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Cattle Raising Practices in North-West Cambodia

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Abstract: We aimed to assess current cattle farming practices in northwest Cambodia in terms of economy, practical management, productivity, and sustainability. The study sites were selected in four provinces (Pursat, Battambang, Pailin, and Banteay Meanchey) with 316 cattle livestock farmers interviewed as representative samples using systematic sampling. A stratified sampling method was utilized. Data were analyzed and descriptive statistics was used to quantify and summarize the data. The statistical significance of the mean differences between the data sets was determined using cross-tabulation and frequency to verify its variance. The univariate was tested for the normal distribution. The Pearson correlation was used to evaluate the annual income between cattle local breed-crossbred and infectious diseases. The result elucidated that 90.51% were males and 9.49% were females. Most farmers' education is in primary school (61.71%) followed by no education (18.04%), secondary school (14.24%), and 6.01% for high school education. Livestock farmers in northwest Cambodia had some constraints based on animal feed sources, insufficient labor, technical management, and infectious diseases. However, Livestock farmers are still able to earn approximately 500-1,500 US dollars from their investigations annually. Separately, Livestock farmers who raise crossbred cattle have the opportunity to earn more than local breed cattle farmers, approximately 8,000 US dollars annually. Annual sales of crossbred had a very high positive correlation with the total revenue of crossbred cattle and were statistically significant ($r = 0.91$, $p<0.001$) and annual sales of local breeds were moderately positive ($r = 0.67$, $p<0.001$). Thus, Cattle farmers who raise cattle are the main contributors to enhancing livelihood incomes. So, crossbred cattle have been encouraged in northwest Cambodia.

Keywords: Constraint, Crossbred, Local Breed, Northwest Cambodia

Introduction

According to projections of world population growth, increasing revenue and urbanization were needed to meet the demand for livestock production (Morm *et al.*, 2024). It plays a crucial role in improving food security and human society sovereignty, promoting adjustment of the agricultural structure and realizing comprehensive resource utilization (Puente-Rodríguez *et al.*, 2019; Han *et al.*, 2020; Wei and Zhen, 2020; Akash *et al.*, 2022). The intensification of livestock production is primarily needed to meet the rising demand and this has changed due to the human population transition from rural to urban status, which corresponds to many farming and animal housing densities (Akash *et al.*, 2022). Meanwhile, cattle raised by smallholder farmers used natural grasses and crop residues to feed their animals. In northwest Cambodia, smallholder farmers face many obstacles that hinder their ability to take advantage of agricultural prospects. A comprehensive strategy that increases access to funding, advances knowledge and skills, reduces environmental dangers, and fortifies institutional support is needed to address these issues. The lack of capital makes it difficult for these farmers to adopt modern farming techniques, such as mechanization or using high-quality seeds and fertilizers, essential for increasing productivity (Mwangi *et al.*, 2021). Moreover,

smallholder farmers often lack access to credit facilities, further exacerbating their inability to invest in necessary inputs and technologies (Pekarcik *et al.*, 2023). As a result, low cattle productivity increased due to the feed resources for cattle having become constrained in the area cultivated, with crops increasing as the cattle population increased (Khoeun *et al.*, 2023). The World Food Security Committee of the United Nations (WFSCU) asserted that the nutrient was a significant constraint on cattle production (Varijakshapanicker *et al*., 2019). The sustainability of livestock is recognized in three dimensions: Environmental, economic, and social. Environmental sustainability focuses on minimizing the ecological footprint of livestock production which includes reducing greenhouse gas emissions, improving feed efficiency, and promoting practices that enhance biodiversity and ecosystem services (Bansok, 2011; Smith, 2024). Galioto *et al.* (2017); Herrero *et al.* (2023) revealed that sustainability of economic contributed equality is vital and profitable for livestock, producing cost recovery and achieving profitability without social standards or compromising the environment. Social sustainability which encompasses animal welfare and community well-being is increasingly recognized as a critical component of sustainable livestock farming. Currently, agriculture and livestock production in Cambodia play an essential role in economic acceleration, increasing food security and employment, especially in rural regions and communities (M.A.F.F., 2013; Keenan *et al.*, 2015). The Cambodian population is approximately 80% in rural areas and 71% depend on agriculture (rice cultivation) and livestock products for their livelihoods (United State Department of Agriculture, 2010; Dahl, 2016; Siek *et al.*, 2017). Cattle production is a potential sector contributing to improved livelihood income. Raising cattle is a path to food security, nutritional modification, economic growth, and poverty reduction (M.A.F.F., 2018). Increasing the demand for livestock products will provide an essential economic opportunity for farmers. However, in Cambodia, the cattle are mostly raised under a subsistence production system with traditional methods (Siek *et al.*, 2017). In addition, livestock productivity has contributed approximately 11.4% of the agriculture sector's Gross Domestic Product (GDP) economic growth (Harry, 2011). Traditionally, in Cambodia, a small-scale system of cattle raising was typically fed based on grazing in dry conditions. The system mostly used rice straw, a very poor nutrient for survival in rainy seasons. Through a labor and time-intensive or flood season, cattle were tethered and fed on a ‘cut-and-carry’ of native grasses and crop residues (Young *et al.*, 2013). On the other hand, the typical constraints on cattle productivity in Cambodia were poor husbandry management, including weaning, vaccination, and breeding practices (Pen *et al.*, 2010). Still, Mob *et al.* (2012) asserted that better cattle housing with proper health care improved the feeding systems and cattle production for better farmers' income. Thus, this study aimed to assess current cattle farming practices in northwest Cambodia in terms of economy, practical management, productivity, and sustainability.

