

# Impact of Forage Programme on Cattle Body Condition Score of Smallholder Farmers in Cambodia

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**Abstract:** The survey was conducted in the target provinces, Kampong Cham and Pursat province, of Beef for Market Project funded by ACIAR, Australia, in January and July 2016. Survey was designed with three different types of farmers such as adopted farmer, exposed farmers and non-exposed farmers. The objective of the study is to evaluate the impact of the introducing forage on cattle production of smallholder farmers supported by the project. The adopted farmers, who have involved in the project, planted the forage to supplement their cattle, got higher BCS (Body Condition Scoring) and total income than exposed and non-exposed farmers. However, the BCS varied with season and gender of cattle as well, when in the raining season male cattle produced higher BCS than dry season and female cattle respectively. However, further study on impact of converting cropland into forage planting should be deeply analyzed, since there was competition of land use.

**Key words:** Types of famers, season, BCS, income.

## 1. Introduction

The major constraint limiting the development of livestock production in many developing countries is inadequacy of animal feed resources, which is most often the crucial factor [1]. Feed shortages, both quantitatively and qualitatively, are limiting livestock productivity. During ploughing of crop fields, these shortages seriously affect working ability of oxen and they depress the production of dairy and meat units managed by small-scale commercial farmers. Beef for Market project funded by ACIAR has introduced the forage into the project farmers in Kampong Cham and Pursat province from 2013-2016 in order to promote fattening cattle for better price for market with supplementing planted forage. Forage production and technology has been successfully introduced into smallholder cattle systems in Cambodia as an alternative feed source to the traditional rice straw and

native pastures, improving animal nutrition and reducing labour requirements of feeding cattle [2]. It was agreed with other researchers, who addressed that providing improved forage quality and increased quantity to cattle resulted in gains of liveweight and animal value, and time savings for searching feed or care for animals grazing rice stubble [3]. In general, planting forage can provide an economical source of livestock feed, reduce labor requirements, build soil tilth and fertility, reduce erosion, and reduce invasions of noxious and poisonous weeds. While the opportunities to expand the area of forage crops are limited due to the competition with field crops for land and water resources, increases in forage production may be possible through intercropping, alley cropping, or integration of legumes via crop rotation [4].

The hypothesis for research and testing is that the project farmers practicing forage plantation and supplementing their forage to cattle will get highest body scoring of cattle. Raining season will have

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available communal grazing area and providing good condition for growing forage will bring better body scoring of cattle.

## 2. Material and Methodology

### 2.1 Study Area and Period

This second survey has been conducted at two provinces (Pursat and Kampong Cham) after the preliminary data of baseline survey. There were 2 districts in Pursat, and 1 district in Kampong Cham that were selected as the target study. The study has been conducted two times, middle dry season in January 2016 and middle raining reason in July 2016.

### 2.2 Sample Selection

The total number of interviewed farmers was 90 households with the proportion of 30 project participants (adopted farmers), 30 non-project participants in target village (exposed farmers) and others 30 non-project participants from other villages (non-exposed) (Table 1).

### 2.3 Data Collection

Data collection has been made two times, middle dry season in January 2016 and middle raining reason in July 2016. The questionnaire has been designed for two forms to get the primary data.

Firstly, the questionnaire was designed to interview the household farmers who were selected, in Kampong Cham and Pursat. The questionnaire focused on the common practice of the farmers in managing the cattle, what type of cattle farmer have, what kind of the feed farmers supplement to the cattle before selling.

Secondly, the questionnaire was designed for cattle assessment including breed type, sex, age, color and body condition score, the interviewer will assess this work with farmers in Pursat and Kampong Cham. BCS (Body Condition Scoring), was adopted from DEFRA [5], and was assessed on a scale of 1-5, in which score 1 is extremely thin and score 5 is extremely fat.

