



Women's roles and opportunities in cassava value chains in Son La province in Vietnam

Technical Report

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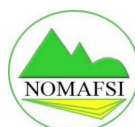
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Abstract

Cassava is a major export-oriented cash crop in Vietnam. Unlike other cash crops, such as coffee, fruits, and maize, cassava requires limited agricultural input and labour and can grow in nutrient-poor uplands. Research on cassava breeding, seed systems and value chains in Southeast Asia is increasingly focused on market-oriented aspects such as developing hybrid varieties favourable to the cassava starch industry, disease control on large-scale farms, and seed systems driven by the private sector. However, in the northern mountainous areas of Vietnam, ethnic minority farmers use cassava roots, leaves and sticks for numerous reasons, including starch production, fish and animal feed, firewood, and home consumption. Women play significant roles in those non-market-oriented activities (often collecting left-over small roots in the field, drying roots, and cutting leaves and stems) but little is known about how this work influences women's roles, decision-making and opportunities in cassava value chains. Hence, this study provides that data with an eye to see how women may find more opportunity for creating small business enterprises with cassava. Fieldwork was conducted in July 2021 in the Chieng La commune (Thuan Chau district) and the Muong Bon Commune (Mai Son district). Findings show that although women are less involved in decision making on cassava production and overall agricultural investment, they play important roles in cassava production and post-harvest activities. Therefore, it is extremely important to collect and analyze women's preferences, concerns and constraints in cassava research and interventions. In the conclusion, we highlight additional areas for research on this topic.

1. Introduction

Cassava is a major cash crop in some North Vietnamese provinces. Although its fresh root prices fluctuate considerably each year, it is still an attractive crop for poor smallholder farmers, including those from ethnic minorities, as it grows well in nutrient-poor uplands with little technical and financial investment compared to other major cash crops from this region (e.g., mangoes, coffee and maize).

Although using new hybrid varieties of cassava to increase productivity has been the major focus for previous research and interventions on cassava, ethnic minority smallholders still prefer to use local varieties (despite their comparatively lower productivity) because they have other household uses as animal feed and household consumption and because local varieties have established local seed systems based on self-multiplication and exchange among the farmers. Understanding farmers' perspectives for their crop choices and local varieties is, therefore, necessary for providing appropriate support to meet their needs. However, the existing literature leaves a gap in our understanding of smallholder knowledge, practices and decisions at the household level, and in particular, intra-household gender relationships and the role and influence of women in cassava value chains.

To answer these questions, this study pursues three objectives:

1. Providing details on intra-household decision making over crop choices and farming strategies;
2. Assessing the value of cassava for ethnic minority farmers, especially women farmers; and
3. Proposing possible entrepreneurial opportunities for women in cassava value chains.

Taken together, these objectives will help develop support plans that can support ethnic minority women farmers through interventions such as the distribution of quality planting material, post-harvest technologies, and improved market opportunities that meet women's needs and interests.

In the next section, we briefly explain the methods employed in this study. Section 3 outlines the research contexts based primarily on data from a household survey conducted in 2020. Section 4 presents findings across three themes: 1) intra-household decision-making in agriculture-related issues; 2) the market and non-market-oriented value of cassava for ethnic minority farmers; and 3) opportunities for women in cassava value chains. In the final section, we discuss the importance of understanding multiple uses for cassava roots and leaves as these areas are of greatest significance for female cassava users. Finally, we propose possible areas for future research.

2. Research Methods

A qualitative case study was conducted in July 2021 in Thuan Chau and Mai Son districts in Son La Province. Data were collected via focus group discussions (men and women separately), key informant interviews (input suppliers, cassava traders, female dried-chip entrepreneurs, a male cassava factory owner) and in-depth interviews with eight couples who participated in a household survey in 2020.

The selection of respondents was conducted by village leaders as the Vietnamese government does not allow researchers to lead this process. To avoid bias, we provided criteria for the respondents, and the village leader listed potential respondents that met these criteria. However, as the number of respondents was more than double the required number, we randomly selected respondents from the list provided. The respondents for the in-depth interviews on the impact of Covid were selected based on guidance from a female local government officer who was knowledgeable about migration in the commune. We requested that only respondents with typical cases who have been affected by the pandemic be selected. All the respondents were female because women's migration has been affected more seriously than men's and their experiences include intersectional constraints based on gender, ethnicity and poverty.

