G-FEAST Final Report

Assessment of feed resources availability and use for cattle and pigs in Mai Son District, Son La Province, Vietnam

October 31, 2023

Tran Thi Bich Ngoc[1]; Nguyen, Thien Truong Giang[1]; Hoang, Xuan Thao[2]; Dao, Thi Thu Hang[3]; Nguyen, Thi Minh Phuong[4]; Triana, Natalia[3]; Peters, Michael[3]; Duncan, Alan[4] and Atieno, Mary[3]

[1]National Institute of Animal Science (NIAS), Hanoi Vietnam
[2]Northern Mountainous Agriculture & Forestry Science Institute (NOMAFSI)
[3]Tropical Forages Program, International Center for Tropical Agriculture (CIAT)
[4] International Livestock Research Institute (ILRI)

CGIAR
INITIATIVE ON
Sustainable Animal Productivity

Citation: Ngoc, T.T.B.; Giang, N.T.T.; Thao, H.X.; Hang, D.T.T.; Phuong, N.T.M.; Triana-Ángel, N.; Peters, M.; Duncan, A.; Atieno, M. (2023) Assessment of feed resources availability and use for cattle and pigs in Mai Son District, Son La Province, Vietnam. Hanoi (Vietnam): International Center for Tropical Agriculture. 40 p.

Patron: Professor Peter C Doherty AC, FAA, FRS
Animal scientist, Nobel Prize Laureate for Physiology or Medicine–1996

Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax +254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
better lives through livestock

ILRI is a CGIAR research centre

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

ILRI has offices in East Africa • South Asia • Southeast and East Asia • Southern Africa • West Africa

Contents

List of Tables

List of Figures

List of Appendix Tables

Acknowledgments

This work was conducted as part of the CGIAR Initiative on Sustainable Animal Productivity. CGIAR research is supported by contributions to the CGIAR Trust Fund. CGIAR is a global research partnership for a food- secure future dedicated to transforming food, land, and water systems in a climate crisis.

We warmly thank the local authorities of Son La province, Mai Son District People's Committee, Sub-Department of Animal Health, Animal Husbandry & Aquaculture (Sub-DAH) and People's committee of Co Noi and Hat Lot communes for their substantial support and the farmers for their time and patience. Special thanks to the enumerators from Northern Mountainous Agriculture and Forestry Science Institute, Vietnam (NOMAFSI) (Nguyen Tien Sinh, Lu Thi Yen, Van), from National Institute of Animal Science (NIAS) (Hoang Dinh Hieu), and from Sub-DAH (Ngo Quang Tien).

ABSTRACT

Son La province has recently put in place policies and programs to support expansion of livestock production, however the province still faces low livestock productivity due to low quality and availability of forages and feedstuff. One of the provincial government's priorities is to increase productivity of cattle and pigs through improved animal nutrition practices such as increased cultivation of improved forages and better feed management and utilization. Using the Gendered Feed Assessment Tool (G-FEAST), this study assessed the availability and use of local feed resources, and identified feed gaps, challenges and constraints affecting livestock production to inform the design of context-specific and inclusive feed intervention strategies. The study was carried out in four villages in Hat Lot and Co Noi communes, Mai Son district, Son La province, Vietnam. Gender-disaggregated data was collected from 16 focus group discussions (FGDs) (eight FGDs with women and eight FGDs with men) and 49 individual interviews (23 women and 26 men). Winter feed shortage was reported as the most pressing challenge. Further constraints included low yield and/or nutritive value of local forages varieties (mainly Napier). The poor quality of diets arising from use of high proportion of crop residues such as rice bran, banana trunk and sugarcane tops was also flagged as a challenge. Men tend to be engaged in activities such as preparing land, planting forage, harvesting, and purchasing, while women are more engaged in cleaning of feeding points, watering, and weeding. The results present key opportunities and entry points for gender-responsive locally suited feed intervention strategies that can address these context-specific challenges, mainly winter feed shortage, can greatly improve livestock productivity and efficiency. Such interventions include capacity building of women and men farmers, extension & vet staff on utilization of locally available feed resources and purchased feeds, feed conservation, diet formulation, and feeding regimes, and promoting improved forage varieties (establishment, management, and utilization), for cattle and pigs.

1. INTRODUCTION

In recent years, livestock development has been emphasized in Son La province. There are many directives and programs from the province and districts encouraging the development of commercially oriented livestock production. Support from the Department of Agriculture and Rural Development geared towards mitigating climatic shocks affecting livestock e.g., cold temperatures in winter, preparing winter feed reserves, and artificial insemination (AI) programs have demonstrated the local government's concern for increasing livestock production. Livestock plays an important role in the economy of smallholder agriculture in the region. It serves as a savings commodity that is liquidated when families need funds e.g., for building a house or getting married. Livestock farming also makes use of agricultural by-products, and even older workers who have difficulty working on farms can still earn income from livestock raising.

Long-term grazing of livestock has long been practiced, but there have been many changes in recent times with transition to semi-intensive or intensive systems, as grazing areas have significantly reduced. Few forage varieties have been introduced in the province, however, limitations of these new varieties and climatic conditions still lead to feed shortage during the dry season. One of the biggest challenges in promoting suitable forages in Son La is the cold, dry weather. Guinea grass is one of the forage grasses that has been introduced in the province and has been taken up by a number of farmers. Most farmers still rely on agricultural by-products such as rice straw, banana trunk and sugarcane tops, as animal feed.

The CGIAR initiative on Sustainable Animal Productivity for Livelihoods, Nutrition and Gender inclusion (SAPLING) initiative aims to enable pigs, beef and chicken farmers to engage in inclusive value chains and achieve sustainable productivity gains up to 10% resulting in improved livelihoods in Northwest Highlands of Vietnam. Animal nutrition is one of the key technological components of the initiative, to help address challenges in livestock value chains in Son La province, including feed shortage.

In order to design context-specific feed interventions, an initial assessment of the local context, challenges, feed resources and utilization need to be conducted. The Feed Assessment Tool (FEAST) was originally developed by International Livestock Research Institute (ILRI) and the International Centre for Tropical Agriculture (CIAT) (Duncan et al., 2012), and further improved under the CGIAR Research Program on Livestock (Livestock CRP). FEAST provides a rapid assessment of the availability and use of local feed resources which informs the design of site-specific intervention strategies for improved feed supply and utilization (ILRI, 2019). FEAST was recently evolved further into the Gendered Feed Assessment Tool (G-FEAST) which adds value to the existing FEAST approach by identifying which aspects of gender relations in households affect animal feeding practices and the uptake of feeding interventions; and identifying opportunities and constraints in animal feeding for different household types (Lukuyu et al., 2019a). GFEAST is a new version of FEAST which includes a gender dimension involving collection of gender disaggregated data from separate male and female focus group discussions, with additional questions to help users to understand gender dimensions of decision making and labor allocation in livestock feed production and use (Duncan et al., 2023).

In this study, G-FEAST was used to characterize livestock production systems and in particular feed- related aspects in 4 villages of Hat Lot and Co Noi communes, Mai Son district, Son La province, Vietnam. The study was conducted on 6-9th December 2022 with the objective to provide a general overview of the availability and use of feed resources, identify challenges and constraints affecting livestock production through a gender lens, opportunities for improved animal nutrition and propose context-specific interventions on livestock feed for improved animal nutrition. The assessment was carried out through FGDs and individual interviews with

farmers ensuring an equal representation of women and men, following the G-FEAST focus group discussion guide (Lukuyu et al., 2019a) and G-FEAST individual farmer interview questionnaire (Lukuyu et al., 2019b).

2. MATERIALS AND METHODS

2.1. Study location

Mai Son district in Son La province was deliberately selected as the study location to represent various livestock-related challenges and needs in the North-West Highlands of Vietnam. Son La province, which encompasses an area of 1.4 million hectares and has a population of 1.24 million people, is the largest mountainous province in northern Vietnam. The population is comprised of 12 different ethnic groups, with the Thai group accounting for 53.6% followed by Kinh (16.3%), H'mong (16.1%) and others (14%) (GSO, 2019). The target district, Mai Son displays a range of farming types, from extensive grazing systems located at the top of the mountains to intensive farms with a combination of crops and livestock situated at the bottom of the valleys. Additionally, the area exhibits a diverse array of socio-economic and ecological conditions (Douxchamps et al., 2019).

The selection of Mai Son district as a study site for SAPLING builds on the recently completed Li-chan project (Livestock CRP) implemented in the same district, with the aim of continuing to test and scale Li-chan interventions. Li-chan targeted three farming system types (A, B and C) based on accessibility i.e., distance to the main road or market, and production system.

> **Type A:** intensive systems in the lowlands with good access to markets and relatively better capacity for innovation.
> **Type B:** mixed crop-livestock system in the mid-altitudes with mainly Thai ethnic minorities.
> **Type C:** remote extensive systems in the high altitudes, with low access to market, fragile environment, mainly Hmong ethnic group.

SAPLING targets Type A and B systems as these have better innovation capacity and high potential for scaling, a core objective of the project.

The study was conducted in four villages of Co Noi (Nhap and Mon) and Hat Lot (Na Sang and Ngo Hen) communes (Table 1). These are two areas with relatively high livestock numbers with potential for further development and scaling of promising technologies. Hat Lot and Co Noi communes have advantages over other communes in Mai Son district such as high livestock numbers, large land area, and producing diverse crops and agricultural by-products for feed.

Table 1. Village characteristics in Co Noi and Hat Lot communes

Typology	A		B	
Village	Nhap	Na Sang	Mon	Ngo Hen
Ethnicity	Thai	Thai	Thai	Thai
Total number of HHs	159	178	210	156
Distance to concrete road (mins drive by motorbike)	0	0	5	0
Altitude (highest point in the village)	746	684	928	1025
Distance to market Hat Lot/Co Noi) (km)	5	15	12	17

Table 1. Village characteristics in Co Noi and Hat Lot communes				
Typology	A		B	
Distance to commune people committee (km)	5	8	12	7
Livestock holding (cattle)	197	114	163	277
Livestock holding (buffalo)	170	163	181	64
Livestock holding (pigs)	402	161	257	662

2.2. Selection of participants and survey structure

The study was conducted in December 2022 by a team of seven researchers from National Institute of Animal Science (NIAS), Northern Mountainous Agriculture and Forestry Sciences Institute (NOMAFSI), ILRI, The Alliance and Son La Sub-Department of Animal Husbandry (Sub-DAH). A total of 94 farmers (37 women and 57 men), who keep cattle and/or buffaloes and/or pigs, were invited to participate in the study (Table 2). These farmers were selected to ensure a gender balance and to represent different land- and livestock holdings for the focus group discussion and individual interviews using the G-FEAST tool. From each FGD, three participants representing each of the landholding categories (small, medium, and large) were selected for individual interviews.

Table 2. Survey respondents				
Items	FGD		KII	
	Women	Men	Women	Men
Type				
Type A	21	28	12	12
Type B	16	29	11	14
Farm Size				
Small			2	2
Medium			13	16
Large			8	8
Age groups of respondents				
<=35			12	5
36-50			5	13
>50			6	8
Total	37	57	23	26

Gender analysis in this report is based on data from individual interviews from 26 men and 23 women. The analysis examines gendered division of labor within households in securing feed and forage for cattle, pigs, goats, and poultry. The report also analyzes participation of men and women in decision-making processes in forage planting, feed purchase, crop residues use, and livestock sales. In addition to quantitative data, the report uses qualitative research findings from a gender norms study conducted under the SAPLING initiative.

2.3. Data processing

Narrative reports collected from the FGDs were initially compiled in an Excel file for data cleaning before reporting. Individual interview results were entered and processed using the FEAST data app (www.ilri.org/feast). All the data was uploaded to FEAST data repository for public access (feastdata.ilri.org).