**Table 1 The number of farmer selected for the interviewing.**

Province	District	Commune	Villages	Type of farmer	No farmer	
Kampong, Cham	Tropang Preh		Koh Svay	Adopted	5	
			Tropang Pil	Exposed	5	
				No-exposed	5	
	Prey Chhor	Chrey Vean		Toek Noem	Adopted	5
				Koh Taphem	Exposed	5
					No-exposed	5
				Dey Krohom	Adopted	5
	Mean				Exposed	5
					No-exposed	5
Sub-total					45	
Pursat	Sampov Meas	Chamrein Pal	Toul Kros	Adopted	5	
			Ou Thkov	Exposed	5	
				No-exposed	5	
	Roleap			Roleap	Adopted	5
				Prey Oy mal	Exposed	5
					No-exposed	5
	Krokor	Kbal Trach		Krolanh	Adopted	5
				Tul Trear	Exposed	5
Sub-total					45	
Total					90	

Adopted farmers: Project farmers.

Exposed Farmers: Non-project farmers, but they are living close to or in the project target villages.

Non-exposed farmers: Non-project farmers, but they are living far away from the project target villages.

### 2.4 Data Management and Data Analysis

The collected data will be edited to detect the errors and omission and each questionnaire has been coded for facilitating the analyzing process, then will be entered in excel. Excel or SPSS program has been used for data analysis.

## 3. Result and Discussion

### 3.1 Family Member

The average members (Table 2) in each household of those three types of farmers in both provinces are not significantly different, however in Pursat province

the group of adopted farmers seems to have less members than other groups.

### 3.2 Cattle Number

Through Table 3 it was shown that there were no significant differences for the average number of cattle in each farmer group, even in the different season, however adopted farmer groups of both provinces seem to have higher number of cattle than other two groups (Fig. 1).

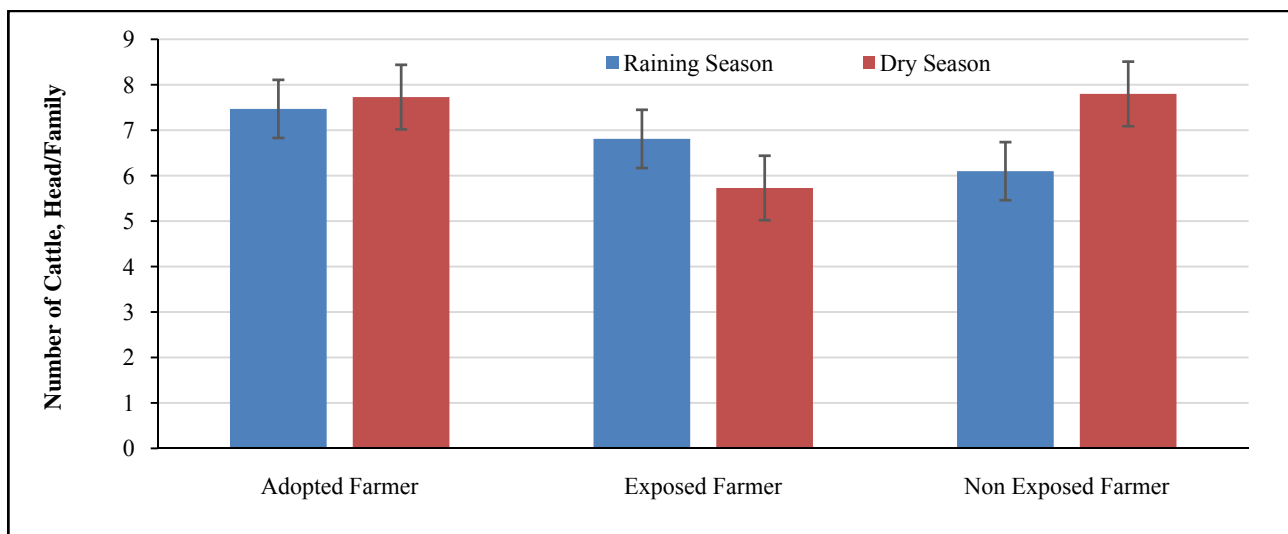
The research result, in Fig. 2, has shown that there were no significant correlations found between household member and number of cattle; however

**Table 2 Family member in each household.**

Type of farmer	Kampong Cham	Pursat
Adopted farmer	5.47	4.50
Exposed farmer	5.70	5.43
Non exposed farmer	5.20	5.40
SE Mean	0.33	0.40
<i>p</i> -value	0.629	0.186