The tables below present the characteristics of the respondents for both the in-depth interviews and key informant interviews. Names have been changed to ensure anonymity.

Cassava-growing households in Thuan Chau

#	HH No.	Name	G	Age	Cassava area (ha)/ total farm areas Income (million)	Seed The year self- multiplication started	Other income (million)
001	302	Nhan	M	39	0.51/0.51 12.9 m	2009 La Tre	Livestock 40 m
		Hong	F	40			
002	304	Trung	M	60	0.57/1.47 11 m	1987 La Tre 2010 Xanh	Livestock 70 m Fruits 4.4 m Off-farm 7 m
		Loan	F	59			
003	308	Dat	M	45	0.6/20.5 40.8 m	2010 La Tre	Livestock 60 m Fruits 9.25 m Off-farm 3 m
		Quynh	F	45			
004	310	Phu	M	60	0.39/1.04 16 m	2006 La Tre 2017 Xanh	Livestock 48 m Fruits 0.8 m Off-farm 62 m
		Thuc	F	58			
005	313	Quan	M	34	1.43/1.87 20.9 m	2011 La Tre 2019 Xanh	Livestock 30 m Fruits 22 m Off-farm 1.8 m
		Binh	F	26			

Key informants in Thuan Chau

#	Name	G	Age	Occupation	Services Year starting business
006	Tri	M	n/a	Input shop owner	2 input shops in the commune. Has sold seeds (rice, maize, vegetables) and fertiliser since 2017.
007	Hau	M	n/a	Trader	Trades corn, cassava, fruits, traditional medicine. Bought a truck in 2018 and sold it in 2020. Has now stopped transporting goods due to Covid, only collecting from local farmers.
008	Dong	M	59	Trader	Sells inputs (maize seeds, fertilisers) and collects produce (corn, cassava) from farmers. Was the first person in the commune to buy a truck in 1998.

Cassava-growing households in Mai Son

#	HH No.	Name	G	Age	Cassava area (ha)/ total farm areas	Seed The year self- multiplication started	Other income (million)
015	109	Khanh (daughter- in-law)	F	29	1.2/3.1 23.4 m	2000 High Yield 1 High Yield 2	Livestock 20 m Other crops 66.5 m Off-farm 35 m Pension 30 m
		Duan	F	67			
016	111	Tien	M	50	0.32/2 12.8 m	High Yield 1	Own agri-business 24 m Fruits 54 m Off-farm 82.8 m
		Yen	F	46			
017	113	Minh	M	34	0.2/2 6 m	2017 High Yield 1	Fruits 7.9 m Off-farm 100 m
		Nga	F	28			

Key informants in Mai Son

#	Name	G	Age	Occupation	Services Year starting business
018	Ha	F	53	Cassava processing & trade	Processing and selling dried chips. Also investing in and trading fresh roots since 2014.
019	Kieu	F	38	Cassava processing & trade	Processing and selling dried chips since 2015.
020	n/a	M	n/a	Cassava factory Vice- Director	Cassava processing factory since 2012.

All interviews lasted around one hour, with translators present for the interviews with the Thai women. In addition, we visited the respondents' cassava farms where possible. Interviews were not recorded but a note-taker took notes with informed consent.

3. Research Context

3.1 Cassava in Son La province

Son La province is located in Northwest Vietnam. With an area of 37,017 hectares (ha) and with 439,657 tonnes of cassava produced annually, Son La was the 5th largest cassava producing province in Vietnam in 2019. Mai Son, Thuan Chau and Phu Yen are some of the major growing districts within the province (Vietnam General Statistics office, 2020).

According to the household survey conducted in Son La province by the Alliance of Bioversity and CIAT in 2020¹, and the planting season starts between February and April, with harvesting from October to March. In addition to cassava, farmers also grow rice, maize, coffee, fruit trees, forest trees and other crops, typically on separate plots of land. Intercropping with cassava remains very low.

¹ This study was conducted as a follow-up study of the household survey led by Vanya Slavchevska and conducted by her team in 2020.

Over the past two decades, cassava production has been growing steadily, averaging about 7.6% annually. The yield has also been relatively stable since 2010, at around 12 tonnes/ha (Figure 1).