Materials and Methods

Description of the Study Area

Based on the availability of cattle fattening, financial beneficiaries, cattle management, cattle diseases, and live animal markets in north-west Cambodia. The area studied was selected in Pursat province which targeted Bakan and Talousenchey districts; Battambang province targeted Rattanak Mondul and Koh Krala districts; Banteay Meanchey targeted Ochrov and Preahneatpreah districts; Pailin targeted Krong Pailin and Salakrau districts Fig. (1). These provinces are located at Tonle Sap Lake in Cambodia except Pailin province. These selected provinces are the most popular for raising ruminant livestock, a specific agroecological or socio-economic factor that influenced the selection.

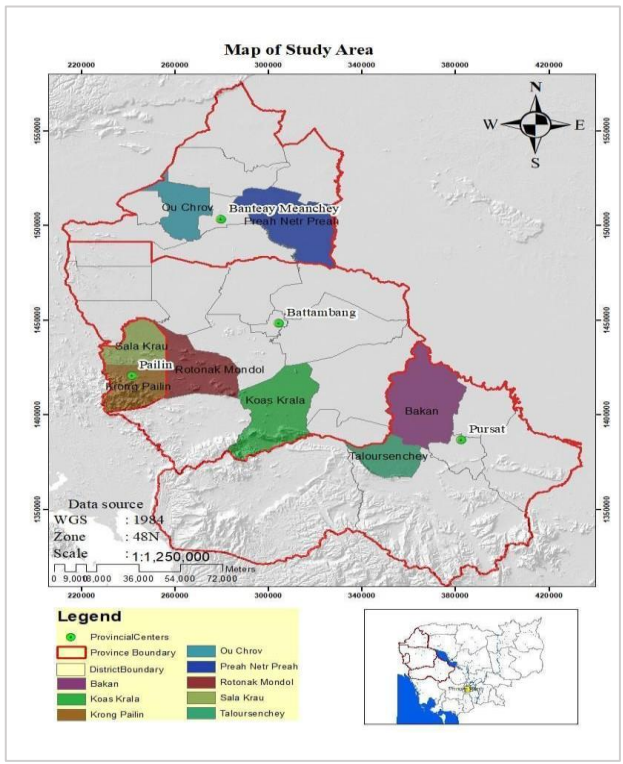

Fig. 1: North-west Cambodia including Pursat, Battambang, Pailin, and Banteay Meanchey provinces were selected

Sampling Methods

The study sites were selected in four provinces (Pursat, Battambang, Pailin, and Banteay Meanchey), with 316 cattle livestock farmers of the total interviewed as representative samples using a systematic sampling method. A stratified sampling method was utilized. Yamane (1973) was used to determine the sample size with a confidence level of 90% Table (1):

$$n = \frac{N}{1 + N(e)2}$$

where:

n Sample size representative
N Population size denotative
E Precision levels
1 Constant

With the assumption of a 5% level of precision, a total of 1,515 population sizes were taken from this total population sample sizes as follows:

$$n = \frac{1{,}515}{1 + 1{,}515(0.05)2}$$

$$n = 316$$

Therefore, these potential areas are popular for raising cattle. The number of cattle is approximately 34% or 830, 000 heads in cattle production in Cambodia (N.I.S., 2019).

