Journal of Agricultural Extension

Vol. 27 (4) October 2023

ISSN(e): 24086851; ISSN(Print): 1119944X

Website: https://www.journal.aesonnigeria.org; https://www.ajol.info/index.php/jae

Email: editorinchief@aesonnigeria.org; agricultural.extension.nigeria@gmail.com

Husbandry System and Efficiency of Goat Fattening among Households in Nghe An Province, Vietnam

https://dx.doi.org/10.4314/jae.v27i4.3

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Submitted: 24th June 2023
First Request for Revision: 13th July 2023
Revisions: 15th, 21st, 30th July, 6th August, 25 September 2023
Accepted: 27 September 2023
Published: 15th October
Cite as: Nam, L. V., Van, N. H., Hung, P. H. S., Dung, N. M. Ba, N. X. (2023) Husbandry System and Efficiency of Goat Fattening among Households in Nghe An Province, Vietnam. *Journal of Agricultural Extension 27* (4) 20-29, https://dx.doi.org/10.4314/jae.v27i4.3

Keywords: Economic efficiency, goat fattening, husbandry system, household, Vietnam
Conflict of interest: The authors declare no potential conflict of interest.
Acknowledgement: Authors would like to acknowledge the Project "Goat Production Systems and Marketing in Lao PDR and Vietnam" (ACIAR-LS/2017/034) funded by the Australian Center of International Agricultural Research for providing financial support to carry out this research.
Authors' contributions:
NLV: (25%) Conceptualization; Investigation; Data curation; Formal analysis; Software; Methodology; Writing - original draft; Writing - review & editing
VNH (20%): Conceptualization; Methodology; Resources; Software; Supervision; Validation; Visualization.
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Abstract

This study assessed the goat-fattening system among households, its economic efficiency, and farmers` constraints in goat fattening. A survey was conducted with 30 goat farmers randomly

selected in Nghe An province. The results showed that goats are kept confined and fed a high level of commercial concentre (46-60%) in the diet. Two types of goats have been used for fattening: growing goats and culled female goats and two types of breeds (Co breed/Lao goat and Boer crossbred). The average fattening farm size was 88.2 goats/period. The weight of fattened goats for selling was from 29.0 to 38.3kg/head and live weight gain was from 3.7-5.4 kg/head/month. The profit of goat fattening was relatively good, from 494-590.8 thousand VND/goat/period (2-4 months). The goat fattening was a profitable alternative income opportunity for farmers in the study areas. Most of the farmers are facing difficulties in disease control, high prices of commercial concentrate, and unstable markets. The study suggests that extension programs need to improve the capacity of farmers in goat fattening techniques and disease management, as well as establish a sustainable linkage in the goat value chains for the sustainable development of goat farming.

Introduction

The demand and the price of goat meat have increased rapidly over the past few decades in Vietnam (Gray & Walkden-Brown, 2019). Although goat meat only accounted for about 0.65% of the total meat consumption of Vietnamese people in 2021, the supply of goat meat for the Vietnamese market is in great shortage. This has created great opportunities for farmers in Vietnam and Laos to promote livestock development, creating high and sustainable income (Nguyen Xuan Ba et al., 2021). In recent years, goat farming in Vietnam has been growing rapidly in quantity, changing the scale and raising the system to meet the increasing demand of the domestic market. The whole country has about 2.7 million heads and the annual herd growth rate in the period 2010-2020 is about 14.72% per year. The annual output of goat meat supplied to the market is about 35-36 thousand tons (Department of Statistics, 2021). The goat production system is shifting from grazing and extensive farming to semi-intensive and intensive farming. Market demand for goat meat in 6 central provinces of Vietnam from Da Nang City to Nghe An provinces was estimated at 160,000 meat goats, equivalent to about 4000 tons of live weight (Nguyen Xuan Ba et al., 2022). The supply of meat goats to the Central Vietnam market is mainly imported goats (84%) from the southern provinces of Vietnam (Dong Nai, Long An, Binh Phuoc) and goats imported from Laos (Nguyen Xuan Ba et al., 2022). After being imported, goats can be slaughtered immediately or fattened and then distributed to the local market and the northern provinces of Vietnam.