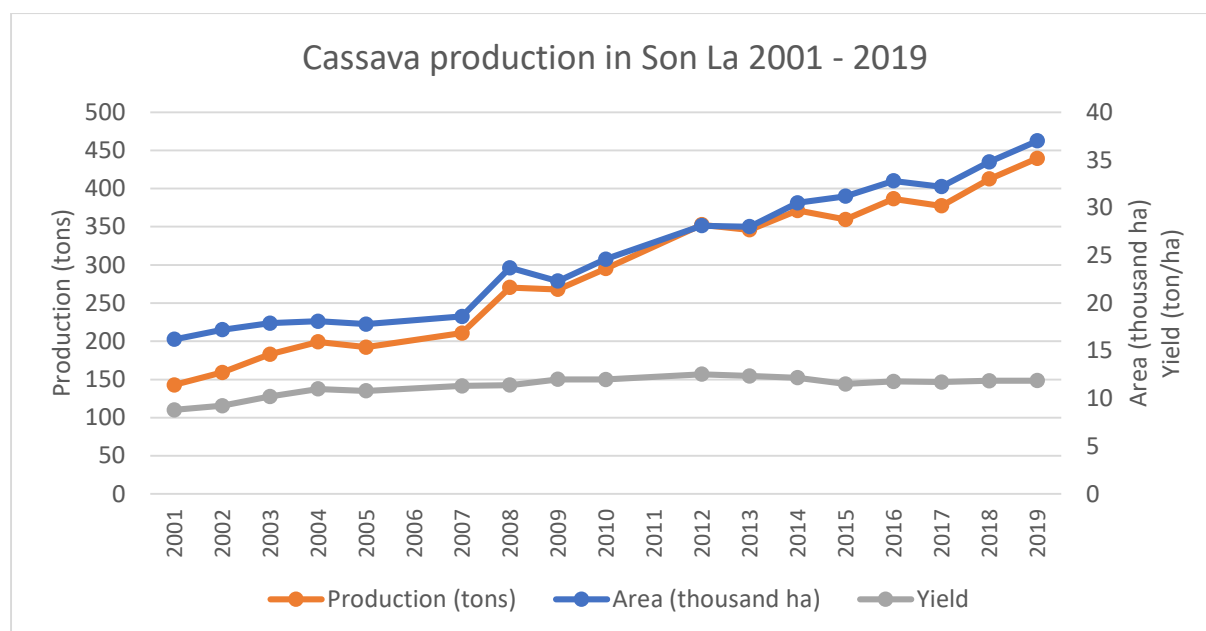


Figure 1: Production, Planted Area and Cassava Yields, 2001–2019, Son La.
Source: Vietnam Statistical Yearbooks 2010–2019.

In 2015, Thuan Chau district was the largest cassava producing district in Son La, with an annual yield of 96,284 tonnes, almost double that of Mai Son district which was the second largest. However, until 2019, cassava production in Thuan Chau had been in decline (25.3% decrease between 2015 and 2019). By contrast, cassava production in Mai Son and Yen Chau has been rising (31.1% and 113.5%, respectively between 2015 and 2019).²

According to the forementioned household survey (39 cassava-growing households) conducted in Son La in 2020, the average farm size per household for cassava production was around 0.38 ha, yielding approximately seven tonnes of harvest. The average household profit from the crop was around USD 711 annually, which makes up 35% of agricultural activities and 17% of the total household income (farming, non-farming and other sources). Most households used their own planting materials; only two households said that they purchased planting materials. None of the respondents reported using pesticides on their cassava fields. The total investment cost for fertiliser, herbicide and planting material was around USD 43 per cropping season (USD 40 for fertiliser, USD 1.7 for herbicide, and USD 0.4 for planting materials). In Son La, cassava production is mainly undertaken by family members (of which 54 % are women). On average, only around 6% of the total labour was hired labour, where both men and women were usually paid VND 140,000–180,000/day (USD 6–8/day) for work such as land preparation, planting, fertiliser application, weeding, harvesting and transporting.

