16	10	5.78[a]	0.62
Maize (tons/ ha)	10	11.72[a]	4.96	10	9.62[a]	4.72	1	20.00[a]	-
Cassava (tons/ ha)	1	35.00	-	0	-	-	10	18.95	7.68
Sugar cane (tons/ ha)	0	-	-	1	100.00	-	0	-	-

Village differences insignificant for output of rice (F=0.17*, dfmodel=2, dferror=27) and

maize (F=2.24*, dfmodel=2, dferror=18). Means in a row followed by a common letter are not significantly different at p≤0.05. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: Own survey)

Cassava cropping was more popular in Nam village, but not in Chieng Ban and Na Pan. The average area of cassava in Nam was 0.31 ha and yield was 18.95 tons/ ha. Coffee was a new crop in Nam village and it was grown by 90% of the investigated households. The average area for coffee was 0.29 ha. The coffee was harvested for the first time in seven households with a total output of 2.1 tons. Sugar cane was grown in two of the investigated households (average 0.25 ha) in Na Pan village.

Improved grasses (elephant grass) were grown in 80% of the households in Chieng Ban, compared to 40% and 30% of the households in Na Pan and Nam, respectively. The area of cultivated grasses is quite small, ranging from 0.04 to 0.05 ha in Chieng Ban and Nam, respectively, but higher in Na Pan (0.11 ha). The elephant grass was grown around the pond in almost all of the households. Only one respondent in Na Pan used 0.3 ha slope land to grow grass for cattle.

4.1.3.2.Methods to improve quality and preservation period of crop by-products

Cattle keepers were asked about their knowledge and knowledge sources of methods to improve crop by-product quality and preservation time. Three methods were asked including urea-treated rice straw, urea-molasses multinutrient blocks and maize silage. The outcome is shown in Table 8.

Table 8: Crop by-products treatment known by farmers

Village	Chieng Ban	Na Pan	Nam
	%	%	%
Urea-treated rice straw	40	10	10
Urea molasses multinutrient block	10	10	0
Maize silage	20	10	10

(Source: Own survey)

Table 8 shows that urea-treated rice straw was the best known method for feed improvement in the study regions. There are 40% of the respondents in Chieng Ban, 10% in Na Pan and 10% in Nam, who had information about this method. Maize silage was known by 20% of the respondents in Chieng Ban, 10% in Na Pan and 10% in Nam. Only 10% of the respondents in Chieng Ban and Na Pan had information about UMMB. The information of these methods was given by extension agents or through development projects, television and radio. None of the respondents so far applied any of these methods.

4.1.4.Cattle production

4.1.4.1. Reasons for keeping cattle

In the investigated households, cattle are kept for multiple functions, including savings, income generation, draught force and manure. Saving money and a source of manure were

the functions of cattle in all of the households. Draught power was more important in Na Pan and Nam, but only 50% of the respondents in Chieng Ban kept cattle for draught power. Income generation was reported in 40% of the households in Na Pan and 20% in Chieng Ban and Nam villages, respectively (Table 9).

Table 9: Reasons for keeping cattle

Village	Chieng Ban	Na Pan	Nam
Saving mean (%)	100	100	100
Draft force (%)	50	90	100
Manure (%)	100	100	100
Income generation (%)	20	40	20

(Source: Own survey)

4.1.4.2. Cattle breed

Yellow cattle were the only breed kept by all of the respondents in the investigated villages. In the past, some other breeds (Laisindh, Brahman, Sahiwal) were introduced by government projects. Due to the information from farmers and head of village, the Laisindh were introduced in Chieng Ban and Na Pan. They have a larger frame size, higher growth rate and a better market price than Yellow cattle. But the shortage in feed was the main reason for the failure of keeping this breed on the respective household farms. A fierce character of Laisindh cattle was reported by one respondent in Na Pan. All Laisindh cattle

were sold out in the study areas. Only few offspring of the introduced Laisindh cattle remained in the investigated villages. All the respondents knew about Laisindh cattle through newspapers, television, extension services and farmer associations, but only two respondents in Chieng Ban wanted to change from keeping Yellow cattle to Laisindh cattle.

4.1.4.3. Cattle herd composition

All of the respondents had at least three cattle and had access to communal pastures. Cattle composition in the investigated households is shown in Table 10.