3. RESULTS AND DISCUSSION

3.1. Farming system

Most households have a land use right certificate in the study sites (Mon, Nhap, Na Sang, Ngo Hen villages) and the parents are usually named in the certificate, thereafter they can divide the land to their children, but still hold power to decide on land use without granting them a separate land certificate. Although both women and men participate in land use and decision making on agricultural activities, only men hold the legal tenure of land, which evidences largely common dynamics in this regard, with men comprising the majority of landowners. Communal land in the villages and communes is sometimes leased to contract individuals for crop production. In some areas, communal land is used for afforestation, and grazing or planting forage crops is not permitted. Animals are only allowed to graze on cropland after harvesting.

Most households fall under the small and medium landholding categories for Type A (accounting for 25.44% and 54.25% respectively), while the medium and large landholding categories in Type B account for 51.75% and 32.04% respectively (Figure 1). The landless category has a very small presence in Type B landholdings, with only one household accounting for 0.09%. The large landholding category has a relatively small presence in Type A, with 63 HHs (19.06%), whereas the small landholding category in type B occupies about 16.13% (52 HHs).

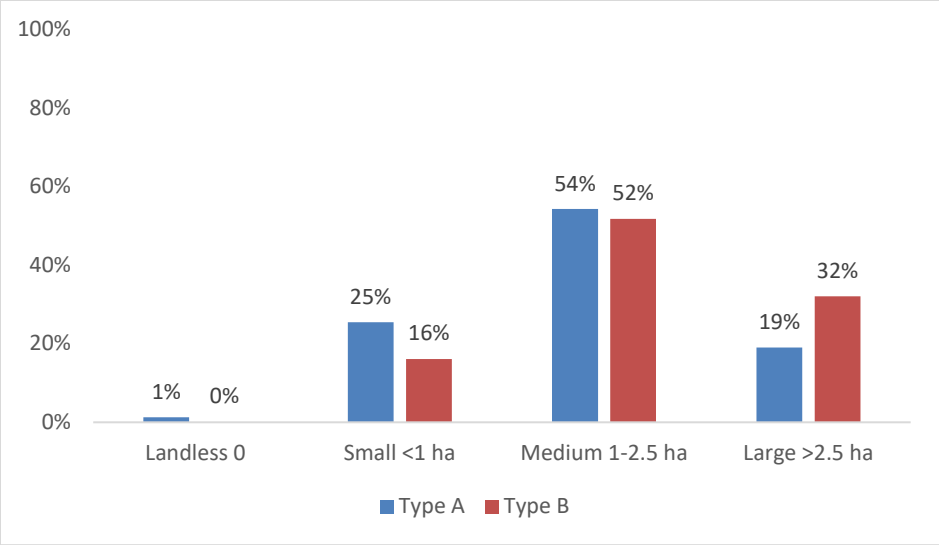


Figure 1. Percentage of land size categories

Mixed crop-livestock system is the most predominant farming system in both Type A and Type B households. The main crops in Type A include sugarcane, vegetables, maize, followed by arrowroot, cassava, longan, mango; while sugarcane, maize and coffee are mainly grown in Type

B, followed by longan, mango, and strawberry (Figure 2).

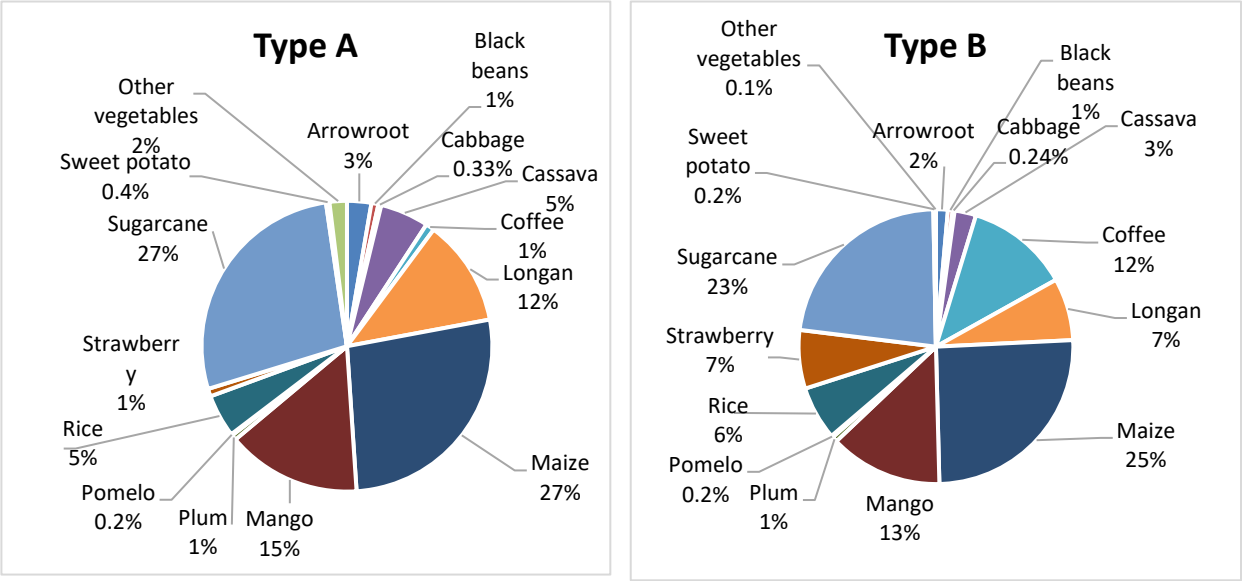


Figure 2. Proportion of main crops in Type A and type B

Elephant grass and banana are the main fodder crops cultivated in both Types A (0.07 ha/HH and 0.076 ha/HH respectively) and Type B (0.07 ha/HH and 0.04 ha/HH respectively) (Table 3). Guinea grass is the only improved forage variety grown in a small area in Type B (0.02 ha).

According to the 2022 annual report for Co Noi and Hat Lot communes, land area with forages (mainly elephant grass) stands at 55.7 ha in Co Noi and 27.05 ha in Hat Lot; with this area the estimated fresh yield is around 16,710 tons/year/ha (3,342 tons DM/year/ha) in Co Noi and 8,115 tons/year/ha (1,623 tons DM/year/ha) in Hat Lot, while total population of cattle and buffalo is 5,207 heads in Co Noi and 2,217 heads in Hat Lot. If the average body weight of cattle and buffalo is more than 150 kg/head, the DM intake requirement for cattle and buffalo is more than 8,553 tons/year in Co Noi and 3,642 tons/year in Hat Lot. Thus, feed scarcity for cattle and buffalo is rampant, particularly in the winter/dry season.

Table 3. Fodder cultivation in the study area

Fodder cultivation	Average ha per HH	
	Type A	Type B
Banana (Musa sp.)	0.07	0.04
Maize (Zea mays)	0.01	
Barnyard Millet (Echinochloa crusgalli)	0.004	
Elephant grass (Cenchrus purpureus)	0.07	0.07
Guinea grass (Megathyrsus maximus)		0.02

Ten out of sixteen FGDs indicated that the area under cultivation has not changed over time. However, the remaining FGDs reported that the cultivation area has gradually decreased, due to the increasing population or land degradation from soil erosion. When the number of family members increases, land is divided amongst the offspring.

“Land area does not increase, but people increase”, one farmer reported.

Besides, one farmer group in Mon village reported that the total area is unchanged, only the types of crops have changed. For instance, the area under sugarcane and corn has reduced, while the area for strawberries has increased. All farmers confirmed that there is no land being put to fallow in both Types A and B. Crops are continuously grown season after season. In some cases, farmers leave their land fallow for a short period of two to three months after harvesting rice and cassava.

In the four villages surveyed, there is no irrigation system constructed by the government for cultivation, and the main water source for crops is mainly rainfed, drilled wells, and streams. Farmers install water canals with concrete or pipes to access water from the streams to their fields. There are no irrigation restrictions for men and women. Rice, fruit trees, strawberries, and vegetables are the main crops that benefit from irrigation. In the dry season, there is a shortage of water for irrigation and farmers source water from nearby villages.

Labour is required throughout the year for livestock production, as well as during harvesting time for sugarcane, coffee, strawberries (October to March), and for longan and mango (June to August). The average labour cost is around 0.87-10.87 USD/day during harvesting time and varies depending on the crop, the highest being for coffee, up to 17.39 USD/day. These labour costs were reported to be affordable for most households, and for both men and women. If there is less labour requirement, farmers can assist each other, and only hire additional labour in the peak season of harvesting.

The roads in types A and B are easily accessible throughout the year because they are built with asphalt and concrete. However, there are some narrow roads which can be challenging for trucks to go through. In Na Sang village, the roads are sometimes flooded in the rainy season. Farmers in the four villages can easily access markets to buy agricultural inputs.

3.2. Major income sources

The largest contributor to the income of both Type A and Type B households is from cropping activities (69% and 68% respectively; Figure 3). Livestock activities are also significant contributors to household income in both types, with a higher contribution in Type B households of up to 28% of total income compared to type A (22%). Income from business activities does not vary between Types A (5%) and B (4%), while Type A has a larger contribution of income from labor activities (4%) as compared to Type B (0%). Similarly, major income sources for women in both Type A and Type B households is from cropping activities, followed by livestock production (Figure 4).

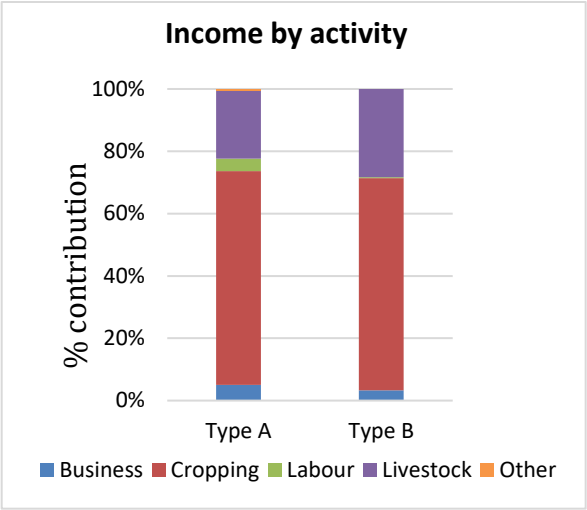


Figure 3. Major income sources by activity

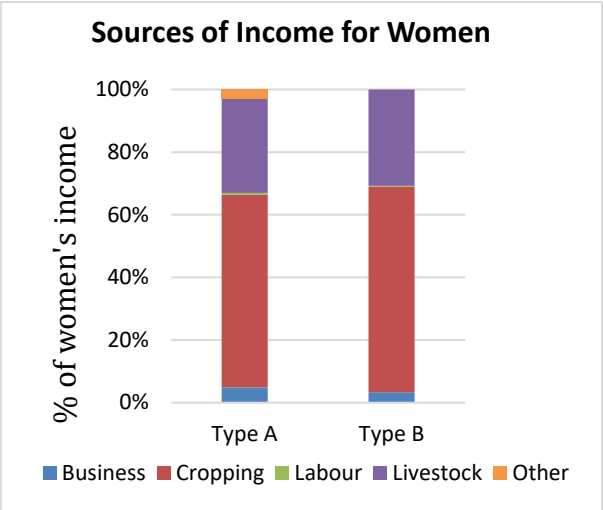


Figure 4. Major income sources for women

In both Types A and B, only a few people migrate to the city for work or study, mostly youth. Reasons for migration include limited cultivation land, unstable income from farming, and need for higher income. They go to work in industrial zones to earn money to cover their living expenses and support their families. Some women who have lost their husbands and have limited land go to work in other villages to get income to raise their children.

