

IMPROVING VEGETABLE FARMING SYSTEMS AND MARKETING FOR SMALL-SCALE PRODUCERS IN BAC HA DISTRICT, LAO CAI PROVINCE

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ABSTRACT

Vegetable production has contributed to improving the livelihoods of many farmers in Lao Cai province as well as in the Northwest region of Vietnam. However, there are both technical and marketing issues constraining the development of efficient vegetable farming systems in the province. This study aimed to understand the opportunities and challenges to the development of the vegetable sector in Bac Ha district. The study conducted interviews with 105 vegetable producers of different vegetable farming systems, organized four focus group discussions with members of two vegetable co-operatives, and conducted in-depth interviews with the leaders of three vegetable production and marketing co-operatives and 5 vegetable traders. The findings indicate opportunities for vegetable production including increasing demand for vegetables at wet-markets, and the potential for the development of high quality vegetable production by utilizing local favorable natural conditions for off-season vegetables and high in nutrient indigenous vegetables. Some of the challenges to local vegetable production and marketing identified by the study were the frequent occurrence of extreme weather events, outbreaks of pests and diseases, and a poor marketing system. Recommendations have been made on strengthening both the technical and marketing capacities for local vegetable producers and moving value-chains from supplying bulk-products for local wet-markets to producing products with assured attributes demanded by the larger regional market. The study also highlights the need for future research interventions with a focus on improving the value chains of vegetable production in Bac Ha district with the goal of achieving sustainable livelihoods for the local farmers and environmental sustainability.

Keywords: Vegetable production, opportunities and challenges, Lao Cai province, Bac Ha district.

1. INTRODUCTION

The Northwest highlands of Vietnam are characterised by high ethnic diversity and include the six provinces of Son La, Lai Chau, Dien Bien, Hoa Binh, Yen Bai, and Lao Cai. The highlands are identified as one of the poorest regions of the country (Nguyen *et al.*, 2016). Despite having advantages in agricultural production and tourism development, Lao Cai province is one of the poorest provinces in Vietnam with 27.4% of the population living below the poverty line (People's Committee of Lao Cai, 2016). Utilizing local available resources in terms of soil and favorable climate for development, Lao Cai province has been

making efforts in developing its fruits and vegetable production, especially in Bac Ha district. According to Newman (2016), Bac Ha has the potential to be a major vegetable supplier to northern markets. However, vegetable production in the Northwest has been facing a number of challenges such as low relative competitiveness compared to peri-urban and regional producers, low capacity of farmers, poor infrastructure and logistics, and limited access to modern markets in Lao Cai city and Hanoi (Bui, 2017). Therefore, enhancing the roles of vegetable production will contribute to improving household incomes and livelihoods of farmers and work towards reducing poverty in this province. This paper

aims to provide an economic analysis of vegetable production in Bac Ha district, Lao Cai province, and to explore the challenges and market opportunities towards improving the farming systems and marketing for small-scale producers in Bac Ha district, Lao Cai province.

2. METHODS

Documentary research was used to gather secondary data related to vegetable production and marketing in Lao Cai province, in the Northwest region in general and in Bac Ha in particular. The main secondary data was gathered from the local communes' statistics, and annual social economic development reports and reports of development projects, especially the Australian Centre for International Agricultural Research (ACIAR) funded vegetable project.

A household survey was conducted in three communes: Na Hoi, Ta Chai, and Bao Nhai communes in Bac Ha district of Lao Cai in 2017 for gathering primary data and information about vegetable production and marketing. The total designed sample was 105 farmers involved in vegetable production in different farming systems including rice-vegetable (R-V), fruit trees-vegetable (FT-V), and vegetable-vegetable (V-V). The study employed stratified random sampling for sampling selection. The sample size in each commune was determined proportionally after strata of the vegetable farming systems had been identified. The study conducted four focus group discussions with members of two vegetable co-operatives and in-depth interviews with leaders of two co-operatives and five big vegetable traders. The

sampling of the study is summarized in Table 1.

The descriptive statistics method was used for data analysis focusing on basic statistical indicators such as sum, average, frequency, count, and standard errors. The comparative statistics method was applied to compare economic performance in vegetable production and vegetable marketing of different farmer groups and different vegetable types.

3. RESULTS AND DISCUSSION

3.1. General information about farm households

The results of the study indicated that more than two-thirds of the respondents were female. This was probably due to the fact that women are more involved in vegetable production in local communes. Almost all the household heads were male. The average age of the respondents was 48 years. The number of schooling years of household heads was approximately 7 years, or secondary school level. A few respondents attended vocational training courses such as agricultural extension and tourist guide training.