Fattening is the last step in the process of raising meat goats, to provide high-quality products to the market to meet the needs of consumers. Goat fattening has only been implemented in a few localities and certain households in recent years in Vietnam (Nguyen Xuan Ba, et al., 2022). Therefore, to date, understanding of the goat fattening system and the efficiency of goat fattening among households in Vietnam is still limited. This affects the development of suitable economic-technical solutions to improve the current goat production system. This study aims to assess (1) the goat fattening system in households; (2) the economic efficiency of goat fattening; and (3) the constraints of farmers in goat fattening. The result of the study can inform for further extension of goat fattening.

Methodology

The study was conducted in two communes (Nam Nghia commune in Nghia Dan district and Tay Hieu commune in Thai Hoa town) of Nghe An province (latitude of 18°33'N to 20°01'N degree and longitude of 103°51'E to 105°48'E degree) located in the North Central of Vietnam where local farmers newly practised goat fattening model (Nguyen Xuan Ba et al., 2022). The study used the semi-structured interview by questionnaire with 30 households raising fattening goats randomly selected in two communes. In each study commune, the study randomly selected 15 households that are fattening goats based on the list of total goat-raising households provided by the Commune People's Committees. In addition, the study also conducted in-depth interviews with

key informants including 1 commune officer, 2 typical fattening goat farmers, and 4 goat traders in 2 communes to collect and evaluate in-depth research contents.

Data were processed for mean, standard deviation, minimum and maximum value, and percentage and analysed using Excel 19 and IBM-SPSS 20.0 software.

Results and Discussion

Goat Fattening System in Households

Scale and Structure of Fattening Goat

Table 1 shows that the average fattening size per household is 88.2 heads, and households with the largest number of up to 250 heads and the smallest raising scale are 30 heads. Among the total number of fattening goats in the surveyed households, Boer crossbred goats and Laos goats account for 32.6% and 67.4% respectively. Among types of goats used for fattening, the percentage of culled reproductive female goats only accounted for 8.8%, while growing goats accounted for 91.2%. In-depth discussions with the households revealed that the selection of goat breeds and types of goats for fattening are highly dependent on market demand. According to surveyed traders, market demand for goat meat in the northern provinces of Vietnam is very high, especially Laos goats with a small weight (average 30-35kg/head) are preferred over crossbred goats. In-depth interviews with goat fattening farmers show that Boer crossbred goat fattening is less susceptible to disease than Co goats from Laos. However, the selling price of Co goats from Laos is higher than that of crossbred goats, so farmers are fattening Lao`s goats more than crossbred goats. This shows that the market demand for goats highly affects the goat fattening of farmers.

Table 1: Farm size and structure of goats by breed and type of fattening goats

Items	Quantity	Percentage (%)
Total number of goats in surveyed households (heads)	2646	
The average number of goats/household (heads/household)	**88.2**	
Structure by breed		
Boer crossbreed goat (heads)	863	32.6
Co goat/Lao goat (heads)	1783	67.4
Structure by type of goat		
Growing goat (heads)	2412	91.2
Culled breeding female goats (heads)	234	8.8

Source: Field Survey 2023

Raising Methods and Feed for Fattening Goats

The method for goat fattening in households is commonly intensive husbandry. Goats are kept confined and provided feed at the shed. The types of feed used for fattening goats are presented in Table 2. The survey result shows that two types of roughage, namely fresh grass (*Pennisetum purpurium*, *panicum maximum*) and silages were used for fattening goats. Most of the households (100%) used fresh grass and silages in fattening culled-breeding female goats, while about 90% and 56.7% of households used fresh grass and silages in fattening growing goats. In addition, there were 25% and 40% of households used tree leaves to feed clued-breeding female goats and growing goats.