Table 10 shows that the average cattle herd size was highest in Na Pan (14.6 cattle/ household), while the lowest average is found in Chieng Ban (8.0 cattle/ household). According to age group, cattle were divided into three groups. The calf was less than 1 year old, adult was more than 2 years old and the yearling was in ranged 1 to 2 year old. The proportion of adult cattle was the highest. The proportion of yearling was higher than the calf group. Female cattle account around 60% of total herd. It was reflected the trend to keep female animal for reproduction purpose in study areas. For adult cattle, the female was predominant. In all villages, female cattle was kept for reproduction while male cattle usually be sold when the farmer need cash. For yearlings and calves, the ratio between female and male was quite balanced, except in Chieng Ban, where fewer female calves were kept than compared to male calves. Number of female yearlings, however, was higher than number of male yearlings.

Table 10: Cattle herd composition in investigated households, by villages

Village	Chieng Ban		Na Pan		Nam	
	Mean	SD	Mean	SD	Mean	SD
Total of cattle	8.0	3.8	14.6	13.5	10.3	7.2
Male cattle	2.9	1.7	6.0	4.6	4.0	2.6
Female cattle	5.1	2.5	8.6	9.1	6.3	4.7
Male adult	0.7	0.9	2.7	1.8	1.4	0.8
Female adult	2.9	1.6	5.0	5.89	3.6	2.5
Male calf	1.1	1.2	1.3	1.6	0.9	0.7
Female calf	0.6	0.7	1.6	1.8	1.0	1.1
Male yearling	1.1	0.6	2.0	2.0	1.7	1.4
Female yearling	1.6	1.3	2.0	1.8	1.7	1.4

(Source: Own survey)

4.1.4.4. Cattle herd disposal

The main reasons for disposal of animals were sales, gifts, slaughter and deaths Cattle were sold to middlemen or to other farmers in the same village. None of the cattle were

sold directly to a livestock market. Cattle were slaughtered for Tet celebration[2], wedding parties and funerals. They were also often given as a dowry to the new family from their parents, building the main source of cattle herd foundation for young families. Death of cattle (almost old cattle and calves) can be found in all villages for various reasons, mainly due to cold weather in winter time and accidents on the communal pastures during the rainy reason. Theft was reported in Chieng Ban and Na Pan, but not in Nam village. About 13% of the respondents had not disposed of any cattle.

Setianingrum reported that in 2009, there are 83% of the investigated households disposed of cattle through selling, giving as gift, slaughtering or losing by death and theft. In 2010, a total 112 cattle were disposed in all investigated villages. Selling cattle accounted for 63.4% of the total disposed cattle. The cattle were sold to middlemen or neighbours. It is in agreement with Setianingrum (2010) that no cattle were sold to a livestock market. About 13.4% cattle were slaughtered by respondents for big events (e.g. New Year, wedding day and funeral). From December to January, there is free time for farmers (finished harvest maize and rice and prepare for New Year). This period is a good time for wedding and building new house. In H'Mong villages, there are only two months per year for young couples to get married. Many weddings and house contructions occurring in this period. Pigs and some cattle were slaughtered for ceremonies. Following Thai culture, the gloom must stay in the wifes house to work for at least one year. After that they can build up their own family. They can get one or some

[2] Tet celebration is the biggest even in Vietnam to celebrate New year. It is held during 4 day including the last day of the year and three first day of next year of moon calendar. It is held in January or February. In this time, all members of family reunite in parents' house, pray and express their respect to ancestor

cattle from their parents to start their own business. About 9.8% of the disposed cattle were given as a gift in 2010. Theft was not popular in the study region, only 2.7% of cattle were stolen in 2009. About 10.7% of the disposed cattle were died in accidents or due to cold weather in the winter. Accidents (fall from the cliffs in rainy days) occurred mainly in Na Pan and Nam village.

Table 11: Kinds of cattle herd disposal by villages experienced during last year

	Total	Chieng Ban			Nam			Na Pan		
		%hh	No.	%	%hh	No.	%	%hh	No.	%
Disposal	112	100	31	100.00	100	21	100.00	100	60	100.00
Sell	71	90	13	41.94	70	13	61.90	60	45	75.00
Give calf	11	50	8	25.81	0	0	0.00	20	3	5.00
Slaughter	15	50	6	19.35	30	4	19.05	40	5	8.33
Death	12	20	2	6.45	30	4	19.05	40	6	10.00
Theft	3	10	2	6.45	0	0	0.00	10	1	1.67

(Source: Own survey)

There are 13% of the investigated households, which did not dispose their cattle in 2009. They are relatively new in keeping cattle, with range of experience between three to seven years. They are enlarging their cattle herd by reproduction.