Farmers can access loans for crop/livestock production from the policy bank, agricultural bank, or credit unions. However, the conditions for obtaining cash/credit are mortgage certificates of land ownership with the commitment of all family members. If the farmer does not have certification of land ownership, they need to ask the cadastral office to draw a land diagram. In case farmers do not have the red book, they can only borrow no more than 2,174-4,348 USD. Besides, farmers can get inputs from suppliers in advance, and pay after selling their farm products. However, female-headed households often have difficulty accessing credit sources because they either have no collateral, or the assets belong the son due to inheritance, therefore they must have an heir who is a son, or they ask their brothers to access credit on their behalf.

Joint decision-making for most income sources is the most common approach for both Type A and Type B households (Figure 5). However, there are some activities where men or women have a more significant role in decision-making. In Type A households, men are more involved in decision-making on cash crops, food crops, fattening cattle, and pigs, while women are more involved in decision-making on fattening sheep and goats, labouring/service, and off-farm businesses. In Type B households, men are more involved in decision-making on cash crops and food crops and fattening animals, while women are more involved in decision-making on labouring/service and off-farm businesses. It is important to note that the data provided only considers the decision-making on major income sources and there may be other activities where decision-making is more gender balanced.

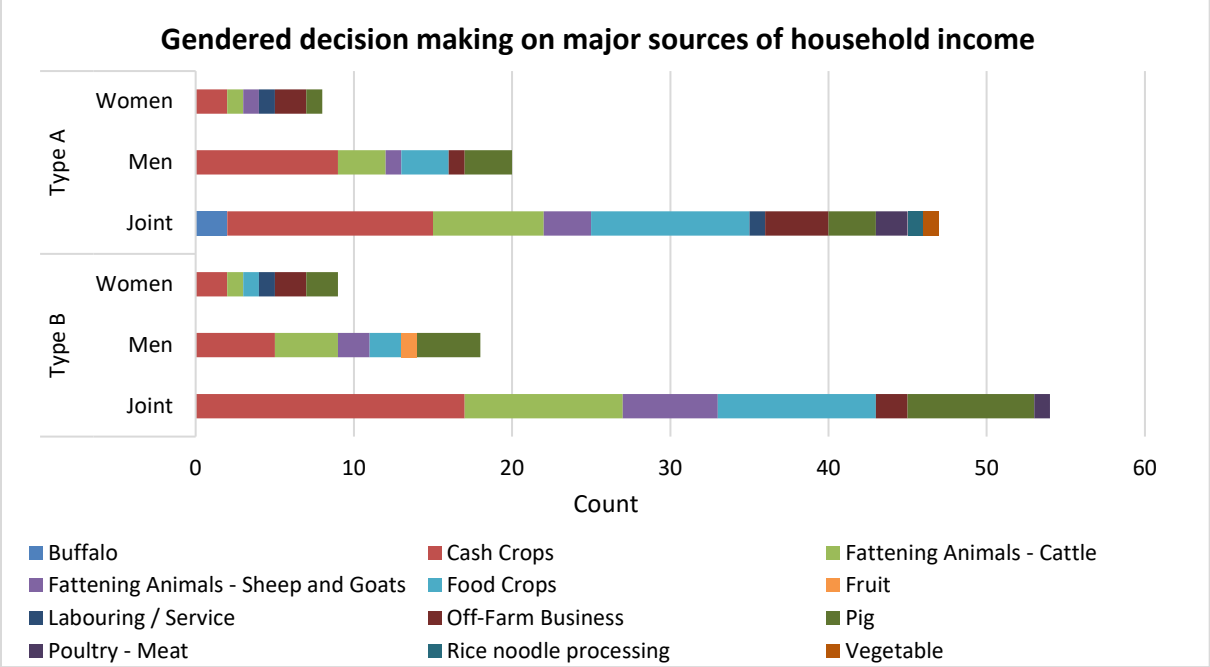


Figure 5. Gendered decision making on major sources of household income.

Cash crops provide the main source of household income in both Type A and Type B households, contributing 50% and 62% respectively. Food crops and fattening animals (cattle and sheep/goats) also make a significant contribution to household income in both types. In terms of women's income, fattening animals (cattle and sheep/goats) are the top contributors in both Type A and Type B households, contributing 16% and 14% respectively in Type A households and 3% and 2% in Type B households (Figure 5). Cash crops also make a significant contribution to women's income in both types of households. It is interesting to note that in Type A households, rice noodle processing is a significant source of women's income, contributing 3% compared to only 1% of household income. This is not the case in Type B households, where rice noodle processing does not make a significant contribution to either household or women's income.

Overall, the relative contribution of major sources of income to household and women's income differs slightly between Type A and Type B households, but cash crops and fattening animals (cattle and sheep/goats) remain important sources of income in both types of households.

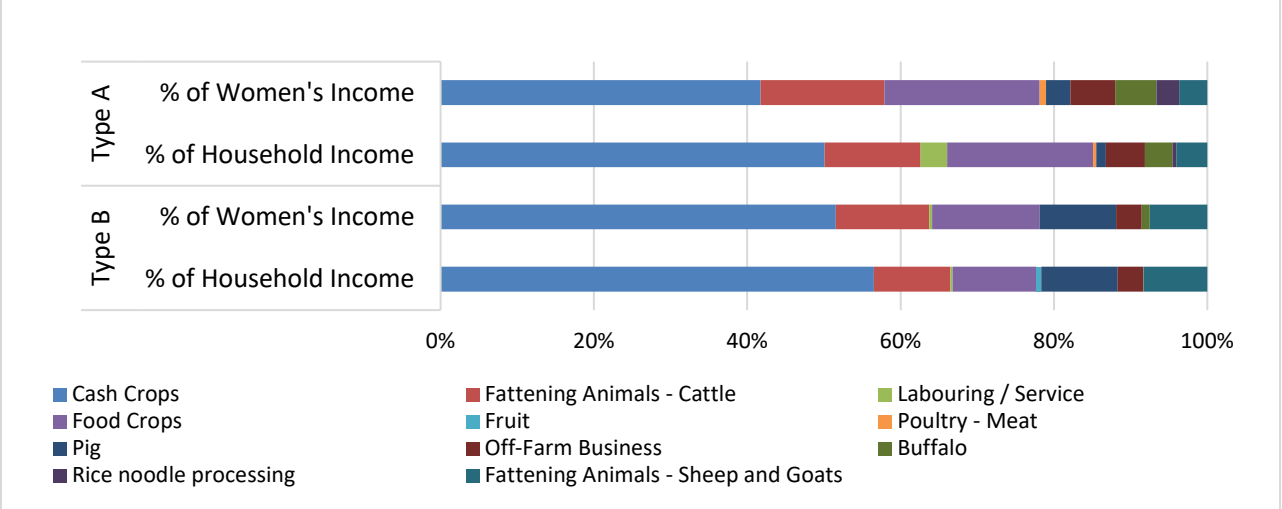


Figure 6. Relative contribution of major sources of income to household and women's income

3.3. Livestock production system

In Type A, the most dominant livestock species are local cattle and buffaloes (1.91 and 2.18 TLU, respectively), followed by pigs (0.86 TLU) and poultry (0.35 TLU), and the lowest for goats (0.27 TLU). However, in Type B, pigs and cattle are the most dominant livestock species (2.03 and 1.94 TLU, respectively), followed by buffalo (1.42 TLU), goats (0.92 TLU) and poultry (0.41 TLU). In general, average livestock holdings per household in Type B is higher than in Type A. This is probably due to the number of households owning ≥ 2 ha of land areas being higher for Type B than for Type A, possibly implying more land for grazing or growing forages. Atieno et al. (2021) reported that in Chieng Luong and Chieng Chung communes, total livestock herd per household was lower in Type A than in Type B households.

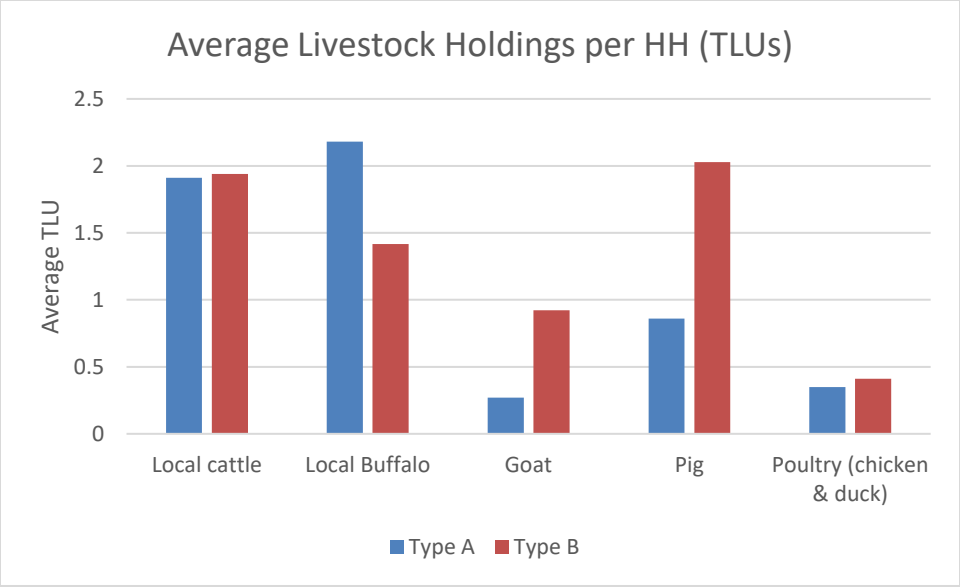


Figure 7. Average livestock holdings per household (TLU)

Gendered decision making on livestock types and sales.

Joint decision making by both men and women is common for the main livestock types and sales in most households across the 2 types (Figure 7). In both Type A and B households, there

are a more men who make decisions on livestock types than women, except for poultry in Type B where the same number of men and women are involved in decision making. Men predominantly decide on all livestock sales, except for poultry sales in Type A which is dominated by women.

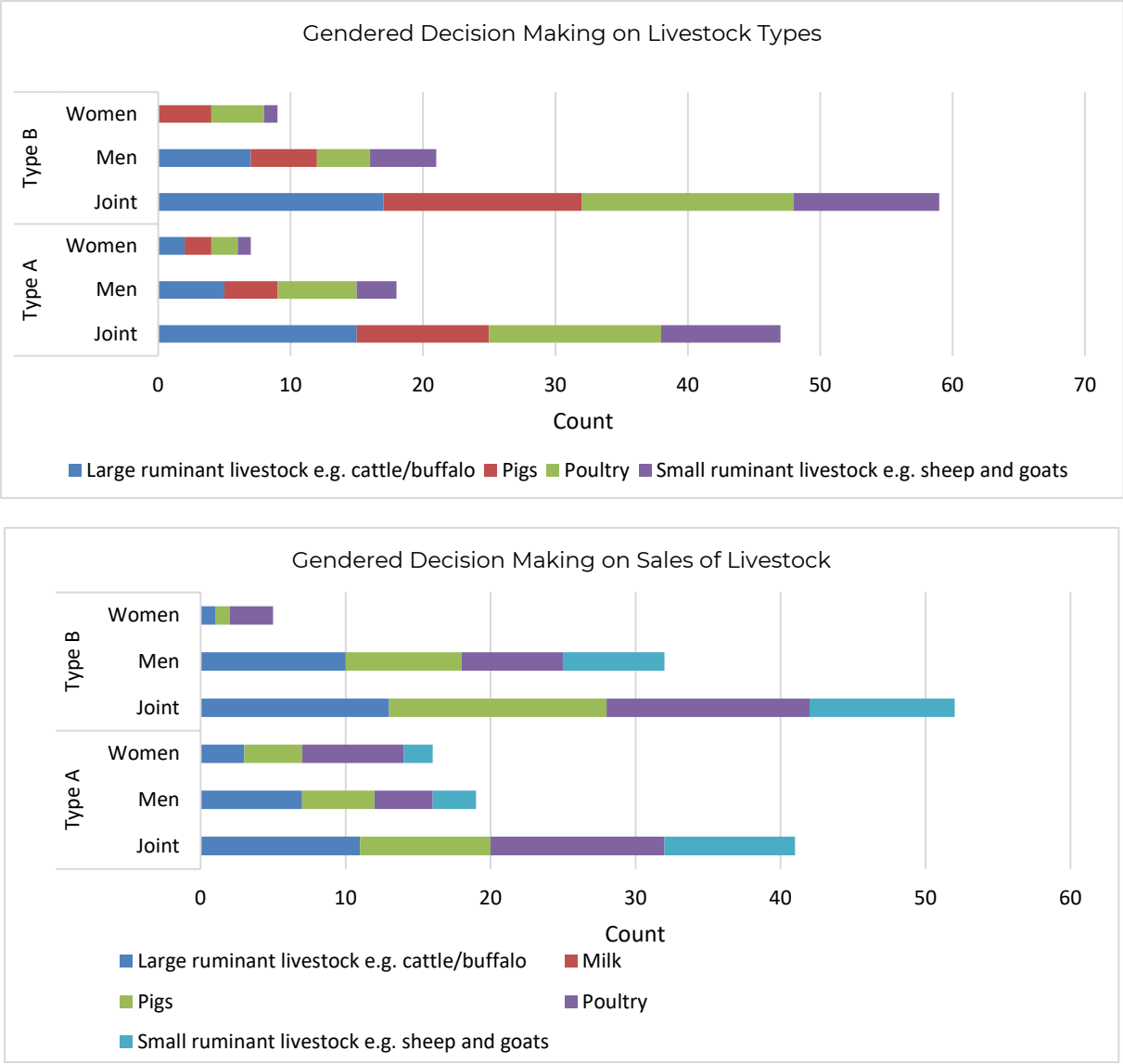


Figure 8. Gendered decision making on livestock types and sales.