On average, a farm household earned 69 million VND per year. This income level was high in comparison with the average income of rural people in Bac Ha because commercial vegetable production is mainly in communities living near the district town or main roads. Agriculture still played the most important role in these surveyed households, contributing nearly one-third of the total farm household income. Agricultural activities generated about 23 million VND for a household on average.

Table 1. Summary of the study sites and sampling (households)

Farming system		V-R	FT-V	V-V	Total
Communes	Ta Chai	33	24	9	66
	Na Hoi	1	2	17	20
	Bao Nhai	15	0	4	19
Total		49	26	30	105

Table 2. Crop production and product selling in the farm households (%)

	Involved households (n = 105)	Household selling products
Vegetable	100.0	90.5
Rice	87.6	4.8
Maize	74.3	21.9
Fruits	29.5	22.9
Artichoke	2.9	2.9
Others	11.4	9.5

All farm households planted vegetables and 90.5% of the total households sold vegetables to markets (Table 2). Rice and maize were the two main crops, planted by three-fourths of farm households in Bac Ha. Products of these two crops were also mainly used for home consumption (food and feeding animals). About 30 percent of farm households in Bac Ha planted fruit trees, and only about 23 percent of them sold fruits out to markets. Artichoke has recently been introduced to the study site, but very few farmers grew this plant. Other crops such as potato, sweet potato, and orchids were also planted for the market. Generally, vegetables and fruits generated cash income for the majority of farm households in Bac Ha.

On average, a household had about 0.47 ha of agricultural land. Some households had land near roads, which is convenient for both taking care of, harvesting, and selling vegetables. Other households owned farms that are located two kilometers away from a road.

As shown in Table 2, about one-third of the agricultural land is hilly. Ground water and rain were the main sources of water for agricultural production, which covered about one-fourth of a farm's agricultural land. Irrigation systems served one-fifth of agricultural land. Some farm households took water from streams, ponds, or lakes for vegetable production. Some farmers believed that there was no need to irrigate or apply fertilizer for vegetables because these crops can grow naturally for their home consumption.

3.2. Vegetable production and marketing by the farm households

3.2.1. Description of existing vegetable farming systems

The results of the findings indicated that there are currently three existing vegetable farming systems at the local district level: i) Vegetable-Vegetable system (V-V system); ii) Fruit Tree-Vegetable system (FT-V system); and iii) Rice-Vegetable system (R-V system).

In the V-V system, cabbage & mustards (of all types) were the major crops. Among cropping patterns in the V-V system, the two main cropping patterns were cabbage (whole year), and cabbage-mustards. The normal planting season of cabbage normally starts from November to February, the off-season is from April to the late June, and the early cabbage season is from July-October. Many types of mustards (i.e. cai meo¹) can be grown throughout the whole year. Bap cai xoe² was found to be planted in Bac Ha, which is a famous indigenous product in the Northwest region.

It was noted during the survey that in the FT-V system, most of the farmers planted vegetables during the first period of fruit tree development when the fruit trees' leaves still do not shade the whole farm. There were also several cases where some fruit trees already existed in the gardens and vegetables were grown under these trees during the appropriate season (i.e. when the trees lose their leaves).

¹ Cai meo: H'Mong mustard greens

² Bap cai xoe: Native cabbage of Bac Ha

Therefore, vegetable production in this system is at small scale, largely temporary, and for home consumption. In Bac Ha, farmers grew mostly mustards under fruit trees. Because the density of the fruit trees in the gardens was very low, farmers grew vegetables in these gardens and the orchards were often not fully established.

In the R-V system, vegetables like mustards and cabbage were rotated with rice. Some farmers in Bac Ha produced two rice seasons, and then in season cabbage. In general, vegetable production in this rotational farming system was mainly in the winter season.

3.2.2. Economic performance in vegetable production by farming systems

Cost of production

On average, the total cabbage production cost was estimated at about 22.3 million VND in the cropping season and 24.5 million VND per hectare in the off-season, of which fertilizer and seed incurred the largest costs. V-V farmers paid the highest costs in cabbage production in both seasons due to pesticide costs (Table 4). In addition, off-season cabbage also required higher costs in comparison with in season cabbage. As expected, the production costs of cai meo (H'mong mustard) were the lowest among the vegetables. On average, one hectare of cai meo costs about 14.3 million VND and varies among systems. However, the differences in production

costs of cai meo among systems were not significant. The total cost of bap cai xoe production was quite modest, and was a bit higher than cai meo production costs.