4.1.4.5. Feeding practices

All investigated villages had access to communal pastures or forests, where farmers can graze their cattle. There are various feeding practices applied in the villages. In the cropping season (from April to October), cattle are restricted to access cultivated areas of rice or maize. In Chieng Ban and Na Pan, cattle were moved to pastures and forests. Only some cattle (mainly draught cattle and sick animal) were kept in the villages and tended by a family member. Individual households or a group of households set up a fenced area to keep their animals, where the cattle are able to graze. Cattle were observed by a family member in Chieng Ban, while they were totally free without observation in Na Pan. In Na Pan, the owners sometimes must look for hours, days, or even weeks in order to find their cattle. Households without having access to communal pastures or small cattle herds, keep their animals tended in the village. In Nam village, all of the cattle, except for draught cattle, were located permanently in the mountains all year long. Only sick cattle were brought back to the village for treatment. Cattle are released for grazing during the day time and brought back to the barn at night. Limitation of pastures was more serious in Nam village, because releasing cattle to the forest was forbidden.

The main feed sources of cattle were native grasses, bushes and leaves. After harvesting time, cattle are brought back to the village and released to the harvested fields. Remaining fresh maize leaves and stems are utilised after harvest time. When maize leaves and stems

become dry and harder, native grasses and bushes on the field are the main feed resources for cattle. No cut-and-carry system was applied in the studied areas. During rainy days or when native grass resources are not sufficient to meet feeding demand, other alternative feed sources, including improved grasses (elephant grass), cassava roots, rice straw and sugar cane tops are fed. Rice bran and maize meal were given to draught cattle during working days.

4.1.4.6. Alternative feed sources

Native grasses are the main feed source for cattle. Alternative feed sources used for cattle in the study region are shown in Table 12.

Table 12: Cattle feedstuffs in investigated households in dry season

	Chieng Ban	Na Pan	Nam
Rice straw (%hh)	100	100	80
Maize leaves (%hh)	100	100	10
Banana stem (%hh)	50	60	20
Improve grass (%hh)	80	40	30
Sugar cane top (%hh)	30	40	20
Cassava root (%hh)	10	0	90
Rice bran (%hh)	30	60	40

(Source: Own survey)

Rice straw and maize leaves were fed to cattle in all of the respondents' households in Chieng Ban and Na Pan. In Nam village, burning of rice straw in the field instead of feeding cattle was reported by two respondents. Maize leaves were fed to cattle by only one respondent in Nam village. Banana stem is a feedstuff rather utilised for pigs, but due to the shortage of feed and the availability of this feed, it was used for cattle by 50% of the respondents in Chieng Ban, 60% in Na Pan and 20% in Nam village. Banana stem is usually cooked before feeding. Cattle were fed with improved grasses (elephant grass) in 80% of the households in Chieng Ban, 40% and 30% in Na Pan and Nam, respectively. The area of elephant grass was limited to around 300 m² per household and located around ponds or in the garden. All of the respondents reported that elephant grass was considered as a feeding reserve for cattle in times of feed shortages or on rainy days. Sugar cane tops were fed to cattle by 30% respondents in Chieng Ban, 40% in Na Pan and 20% in Nam villages.

Cassava was used as a supplementary feed in 90% of the investigated households in Nam village, whereas only 10% of the investigated households in Chieng Ban and no respondents in Na Pan used cassava. Rice bran was used in 30% of the households in Chieng Ban, 60% in Na Pan and 40% in Nam villages. Maize meal was not popular as a feed for cattle. Only a small amount of maize was kept for animals in the investigated villages and mainly for chicken and pigs.

4.1.4.7. Constraints of cattle production

The limitation of pasture areas and the shortage of feed for cattle in winter were reported

to be the main constraints for development of cattle production by 90% of the respondent in all villages. Financial shortage for development was reported as the second constraint. More than 80% of the respondents in the investigated villages did not have enough cash for an improvement of their cattle production. Disease was reported as the third constraint in Chieng Ban (80% of households) and Nam village (40% of households). The most popular diseases in these villages were diarrhoea in calves and parasites.