Generally, there is no difference between male and female respondents' opinions on who decides to raise livestock. About two-thirds of the surveyed households reported that raising buffaloes/cows, goats, pigs, and poultry involved joint decision-making of both husbands and wives. About a third of the remaining households only have husbands or wives to decide on the livestock types. 26.7% of the respondents reported that only men in their family decided to raise cattle, while this rate for women was only 4.4%. 21.9% of respondents reported that men are also sole decision-makers for raising goats.

For pigs and poultry keeping, women have more independent decision-making power than for cattle. In selling cattle, goats, pigs, and poultry, the footprint of men's decision-making increases much more. Although the proportion of households that have joint decision-making by both husband and wife on the sale of cattle, goats, pigs, and poultry accounts for a relatively high

proportion, the proportion of men who make decisions in livestock sales is still high, especially for cattle. 36.4% of respondents reported that only men decide on the sale of buffaloes and cows, and only 9.1% said that only women decide on the sale of cattle. Examining the perceptions of male and female respondents about the decision-making power of men and women in the family regarding what animals to raise and sell suggests that women are somewhat reserved in their decision-making role for livestock with high economic value (such as buffalo, cattle, goats), which resonates with the findings derived from the gender norms study, illustrating that while perceptions on joint decision making arise in interviews and group discussions, gendered norms and behaviors that undermine women's capacities and abilities when it comes to household leadership and productive decisions prevail.

"A man must be more knowledgeable and smarter than his wife. A woman needs to be smart, but she doesn't need to be smarter than her husband. Men must have a voice over their wives." (A focus group discussion of women from the gender norms study, H'mong ethnic, Rung Thong village, Muong Bon commune).

Moreover, most men acknowledge the participation of both men and women in decision-making making on livestock types and sales. However, there are still some men who believe that men have the primary decision-making power, especially in raising buffaloes, cattle, and goats. They also underestimate the decision-making role of women.

In young families, some women have the power to make independent decisions about raising cattle or selling them. Only a few young women can make independent decisions about raising livestock, such as pigs and poultry (about 29.4% and 13.5% of young households expressed this opinion). However, for pigs and poultry, the number of young women who can make independent decisions decreases (5.9% and 11.8% of respondents said that women decide on the sales of pigs and poultry). Young daughters-in-law living with their husband's family have more difficulty making decisions on livestock sales. This too echoes findings of the gender norms study regarding land tenure and property rights, as traditional forms of inheritance and ownership after marriage further prevent women's access to formal land rights, complicating decision-making processes in productive units and, thus, equal participation in markets.

"If my parents-in-law want to sell any animals, they can sell by themselves. They never ask me. Even if I want to say something about the animals, I cannot. They would not listen to me even if I wanted to tell them. They say they can do it themselves. I am a woman, so they do not let me interfere in that decision. Decisions are mainly made by my husband and my father-in-law (An in-depth interview from the gender norms study, H'mong ethnic, Keo Lom village, Chieng Luong commune).

3.4. Management of livestock

In both Type A and B households, pigs and poultry are raised in pens throughout the year. They are fed concentrates, vegetables, and banana trunks. Farmers who raise Ban pigs cook concentrates (such as corn, rice bran, broken rice...) with vegetables or banana trunks before feeding. The main rearing practice for cattle and buffalo is intensive system (stall feeding) because farmers have limited grazing land, or it is difficult to find the grazing areas. Cattle and buffaloes can only be grazed after rice and maize harvest, along the hill or grazing in forest areas in Na Sang village. These results are in accordance with Ba et al. (2015), who reported that cattle production systems in the region tend to transit from extensive to semi-intensive and intensive systems. There are seasonal differences in feeding style for cattle and buffaloes. In the rainy season, they are mostly given fresh biomass (e.g., elephant grass, biomass maize) or sometimes grazed. Due to lack of fresh forage in dry season, cattle and buffaloes are mostly fed rice straw, sugarcane tops, banana tree trunk or maize silage, and some farms supplement rice bran or corn to cattle and buffaloes.

In Co Noi and Hat Lot communes, only a few farmers know how to prepare silage from biomass maize, elephant grass and sugarcane tops or urea-treated rice straw for ruminants. For non-ruminants, farmers can mix concentrate from available feed sources (such as corn, rice bran, cassava meal...) based on their experiences, however, they have limited knowledge on feed formulation.

Most of the households reported that there are no differences in animal feeding style between male and female-headed households. Some farmers indicated that men would give more feed to animals than women all-year round, especially during winter. Almost all men cover or heat the animal barns or use warm clothes for animals to protect them from the cold during the winter season. Besides, animals are supplied warm water for drinking on very cold days.

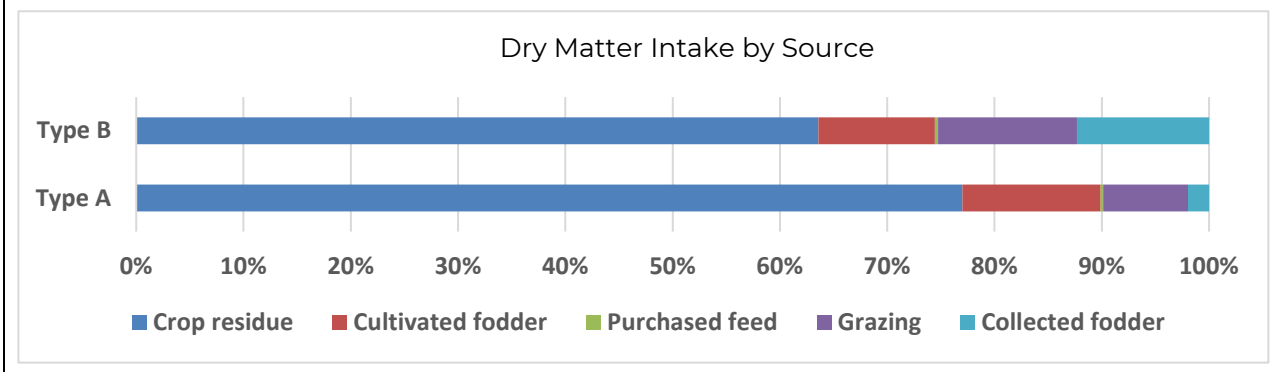
There are some common types of health problems that affect animals in the study area. Cattle and buffaloes in all interviewed households suffer from foot and mouth disease, and rumen bloating. If cattle and buffaloes are grazed, they are easily infected by rumen bloating from eating rotten corn and cassava. Nodular dermatitis and pasteurellosis are also reported in large ruminants. Pigs are commonly infected with cholera, E. coli, swollen head disease, Porcine Reproductive & Respiratory Syndrome, pasteurellosis, and dermatitis. In addition, recently pigs have been affected by African Swine Fiver (ASF). The majority of poultry are infected by diarrhea, bird flu, asthma and pasteurellosis. To prevent common diseases in ruminants and non-ruminants, vaccination programs are organized every year in Hat Lot and Co Noi communes. According to annual reports of Hat Lot and Co Noi communes in 2022, animals were vaccinated with around 6400 doses in each commune, which were mainly for foot and mouth disease, nodular dermatitis, pasteurellosis, swine cholera for cattle, buffaloes, and pigs. Besides, disinfection spraying was applied to markets, villages, and sub-zones, about 150 liters in Co Noi commune and 80 liters in Hat Lot commune.

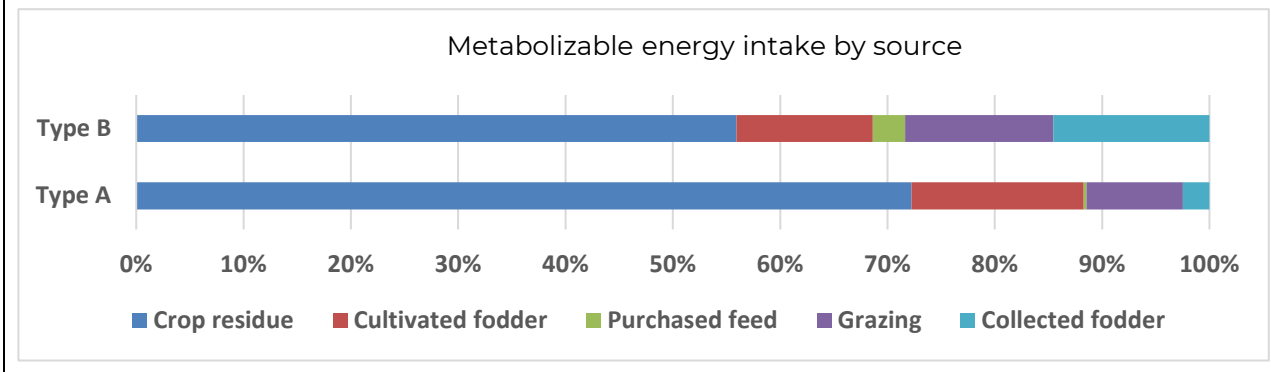
Traditional veterinary practices are commonly used for treating animals infected with common diseases. For example, sour bamboo shoot, lemon juice and lime are used to treat foot and mouth disease. Guava leaves, apricot leaves and forest leaves are used for curing diarrhea in cattle, pigs and poultry. Crushed garlic and salt soaked in water is often used to treat rumen bloating. Most elderly people know how to use these traditional practices and they can identify and collect forest leaves for disease-treating purposes. Most households apply these traditional practices, because these are passed down from previous generations and are reported to be effective. Men are mostly responsible for treating diseases in cattle and buffaloes, while both men and women apply traditional veterinary practices for pig and poultry diseases.

Direct mating (bull service) is the most commonly used method for cattle and buffalo reproduction in all villages. This service is available for free in all villages surveyed, except for Nhap village where it costs 13.04USD/time. On the other hand, artificial insemination (AI) for pigs is more popular in all villages, especially for exotic and crossbred pigs, with the cost of 0.435 –0.52USD/time. Ban pigs mostly reproduce via direct mating, with the cost service of 0.87-13.04USD/time. Using bull or boar service can cause genitourinary tract infection and inbreeding which results in low quality breeds, poor immune system, and increased mortality of newborns.