Table 2 indicates that most households (100%) used commercial concentrate for goat fattening. However, the commercial concentrate feeds used for goat fattening among households are diverse in type, price, and quality. Some households used commercial concentrate special for pigs or poultry (18-20% protein), while others used commercial concentrate for goats (14-19% protein). Metabolizable energy (ME) values also vary widely among commercial concentrates. In-depth discussions with farmers showed that farmers still have certain difficulties in using commercial concentrate for fattening goats. Most households lack the knowledge and information to decide which type of concentrate feed should be used for goat fattening on both nutritional requirements and economic efficiency, especially in the context of the rapid increase in the price of commercial concentrates. Shewangzaw, et al., (2019) also concluded that the high cost of supplementary feed in the market was a barrier for farmers in fattening small ruminants.

This study also suggested that alternative and non-conventional feeds with low prices for fattening small ruminants. So, to improve the efficiency of fattening goats, extension programs should focus on guiding farmers to use reasonable feed for fattening goats, especially mixing concentrates from by-products (bran, corn, cracked rice) to reduce the use of commercial concentrate feed costs. This is in agreement with Aplocina and Degola, (2019) and Anwar Seid Hassen, et al., (2020). These studies also recommended that feed mixing is an ideal choice for farmers in fattening goats. However, there should be further research on feed mixing formulas from available material sources and by-products to improve farmers` economic efficiency in fattening goats.

Table 2: The percentage of households that use type of feeds for fattening goats

Type of feed	Types of fattening goats	
	Growing goats	Culled-breeding female goats
Fresh grass	90.0	100
Silages	56.7	100
Tree leaves	40.0	25.0
Commercial concentrate	100	100

Source: Survey, 2023

Ration for Fattening Goat among Households

Table 3 shows the ratio between concentrate and roughage feeds, and the daily feed intake (% LW) of fattened goats. There was a slight difference in the ratio between commercial concentrate and roughages on the diets of growing goats and culled-breeding female goats. Growing goats were fed with less commercial concentrate (46.2%), with a feed intake of 1.8% LW. For culled-breeding female goats, a higher proportion of commercial concentrate was added (nearly 60% of the diet), and the feed intake was also slightly higher (1.9% LW). Goats were fed at least 3 times a day. Usually concentrate was given first, then came roughages. The concentrate was fed limited, depending on the type of goat and live weight. Farmers have known how to gradually increase the amount of concentrate as the goat's live weight increases. The roughages were provided in a separate feed trough and were usually *ad libitum*.

Goats are selective feeders and their feed intake depends on many factors, such as quality of diet, the ratio between concentrate and roughage, and feeding management…. Brand et al., (2020) showed that the feed intake of Boer goats was different between different energy diets and was between 3.4 to 4.0% of body weight. Mohammad et al., (2015) reported that the feed intake of cross-bred goats (Boer × local) fed with different types of roughages in diet were significantly different and about 3.4-3.7% of body weight. In this study, the feed intake of different types of fattening goats was from 3.4 to 3.9% BW. The feed intake was a little bit higher in the growing

group than the culled one. Clearly, concentrate supplementation is undoubtedly essential to fulfil nutrient requirements for fattened goats. The high-concentrate diet decreased rumen pH in goats (Serment et al,. 2011; Desnoyers, et al,. 2008). Goats fed concentrate several times a day can reduce the risk of bloat. So, it is necessary to instruct farmers on using suitable ration concentrate and roughage in fattening goats.