Table 13: Constraints of keeping cattle in investigated households

Village	Chieng Ban	Na Pan	Nam
Limited pasture area (%hh)	90	90	90
Lack of funds for investment (%hh)	80	100	80
Disease (%hh)	80	0	40
Technique transfer (%hh)	40	10	20
Rainy (%hh)	0	70	0
Labor shortage (%hh)	0	0	10

(Source: Own survey)

In Na Pan Village, disease was not reported as a constraint. Rain was reported as a constraint by 70% of the respondents in Na Pan village. It was the reason of many death of cattle (fall from cliff in rainny days). Difficulty of technique transfer was reported by 40% of respondents in Chieng Ban, 10% in Na Pan and 20% in Nam village. These

households got the information of new techniques but found hard to apply them due to lack of support from extension officers.

4.2. Feeding trial

4.2.1. Two frame size groups of Yellow cattle in the study region

Yellow cattle were the only cattle breed kept in the study region at the time of the survey. They were categorised into two groups (small frame size and large frame size). Both groups of cattle have a good adaptability to the local environment and the poor nutrient content of the feedstuffs.

At the beginning, forty one cattle were chosen for the feeding trial. Three LFS cattle were added in treatment 1 in the second month Initial weight of experiment cattle were shown in table 14.

Table 14: Initial weight of experiment cattle by frame size

	Small frame size group			Large frame size group		
	No	Mean	SD	No	Mean	SD
Initial weight (kg)	24	109.9[a]	12.9	17	141.2[b]	6.4

Frame size group differences significant for initial weight (F=84.38***, dfmodel=1, dferror=39). Means in a row followed by a common letter are not significantly different at p≤0.05. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: own feeding trial)

The initial weight of SFS and LFS cattle was 109.9 kg and 141.2 kg, respectively (P<0.001). The control group was fed according to the farmer's regimen. This means that there was no intervention for improving the rations. The ADG of the control groups was calculated to figure out the differences in growth rate between the two frame size groups. In the first month, ADG of the SFS cattle was statistically different in comparison with the LFS group (P<0.05), i.e. 216.4 g and 259.2 g, respectively. In the second month, when the cold weather occurred, the ADG of both groups dropped, particularly the ADG of the LFS group in comparison to the ADG of the SFS cattle (P<0.001). The average ADG for both months of the SFS group was higher than for the LFS group (P<0.001).

Table 15: Initial weight of experiment cattle by village

	SFS								LFS		
	Chieng Ban			Na Pan			Nam		Chieng Ban		
	No	mean	SD	No	mean	SD	No	mean	SD	No	Mean	SD
		kg	kg		kg	Kg		kg	kg		Kg	kg
Initial weight	8	107.8[a]	13.5	8	112.7[a]	11.2	8	109.5[a]	15.1	17	141.2[b]	6.4

Village differences insignificant for initial weight of SFS group (F=0.28*, dfmodel=2, dferror=21). Frame size group differences significant for initial weight (F=84.38***, dfmodel=1, dferror=39). Means in a row followed by a common letter are not

significantly different at p≤0.05. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: own feeding trial)

Table 16: ADG of the control treatments in the two frame size groups

	SFS			LFS		
	No	Mean	SD	No	Mean	SD
		g	G		G	g
ADG1	12	216.4[a]	30.5	8	259.2[b]	47.3
ADG2	12	12.5[a]	15.3	8	-275.8[b]	67.4
ADG3	12	114.4[a]	19.3	8	-8.3[b]	38.2

ADG1: average daily gain in the first month; ADG2: average daily gain in the second month; ADG3: average daily gain in the whole experimental period. Frame size group differences significant for ADG1 (F=6.12*, dfmodel=1, dferror=18), ADG2 (F=208.96***, dfmodel=1, dferror=18) and ADG3 (F=91.07***, dfmodel=1, dferror=18). Means in a row followed by a common letter are not significantly different at p≤0.05. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: feeding trial)

4.2.2. Feeding trials with different husbandry and feeding managements for two different frame sizes of cattle

The experiment was established to compare the effects of using supplementary feed for

cattle in the northern mountainous areas of Vietnam. The three types of supplementary feed utilised were UMMB, UTRS and a fixed ration. The fixed ration included 5 kg of elephant grass, one kg of maize meal and ad libitum of UTRS. The initial weight of the experimental cattle is shown in Table 17.