Table (1), four potential provinces in livestock raising located in northwest Cambodia have been selected for evaluation on livestock conditions, including animal feeding, disease management, breeding, and financial flows. The total number of selected livestock farmers was 316 households: Battambang selected 51 households and represented 7 villages, Pursat selected 142 households and represented 4 villages, Pailin selected 72 households and represented 7 villages and Banteay Meanchey selected 51 households and represented 4 villages.

Data Type and Collection Methods

Both primary and secondary data were collected. The primary data were gathered using questionnaires, interviews with informants and stakeholders, and direct field observation on feed management, house management, fattening cattle selection, and disease control, which were essential parts of the research process. Secondary data has been collected from various written documents, both public and unpublished. Demographic characteristics, cattle fattening techniques, cattle selection, feeding systems, feed sources, annual fattening frequency, housing, and other crucial husbandry procedures, challenges associated with cattle fattening practices and marketing and systems for marketing needs, fattened cattle, cattle diseases were all evaluated through the preparation of questionnaires.

Data Analysis

Collected data were analyzed using IBM Statistical Software for Social Science (SPSS) V.21.0 and descriptive statistics was used to quantify and summarize the data.

Table 1: The target interviewed livestock houses in northwest Cambodia

Provinces	Krong/ District	Communes	Villages	Households
Battambang	Kohkrolar (district)	Chhnal Maon	Chhnal Maon	11
			Krang Svat	5
			Chay Balang	2
	Rokhakiri (district)	Basak	Basak village	2
			Preakchik	12
		Duonba	Kokroka	16
			Duonba	3
Pursat	Bakhan (district)	Me Tuek	Opreal	34
			Trang	42
			Angkanh	37
		Talosenchey	Preyveang	29
Pailin	Pailin (krong)	Otavau	Deikrohorm	7
		Tuolvea	Tmey	19
		Salakrao	Sambo	15
			Srae Antek	13
		Stengkhach	O Andong	3
			Stengkhach	4
		Stengtrong	Tomnub	11
Banteay Meanchey	Ou Chhrov (district)	Changha	Ta Chreng	6
			Beng Sela	9
	Preah Netpreah (district)	Chhor Manchey	Kok Trach	18
			Samroungthom	18

The statistical significance of the mean differences between the data sets was determined using cross-tabulation and frequency to verify its variance. The UNIVARIATE was tested for the normal distribution. The Pearson correlation is used to evaluate the annual income compared to the education levels.

Results

In Table (2), The respondents responded that 90.51% were males and 9.49% were females. Most farmers' education is in primary school, followed by no education, secondary school, and high school education, respectively. Most cattle farmers are married, divorced, and single, respectively. The majority of the respondents were middle-aged. In addition, several age respondents found that the number of livestock between 25-30 years old is smaller than other age groups. Younger farmers are not very interested in livestock; they are familiar with informal business (garment, labor sale, tourist services, etc.). At the same time, the number of livestock farmers in Pursat is more interested in animals than in Battambang, Pailin, and Banteay Meanchey. Livestock farmers in Pursat preferred to raise animals; this could be due to suitable geographic conditions and the large amount of forage they had to supply their animals.

Table 2: Statistical respondents of the social demographics in the interviewed sites