3.5. Livestock feed resources and seasonal availability

Crop residues comprise the largest dry matter (DM), metabolizable energy (ME) and crude protein (CP) intakes in both Type A and B (Figure 9). DM intake from crop residues and cultivated fodder are higher for Type A (76.99 and 12.89%) than Type B (63.5 9 and 10.86%), whereas DM intake from grazing and collected fodder in Type A (7.90 and 1.97%) are lower than in Type B (12.96 and 12.31%). This difference can be due to Type B having a greater land area for crops and smaller areas for cultivated fodder than Type A.





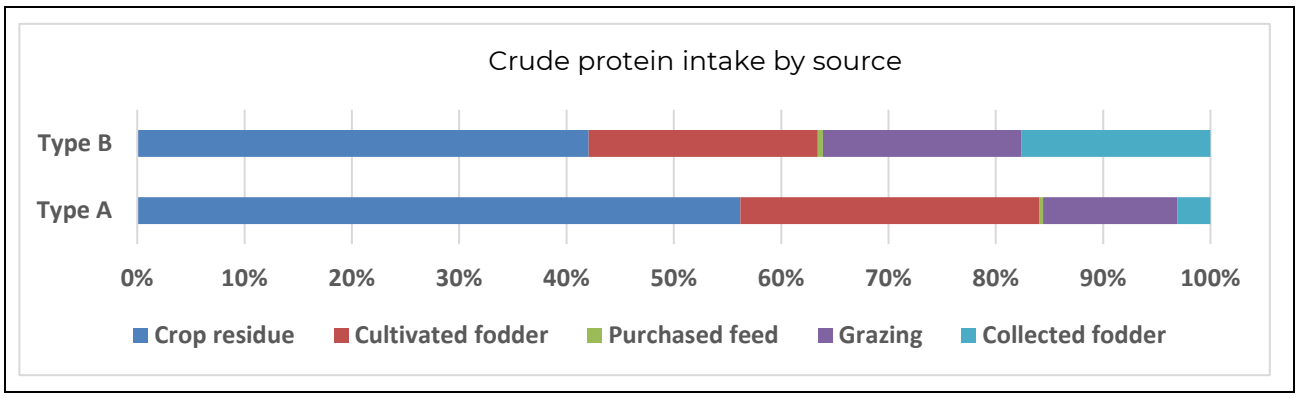
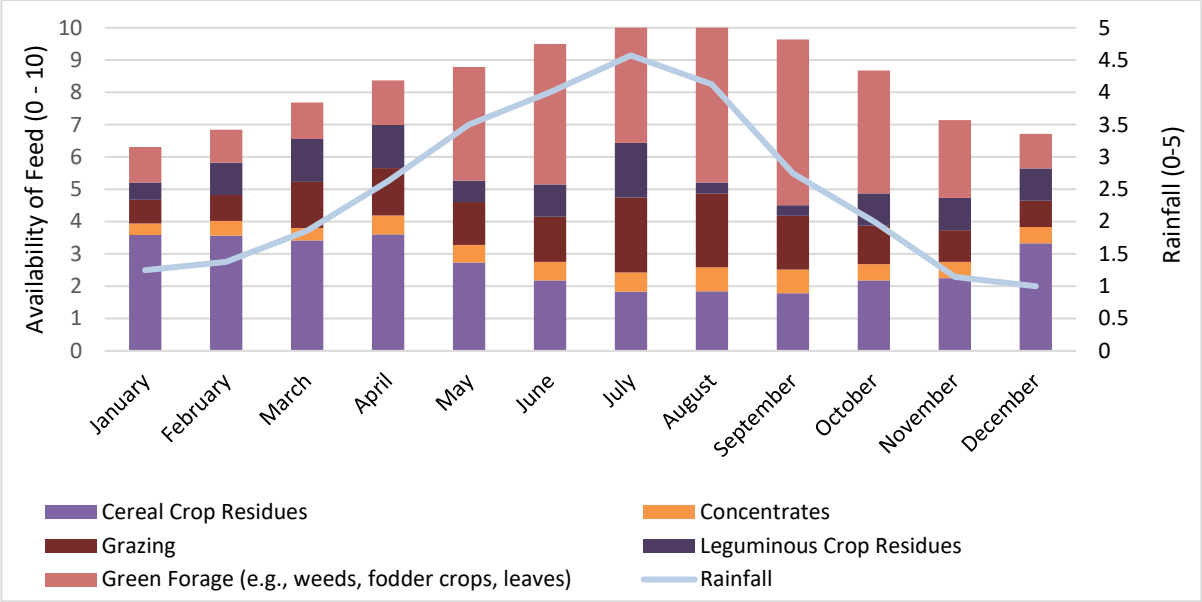


Figure 9. Contribution to dietary requirements in the study area

Seasonal availability of feed resources varies significantly between the two household types. In both Types A and B households, green forages (elephant grass and maize) are more available in the rainy season, while crop residues (especially sugarcane tops and rice straw) are more available in the dry season (Figure 10). In the dry season, farmers mainly rely on available rice straw, banana trunk, sugarcane tops. Cattle and buffaloes are grazed on the field after harvest or on the roadsides from September to November in Type B and from March to October in Type A. Concentrate feed is available throughout the year, however, Type A households use more concentrate feed than Type B households, this can be due to type A villages being located closest to the market. In contrast to Type A, there are no leguminous crop residues throughout the year in Type B. In all the four surveyed villages, pigs and poultry are fed with concentrates, banana trunk, vegetables.

Farmers use crop residues for animals either without processing or after processing (e.g. sugarcane tops silage, urea treated rice straw, chopping banana trunk). Silage from sugarcane tops is often prepared by mixing with only salt and stored for later use. Cooked ground corn and rice bran mixed with vegetables, taro leaves, sweet potato vines and banana trunk is fed to Ban pigs.

Type A



Type B

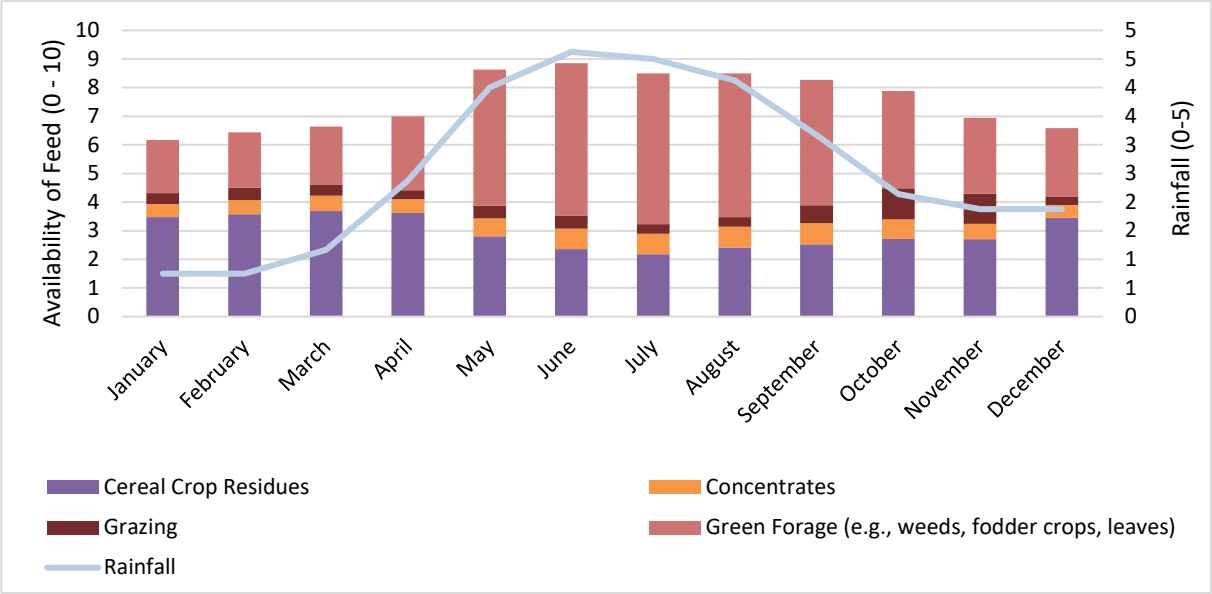


Figure 10. Availability of feed resources in Type A and B households

Gendered decision making on crops and feeding

Joint decision making is common in both Type A and B households including food and forage crops grown, crop residue use, and feed purchase (Figure 11). Approximately 60% of households surveyed reported that women and men discuss and make joint decisions.

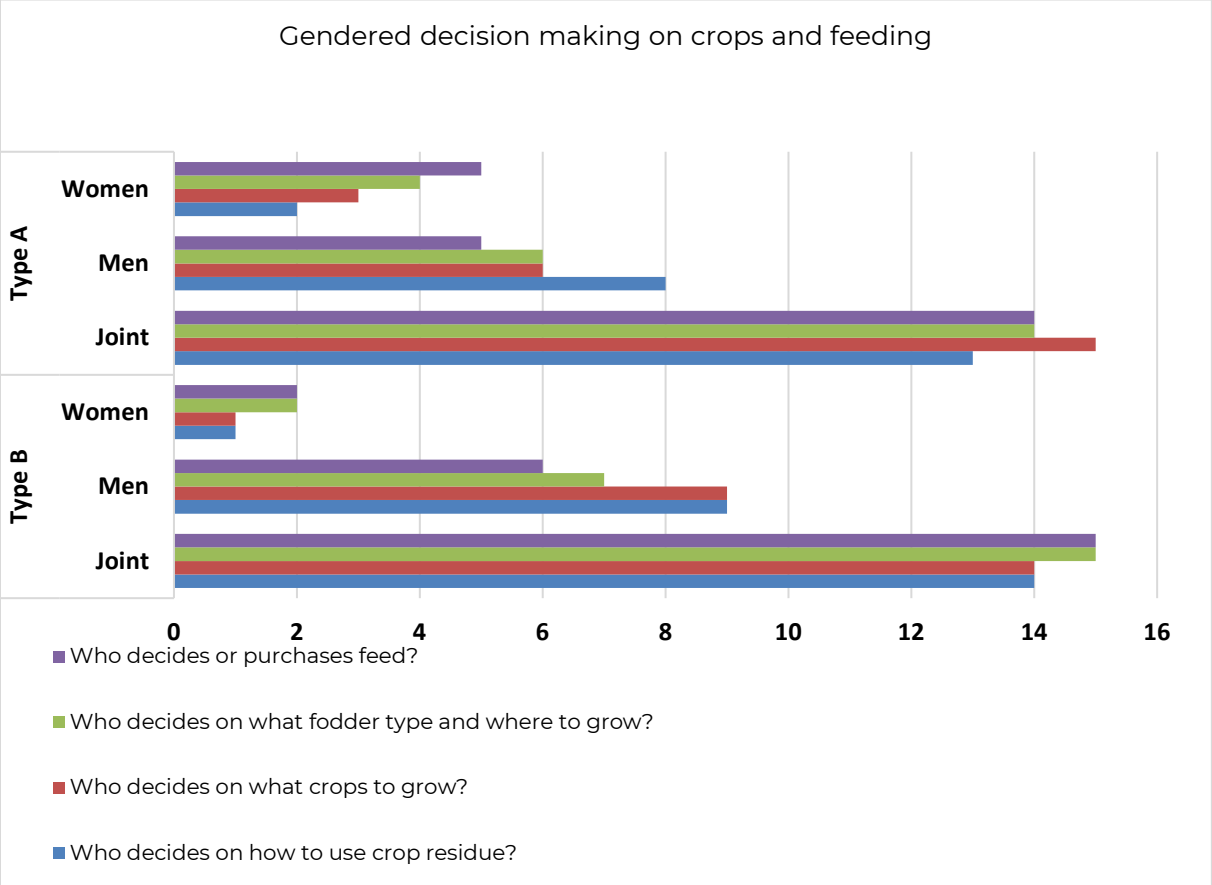


Figure 11. Gendered decision making on crops and feeding

The proportion of male-headed households making decisions on what crops to grow, use of crop by-products, forage crops, and purchase of animal feed ranges from 23% to 36%. This is common in all three age groups. However, considering village types, we can see that the overall decision-making trend of both husband and wife in type A villages is more favorable than in type B villages. The percentage of women who can make decisions independently is higher in type A than in type B. Men in village type B have much more decision-making power than women. Thus, men's more robust physical strength characteristics may strengthen their decision-making role under more difficult production conditions. When production conditions are more favorable, women have easier access to transportation. They can actively participate in the production process, so their voice and decision-making power will also be improved.