**Table 3 Number of cattle in each village.**

Type of farmer	Raining season			Dry season		
	Kampong Cham	Pursat	Average	Kampong Cham	Pursat	Average
Adopted farmer	5.87	9.07	7.47	6.73	10.1	7.73
Exposed farmer	6.67	6.94	6.81	4.60	6.07	5.73
Non exposed Farmer	5.64	6.50	6.10	6.20	8.20	7.80
SE Mean	0.76	0.98	0.64	0.71	1.15	0.71
<i>p</i> -value	0.608	0.162	0.319	0.081	0.06	0.071



**Fig. 1 Average number of cattle per household.**

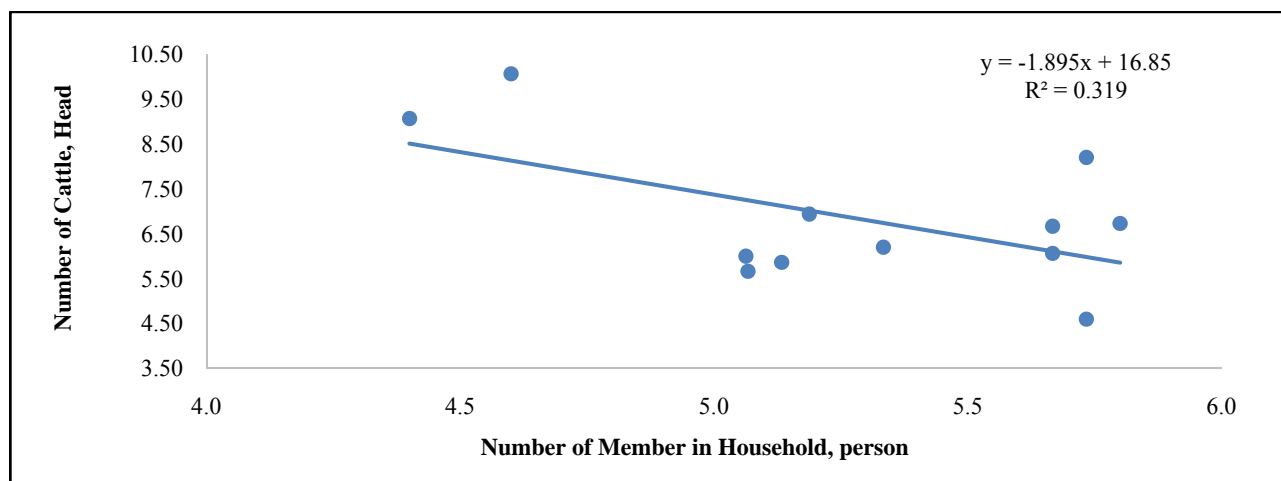


Fig. 2 Correlation between household members with number of cattle.

Table 4 Plotting size area (30 project farmers).

Province	Raining season		Dry season	
	Min. size (m <sup>2</sup> )	Max. size (m <sup>2</sup> )	Min. size (m <sup>2</sup> )	Max. size (m <sup>2</sup> )
Kampong Cham	5,000	200	2,000	100
Pursat	6,000	150	2,400	200
Combination of provinces	6,000	150	2,400	100

Table 5 Comparison of plotting area by season (30 project farmers).

Province	Raining season		Dry season		<i>p</i> -value
	Area (m <sup>2</sup> )	SE	Area (m <sup>2</sup> )	SE	
Kampong Cham	1,397	324	620	137	0.049
Pursat	1,357	387	993	143	0.327
Combination of provinces	1,377	248	807	146	0.032

Table 6 Comparison of plotting area by province (30 project farmers).

Periods	Kampong Cham		Pursat		<i>p</i> -value
	Area (m <sup>2</sup> )	SE	Area (m <sup>2</sup> )	SE	
Raining season	1,397	324	1,357	387	0.937
Dry season	620	137	993	143	0.070
Combination Period	1,008	187	1,175	205	0.551

there was about 32% of number of cattle in household which has negative relationship with household numbers, it meant the lower member in household, the higher number of cattle will be occupied, while 68% came from other factors.

### 3.3 Planting Area

For the total of 30 project farmers, adopted farmers in Tables 4-6, used the plot area to plant the forage which has highly varied with the household, and the maximum plot was 6,000 m<sup>2</sup> for raining season and

2,400 m<sup>2</sup> for dry season, while the minimum size was almost similar for those two seasons. In addition, the average size of plotting area also varied depending on season, especially there were more plating areas in raining season than dry season; but there was no different size between those two provinces (Fig. 3).