Table 17: The initial weight of experiment cattle

	Treatment 1			Treatment 2			Treatment 3			Control		
	No	Mean	SD	No	Mean	SD	No	Mean	SD	No	mean	SD
		kg	kg		kg	kg		kg	kg		kg	Kg
SFS***	4	108.0[a]	16.7	4	107.3[a]	17.4	4	109.3[a]	9.1	12	111.7[a]	12.7
LFS***	1	138.7[a]	-	4	135.6[a]	2.5	4	146.9[a]	6.3	8	141.5[a]	5.9

Treatment differences insignificant for initial weight of SFS group and LFS group (F=11.46*, dfmodel=7, dferror=33). Means in a row followed by a common letter are not significantly different at p≤0.05. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: own feeding trial)

The initial weight of experiment cattle was similar in the same frame size group (P<0.001). The weight of SFS group was lower than LFS (P>0.05). The LFS group was 28.5% heavier than SFS group. It could easily be recognized the difference by the phenotype of cattle. The LFS group has bigger body, rounder and longer body.

A test for interaction between frame sizes and treatments was applied with the F-test. The result shows that there was significant interaction between frame size and treatments ($P<0.01$). The contribution to the variance of each factor was calculated indicating the effect of each main factor to ADG. The treatment factor contributed 31.76% for the differences in ADG in the first month, 74.97% in the second month and 5.70% for all experiment period, in comparision to the contribution of treatment were 42.46%, 16.72% and 65.33%, respectively.

Table 18: Percentage effect from frame size and treatment factors to the change of ADG

	ADG1	ADG2	ADG3
% effect of frame	31.76	74.97	5.70
% effect of treatment	42.46	16.72	65.33
% effect of frame size and treatment interaction	13.60	2.74	19.82
% effect of error	12.18	5.57	9.15

R-square of ADG1 = 0.82; R-square of ADG2 = 0.92 and R-square of ADG3 = 0.90. (Source: own feeding trial)

The ADG was calculated determine the effect of the different feedstuffs on the two frame size groups. The average ADG of SFS cattle by month and for the whole experimental period is shown in Table 19. In the first month, the ADG of cattle receiving the fixed ration was highest with 391.7 g. The ADG of the group receiving UMMB was not

significant higher than for the group using UTRS with 323.3 g and 263.3 g, respectively. The ADG of the control group was similar to the group fed on UTRS and significant lower than for the other groups. In the second month, the cold weather had a strong effect to all cattle in the feeding trial and the ADG dropped sharply. The groups receiving the fixed ration and UMMB had a similar ADG level, which was higher than compared to the other groups with 121.7 g and 105 g/ day, respectively. The groups fed on UTRS and the control group had a similar ADG level at 34.2 and 12.5 g/ day, respectively. For the whole experimental period, the ADG of cattle fed on the fixed ration and UMMB was sinificant higher than for the groups receiving UTRS and the control group.

Table 19: Average daily gain of SFS cattle with different treatments

	Treatment 1			Treatment 2			Treatment 3			Control		
	No	Mean	SD	No	mean	SD	No	Mean	SD	No	Mean	SD
		g	g		g	g		g	g		g	g
ADG1	4	391.7[a]	49.3	4	323.3[b]	42.6	4	263.3[bc]	19.4	12	216.4[c]	30.5
ADG2	4	121.7[a]	48.3	4	105.0[a]	31.1	4	34.2[b]	12.6	12	12.5[b]	15.3
ADG3	4	256.7[a]	14.0	4	214.2[a]	32.6	4	148.8[b]	11.3	12	114.4[b]	19.3

Treatment differences significant for ADG1 (F=21.30***, dfmodel=7, dferror=33), ADG2 (F=59.56***, dfmodel=7, dferror=36) and ADG3 (F=44.23***, dfmode=7,

dferror=33). Means in a row followed by a common letter are not significantly different at p≤0.05. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: feeding trial)

Table 20: Average daily gain of LFS cattle with different treatments

	Treatment 1			Treatment 2			Treatment 3			Control		
	No	Mean	SD	No	mean	SD	No	mean	SD	No	Mean	SD
		g	g		g	g		g	g		g	g
ADG1	1	570.0[a]	-	4	368.3[b]	80.8	4	439.2[c]	53.8	8	259.2[d]	47.3
ADG2	4	-56.7[a]	66.3	4	-111.7[a]	57.3	4	-195.8[b]	18.1	8	-275.8[c]	67.4
ADG3	1	303.3[a]	-	4	128.3[b]	52.2	4	121.7[b]	32.1	8	-8.3[c]	38.2