Major problems identified by the household survey included soil erosion and poor soil conditions (36%). Unfavourable weather was also a key issue, with 18% of the cassava farmers listing it as one of the major problems that has affected cassava production in the past. Additionally, all of the village-level survey respondents reported rainfall being either too little/too much and ending either too early or too late last year.

² Son La province official website <https://sonla.gov.vn/4/469/63804/557500/thong-tin-ve-nong-san/phat-trien-on-dinh-dien-tich-trong-san>

The village of Chieng La commune, Thuan Chau district was selected for this study as the majority of villagers grow cassava. The village was newly established in 2009 for the resettlement of people whose home villages were taken over for hydroelectric power generation. While this new village has good road infrastructure compared to their home villages, it is located far from any water source and the village does not have paddy fields. The main income source from agriculture is livestock. All villagers are from Thai ethnic minority groups, and many women (except for young women in their 20s) do not speak Vietnamese.

The village of Muong Bon Commune, Mai Son district was selected because of its proximity to a cassava processing factory. Most of the villagers are Kinh, and they are progressive farmers. Fruit production for export has become increasingly popular in this area.

3.2 Varieties, certification and markets

In Son La, the majority (72%) of households reported that they are currently growing *Lá Tre* (bamboo leaf), a plant characterised by long skinny leaves and red stems, sometimes referred to as the *Đỏ* (red) variety. Additionally, 20% of households mentioned that they were growing the *Cao Sản* (high yielding) variety. The *Xanh* (green) variety was also cited by 15% of the cassava farmers. Smaller numbers of respondents also mentioned growing the *Trắng* (white) variety and the *Mới* (new) variety, whose name is unknown.

Son La contains one processing factory, the Son La Starch Processing Factory, located in Muong Bon commune, Mai Son district. The factory belongs to the Fococev conglomerate,³ which is based in Ho Chi Minh city and currently owns 11 cassava starch factories throughout Vietnam. Son La factory can process more than 1,000 tonnes/day. Although fresh roots are purchased from local traders without formal written contracts, the links between the factory and local collectors and traders are relatively stable and long-lasting (Sen et al., 2018). However, because of COVID-19, the factory only managed to purchase 50,000 tonnes of fresh roots and only produced 14,000 tonnes of starch during the 2019–2020 production season, which were mainly exported to China. For the 2020–2021 season, it plans to purchase around 120,000 tonnes of fresh roots from within the province at stable prices of between 1,750–1,800 VND/kg (USD 78/tonne). Other than the main product of starch, the factory also sells cassava residue to livestock producers for use in animal feed (Thuan, 2020).

The survey sample indicated that farmers mostly sold their produce to local traders (72%) at the cassava plots or at local markets/collection points. Four households (10%) also reported selling cassava to the starch factory. The average selling price was 1,276 VND/kg (USD 55.5/tonne) in the last harvesting season before the survey (2019/2020).

³ <https://fococev.com>

3.3 Animal feeding, processing, and storage

According to the household survey, on average, households in Son La sell most of their root crop (93.6%); only 6.2% of the roots are used in animal feed and only 0.2% are for home consumption. These data do not appear to include roots left in the fields.

Only fresh cassava roots are sold; none of the respondents reported selling dried chips or any processed products. After harvesting, more than half of the households (56%) sold their cassava to traders on the spot (at the cassava plots). The village-level survey revealed that none of the cassava was stored prior to selling.

In Thuan Chau, cassava growers use cassava for animal feed, such as sticks for cattle and goats, leaves for fish and leftover roots for pigs. This was not properly recorded in the household survey, which focused on the utilisation of the roots. We will discuss this later in the section on findings.



Figure 2: Photos from left: 1) Cassava in a private garden grown for home consumption; 2) Children in front of a typical Thai house; 3) The research team on the way to visit the next household; 4) Cassava farms in the uplands.

3.4 The impact of Covid-19 on agriculture supply chains

According to the household survey and the key informant interviews, the COVID-19 pandemic in 2020 did not affect cassava and maize production at the study site as the produce were traded within the province. It did affect fruit producers, however, as the major routes to trade destinations were disrupted by COVID restrictions. For example, Mr Tong Van Hau, a long-distance trader/truck driver used to have a fruit trading business, delivering bananas, mangoes, and longans from Son La to exporting stations such as Hai Duong and Lai Chau. He stopped driving long distances in late 2020 due to rising concern over COVID measures, with many checkpoints established on route. As a result, the price of mangoes decreased sharply from around VND 5,000/kg to VND 2,000/kg, according to mango producers in Mai Son.