### 3.4 Types of Planting Grass

The project has supported the seed of five varieties of grass to farmers, in Table 7, such as Stylo, Mulato II, Symboung, Russie and Paspalum. However, Russie

grass seems to be less interesting for farmers in Kampong Cham in raining season while, Stylo is type of legume that has been applied to plant by about 80% of farmers in Kampong Cham.

3.5 BCS

The number of male and female cattle of these three types of farmers selected for BCS was not significantly different, it meant that those farmers had similar percentage rate of male and female cattle, which could not affect our study (Table 8).

Through result in Table 9, the frequency of BCS in both provinces found that the adopted farmers occupied the highest percentage of BCS #3, accounting for 19.1% and 7.72% in Kampong Cham and Pursat of those 2 seasons respectively followed by exposed farmers; in contrast, the adopted farmers occupied the lowest percentage of BCS #1.

For BCS of cattle, in general there were relationships with the gender of cattle, male cattle had

higher body scoring than female. If we compared BCS of cattle with the age, we found that, cattle at age of 1-3 years old has higher BCS than other, and is followed by age under 1 year and over 3-5 years old, yet when cattle became older than 5 years old they made the BCS lower, shown in Table 10 and Fig. 4.

The BCS of cattle in Kampong Cham province was higher than in Pursat and the average of both seasons was 2.24 and 1.96 respectively. It was similar when comparing by seasons in Kampong Cham where the BSC varied with the season, however, there was no difference for Pursat province. In general, the BSC has varied depending on season, in raining season, the cattle had higher BSC than in dry season, indicated in Table 11 and Fig. 4.

The adopted farmers had better BCS of cattle than exposed and non-exposed farmers, in average they were 2.56 in Kampong Cham and 2.15 in Pursat. Even in different seasons, the adopted farmers had also

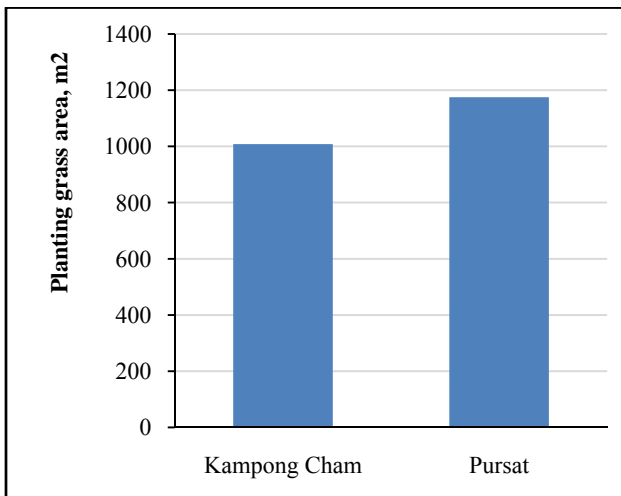


Fig. 3 Plotting area of project participants.

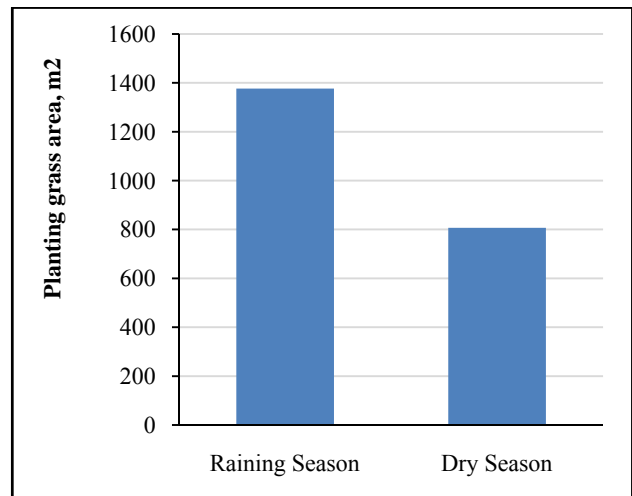


Table 7 Planting grass.