Gender division of labour for livestock management practices

There are differences in gender division of labour for different livestock management practices, in both Type A and B households. Men are mostly involved in feed production, harvesting and feeding as compared to women in both Types A and B households, except for cleaning of feeding and watering facilities and watering in Type A which is mostly done by women (Figures 12 and 13). A small number of children and youth support some activities in Type A households (such as mixing feed ingredients, planting forages, processing feed, storage feed and forages and weeding of forage crops), while around 4.17% of children and youth only work on cleaning of feeding and watering facilities in Type B households.

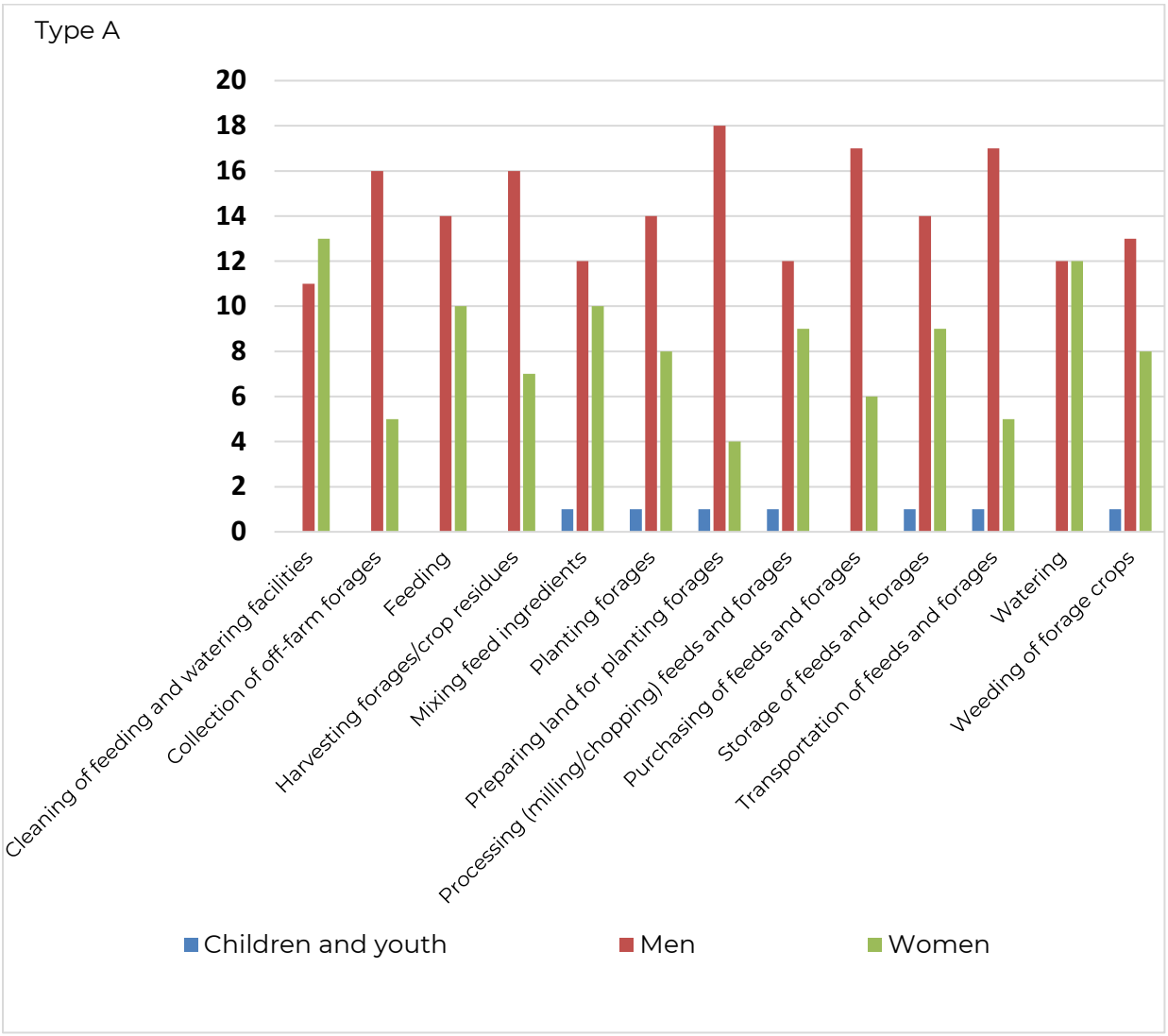


Figure 12. Gender division of Labor in feed production, harvesting and feeding for Type A households

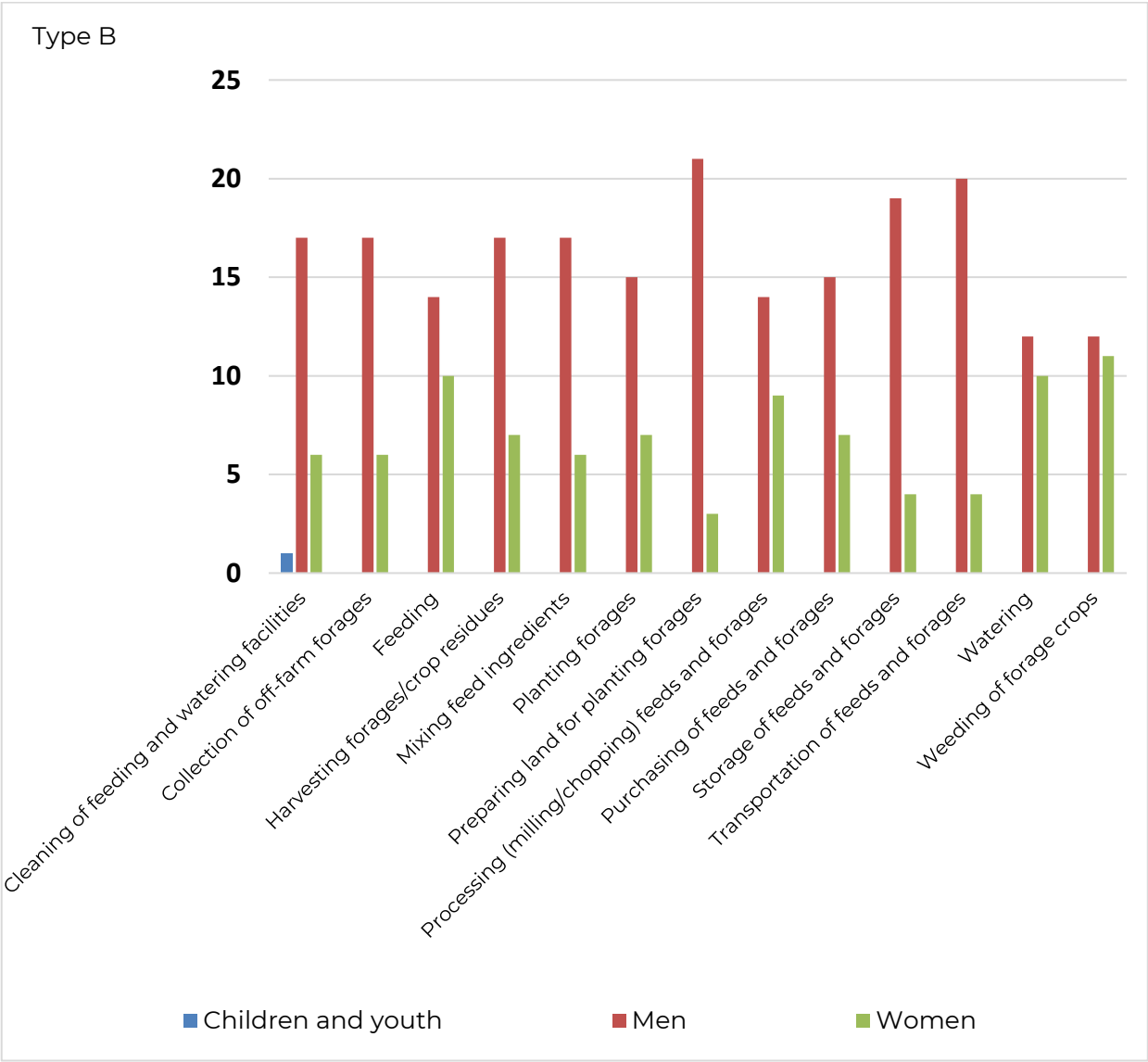


Figure 1314. Gender division of labor in feed production, harvesting and feeding for Type B households

For cattle raising, gender division of labor in Thai households today still has many traditional features of division, that is, taking on heavy tasks that require men's strength. For example, men are responsible for preparing the land to grow forage crops. Men are also in charge of transporting forages from the field to the house.

"*To cut grass, women can cut it. Take it home, women can drive motorbikes to carry it, but they cannot drive motorbikes to carry heavy load. To carry grass by hand, women can, but they can't carry much. Men can carry much more grass. They can drive a motorbike and carry a lot of grass. If women drive on a bad road, women can't carry it anymore, while men on a bad road can still drive motorbikes with a lot of grass." (An in-depth interview from the gender norms study, a woman positive deviant, Thai ethnic, Rung Thong village, Muong Bon commune).*

Driving a motorbike on earth roads in mountainous areas to transport forage is challenging for women, especially middle-aged women. During harvesting of forage crops, the role of men continues to be more prominent than that of women. In low land areas with high accessibility,

the heavy work done by men is partly shared by women. For example, 100% of people in Type B commented that men always had to **prepare land for planting forages**, but this percentage in Type A dropped to 75% ($p = 0.01$).

The male role is dominant in most stages involved in growing forage crops for livestock. These activities are associated with traditional concepts and the context of men taking on somewhat arduous tasks, which are considered physically more suitable for men than women. Even so, some stages in which there is no need to drive a motorbike on bumpy roads, prepare for soil, or harvesting requires physical strength, while women still play less role than men, such as mixing and preserving forage. 61.7% and 68.8% of the respondents reported that men are involved in feed mix and processing, as compared to 25% and 31.9% women respectively. Both mixing and storage may require technical knowledge and experience, but women do not play the primary role. The situation is similar in feeding and cleaning utensils where majority of men still dominate. There is no difference between age groups in terms of labor division by gender related to feed preparation. The labor division by gender in most households still seems to follow traditional patterns, where women's involvement comprises both productive and domestic labor.

In addition to physical or technical reasons, are women less interested in livestock production than men, thus less involved in growing forages and processing animal feed. Looking at respondents' age groups shows that women in older age groups are less involved in feed-related activities than younger women. 52.9% of young people commented that women are responsible for weeding of forage crops, while these rates in the two older age groups are 28.6% and 33.3% ($p = 0.009 < 0.01$). Similarly, women in older families are also less responsible in milling and chopping forages. Contrary, in young families, men and women participate equally in planting, processing, cutting, milling, and chopping forages. Younger women are more actively involved in livestock activities than older women. Younger families tend to move towards an equal share of women and men in livestock-related activities than middle-aged and older families. Generally, the same labor division by gender in livestock production occurs in both Type A and B villages.

3.6. Livestock production constraints

In both Types A and B households, farmers listed the main constraints affecting livestock production, such as lack of capital, lack of knowledge, market, livestock diseases and feed. The respondents also highlighted a gap in information and advisory services pertaining to markets and livestock husbandry. Tables 4 and 5 provide a summary of identified problems, gender-disaggregated ranking and proposed solutions.