Table 3: Feed intake (%LW) and diet composition for fattening goats (%)

Type of feed	Type of goat fattening			
	Growing goats		Culled-breeding female goats	
	% in ration	% LW	% in ration	% LW
Concentrate	46.2	1.8	59.7	1.9
Roughages	53.8	2.1	40.3	1.5
Total	100	3.9	100	3.4

% LW: Feed intake as % of live weight (LW, kg), calculated on dry matter (DM)

Source: Field survey, 2023

As shown in Table 3, the crude protein content (CP, %) of the fattening diets for growing goats and culled-breeding female goats were 12.6 and 14.0; and the metabolic energy of these diets were 2500 and 2580 kcal ME/kg DM, respectively. Compared to the data of fatten Boer goat diets in a study by Hua Sun et al*.* (2022) (10.82% CP and 2300kcal ME/kg VCK) and Brand *et al.* (2020) (14.98% CP and 3038 kcal ME/kg DM), the fatten goat rations applied by households in this study is equivalent. However, further research on the ratio between concentrate and roughages in the diet, the nutritional value of concentrate for each breed, and the fattening stage should be conducted to maximize goat meat production.

Fattening time, Live Weight Gain and Feed Conversion Ratio in Fattening Goat

Farmers practice about 3 to 4 goat fattening cycles in the form of alternating between cycles in a year. The fattening period depends on the type of goat. Table 4 showed that the fattening time of growing goats was an average of 3.3 months for Boer crossbred goats and 3.9 months for Lao goats. As reported by farmers, the initial weight of growing goats at the beginning of fattening is from 13 to 20 kg/head. Therefore, to reach the selling weight of 30-35kg/head, the fattening period is also longer. The average fattening time for culled-breeding female goats was 1.8 months. This is explained by the aim of fattening culled-breeding female goats to goats regain weight. The initial weight of culled-breeding female goats was fattening from 30 to 35 kg/head, and farmers usually sold when the goats reach 35-40 kg/head, so the fattening period is shorter than that of growing goats. In fact, the fattening period depends on type of goats, feeds, raising environment, and market requirements. The study results of Sabri and Osman, (2021) also recommended considering the fattening period of goats according to the market requirements to increase the profitability and carcass quality. Therefore, it is necessary to have further research on fattening time according to different types of goats, fattening conditions, and market demand.

Table 4: Live weight gain and feed conversion ratio in goat fattening

Items	Types of goats					
	Boer crossbred goat		Co/Lao goat		Culled-breeding female goat	
	Mean	SD	Mean	SD	Mean	SD
Fattening time (months)	3.3	0.5	3.9	0.4	1.8	0.3
IBW (kg/head)	17.5	5.1	15.0	2.0	30.7	1.5
FBW(kg/head)	35.3	3.4	29.1	2.8	38.3	2.9
LWG (kg/head/period)	17.8	2.4	14.1	1.9	7.7	2.5
Total feed consumption (kg/head)	88.2	39.7	151.7	36.6	47.6	15.9
FCR	7.9	3.2	8.4	3.0	9.1	3.5

Source: Field survey, 2023

IBW: Initial body weight; FBW: Final body weight; FCR: Feed Conversion Ratio

Live weight gain (LWG) and feed conversion ratio (FCR) are important indicators of biological and economic efficiency in fattening goats. Table 4 indicated that the Final body weight (FBW) was 35.3, 29.1, and 38.3 kg/head for Boer crossbred goats, Lao goats, and culled-breeding female goats, respectively. Live weight gain (kg/head/month) of Boer crossbred goats, Lao goats, and culled-breeding female goats were 5.4; 3.7, and 4.3 kg, respectively. The corresponding FCR index was 7.9, 8.4, and 9.1. The LWG of fattened goats among households was not very high, but the FCR index was quite high. A previous study on the effects of different dietary energy levels (from 11.3 to 12.7 MJ ME/kg of feed) in a feedlot system of Boer goats (from 126 to 266 days of age) showed that the FBW ranged from 47.1 to 48.2 kg/head; the LWG was varied from 192.2 to 197.2 g/head/day; and the FCR index was from 5.9 to 6.93 (Brand et al., 2020). Fattening of Nubian goats for 120 days (initial weight at 28 kg/head and final weight at 45 kg) with a diet containing 17% CP, showed that LWG and FCR index was 140g/head/day and 7.87, respectively (Yujian Shen et al., 2022). Hua Sun et al. (2022) report that boer goats at an initial weight of 29kg/head were fatten using a 35:65 or 65:35 ratio of concentrate and roughages in the diets, with 10.82% CP and dietary energy values from 8.10 to 9.63 MJ ME/kg DM. It was reported that the final weights were from 40.1 to 42.9kg/head; LWG values were from 214 to 267 g/head/day; and FCR values were from 4.88 to 5.88.