Type of grass	Raining season				Raining season			
	Kampong Cham		Pursat		Kampong Cham		Pursat	
	Number	%	Number	%	Number	%	Number	%
Stylo	13	86.7	15	100	12	80.0	15	100
Mulato II	15	100	15	100	14	93.3	13	86.7
Symoung	15	100	15	100	13	86.7	15	100
Russie	9	60.0	15	100	14	93.3	13	86.7
Paspalum	15	100	15	100	14	93.3	13	86.7

**Table 8** Number of cattle estimated the BCS.

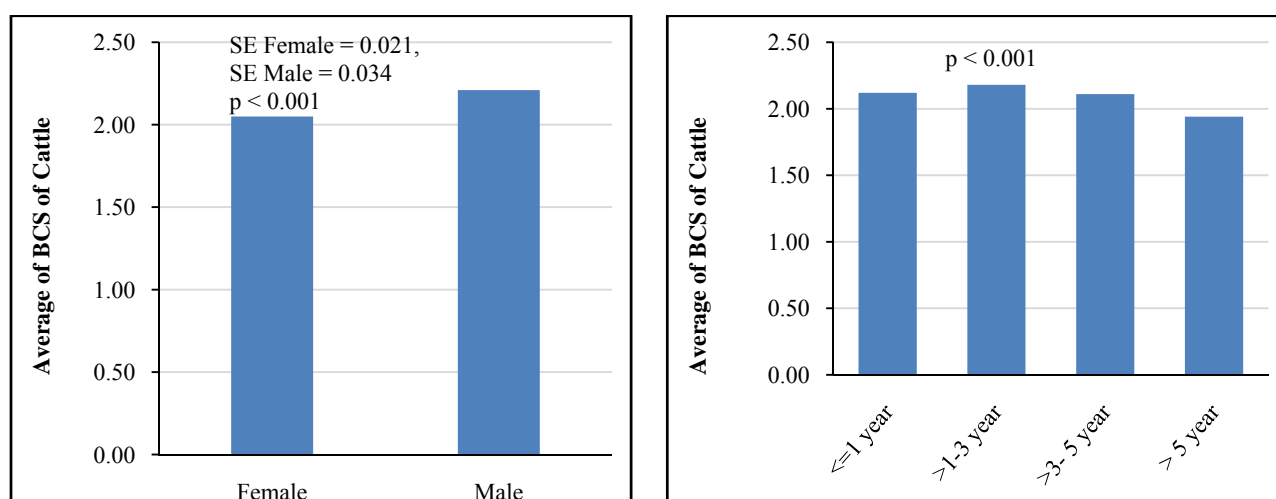
Kampong Cham Province												
Parameter	Raining season				Dry season				Average			
	Male		Female		Male		Female		Male		Female	
	No. head	%	No. head	%	No. head	%	No. head	%	No. head	%	No. head	%
Adopted farmer	40	34.5	76	65.5	16	18.6	70	81.4	28	27.7	73	72.3
Exposed farmer	21	23.1	70	76.9	14	23.7	45	76.3	17.5	23.3	58	76.7
Non exposed farmer	15	18.8	65	81.3	23	27.1	62	72.9	19	23.0	64	77.0
Chi-square	6.81				1.74				0.68			
<i>p</i> -value	0.078				0.627				0.878			
Pursat Province												
Adopted farmer	28	34.1	54	65.9	46	35.4	84	64.6	37	34.9	69	65.1
Exposed farmer	32	35.2	59	64.8	21	24.7	64	75.3	27	30.1	61.5	69.9
Non exposed farmer	25	30.9	56	69.1	13	21.0	49	79.0	19	26.6	53	73.4
Chi-square	0.38				5.29				1.44			
<i>p</i> -value	0.944				0.152				0.696			