By contrast, cassava prices were relatively high during the previous season. The Vice-Director of the Mai Son processing factory said that the price of fresh cassava roots was VND 1,600/kg at the beginning of the 2020–2021 harvesting season before prices increased to a high of VND 2,800/kg due to China’s economic recovery from the Covid pandemic. Furthermore, some factories in Northern Vietnam used to import fresh roots from Laos to process in their factories. However, since the closure of the border with Laos, some Vietnamese factories sent traders to Thuan Chau to purchase more roots from Northern Vietnam to fill the gap. This also helped increase prices in the district.

4. Findings

4.1 Intra-household decision-making in agriculture-related issues

According to the focus group discussion, both farming and non-farming (labour migration) activities are considered as collective household work, undertaken by both men and women. Husbands and wives often go to their farms together during the planting and harvesting seasons. It is also common for a couple to migrate to Hanoi or other industrial areas during the winter season. These data agree with the household survey in Son La (n=39), where 64% of the respondents (F=16 M=23) perceived men and women to be earning equal incomes. On the other hand, focus group discussions show that there are some demarcations in gender roles and decision-making within those joint activities. Both men and women stated that women have more knowledge, labour input and decision-making power than men in major areas of animal husbandry (e.g., feeding, health monitoring, and breeding chickens and pigs), home garden vegetables and fruit selling. By contrast, men have more knowledge, labour input and decision-making power than women regarding upland crop production (e.g., cassava, elephant grass, fruit trees) and areas of animal husbandry such as rearing and selling fish, cattle and buffaloes.

In-depth interviews with eight households, with husbands and wives interviewed separately, revealed the nuanced notions of decision-making between the spouses. Although women participate in farming and other economic activities, the final decisions relating to important issues regarding agriculture are usually made by the men, including which crops to grow and which new breeds of crops and livestock to invest in.

For example, Mr Dat (45) decided to stop growing cassava and to invest in cardamon and coffee to increase his long-term profits from agriculture. However, when these new crops failed, he returned to cassava. It was his decision because, according to him, he knows more than his wife about market trends, where to buy new breeds of crops and how to grow upland crops. This may also be related to the language barrier the most of Thai women in our study site has as well as their limited mobility (women tend to stay home) in general. His wife, Quyen (45) stated that, in her household, her husband makes the final decisions for both agricultural and household matters, including how much to invest in cassava. Quyen also stated, 'my first son (who lives with her) is the second most important decision-maker in my household. Although I participate in discussions, I have very little (almost no) decision-making power in important issues in agriculture.' This is because she 'stays at home, mainly looking after the livestock'.

Similarly, a Kinh couple, Tien and Yen, work together in the fields. The husband, Tien, has more decision-making power regarding agriculture. For example, he made the decision to stop growing cassava and to invest in fruit trees as cassava requires a lot of labour for land preparation every year, which is his role. His wife, Yen, agrees because it was her husband who had to work the hardest. Tien went to a district market to buy planting materials (e.g., plum, mango, longan, etc.) and to negotiate with a gardener to graft his trees.

However, men having greater decision-making power does not mean that women know nothing about cassava production. Ms Thuc (58) believes that she knows more about cassava than her husband in terms of details about the selection and preparation of planting materials, the best angle to plant, and the distance between the individual plants – knowledge and skill that she has acquired through her own experience. Nevertheless, she said: ‘I could have an opinion, but the final decision is made by my husband for agricultural matters...(because) my husband is more responsible for activities on the farms while I am more responsible for our home garden and animal husbandry’. Her husband believes that he knows more about agricultural market trends and investment costs as he is the person who interacts with people both inside and outside the village and also goes to the farm every day to monitor crops (as his wife cannot ride a motorbike).