Table 4. Major livestock production constraints and suggested solutions in type A households			
Men's rank	**Problem lists**	**Most affected**	**Suggested solutions by male farmers**
1	High input price and low output price, unstable price, lack information on market demand and supply	All	Training on market information; Find other suppliers and sell to other markets with better prices; Need government support to regulate input and output prices; Utilize effectively available feed resources to reduce feed cost: Linking households to slaughter animals together and sell to consumers; Large state enterprises to sign contracts to purchase products. Proposing to the government to restrict imports
2	Lack of fresh forages in winter and low quality of forages in winter	All	Training on feed processing and preservation: Provide banana trunk, rice straw, sugarcane tops to animals: Increase land areas for forage planting: Increase forage storing in the winter
3	Lack of knowledge on animal health, livestock management, animal feed and feeding		Cross learning among farmers; Training on how to identify animal diseases; livestock management, livestock feeds and feeding; Visiting and learning from demonstration farms; Dissemination of technical knowledge through the public media
4	Animal health	All	Using veterinary services or buy medicine; Using traditional veterinary practices for curing common diseases; Vaccination program; Training on how to identify diseases and improve animal health; Cleaning animal house

5	Lack of input investment	All	Get loans from Agricultural bank, policy bank or credit funds; Get inputs from suppliers in advance, then pay after selling products
Other constraints	Lack of land area for crops	All	No suggested solution
	Lack of forage seeds/planting materials	All	No suggested solution
	Water pollution	All	No suggested solution
	Animal breed	All	Provide good quality breeds by agricultural service center at the district level
Women's problem rank	**Problem lists**	**Most affected**	**Suggested solutions by female farmers**
1	High input price and low output price, unstable price, lack information on market demand and supply	All	Need government support to regulate input and output prices; Linking households to slaughter animals together and sell directly to consumers;
2	Lack of knowledge on animal health, livestock management, animal feed and feeding		Organize technical trainings; Visiting and learning from demonstration farms;
3	Animal health	All	Vaccination program; Training on how to identify diseases and improve animal health
4	Lack of fresh forages in winter and low quality of forages in winter	All	Increase forage storing during winter; Training on feed processing and preservation:
5	Lack of input investment	All	Get loans from Agricultural bank, policy bank or credit funds; Get inputs from suppliers in advance, then pay after selling products
Other	Lack of land area for crops	All	Need have more fodder cultivation land

constraints	Lack of forage seed/planting materials	All	No suggested solution
	Water pollution	All	No suggested solution
	Animal breed	All	No suggested solution

Table 5.6 Major livestock production constraints and suggested solutions in type B households

Men's problem Remark	Problem lists	Most affected	Suggested solutions by male farmers
1	High input price and low output price, unstable price, lack information on market need and supply	All	Find other markets with stable input/output prices; Need government support to regulate input and output prices; Linking households to get input materials and sell products at better prices: Link households to slaughter animals together and sell directly to consumers
2	Lack of input investment	All	Get loans from Agricultural bank, policy bank or credit funds; Get inputs from suppliers in advance, then paying after selling products
3	Animal health	All	Using traditional veterinary remedies; Vaccination program; Farmers buy medicines for curing their animals with common diseases
4	Lack of knowledge on animal health, livestock management, animal feed and feeding	All	Cross learning among farmers; Training on how to identify animal diseases, livestock management, livestock feeds and feeding; Visiting and learning from demonstration farms; Using local knowledge

5	Lack of fresh forages in winter and low quality of forages in winter	All	Training on feed processing and preservation, improve feed quality; Technical support on growing suitable forage varieties; Increase the utilization of available feed resources.
Other constraints	Lack of land area for growing forages	All	Intercropping with other crops
	Lack of forage seeds/planting materials		No suggested solution
	Lack of fresh water	All	Support well drilling
	Difficulty to transport in the raining days	Men	No suggested solution
Women's problem Rank	**Problem lists**	**Most affected**	**Suggested solutions by female farmers**
1	High input price and low output price, unstable price, lack information on market need and supply	All	Increase utilization of available feed resources to reduce feed cost; Need government support to regulate input and output prices for stable;
2	Animal health	All	Using traditional veterinary remedies; Vaccination program
3	Lack of knowledge on animal health, livestock management, animal feed and feeding	All	Training on how to identify animal diseases, livestock management, livestock feeds and feeding; Visiting and learning from demonstration farms;

4	Lack of fresh forages in winter and low quality of forages in winter	All	Training on feed processing and preservation, improve feed quality;
5	Lack of input investment	All	Get loans from Agricultural bank, policy bank or credit funds; Get inputs from suppliers in advance, then pay after selling produce; Using traditional veterinary remedies; Vaccination program
Other constraints	Lack of land area for growing forages	All	No suggested solution
	Lack of forage seeds/planting materials		No suggested solution
	Lack of fresh water	All	No suggested solution
	Difficulty to transport in the raining days	Men	No suggested solution

4. PROPOSED FEED INTERVENTION STRATEGIES

Participatory forage development: selection, establishment, management, and utilization

Most farmers raising cattle and buffaloes rely mainly on elephant grass and crop residues which are low in nutrient content and elephant grass does not develop well in winter. There are several options to improve animal nutrition and increase the level of animal productivity and efficiency, which remains very low in the study area. Improvement of forage quality and yields should continue with the selection of improved cultivars suited to the farming systems, soil, and climatic contexts, ultimately allowing women, men and youth farmers to select forages that meets their needs and preferences. In at least each commune, one demonstration farm on improved forage planting will be selected according to the criteria given by the project for planting improved forage varieties, such as Mun River, Mulato II, Ubon stylo, Mombasa Guinea, Green elephant grass, and biomass maize.

Utilization of locally available feed resources

To reduce feed shortage and feed costs, available crop residues should be utilized more effectively on farms. Treatment methods of forage conservation (e.g., silage, urea treatment) that assist in maintaining higher nutritional quality and digestibility should be used more widely by livestock producers. Therefore, setting up demonstration farms on feed processing and feeding trial should be also introduced in each commune, to act as a central hub for capacity building of women and men farmers. The demonstration farms will be typical examples for nearby farms within communes to visit and learn, then they will choose the best options for their own farms.

Building capacity through training for trainers and farmers

Lack of knowledge on animal health, livestock management, animal feed and feeding are one of the main constraints affecting livestock production in Hat Lot and Co Noi communes. In Li-chan project, farmers in four villages of Chieng Chung and Chieng Luong were trained on feeds and feeding regimes, however, the farmer's receptivity to knowledge was still limited due to the short project duration and other operational barriers. Therefore, training for trainers with local extension staff and veterinary officers, and farmer trainings with women and men farmers and farmer groups should be organized. Farmer-friendly training materials should include forage establishment and management, feed classification, diet formulation, feeding regimes for cattle or pigs at different phases, and feed processing (silage, rice straw treated with urea, and feed fermentation with probiotics).

Establish the supplying network of seeds/planting materials

In Mai Son district, there are no commercial forage seed suppliers, except for NOMAFSI that supplies small amounts of forage planting materials to farmers. To ensure farmers in the piloted

area access to seed or planting materials, demo farmers will be guided on multiplying planting materials which can then be shared with other farmers. Besides, interested farmer groups link together and with seed suppliers outside Mai Son, NOMASI, NIAS, local extension staff, commune veterinary officers, and the local government to get seed or planting materials. Thus, the establishment of the supplying network of seeds/planting materials is very necessary.

Approaches for strengthening inclusive and profitable linkages with input and output markets

Feeds and forages interventions (complemented with animal health and genetics interventions) should have strong linkages to both input and output markets to incentivize inputs and service providers (e.g., forage seeds and feed suppliers) to avail these interventions and for producers to adopt them. This calls for gender-sensitive approaches for strengthening market linkages by building technical and business capacity and business models for women and men farmers and inputs/service providers, and potentially including agri-business incubation and/or entrepreneurship training. Also, through strengthening collective capacity of producers so that they are better able to engage with inputs/providers and with fair and transparent output markets.

5. CONCLUSION

Livestock production is the second main source of income after crop production in the study area. In Type A and B households, crop residues are available throughout the year, particularly a larger volume of sugarcane tops during harvesting time in the dry season. Lack of fresh forage and low forage quality in the dry season is one of the main challenges to livestock production. Therefore, there is a need for training on better crop residue utilization and processing methods for improving livestock production. Besides, forage cultivation is mainly with Napier grass, so this presents an opportunity for introducing and promoting improved forage varieties in the study area.

When organizing training for farmers on planting grass for fodder, it is necessary to invite both husband and wife in young families (<35 years old) to attend. The attendance of young female and male farmers will set a positive typical ideology for technology adoption. In addition, it is also essential to invite middle-aged women to participate in the training to help them keep up with new advances such adoption of high-quality grass forages and feed technologies. It should also be noted that middle-aged and older women may hesitate to participate in trainings and capacity building activities because they may view attending trainings as the responsibility of men (the husbands) or think that men are cleverer and more proficient, due to existing gender norms and constraints for women's participation and engagement outside the household realm. Therefore, the project team needs to mobilize not only women, encouraging to participate in such activities, but also their husbands to support and urge the wives to participate. Communication and advocacy activities to challenge and transform prevalent gender norms and empower women in the future should focus on communicating with men, especially with young families, and enhance their understanding of gender equality. Young men are thus also central agents in facilitating women's empowerment opportunities in families and communities.

REFERENCES

Atieno, M. Mai, T. Douxchamps, S. Peters, M & Duncan, A. (2021) Rapid survey of livestock feed resource availability and use in Mai Son district, Son La province, Vietnam, using the Gendered Feed Assessment Tool (G-FEAST). Hanoi (Vietnam): CGIAR Research Program on Livestock. 22 p. https://hdl.handle.net/10568/111524

Annual report year 2022 on social and economic development in Co Noi and Hat Lot communes, Mai Son district, Son La province.

Ba, N.X., D.V. Dung, N.T. Mui, N.H. Van, P.H. Son, H.T. Mai, T.T. Hai, R. Smith, D. Parsons, & J. Corfield (2015). Cow-calf production systems in households in Vietnam South Central coastal region. Vietnam Journal of Agriculture and Rural Development, 2015(21), 109-117. http://ecite.utas.edu.au/106457

Douxchamps, S., Teufel, N., Nguyen, T., Nguyen, H., Poole E.J. (2019). Livestock CRP Vietnam 2019-2021 Site selection process. International Center for Tropical Agriculture, Hanoi, Vietnam. 11p. https://hdl.handle.net/10568/107277

Duncan, A.J., Lukuyu, B., Mutoni, G. et al. Supporting participatory livestock feed improvement using the Feed Assessment Tool (FEAST). Agron. Sustain. Dev. 43, 34 (2023). https://doi.org/10.1007/s13593-023-00886-9

Duncan, A., York, L., Lukuyu, B., Samaddar, A., Stür, W. (2012). Feed Assessment Tool (FEAST): A systematic method for assessing local feed resource availability and use with a view to designing intervention strategies aimed at optimizing feed utilization. Questionnaire for Facilitators (Version 5.3); updated: 15 June, 2012. ILRI, Addis Ababa, Ethiopia. Available from: https://www.ilri.org/feast

Statistic database, (2019). General Statistics Office of Vietnam (GSO). Retrieved from https://www.gso.gov.vn/wp-content/uploads/2020/09/Nien-giam-thong-ke-day-du-2019.pdf

FAO. 2011. Guidelines for the preparation of livestock sector reviews. Animal Production and Health Guidelines. No. 5. Rome. https://www.fao.org/3/i2294e/i2294e00.pdf

Lukuyu, B., Eerdewijk, A. Van, Kinati, W., Sultana, N., Mulema, A. and Duncan, A. 2019a. Gendered Feed Assessment Tool (G-FEAST) focus group discussion guide. Nairobi, Kenya: ILRI. https://hdl.handle.net/10568/100243

Lukuyu, B., Eerdewijk, A. Van, Kinati, W., Sultana, N., Mulema, A. and Duncan, A. 2019b. Gendered Feed Assessment Tool (G-FEAST) individual farmer interview questionnaire. Nairobi, Kenya: ILRI. https://hdl.handle.net/10568/100244

ANNEX

Table A1. Percentage (%) of male and female respondents' opinions on who makes decisions on raising and selling livestock.