**Table 9** Frequency of cattle with different types of BCS.

Province	Type of farmers	Body score								<i>p</i> -value
		1		2		3		4		
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	
Raining season										
Kampong Cham	Adopted farmer	1	0.35	49	17.1	58	20.2	8	2.79	< 0.001
	Exposed farmer	7	2.44	64	22.3	20	6.97	0	0.00	
	Non exposed farmer	7	2.44	65	22.6	8	2.79	0	0.00	
Pursat	Adopted farmer	1	0.39	63	24.8	18	7.09	0	0	< 0.001
	Exposed farmer	22	8.66	54	21.3	15	5.91	0	0	
	Non exposed farmer	31	12.2	43	16.9	7	2.76	0	0	
Dry season										
Kampong Cham	Adopted farmer	1	0.43	44	19.1	41	17.8	0	0	< 0.001
	Exposed farmer	6	2.61	42	18.3	11	4.78	0	0	
	Non exposed farmer	19	8.26	54	23.5	12	5.22	0	0	
Pursat	Adopted farmer	8	2.89	99	35.7	23	8.30	0	0	< 0.001
	Exposed farmer	12	4.33	72	26.0	1	0.36	0	0	
	Non exposed farmer	14	5.05	41	14.8	7	2.53	0	0	
Combined two seasons										
Kampong Cham	Adopted farmer	2	0.39	93	18.0	99	19.1	8	1.55	< 0.001
	Exposed farmer	13	2.51	106	20.5	31	6.00	0	0.00	
	Non exposed farmer	26	5.03	119	23.0	20	3.87	0	0.00	
Pursat	Adopted farmer	9	1.69	162	30.5	41	7.72	0	0.00	< 0.001
	Exposed farmer	34	6.40	126	23.7	16	3.01	0	0.00	
	Non exposed farmer	45	8.47	84	15.8	14	2.64	0	0.00	

**Table 10** Body scoring of cattle comparing with gender of cattle.

Gender	Unite	BCS1	BCS2	BCS3	BCS4	<i>p</i> -value
Raining season						
Female	Head	52	249	76	3	0.005
	Percentage (%)	13.68	65.53	20.00	0.79	
Male	Head	17	89	50	5	
	Percentage (%)	10.56	55.28	31.06	3.11	
Dry season						
Female	Head	54	262	58	0	0.001
	Percentage (%)	14.44	70.05	15.51	0.00	
Male	Head	6	90	37	0	
	Percentage (%)	4.51	67.67	27.82	0.00	
Combination period						
Female	Head	106	511	134	3	< 0.001
	Percentage (%)	14.06	67.77	17.77	0.40	
Male	Head	23	179	87	5	
	Percentage (%)	7.82	60.88	29.59	1.70	

**Fig. 4** BCS by gender and age of cattle.**Table 11** BCS.

Parameters	BSC	SE Mean	BSC	SE Mean	BSC	SE Mean
BCS by province						
Provinces	Raining season		Dry season		Combined 2 seasons	
Kampong Cham	2.30	0.033	2.16	0.036	2.24	0.026
Pursat	1.95	0.035	1.96	0.033	1.96	0.025
<i>p</i> -value	< 0.001	-	< 0.001	-	< 0.001	-
BCS by season						
Season	Kampong Cham		Pursat		Combined provinces	
Raining season	2.30	0.036	1.95	0.033	2.14	0.026
Dry season	2.16	0.040	1.96	0.044	2.05	0.027
<i>p</i> -value	0.021	-	0.352	-	0.045	-

\* The significant in column, if  $p \leq 0.05$ .

**Table 12 BCS of cattle with different parameter.**

Type of farmer	Kampong Cham		Pursat		Raining season		Dry season		Combination	
	BSC	SE Mean	BSC	SE Mean	BSC	SE Mean	BSC	SE Mean	BSC	SE Mean
Adopted farmer	2.56	0.051	2.15	0.036	2.46	0.042	2.26	0.036	2.35	0.028
Exposed farmer	2.12	0.057	1.90	0.040	2.03	0.043	1.96	0.044	2.00	0.031
Non exposed farmer	1.96	0.061	1.78	0.044	1.86	0.046	1.91	0.043	1.88	0.032
<i>p</i> -value	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-	< 0.001	-

\* The significant in column, if  $p \leq 0.05$ .

better BCS than exposed and non-exposed farmers as well, accounting for 2.46 and 2.26 in raining and dry season respectively. In general, the adopted farmers had highest BCS followed by exposed farmers, then non-exposed farmers who had lowest average of BCS, in Table 12.