Mixed incomes from vegetable production

Off-season cabbage generated the highest income compared to other vegetables in the systems, except the R-V system. The low income of the R-V system can be explained by several main factors including more diseases and lower investments for vegetable production in this system. On average, one hectare of off-season cabbage could generate a mixed income of 145 million VND per production cycle. Income from cabbage varied quite strongly in the V-V system largely due to price variations among farmers and harvesting times. Cai meo generated the lowest income, approximated at 67 million VND/ha (Table 5). Generally, V-V farmers attained higher incomes from vegetables than the others, except in case of *cai meo*.

3.2.3. Marketing of vegetables

Main buyers

The main buyers of vegetables were consumers at public markets, wholesalers, and collectors. Public markets were the most common place for farmers to sell their vegetables, with more than half of the farmers transporting their vegetables to public markets (Table 6).

Table 3. Land for agricultural production

Indicator	Bac Ha
1. Total land area for production/hh (m ²)	4692.1
Standard Deviation (STD)	5533.8
Of which: % is slopping land	37.9
Of which, % area under source of irrigation:	
- Irrigated	57.5
- Non irrigated	42.5
2. Distance from farming area to the nearest road (km)	
- Average	0.5
- Max	2.0

Table 4. Production costs of vegetables in different farming systems (million VND/ha)

Vegetable	R - V (n = 49)	FT - V (n = 26)	V - V (n = 30)	All (n = 105)
In season cabbage	25.0	17.2	29.4	23.2
(STD)	14.5	10.4	11.7	13.6
Off-season cabbage	22.8	20.4	29.8	24.5
(STD)	11.1	9.0	11.2	10.7
Cai meo	2.5	3.5	18.9	14.3
(STD)	-	-	14.0	13.8
Bap cai xoe	-	9.9	22.1	18.6
(STD)	-	2.6	18.0	16.1

Table 5. Mixed income from vegetable production (average for one ha)

Vegetable	R - V (n = 49)	FT - V (n = 26)	V - V (n = 30)	All (n = 105)
In season cabbage	121.2	64.3	143.4	107.2
(STD)	138.2	49.6	160.1	124.1
Off-season cabbage	64.5	86.7	237.6	146.4
(STD)	22.2	42.7	270.7	186.8
Cai meo	57.3	156.1	48.0	67.6
(STD)	-	-	48.0	57.6
Bap cai xoe	-	65.6	88.1	81.7
(STD)	-	123.6	77.7	88.4

Table 6. Main buyers of vegetables (% household)

Buyer	Cabbage (n = 82)	Cai meo (n = 27)	Bap cai xoe (n = 23)
Public retail markets	66.2	64.1	53.9
Wholesalers	20.0	14.8	19.1
Collectors	10.9	3.3	7.8
Cooperatives	2.7	14.1	14.8
Restaurants	0.2	0.0	0.0
Supermarkets	0.0	3.7	4.4

About 15% to 20% of the farmers sold their vegetables to wholesalers, and 3% to 11% of the farmers sold their vegetables to collectors. There was also a supermarket buying vegetables from large-scale vegetable farmers, like the case of Ms. Lieu - one of the biggest collectors in Bac Ha. Every day, Ms. Lieu sent her vegetables to supermarkets and specialty shops in Hanoi by bus. She also bought vegetables from other farmers to sell in Hanoi.

Based on the results of interviews with farmers and FGDs with the local people, it was found that in general, farmers in the R-V and FT-V groups, which have smaller amounts of vegetables, seemed to have fewer numbers of buyers than V-V farmers and sold their vegetables mainly at local markets. For example, all the V-R farmers sold bap cai xoe only at public markets, and the FT-V farmers sold bap cai xoe in public markets and to wholesalers and

collectors. Vegetables sold in local public markets, like the commune and district markets, were mainly for final consumers living in Bac Ha district. On the other hand, V-V farmers sold to many different buyers including consumers in public markets, wholesalers, collectors, cooperatives, and supermarkets. V-V farmers also seemed less dependent on public markets than the other groups.

The farmers' decisions to sell vegetables to a main buyer depended on the types of vegetables as well as the quantity harvested and the perishability of the vegetables. For bulky vegetables or vegetables with a high harvest quantity (such as cabbage), farmers prioritized a fast sale, and therefore, wholesalers and collectors were the main buyers. Farmers also opted to sell at public markets because consumers at markets do not require a large quantity (more than one-third of respondents referred to this reason), and they could sell their vegetables at a relatively higher price. In addition, not all the produce could be sold to wholesalers or collectors because of small scale vegetable production.