A young Thai couple, Quan (34) and his wife Binh (26), have similar arrangements to those of the older generation. The husband, Quan, said, ‘I arrange the work and tell my wife to go to the cassava fields or to do weeding or fertilising... I make the decisions’. His wife says, ‘I join discussions, but the final decisions are made by my husband. When we were living with my parents-in-law, my father-in-law was the most influential decision-maker, then my husband, my grandfather-in-law, my mother-in-law... I had the least power in the household’. However, she also says that she has gained her influence implicitly, as she has autonomy in some areas (e.g., vegetable selling, animal husbandry) and now makes significant labour and income contributions compared with when she was busy with childcare and domestic work (as she was living with a large family, with in-laws).

For the Kinh ethnic majority in the Mai Son district, women have fewer constraints in terms of language and mobility compared to the ethnic Thai minority. Khanh (29) from Mai Son is a full-time farmer. She does not have children and her husband works as a truck driver for a local fruit factory. Therefore, she is responsible for managing the family farms, including 2 ha of cassava. She says that ‘December is the time to take care of the mango flowers and spray buds. February to March is the time to fertilise the coffee plants and spray longan. April is for maize, weeding and preparing the soil for planting. March is the time to prepare the land for cassava’. Although their farms are still owned by her father-in-law, who lives next door, she believes that she is the farm manager and that she will make the decisions on technical matters (agricultural input, the timing of selling, etc.) while decisions on changing crops and investing in new crops/varieties will need to be cleared with her father-in-law and her husband whose opinions would be reflected in the final decision. In her experience, fruits require a lot of pest control, while market prices fluctuate on a daily basis. Therefore, she needs to make quick decisions at the right time throughout the year, which she does on her own based on her experience. Compared with mangoes, she has noted that cassava is an easy crop to grow with few decisions/changes required both in production and selling.

Thus, for the couples we interviewed, important agricultural decisions related to crop change, risks and investment were made by the male heads of the households. Other male household members such as fathers-in-law are also influential, as shown in the cases of Quyen, Binh and Khanh.

On the other hand, Thai women have significant autonomy in matters regarding animal husbandry and selling fruit and vegetables in the local markets. These two areas are exclusively women’s domains. According to the in-depth interviews, all the Thai female respondents state that they regularly went to the local markets to sell fruits and vegetables, and had significant control over their income from those, as opposed to income from upland crops, which are considered as under joint control.

Thuc, for example, cannot ride a motorbike and does not feel confident speaking basic Vietnamese. However, her husband takes her to Nong Lay market every 5 days⁴ (about 7 km away from the village), and she sells her produce to traders and individual customers from 4 am to 8 am. She knows the market prices and can negotiate with traders. Apart from her fruit selling, she is also very proud of her role in animal husbandry, income from which enabled her son to go to university. Both fruit production and animal husbandry are joint activities (e.g., the men collect banana leaves and flowers, leftover cassava roots and elephant grasses in the upland, while the women prepare animal feed from them). However, in this way, women have a small but significant sphere of autonomy, which has important implications for agricultural interventions towards female empowerment. Therefore, it was clear that men and women at the study sites depend on each other's labour, knowledge, and decisions to sustain their livelihoods, although men tend to be the final decision-makers. The implications of these results for agricultural interventions show that it is important to provide information related to crops, markets, pests and diseases to both men and women as both play complementary roles. Women need to have primary access to information and knowledge, as men do, instead of secondary access via their husbands, because women are affected by the consequences of decisions made by their husbands.

4.2 The value of cassava for ethnic minority farmers, their priorities, and incentives for input

In Thuan Chau, farmers have grown a local cassava variety, *La Tre*, since the 1980s. While some farmers had either tried to grow or have adopted hybrid varieties on some of their plots, *La Tre* still predominates at the study site. The productivity of *La Tre* (18 tonnes/ha based on the data from the household survey with 26 households) is lower than the high-yield variety grown at the study site (20–22 tonnes/ha, based on the data from nine households) although it is hard to compare yields directly as soil conditions differ significantly between plots. We argue that productivity is not necessarily a priority for poor smallholders in mountainous regions. Additionally, there are various advantages of using local varieties, which cannot be measured by an economic analysis. Instead, we will describe the advantages of using a local variety from the men and women farmers' points of view.

At the study site, animal husbandry is a major income source for both the poor and the better-off families, accounting for as much as 75% of total household income. Some households earn VND 60-70 million per year. Livestock includes Muscovy ducks, chickens, fish, pigs, buffaloes, cattle and goats. Cassava and bananas are an important source of animal feed for those who have limited land and capital to grow maize and elephant grass. The cost of agricultural input for maize is much higher than that of cassava as maize requires fertiliser twice per season and seeds every season (2–3 times per year).