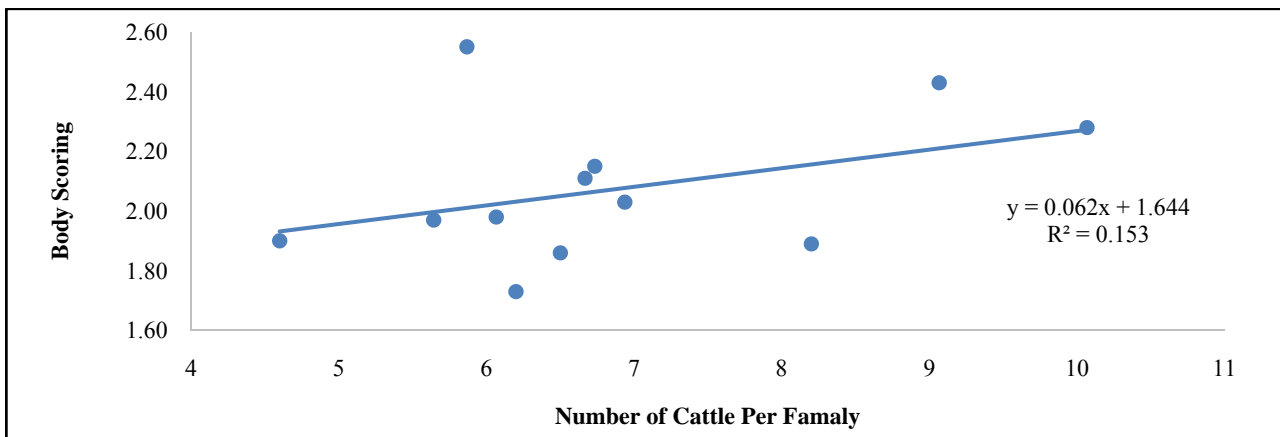
**3.6 Correlation of BCS with Other Variation**

The result of Fig. 5 below, has shown non-correlation between cattle number with BCS, even the average

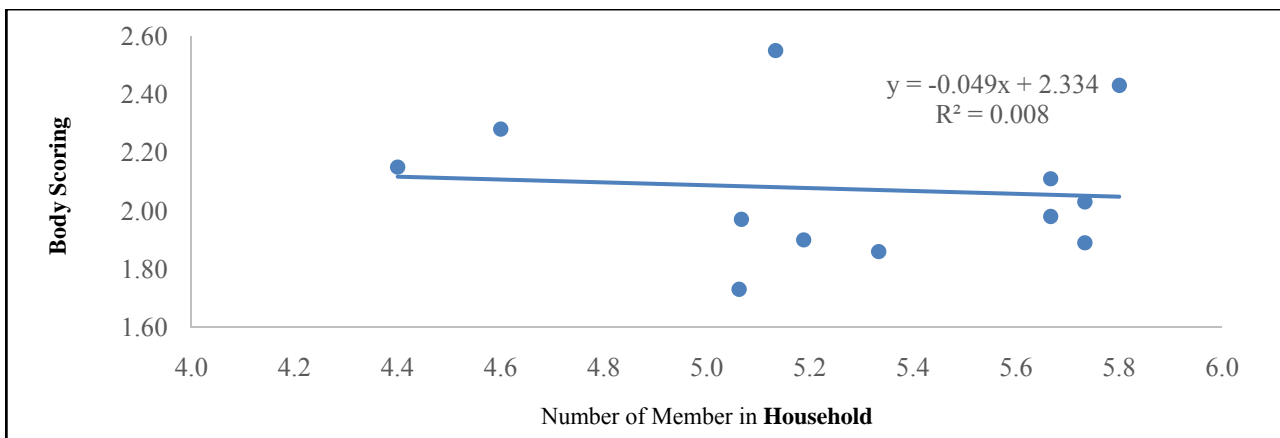
household member also has no relationship to higher or lower BCS; thus it would be affected by other factors.

**3.7 Selling Cattle of the Last 2 Years**

Through the interviewing, most of the correspondents have sold their cattle in the last 2 years and there were no significant differences among those three types of farmers, and in general accounted for 70% to 83.3%, as Table 13 shows.



**Fig. 5 Non-correlation between cattle number and BCS.**



**Fig. 6 Non-correlation between number of household member and BCS.**



**Table 13** Number of household that sold cattle in the last 2 years of the project life.

Types of farmer	Kampong Cham		Pursat		Combination of provinces
	#HH	%	#HH	%	%
Adopted farmer	12	80.00	13	86.67	83.3
Exposed farmer	9	60.00	12	80.00	70.0
Non-exposed farmer	11	73.33	11	73.33	73.3

\* Note: HH = Household.