Farmers also hoped to get higher prices by selling vegetables to a supermarket or

cooperative, (i.e. Di Thang cooperative), but only a few farmers had qualified produce, mostly for cabbage, bap cai xoe, and *cai meo*. Some farmers in Bac Ha had contracts with the Di Thang cooperative. Other reasons for them to sell vegetables to main buyers were: i) the farmers sold to buyers whom they usually sold to, or ii) the farmers sold to buyers who were convenient for them (near the road or on the way to work places). Surprisingly, almost no farmers had any concerns about bargaining.

Current vegetable markets

The most common places for selling vegetables were district markets and commune markets, with about a half of farmers transporting their vegetables to district markets and 5-24% of farmers selling their vegetables at a local commune market (Table 7). Vegetables sold to wholesalers or collectors were transacted mostly in the field. Farmers also sold vegetables along the road to tourists, visitors, and travelling consumers, especially indigenous vegetables such as *cai meo*. A few farmers also ran small vegetable shops or stores along roads or at home to sell vegetables. Some farmers even transported their vegetables to Coc Leu market in Lao Cai city for selling.

Table 7. Places where main vegetables are sold (% farmers)

Vegetable selling places	Cabbage (n = 82)	Cai meo (n = 27)	Bap cai xoe (n = 23)
1. Farmer's field	13.4	3.7	4.4
2. Local commune market	23.7	7.4	4.4
3. Local district market	57.3	70.4	60.9
4. Traders coming to the village to buy produce	4.9	3.7	8.7
5. Roads	1.2	7.4	4.4
6. Cooperatives	3.7	11.1	13.0
7. Other	3.7	3.7	8.7

Table 8. Comparison of prices of vegetables among farmers (% farmers)

Vegetable types	n	Similar	Higher	Lower	Don't know
Cabbage	82	93.9	0.0	3.7	2.4
Cai meo	27	88.9	3.7	3.7	3.7
Bap cai xoe	23	95.7	4.3	0.0	0.0
Others (mustard, spicy vegetable)	17	89.8	2.0	2.0	6.2

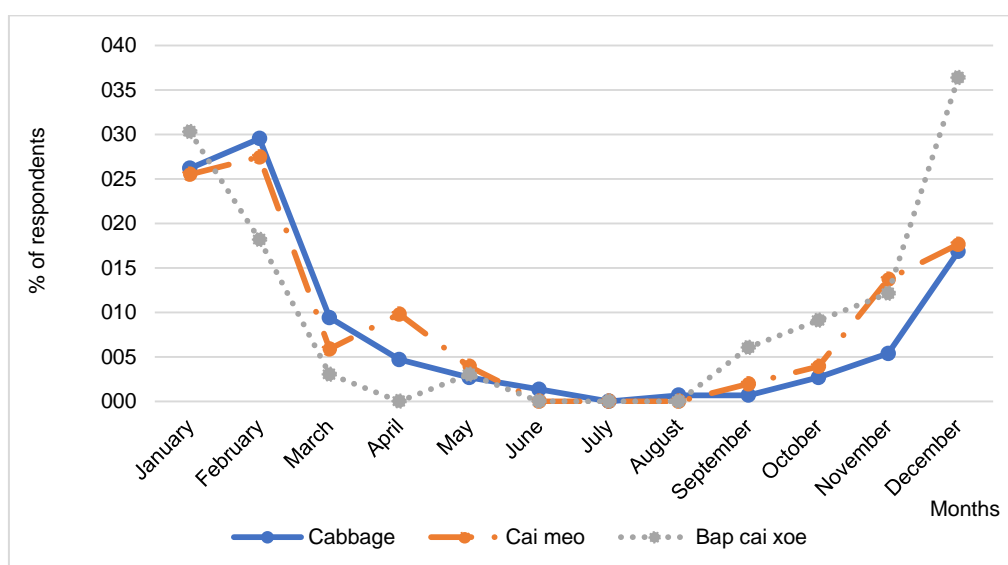


Figure 1. Months when vegetable prices were reported as being the lowest (% farmers)

Vegetable prices and income trends

In comparing vegetable prices among farmers, most farmers agreed that there were no differences in prices (Table 8), there was only a difference in time for completing the sale. For example, vegetables with better quality (i.e. appearance) were sold first and faster. Some farmers received higher prices when they sold vegetables early or late in the season. A few farmers received lower prices because they wanted to have a fast sale, or in the case that the vegetables were of a lower quality.