In the upland fields, it is very hard to carry fertilisers and pesticides from the village to the field, meaning that growing crops with limited agricultural input is better for both men and women. *La Tre* is edible, and its leaves are used for feeding fish, while its sticks and leftover roots are eaten by cattle, buffaloes, pigs and goats. Women are often in charge of drying the leftover roots. According to the in-depth interviews with female cassava growers, the number of leftover roots unharvested in the fields is around 200–700 kg depending on the plot size. In addition, two households stated that they kept 1000–1500 kg of cassava roots for livestock use.

⁴ Before COVID-19, Thai women in our study village used to go to Nong Lay market every morning.

Furthermore, *La Tre* leaves are consumed as vegetables and the women grow cassava in their gardens for home consumption. Cassava sticks can also be used for firewood for cooking animal feed, reducing the need for men and women to collect firewood from the forest. Another benefit of *La Tre* mentioned by both the men and women is that this local variety can be kept in the soil for up to two years. This allows farmers to be flexible with their harvest times depending on market prices. Sometimes, if the price is extremely low one year, some households keep the roots for another year.

La Tre has been grown for more than three decades without major problems with pests and diseases. According to the household survey, only 10% of the households in Son La said that pests and diseases were a major problem, compared to 73% in Tay Ninh Province where farmers grow hybrid varieties and have serious issues with the cassava mosaic disease.

Although both agricultural input and productivity in the northern mountain region is low compared to lowland areas in the southeast and south-central regions, productivity is not a priority in this mountainous region where animal husbandry is critical and carrying fertiliser to the uplands requires a lot of labour.

The choice of cassava varieties is closely associated with women's spheres in agriculture and their social networks. First, women play central roles in animal husbandry in Thuan Chau. According to the focus group discussions and in-depth interviews, both women and men believe that women are responsible for feeding and taking care of the animals. Therefore, their voices must be heard when developing hybrid varieties. Second, the planting material of *La Tre* has been exchanged among farmers, including their matrilineal relatives, for decades. All of the household survey respondents in Thuan Chau have exchanged *La Tre* with relatives and neighbours in the past, compared with 25% of the households in Tay Ninh Province. Obtaining new hybrid varieties requires a new network outside the community or an official network through the local factory or farmers' union, which women may be excluded from or marginalised in. This runs a risk of reducing women's perceived joint decision-making and perceived joint contribution to household incomes. Also, it may affect a small number of already disadvantaged matriarchal households and the households which men are absent due to labour migration as they are not directly connected with men's social and agricultural networks.

4.3 Income generating opportunities for women in cassava value chains

While most of the fresh cassava roots grown at the study sites are sold to factories within the province via traders, there are some local dried-chip enterprises whose produce has different value chain networks from a producer-trader-factory chain. The scale of business varies from a few hundred tonnes to a few thousand tonnes in the form of fresh roots. The largest dried-chip enterprise uses the runways of Na San Airport (a few thousand hectares) for sun-drying by using big construction machines such as power shovels and conveyor belts.

We interviewed two females, medium-scale dried-chip entrepreneurs in Mai Son who also grew cassava, maize and fruits. Nguyen Thi Ha (53) buys 400 tonnes of fresh roots to make sun-dried chips in her household's 4-ha yard (with a maximum capacity of 500 tonnes), which is also used for growing maize. After harvesting the maize, the farm is used for drying cassava. Her business is seasonal, running for four months between October to January during the peak cassava harvesting period. She hires seasonal workers to unload the cassava from trucks (all male), and to use machines for drying and correcting (50% female). There are two types of dried chips: a four-day sun-dried type and a six-day sun-dried type. The former are sold to traders for export to China, while the latter are for the Vietnamese domestic market. Traders keep them in storage and sell them when market prices are sufficiently high.

Nguyen Thi Ha started her small business in 2014 using her own cassava and purchasing roots from neighbours. She eventually expanded her business as there was high demand from both cassava producers and dried-chip traders. Her business has three characteristics which are different from the main cassava (fresh roots) value chains to the factories. First, her business is based on Facebook, where she directly communicates with producers without intermediates. She posts prices (depending on varieties and market prices) along with her phone number and address. Producers contact her, pay her online and arrange a truck for delivery, thereby providing them with autonomy independent of intermediates.