	Male respondents		Female respondents		Total	
	Count	%	Count	%	**Count**	**%**
Who decides on raising cattle?						
Men	8	36.4	4	**17.4**	**12**	**26.7**
Women	0	**0.0**	2	8.7	**2**	**4.4**
Joint	14	63.6	17	73.9	**31**	**68.9**
Who decides on raising goats?						
Men	4	28.6	3	**16.7**	**7**	**21.9**
Women	2	**14.3**	3	16.7	**5**	**15.6**
Joint	8	57.1	12	66.7	**20**	**62.5**
Who decides on raising pigs?						
Men	5	26.3	2	**8.7**	**7**	**16.7**
Women	3	**15.8**	7	30.4	**10**	**23.8**
Joint	11	57.9	14	60.9	**25**	**59.5**
Who decides on raising poultry?						
Men	6	27.3	1	**4.0**	**7**	**14.9**
Women	3	**13.6**	8	32.0	**11**	**23.4**
Joint	13	59.1	16	64.0	**29**	**61.7**
Who decides on selling cattle?						
Men	9	42.9	7	**30.4**	**16**	**36.4**
Women	1	**4.8**	3	13.0	**4**	**9.1**
Joint	11	52.4	13	56.5	**24**	**54.5**
Who decides on selling goats?						
Men	7	50.0	4	**22.2**	**11**	**34.4**
Women	0	**0.0**	2	11.1	**2**	**6.3**
Joint	7	50.0	12	66.7	**19**	**59.4**
Who decides on selling pigs?						
Men	9	47.4	4	**17.4**	**13**	**31.0**
Women	2	**10.5**	3	13.0	**5**	**11.9**
Joint	8	42.1	16	69.6	**24**	**57.1**
Who decides on selling poultry?						
Men	7	31.8	5	**20.0**	**12**	**25.5**
Women	4	**18.2**	5	20.0	**9**	**19.1**
Joint	11	50.0	15	60.0	**26**	**55.3**

Table A2. Percentage (%) of respondents' opinions by age groups on who makes decisions on raising and selling livestock

	<=35		36-50		>50		Total	
	Count	%	Count	%	Count	%	**Count**	**%**
Who decides on raising cattle?								
Men	4	25.0	4	28.6	4	26.7	**12**	**26.7**
Women	0	0.0	0	0.0	2	**13.3**	**2**	**4.4**
Joint	twelfth	75.0	ten	71.4	9	60.0	**31**	**68.9**
Who decides on raising goats?								
Men	3	25.0	3	30.0	first	10.0	**7**	**21.9**
Women	first	8.3	2	**20.0**	2	**20.0**	**5**	**15.6**
Joint	8	66.7	5	50.0	7	70.0	**20**	**62.5**
Who decides on raising pigs?								
Men	2	11.8	3	21.4	2	18.2	**7**	**16.7**
Women	5	**29.4**	2	14.3	3	27.3	**10**	**23.8**
Joint	ten	58.8	9	64.3	6	54.5	**25**	**59.5**
Who decides on raising poultry?								
Men	2	11.8	2	13.3	3	20.0	**7**	**14.9**
Women	4	**23.5**	4	**26.7**	3	20.0	**11**	**23.4**
Joint	11	64.7	9	60.0	9	60.0	**29**	**61.7**
Who decides on selling cattle?								
Men	7	43.8	7	46.7	2	15.4	**16**	**36.4**
Women	0	0.0	2	**13.3**	2	**15.4**	**4**	**9.1**
Joint	9	56.3	6	40.0	9	69.2	**24**	**54.5**
Who decides on selling goats?								
Men	4	33.3	4	44.4	3	27.3	**11**	**34.4**
Women	0	0.0	first	**11.1**	first	**9.1**	**2**	**6.3**
Joint	8	66.7	4	44.4	7	63.6	**19**	**59.4**
Who decides on selling pigs?								
Men	4	23.5	6	42.9	3	27.3	**13**	**31.0**
Women	first	**5.9**	2	14.3	2	18.2	**5**	**11.9**
Joint	twelfth	70.6	6	42.9	6	54.5	**24**	**57.1**
Who decides on selling poultry?								
Men	5	29.4	6	40.0	first	6.7	**12**	**25.5**
Women	2	**11.8**	3	20.0	4	26.7	**9**	**19.1**
Joint	ten	58.8	6	40.0	ten	66.7	**26**	**55.3**

Table A3. Percentage (%) of respondents' opinions by age groups and village types on who make decisions on crops, crop residue, forage crops, and purchase of animal feed

	Age groups of respondents						Types of villages				Total	
	<=35		36-50		>50		Type A		Type B			
	Count	%	Count	%	Count	%	Count	%	Count	%	**Count**	**%**
Who decides on what crops to grow?												
Men	6	35.3	5	31.3	4	26.7	3	14.3	12	**44.4**	**15**	**31.3**
Women	1	5.9	2	12.5	1	6.7	3	**14.3**	1	3.7	**4**	**8.3**
Joint	10	58.8	9	56.3	10	66.7	15	71.4	14	51.9	**29**	**60.4**
Who decides how to use crop residue?												
Men	7	41.2	5	33.3	5	33.3	5	25.0	12	**44.4**	**17**	**36.2**
Women	0	0.0	2	13.3	1	6.7	2	**10.0**	1	3.7	**3**	**6.4**
Joint	10	58.8	8	53.3	9	60.0	13	65.0	14	51.9	**27**	**57.4**
Who decides on what fodder type and where to grow?												
Men	5	29.4	4	25	4	26.7	3	14.3	10	**37.0**	**13**	**27.1**
Women	2	11.8	2	12.5	2	13.3	4	**19.0**	2	7.4	**6**	**12.5**
Joint	10	58.8	10	62.5	9	60.0	14	66.7	15	55.6	**29**	**60.4**
Who decides or purchases feed?												
Men	4	23.5	3	20.0	4	26.7	3	14.3	8	**30.8**	**11**	**23.4**
Women	2	11.8	2	13.3	3	20.0	5	**23.8**	2	7.7	**7**	**14.9**
Joint	11	64.7	10	66.7	8	53.3	13	61.9	16	61.5	**29**	**61.7**

Table A4. Percentage (%) of age groups' opinions on the labor division between women and men to ensure resources of feed and forages for cattle and poultry of households

	<=35 years old		36-50 years old		>50 years old		Total	
	Count	%	Count	%	Count	%	Count	%
Who prepares land for planting forages?								
Men	15	88.2	14	93.3	13	86.7	42	89.4
Women	1	5.9	1	6.7	2	13.3	4	8.5
Joint	0	0.0	0	0.0	0	0.0	0	0.0
Children and youth	1	5.9	0	0.0	0	0.0	1	2.1
Who plants forages?								
Men	7	41.2	12	80.0	11	73.3	30	63.8
Women	8	47.1	3	20.0	4	26.7	15	31.9
Joint	1	5.9	0	0.0	0	0.0	1	2.1
Children and youth	1	5.9	0	0.0	0	0.0	1	2.1
Who weeds forage crops?								
Men	5	29.4	10	71.4	10	66.7	25	54.3
Women	9	52.9	4	28.6	5	33.3	18	39.1
Joint	1	5.9	0	0.0	0	0.0	1	2.2
Children and youth	2	11.8	0	0.0	0	0.0	2	4.3
Who harvests forages/crop residues?								
Men	13	76.5	13	86.7	10	66.7	36	76.6
Women	3	17.6	2	13.3	5	33.3	10	21.3
Joint	1	5.9	0	0.0	0	0.0	1	2.1
Children and youth	0	0.0	0	0.0	0	0.0	0	0.0
Who processes feeds and forages?								
Men	7	41.2	10	66.7	9	64.3	26	56.5
Women	7	41.2	5	33.3	5	35.7	17	37.0
Joint	1	5.9	0	0.0	0	0.0	1	2.2
Children and youth	2	11.8	0	0.0	0	0.0	2	4.3
Who collects of off-farm forages?								
Men	12	75.0	8	61.5	14	93.3	34	77.3
Women	2	12.5	5	38.5	1	6.7	8	18.2
Joint	1	6.3	0	0.0	0	0.0	1	2.3
Children and youth	1	6.3	0	0.0	0	0.0	1	2.3
Who purchases feeds and forages?								
Men	11	68.8	11	73.3	10	66.7	32	69.6
Women	3	18.8	4	26.7	5	33.3	12	26.1
Joint	1	6.3	0	0.0	0	0.0	1	2.2
Children and youth	1	6.3	0	0.0	0	0.0	1	2.2
Who transports feeds and forages?								
Men	15	88.2	13	86.7	12	80.0	40	85.1
Women	1	5.9	2	13.3	3	20.0	6	12.8
Joint	0	0.0	0	0.0	0	0.0	0	0.0
Children and youth	1	5.9	0	0.0	0	0.0	1	2.1
Who stores feeds and forages?								
Men	12	70.6	11	68.8	10	66.7	33	68.8
Women	2	11.8	5	31.3	5	33.3	12	25.0
Joint	1	5.9	0	0.0	0	0.0	1	2.1
Children and youth	2	11.8	0	0.0	0	0.0	2	4.2
Who mixes feed ingredients?								
Men	8	50.0	11	68.8	10	66.7	29	61.7
Women	5	31.3	5	31.3	5	33.3	15	31.9
Joint	1	6.3	0	0.0	0	0.0	1	2.1

Table A4. Percentage (%) of age groups' opinions on the labor division between women and men to ensure resources of feed and forages for cattle and poultry of households

	<=35 years old		36-50 years old		>50 years old		Total	
	Count	%	Count	%	Count	%	Count	%
Children and youth	2	12.5	0	0.0	0	0.0	2	4.3
Who feeds animals?								
Men	9	52.9	10	62.5	10	66.7	29	60.4
Women	6	35.3	6	37.5	5	33.3	17	35.4
Joint	1	5.9	0	0.0	0	0.0	1	2.1
Children and youth	1	5.9	0	0.0	0	0.0	1	2.1
Who takes water for animals?								
Men	8	47.1	7	43.8	8	53.3	23	47.9
Women	7	41.2	9	56.3	7	46.7	23	47.9
Joint	1	5.9	0	0.0	0	0.0	1	2.1
Children and youth	1	5.9	0	0.0	0	0.0	1	2.1
Who cleans feeding and watering facilities?								
Men	12	70.6	10	62.5	7	46.7	29	60.4
Women	3	17.6	5	31.3	8	53.3	16	33.3
Joint	1	5.9	0	0.0	0	0.0	1	2.1
Children and youth	1	5.9	1	6.3	0	0.0	2	4.2

The CGIAR Research Initiative on Sustainable Animal Productivity for Livelihoods, Nutrition and Gender inclusion (SAPLING) is is working in seven countries focusing on livestock value chains to package and scale out tried-and-tested, as well as new, innovations in livestock health, genetics, feed and market systems. SAPLING aims to demonstrate that improvements in livestock productivity can offer a triple win: generating improved livelihoods and nutritional outcomes; contributing to women's empowerment; and, reducing impacts on climate and the environment. Its seven focus countries are Ethiopia, Kenya, Mali, Nepal, Tanzania, Uganda and Vietnam.

It forms part of CGIAR's new Research Portfolio, delivering science and innovation to transform food, land, and water systems in a climate crisis.