Farmers` Goat Caring and Disease Management

Figure 1 shows the survey results on taking care and disease management among farmers in fattening goats. The results reveal that about 90% of households have applied for vaccination for goats, and 100% of households have applied for deworming goats before fattening. This shows that farmers have focused on applying technical measures in the management of fattening goats. However, some kind of technical measures such as mineral and vitamin supplements only have a few households applied (17-27%).

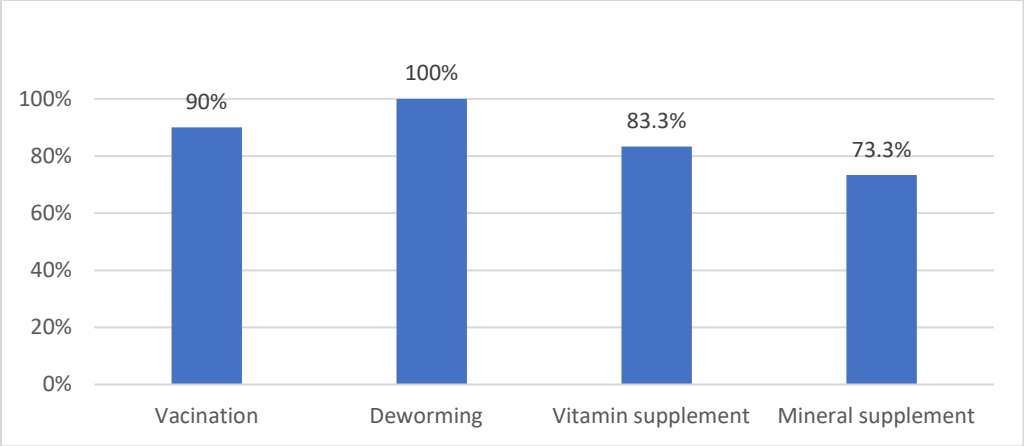

Figure 1: Percentage of households applying measures to take care of fattened goats
Source: Field survey, 2023

The results of the survey on the epidemic situation in fattening goats are shown in Figure 2. Disease is one of the problems that many fattening goat farmers are facing. Although the households have also focused on vaccination, the disease still occurs in the fattening goat herd to varying degrees. Most households have goats with diarrhoea, 90% of households have goats with pasteurellosis, and 73.3% of households have goats with foot and mouth disease. In addition, Oral ulcer disease, bloat in goats, and eye disease also occurred in some households. This is one of the major obstacles that need to be overcome to improve the efficiency of goat fattening.