Second, her business is based on trust. She has been selling her dried chips to the same traders since 2014, which allows her some flexibility in terms of time, amount and prices by negotiations. Third, her Facebook-based agri-business enables her and her clients to obtain or offer cassava planting materials to other districts, which is very different from current local cassava seed systems in which planting materials are only exchanged through local friends and relatives or from a factory to their cassava producers.

Similarly, Nguyen Thi Kieu (38) started her business seven years ago. She began as a cassava producer. However, when the price of cassava was particularly low, she decided to dry it and to wait until prices increased again. This strategy worked very well for her. She initially purchased a slicing machine with 10–15 tonnes of capacity. Eventually, she invested in larger machines to increase her processing capacity. Currently, she rents a 4-ha yard in a vacant area of the industrial park where construction has not started yet. She hires ten people daily and handles 3,000 tonnes of fresh cassava over a two-month period. She purchases cassava from small-scale traders who collect fresh roots in the Thuan Chau district, where cassava production is high, but the factory is relatively far away. She also travels to the cassava factory, 5 km from her house, to purchase unqualified roots (below 27% of starch content) from traders.

After drying, most of her dried chips are sold to animal feed companies in Hoa Binh and Hanoi, while the remaining 50 tonnes goes to Lang Son (on the Chinese border) for export to China.

This business enabled her household to work themselves out of poverty. After marrying at 18, she and her husband struggled to earn money from farming. She used to work as a porter to carry agricultural produce at collection points, which was badly paid and extremely labour-intensive. Her cassava business enabled her not only to invest in farming but also to pay for her children's university education.

Both of these female entrepreneurs identified a niche market in cassava fresh root value chains. Their business supports local producers and traders as it offers an alternative market and reduces dependency on cassava factories and Chinese market prices. They also create new entrepreneurial opportunities for female farmers as drying roots for animal feeding is traditionally a woman's domain.

5. Discussions and conclusion

It is well documented that cassava offers an important cash income for poor families in the mountainous regions of Southeast Asia. This study confirms that cassava, and particularly a local variety, *La Tre*, is particularly important for poor ethnic minority households, due to its multiple uses as animal feed, firewood, home consumption and planting materials for the following season. In this respect, cassava production does not stand alone as a cash income; instead, it is incorporated into broader livelihoods and into household food security, including livestock production for both home consumption and extra income sources. These multiple utilisations of the cassava plant may contribute to women's significant involvement in and labour contribution to cassava production and processing.

Leftover cassava roots in the field play a significant role as an indirect source of cash income. It is difficult for economic research to adequately include the leftover roots in the fields and the multiple utilization of those in household economy as both farmers and researchers often under-estimate and under-value non-market-oriented utilization of crops. Further research on leftover roots is required to see how they can more easily be utilised to save women's labour and time (for collecting roots, drying and slicing). In addition, listening more to women's opinions on cassava varieties, seed distribution and agricultural input is also extremely important as women have significant roles in production, processing and selling.

Cassava also offers niche business opportunities in dried-chip production to female entrepreneurs, which also helps producers to cut out the intermediaries and increase their profits with direct bargaining power. This may be an area in which further research can help us develop alternative markets for flesh roots to benefit poorer families as well as create jobs for ethnic minority women and the youth population.

Although beyond the focus of this report, our interactions with farmers confirm that better-off male farmers, both Thai and Kinh, are unafraid of and are more flexible regarding decisions on crop/livestock changes and investment. Given the rapid market fluctuations during the Covid pandemic, single-crop-focused research and interventions may overlook a bigger picture of agrarian change including labour migration and changing market demands for agricultural produce. Fruit trees are increasingly gaining in popularity among small-scale farmers in Son La Province. Views from the main roads confirm that large areas of cassava and maize farms have been planted with mango, longan, and plum trees. There is no single-crop prescription that can alleviate poverty. It is also important to understand the agricultural strategies for on-farm and off-farm income diversification, and the gender roles therein, in order to provide appropriate support particularly for ethnic minority women.

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