Responded data	Battambang (n = 51)		Pursat (n = 42)		Pailin (n =72)		Banteay Meanchey (n = 51)	
	KKL (%)	RKR (%)	BK (%)	TCS (%)	KP (%)	SK (%)	OC (%)	PNT (%)
No of Households								
1-3	3(5.6)	2(3.70)	20(37)	9(16.70)	3(5.60)	6(11.10)	6(11.10)	5(9.30)
4-7	30(12.90)	10(4.30)	82(35.20)	20(8.60)	20(8.60)	36(15.50)	8(3.40)	27(11.60)
≥8	3(10.30)	2(6.90)	11(37.90)	1(3.40)	3(10.30)	4(13.80)	1(3.40)	4(13.80)
Age (year)								
25-30	2(11.80)		6(35.30)	6(35.30)	2(11.80)	1(5.90)		
31-40	9(13.60)		28(42.40)	5(7.60)	12(18.20)	9(13.60)	1(1.50)	2(3)
41-50	7(8.60)	6(7.40)	23(28.40)	8(9.90)	5(6.20)	19(23.50)	5(6.20)	8(9.90)
51-60	7(9.20)	4(5.30)	26(34.20)	5(6.60)	5(6.60)	10(13.20)	8(10.50)	11(14.50)
61-70	10(17.90)	2(3.60)	22(39.30)	6(10.70)	2(3.60)	2(3.60)	1(1.80)	11(19.60)
≥70	1(8.30)	1(8.30)	4(33.30)			4(33.30)		2(16.70)
Gender								
Male	35(12.20)	13(4.50)	99(34.60)	25(8.70)	25(8.70)	44(15.40)	14(4.90)	31(10.80)
Female	1(3.30)	1(3.30)	14(46.70)	5(16.70)	1(3.30)	2(6.70)	1(3.30)	5(16.70)
Marital Status								
Single	1(11.10)		3(33.30)			2(22.20)		3(33.30)
Married	35(12.20)	13(4.50)	102(35.50)	27(9.40)	26(9.10)	43(15)	14(4.90)	27(9.40)
Divorced		1(5)	8(40)	3(15)		1(5)	1(5)	6(30)
Labor (male)								
1-2	15(9.10)	6(3.60)	65(39.40)	18(11)	11(6.70)	23(13.90)	11(6.70)	16(9.70)
3-5	21(15)	6(4.30)	45(32.10)	11(7.90)	14(10)	20(14.30)	4(2.90)	19(13.60)
≥6		1(14.30)	2(28.60)		1(14.30)	2(28.60)		1(14.30)
Education levels								
Primary school	19(9.70)	8(4.10)	77(39.50)	15(7.70)	17(8.70)	24(12.30)	11(5.60)	24(12.30)
Secondary school	4(8.90)		15(33.30)	10(22)	5(11.10)	9(20)		2(4.40)
High school	2(10.50)		6(31.60)	2(10.50)	1(5.20)	6(31.60)		2(10.50)

Note: KKL = Kohkrrolar, RKR = Rokhakiri, BK = Bakhan, TSC = Talosenchey, KP = Krong Pailin, SK = Salakrau, OC = Ouchrov, PNT = Preahnetpreah, n = frequency, ≥ smaller or equal symbol, ≤bigger or equal symbol

Table (3), elucidated that the livestock raising perception in these four provinces revealed that its simple upbringing due to those raising based on tethered at 69.30% and only 30.38% used zero-grazing. In comparison, their cattle were aligned with vaccination programs based on only four main types, including hemorrhagic septicemia, Foot and Mouth Diseases (FMD), black legs, and Lumpy Skin Diseases (LSD). The LSD vaccinated was higher than the other triple types but followed by FMD. Separately, in antiparasite, very few cattle were injected.

Based on Table (4), the local breed of livestock farmers, fifty-one households in total, responded that they raised cattle between 4-6 heads in Pursat province. Compared to the other three provinces (Battambang, Pailin, and Banteay Meanchey), farmers held cattle between 21-40 heads in Pailin province. Separately, responded farmers who have more than 40 heads of cattle are a domain of Battambang farmers. Those livestock farmers who could sell their cattle at 1-2 heads annually are from Pursat and responded to seventy-four households. Still, only two households that can sell their cattle more than 10 heads annually are from Battambang and Pailin. Therefore, Farmers who raised crossbreeds earned higher incomes, with some earning more than $8,000 annually, while many local breed farmers earned much less.

Table 3: Livestock farmers perception and practical management in north-west Cambodia

Responded data	Battambang (n = 51)	Pursat (n =142)	Pailin (n = 72)	Banteay Meanchey (n = 51)	Total (%)
Livestock farmer's experiences (year)					
1-5	7	26	12	-	14.24
6-10	7	25	19	4	17.41
11-20	21	50	30	34	42.72
>20	14	42	11	13	25.32
Raising perception					
Simple upbringing	50	133	72	47	98.73
Livestock raising behaviour					
Tethering at field	25	115	44	35	69.30
Zero-grazing	25	28	27	16	30.38
Vaccination and parasitic programs					
Hemorrhagic septicemia	15	12	15	8	15.82
Food and mouth diseases	27	45	58	21	47.78
Black legs	1	1	7	0	2.85
Lumpy skin diseases	26	114	63	35	75.32
Antiparasitic	4	7	3	-	4.11
Diseases management					
Self-service	2	3	5	5	4.75
Veterinary service	7	6	11	2	8.23
Core-labor					
Insufficient labour	50	140	68	51	97.78
Livestock raising awareness					
Limited knowledge	42	133	71	48	93.04

Note: KKL = Kohkrrolar, RKR = Rokhakiri, BK = Bakhan, TSC = Talosenchey, KP = Krong Pailin, SK = Salakrau, OC = Ouchrov, PNT = Preahnetpreah, n = frequency, ≥ smaller or equal symbol, ≤bigger or equal symbo