**Table 14** Number of cattle sold in the last 2 years of each province.

Variable	Adopted farmer	Exposed farmer	Non-exposed farmer	SE Mean	<i>p</i> -value
Kampong Cham	2.13	1.20	0.73	0.393	0.047
Pursat	1.67	1.33	1.40	0.383	0.809
Combination of provinces	1.90	1.27	1.07	0.274	0.087

The significant in row, if  $p \leq 0.05$ .

**Table 15** Comparing of number of cattle sold.

Province	Cattle	SE Mean	<i>p</i> -value
Kampong Cham	1.36		
Pursat	1.47	0.224	0.727

**Table 16** Price of cattle of each type of farmer.

Variable	Price per head (Riel $\times 10^6$ )						<i>p</i> -value
	Adopted farmer		Exposed farmer		Non-exposed farmer		
	Riel	SE Mean	Riel	SE Mean	Riel	SE Mean	
Kampong Cham	3.10	0.371	2.78	0.43	2.93	0.387	0.851
Pursat	2.62	0.216	2.1	0.225	2.08	0.235	0.158
Combination of provinces	2.85	0.216	2.39	0.235	2.51	0.230	0.317
	Total income (Riel $\times 10^6$ )						
Kampong Cham	8.42	1.254	5.04	1.45	2.93	1.310	0.017
Pursat	5.12	1.057	3.3	1.10	4.45	1.149	0.492
Combination of provinces	6.71	0.83	4.05	0.91	3.69	0.89	0.029

The significant in row,  $p < 0.05$ .

Exchange rate to USD: 1 USD  $\approx$  4,000 Riels.

The average number of cattle that have been sold by farmers in Kampong Cham was significantly different from those types of farmers, it meant that adopted farmers sold more cattle than exposed and non-exposed farmers did. However, there were no significant differences for Pursat province and for combination of those two provinces, although adopted farmers seem to be sold the cattle a bit higher number than others did. It was the same when comparing with province in Tables 14 and 15.

Selling price per head of cattle was not different significantly from those farmers and selling price ranged from  $2.39 \times 10^6$  to  $2.85 \times 10^6$  Riels. However,

the total income from the total cattle that have been sold was different significantly from those types of farmers in Kampong Cham, and different as well for combination of those 2 provinces; it meant that the adopted farmers got higher income from selling cattle in the last two years than others. In general the adopted farmers got  $6.71 \times 10^6$  Riels and were followed by exposed farmers,  $4.05 \times 10^6$  Riel, then non-exposed farmers  $3.69 \times 10^6$  Riels, shown in Table 16.

If comparing with provinces, the price of cattle per head got by farmer in Kampong Cham was higher than in Pursat province, accounting for  $2.95 \times 10^6$  Riels and  $2.28 \times 10^6$  Riels respectively. However,

**Table 17 Cattle price of province.**

Variable	Kampong Cham		Pursat		<i>p</i> -value
	Riel × 10 <sup>6</sup>	SE Mean	Riel × 10 <sup>6</sup>	SE Mean	
Price per head	2.95	0.183	2.28	0.173	0.01
Total income	5.58	0.761	4.31	0.718	0.228

\* The significant in row of table, if  $p \leq 0.05$ .

Exchange rate to USD: 1 US\$ ≈ 4,000 Riels.

there were no significant differences for total income from selling total cattle of those two provinces, in the last two years (Table 17).

#### 4. Discussion

The developing perennial forage plots close to households have reduced the amount of labor and time that farmers spend on supplying cut-and-carry forage to their animals. In addition, the growing of forages can meaningfully reduce the grazing pressure on common grazing lands, thereby lowering the potential for environmental degradation [6]. The establishment of forage plots in high-intervention project villages provided an improvement in average daily liveweight gain of cattle and saved farmers up to 2 h labour per day [3]. This result is similar to authors' finding that adopted forage farmers had better BCS and income than those who were not involved; however, the exactly time spent among those types of farmers should be further studied.

#### 5. Conclusion

In general, authors conclude that the introduction of planting forage will contribute to improving BCS of cattle; moreover, season, gender and age of cattle also affect the BCS of cattle as well; in addition, it had provided higher income as well. However, the study on the economics of converting cropland to forage plot should be deeply studied, since there are competitions of land using.

#### Acknowledgement

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