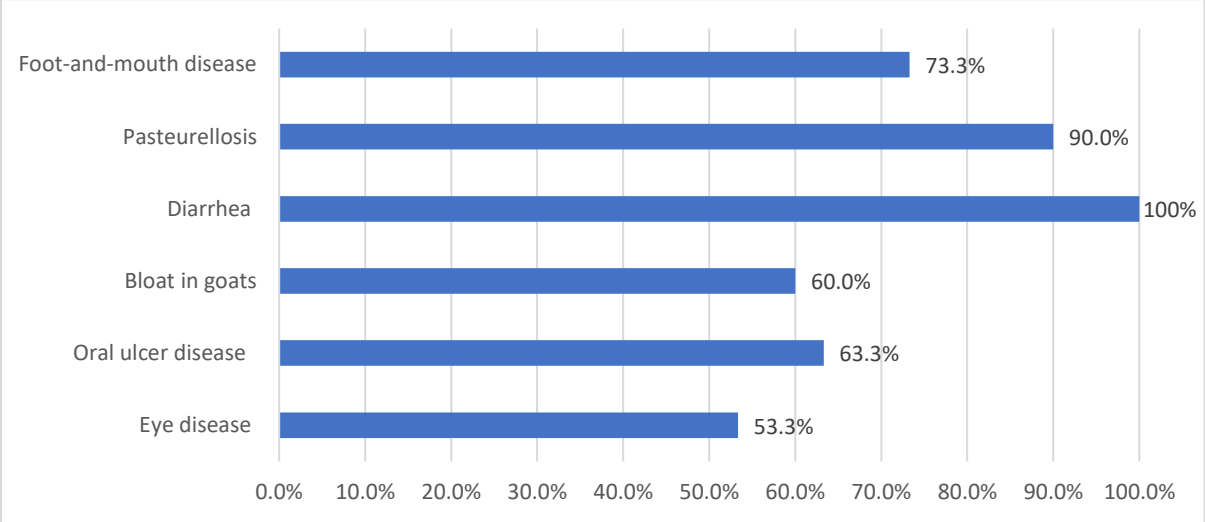

Figure 2: Percentage of households with goats suffering from diseases
Source: Field survey, 2023

Economic Efficiency of Goat Fattening in Households

The economic efficiency of fattening goats was analysed through the indicators of the total cost, average revenue, and profit per goat in a fattening cycle for 2 types of fattened goats: growing goats and culled breeding female goats. The results presented in Table 5 show that the total cost for one fattening cycle of growing goats was on average 3416.6 thousand VND/head and the total cost of culled-breeding female goats is 3479 thousand VND/head. The cost of buying goats for fattening is the highest, averaging 544.6 thousand VND/head for growing goats and 2700 thousand VND/head for culled-breeding female goats, accounting for 57.2% and 77.6% of total

fattening costs, respectively. The average feed cost including commercial concentrate and roughage in fattening growing goats was 1155.4 thousand VND/head, accounting for 33.8% of the total cost. The feed cost for culled-breeding female goats was on average 547 thousand VND/head, accounting for 15.7% of the total cost. In addition, other costs for goat fattening include labour costs, disease prevention, barn depreciation, etc., on average, was 306.5 thousand VND/fattened growing goat and 232 thousand VND/culled breeding female goat, accounting for about 9.0% and 6.7% of the total fattening costs, respectively. After a fattening cycle of 3-4 months for growing goats and nearly 2 months for culled breeding female goats, the average revenue was 4007.4 thousand VND/head for young goats and 3973 thousand VND/culled breeding female goats. The study result indicated that the average profit of farmers was 590.8 thousand VND/growing goats and 494 thousand VND/culled breeding female goats. This means that 1 VND cost of fattening growing goats earns 0.17 VND of profit, while 1 VND of the cost of fattening culled breeding female goats produces 0.14 VND of profit. This implies fattening goat model in study areas was profitable. Furthermore, goat-fattening activities contribute to creating regular jobs for rural households. The surveyed results show that each household has from 1 to 3 family laborers working for goat-fattening, income from goat-fattening accounts for from 30 to 80% of the total income of households. Thus, the fattening goat model considers a profitable alternative income opportunity for smallholder farmers in the study areas.