Treatment differences significant for ADG1 (F=21.30***, dfmodel=7, dferror=33), ADG2 (F=59.56***, dfmodel=7, dferror=36) and ADG3 (F=44.23***, dfmode=7, dferror=33). Means in a row followed by a common letter are not significantly different at p≤0.05. *significant at 5%; **significant at 1%; ***significant at 0.1%. (Source: feeding trial)

The ADG of LFS cattle for different months and the whole experiment period are shown in Table 20. In the first month, the ADG of the animal receiving the fixed ration was highest with 570 g/ day. The ADG of the group fed with UTRS was higher than the group

fed with UMMB, i.e. 439.2 g and 368.3 g/ day, respectively. The control group had the lowest ADG (259.17 g/ day). Under the effect of cold weather, all LFS cattle in the experiment lost weight in the second month. Weight loss in the control group was highest. The group receiving the fixed ration and UMMB slightly lost weight and lost significant less weight than group using UTRS. During the whole experiment period, the control group was slightly losing weight. The animal fed with the fixed ration gained on average 300 g/ day. The group receiving UMMB and UTRS had a similar ADG with 125 g/ day. Which was significantly higher than the control group.

4.2.3. Economic feasibility of the feeding experiment

The economic feasibility analysis shows that the different treatments gave different effects to different frame size group of cattle in different weather condition. This strongly supports that genotype x environment interactions needs to be considered. The cost for the fixed ration ranged from 18,145 VND to 18,491 VND. The cost would be lower (around 16%), when the price of maize would drop back to its usual price level (half of the price compared to the price 2011). The costs for UMMB and UTRS were 3,818 VND and 2,335 VND, respectively. The price for live weight of cattle was 100.000 VND/ kg.

The results reveal that the fixed ration in the SFS group brought lowest benefit in comparison with the other treatments, as well as compared to the LFS group. The benefit of the SFS cattle fed with the fixed ration was even lower than for the control group. Benefit for SFS cattle was highest for the UMMB treatment. This treatment showed higher benefits in the first month, but less benefit in the second month.

In the LFS group, the UTRS treatment gave highest benefit in the first month and for the whole experiment period. In the second month, all the treatment groups showed a negative benefit, which was highest for the control group and lowest for the UMMB treatment. Over the whole experiment period, the fixed ration brought higher benefit than the UMMB treatment and the control group, but still less than the UTRS treatment group.

Table 21: Net benefit accumulation during the experiment by treatment and size group of Yellow cattle (VND/ cattle/ day)

	SFS				LFS			
	No	1st month	2nd month	Whole experiment	No	1st month	2nd month	Whole experiment
		VND	VND	VND		VND	VND	VND
Treatment 1	4	21,021	-6,324	3,674	4*	38,486	-24,170	5,914
Treatment 2	4	28,516	6,683	8,800	4	33,016	-14,984	4,508
Treatment 3	4	24,298	782	6,270	4	41,196	-22,190	10,835
Control	12	21,639	1,250	5,722	8	25,917	-27,583	-406

*In the first month, data of three cattle was not available. (Source: feeding trial)

Table 22: The overall change in net benefit for the treatment groups over the control group (VND/ cattle/ day)

	SFS				LFS			
	No	1st month	2nd month	Whole experiment	No	1st month	2nd month	Whole experiment
		VND	VND	VND		VND	VND	VND
Treatment 1	4:12	-618	-7574	-2048	4:8	12569	3413	6320
Treatment 2	4:12	6877	5432	3077	4:8	7099	12599	4914
Treatment 3	4:12	2659	-468	548	4:8	15280	5393	11241

*In the first month, data of three cattle was not available. (Source: feeding trial)

According to this analysis, the overall rate of change in net benefit over the control group in SFS cattle was 3,077 VND/ cattle/ day with the UMMB treatment; 548 VND/ cattle/ day with the UTRS treatment; and -2,048 VND/ cattle/ day with the fixed ration. In the LFS group, the change of net benefit over the control group was 11,241 VND/ cattle/ day with the UTRS treatment; 6,320 VND/ cattle/ day with the fixed ration treatment and 4,914 VND/ cattle/ day with the UMMB treatment.