Table 4: Annual incomes of cattle farmers between local breed and crossbreed in northwest Cambodia

Responded data	Local breed				Total	Crossbred				Total
	BTB	PS	PL	BMC		BTB	PS	PL	BMC	
Cattle (head), %										
1-3	6(1.90)	48(15.19)	13(4.11)	10(3.16)	77(24.37)	1(0.30)	5(1.60)		4(1.30)	10(3.16)
4-6	15(4.75)	51(16.14)	12(3.80)	14(4.43)	92(29.11)		1(0.30)		4(1.30)	5(1.58)
7-10	14(4.43)	27(8.54)	20(6.33)	14(4.43)	75(23.73)			1(0.30)	1(0.30)	2(0.63)
11-20	12(3.80)	11(3.48)	18(5.70)	7(2.22)	48(15.19)	1(0.30)		4(1.30)		5(1.58)
21-40	1(0.32)	2(0.63)	7(2.22)		10(3.16)					
>40	1(0.32)				1(0.32)					
Annual selling (head), %										
1-2	35(11.10)	74(23.42)	36(11.39)	22(6.96)	167(52.85)		3(0.90)	2(0.60)	5(1.60)	10(3.16)
3-5	7(2.22)	20(6.33)	17(5.39)	4(1.27)	48(15.19)	1(0.30)		3(0.90)		4(1.27)
6-10	2(0.63)	1(0.32)		2(0.63)	5(1.58)					

Table 4: cont.

>10	2(0.63)		2(0.63)		4(1.27)					
Annual Incomes ($), %										
<500	5(1.58)	2(0.63)	1(0.32)	3(0.95)	11(3.48)					
500-1,500	18(5.70)	33(10.44)	20(6.33)	6(1.90)	67(24.37)	1(0.30)	1(0.30)	3(0.90)	2(0.60)	8(2.22)
1,501-4,000	11(3.48)	21(6.65)	8(2.53)	8(2.53)	48(15.19)		1(0.30)			1(0.32)
4,001-8,000	1(0.32)	7(2.22)	6(1.90)	2(0.63)	16(5.06)					
>8,000	2(0.63)	5(1.58)	7(2.22)		14(4.43)			1(0.30)		1(0.32)

Note: BTB= Battambang, PS= Pursat, BMC= Banteay Meanchey, KKL = Kohkrrolar, RKR = Rokhakiri, BK = Bakhan, TSC = Talosenchey, KP = Krong Pailin, SK = Salakrau, OC = Ouchrov, PNT = Preahnetpreah, n = frequency, < smaller symbol, > bigger symbol, $ = U.S dollar

Table 5: Pearson correlation coefficients (r) on income and livestock-raising behavior in northwest Cambodia

Variable	AnS-LB	AnS-CB	In-TLB	In-TCB	TSV	Self-T	V-HS	V-FMD	V-BL	V-LSD
AnS-LB	-									
AnS-CB	0.08	-								
In-TLB	.67**	.02	-							
In-TCB	.13*	.91**	.03	-						
TSV	-0.01	.07	-.04	.07	-					
Self-T	.16**	.17**	.03	.23**	.09	-				
V-HS	-0.07	.05	-.09	.06	-.08	.15**	-			
V-FMD	-0.06	.05	-.02	.08	-.09	.14*	.91**	-		
V-BL	.04	.16**	.02	.15**	-.04	.09	.10	.10	-	
V-LSD	.06	-0.05	.09	-.04	-.02	.10	.02	.01	-0.03	-

Note: AnS-LB = Annual sale of local breed, AnS-CB = Annual sale of crossbred, In-TLB = total income of local breed, In-TCB = total income of crossbred, TSV = Treatment service, Self-T = self-treatment, V-SH = Vaccine on hemorrhagic septicemia, V-FMD = vaccine on foot and mouth diseases, V-BL = vaccine on black legs, V-LS = vaccine on lumpy skin disease

**. Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)

Table (5) elucidated that the conclusion of the annual income and livestock-raising behavior in northwest Cambodia by comparison in Pearson correlation found that annual sales of crossbred had a very high positive correlation with total revenue of crossbred cattle and was statistically significant ($r = 0.91$, $p<0.001$). At the same time, annual sales of local breeds were moderately positive with a total income of crossbred cattle and significant statistic ($r = 0.67$, $p<0.001$). In addition, the cattle were outbreak with several infected diseases, and cattle owners served their animals by themselves on Hemorrhagic Septicemia (HS) and Foot and Mouth Disease (FMD) ($r = 0.15$, $p = 0.01$) was negligible with self-treatment. However, the farmers without vet services had a very high negative with HS and FMD ($r = -0.80$, $p = 0.13$). In addition, livestock farmers didn't use the vet service on FMD and HS because it is an unacute disease transmitted to their cattle. Thus, they thought this kind of virus could recover about 1-2 weeks after their cattle-infected diseases.