Table 5: Expense, revenue, and profit per fattened goat (Unit: 1,000 VND*)

Items	Growing goat		Culled-breeding female goat	
	Mean	**SD**	**Mean**	**SD**
Expense				
Buying breeds	1954.6	205.1	2700	246
Concentrate	759	246.3	399	157
Roughages	396.4	203.5	148	66
Veterinary medicine	10.4	4.2	17	11
Depreciation of barns	34.1	16.5	18	13
Labour	254.3	70.7	191	79
Others	7.8	4.2	6	3
Total expense	**3416.6**	**337.5**	**3479**	**403**
Total revenue	**4007.4**	**272.1**	**3973**	**402**
Profit	**590.8**	**282.2**	**494**	**363**

Source: Field survey, 2023 ** 1 USD = 23,300 VND*

Farmers` Constraints in Fattening Goats

Figure 3 shows that farmers are facing three main constraints that are goat disease control (100%), high commercial concentrate prices (73%), and an unstable goat market (53%). Therefore, improving the capacity of farmers on goat fattening techniques and disease management is very necessary. Enhancing technical guidance for smallholder farmers on mixing concentrates from available sources (bran, corn, cracked rice...) to reduce commercial concentrate-using costs is very important. In addition, to limit the market risks, it is necessary to develop linkages between goat farmers and the value chain actors based on farming contracts to stabilize the goat market for smallholder goat farmers.

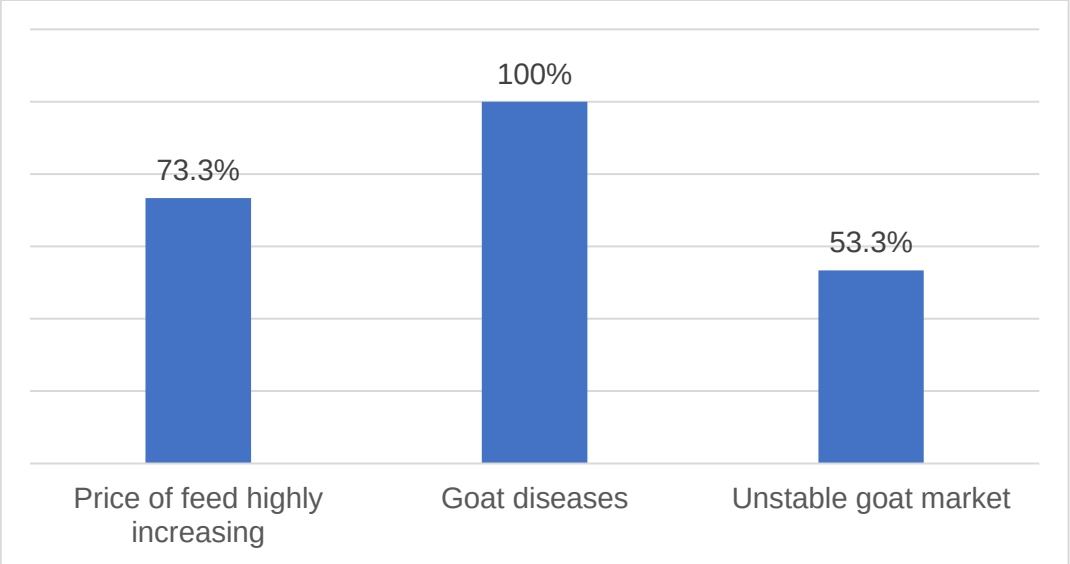

Figure 3: **Percentage of households facing difficulties in goats fattening**
Source: Field survey, 2023

Conclusion and Recommendation

The goat-fattening system among households in Nghe An province was commonly intensive. Two types of goats have been used for fattening: growing goats and culled-breeding female goats and two types of breeds (Co breed/Lao goat and Boer crossbred). Goats are kept confined and fed a high level of commercial concentre (46-60%) in the diet. The average fattening farm size was 88.2 goats/period. The weight of fattened goats was from 29.0 to 38.3kg/head and live weight gain was from 3.7-5.4 kg/head/month.

The profit of goat fattening was relatively good, from 494-590.8 thousand VND/goat/period (2-4 months). The fattening of goat was a profitable alternative income opportunity for smallholder farmers in the study areas. Most of the farmers are facing difficulties in disease management, high prices of commercial concentrate, and an unstable goat market. Extension programs need to improve farmers' capacity in goat fattening techniques through training courses and establish linkages between goat value chain actors to develop a sustainable goat farming system.

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