Discussion

The current results revealed that 90.51% of respondents are males and 9.49% are females among the sample of 316 households. This research finding is similar to Serey *et al.* (2014), who reported that 90% of respondents are males and 10% are females. Young *et al.* (2017) reported that 70.83% are males and 29.17% are females, which differs from previous results. The male cattle producers have carried out most tasks, such as feeding outside the field, watering, collecting forage, manure management, and cleaning. Regarding socio-economics, education is critical and significant for development sectors (Ogunleye *et al.,* 2015). Likewise, the World Bank in 1992 reported that with primary education, farmers could increase their productivity by 7-8% in low-income countries (Oduro-Ofori *et al.,* 2014). In this study, the farmers who got access to education are at most of the primary school level (61.71%). On the other hand, 14.24% of cattle farmers had a secondary school level and 6.01% had a high school education. The educational interventions, especially those that involve participatory training and on-the-job learning, significantly improve farmers' awareness of biosecurity and disease prevention, enhance livestock health outcomes, and produce revenue (Sieng *et al.,* 2022; Young *et al.,* 2017). These results highlight the significance of incorporating educational elements into livestock development initiatives to guarantee long-term gains in farmer incomes (MacPhillamy *et al.,* 2022). Education has been found to significantly influence participation in non-farm employment options, which can give rural households access to alternative revenue streams (Rahut and Micevska, 2012). Thus, informal education should be provided and encouraged, such as training and learning from more experienced farmers through networks. Cattle production

plays a vital role in contributing to the improvement of small-householder farmers' income. It is a point line for food security, nutritional modification, economic growth, and poverty reduction (Han *et al.*, 2020; Wei and Zhen, 2020; Akash *et al.*, 2022). The survey results show that cattle farmers play a crucial role in cattle raising and production. Cattle farmers can earn income as the annual net profit per household is 1,501 US dollars, similar to the findings of Ashley *et al.* (2018), but Young *et al.* (2017) income is 525-528 US dollars annually. However, their knowledge of cattle raising and practical management is still limited, including disease prevention and breeding programs. Young *et al.* (2017); Serey *et al.* (2014); Mutibvu *et al.* (2012) were possible causes of those diseases the fact that farmers feed their cattle in free-space fields and this practice facilitates the spread of infectious diseases while they are grazing together as a herd, similar to current finding. More cattle farmers are facing Lumpy Skin Disease (LSD) followed by Foot and Mouth Disease (FMD) disease outbreaks, accounting for over 80%. According to Khoeun *et al.* (2023), the disease outbreaks had a high morbidity rate, while cattle householders were not practiced and treated for the preference intervention. Furthermore, besides diseases, feeding, and drought are significant constraints to the decline in the farmer's income from cattle production in the areas of the study.

Conclusion

Livestock raising in northwest Cambodia is a significant source of revenue for diversified smallholders, but it is not a primary activity for rural activities. Those of them are based on farms and non-farm activities for their incomes. Furthermore, livestock farmers in northwest Cambodia had some constraints based on animal feed sources, labour insufficient, technical management, and infectious diseases. Livestock farmers are still able to earn approximately 500-1,500 US dollars from their investigations annually. Separately, livestock farmers who raise crossbred cattle have the opportunity to earn more than local breed, approximately 8,000 US dollars annually. Thus, cattle farmers who raise cattle are the main contributors to enhancing livelihood incomes. So, crossbred beef cattle have been encouraged in northwest Cambodia.

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Author's Contributions

Sophany Morm: Questionnaire design, data collection, statistical analysis, draft manuscript, and editing and finalizing.

Koemseang Nhuong, Horn Prum, Vibol Peuo, Kim Koem, Rany Sam, Morin Tieng, Khorn Sok: Questionnaire design, data collection, and draft manuscript.

Mach Din, Phearom Yea, Chady Khy and Pesith Phoeng: Data collection.

Ethics

This is an original research article that hasn't ever been published anywhere else. Authors have been checked and approved by their respondent section. The National University of Battam Bang (NUBB) committees have been approved no. HEIP-NUBB-SGA#01.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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