Almost all the respondents reported that vegetables prices were the lowest during the period between October and February (the winter season), when farmers in many other places can grow cabbage, kohlrabi, or chayote. This was consistent with the data collected by the ACIAR AGB 2012-059 Project (Figure 1).

Like the observed data of the ACIAR project for 2017, almost all the respondents agreed that vegetables had higher prices during the off-season or early in the season, such as from May to October, and these trends applied to all the vegetables. The main reason was that during May and October, farmers in Bac Ha still had favorable conditions for producing off-season vegetables (reported by about three-

fourths of the respondents), while the supply of off-season vegetables was low in most markets. There was also additional demand from tourists during the summer season.

Access to market information

Despite of the importance of vegetable production, less than one half of farmers acquired price information before selling their vegetables. For those transporting their vegetables to public market, they simply asked vegetable traders at the local market and set their prices accordingly. Therefore, vegetable traders at local markets were the most important sources of price information as shared by about two-thirds of the respondents. Farmers reported that this source of information was accurate and most up-to-date. Other farmers who sold vegetables were also a source of price information for about one-third of the farmers. Other sources of information such as the television or radio were not important to farmers. Farmers contracted with the Di Thang cooperative could get price information from the cooperative. Most of the farmers acquired price information daily, normally at the market during harvesting time. In the case of cabbage, some farmers acquired price information throughout the year because they also needed information for planning production.

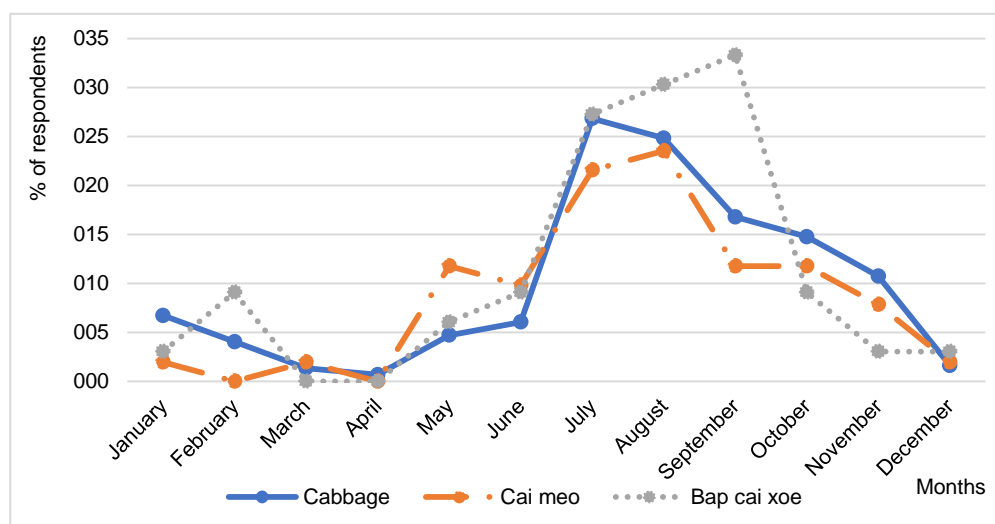


Figure 2. Months when vegetable prices were reported as being the highest (% farmers)

Collaborations between vegetable production and marketing

Almost all of the farmers produced and marketed vegetables independently. Only 12 percent of farm households reported having a collaboration with others in the trading of vegetables. This collaboration was mostly labor exchange during peak times in production (such as harvesting time), or some could ask neighboring farmers to transport and sell vegetables for them when their harvest was low. Some farmers went to sell vegetables together to share transportation costs. Only 4 percent of farmers produced vegetables under marketing contracts with Di Thang cooperative or supermarkets in Ha Noi such as Big Green and Ecomart.

3.3. Roles of co-operatives and market actors in local vegetable production and marketing

Besides the findings from the survey with vegetable producers, the results of the focus group discussions (FGD) and in-depth interviews with co-op leaders, members, and vegetable traders in this study indicated the dominant marketing system of marketing through local wet-markets is inefficient (Yi *et al.*, 2017). It is unable to reward safe vegetable production or differentiate quality because of a

lack of standards and grades. In addition, there is a larger problem of a dysfunctional market. The price mechanism does not appear to be effective in coordinating farm supply behaviors because farms are not fully commercial and lack the capacity to use the market mechanism effectively. From FGDs with local farmers in Na Hoi and in-depth interviews with the leaders of the Di Thang and Na Lang co-ops, it was agreed by local stakeholders that local vegetable production demonstrates clear over-supply behavior during the winter and under-supply during summer season. Low commercialization and lack of farmer business skills are the main factors inhibiting the development of the vegetable sector.

Through FGDs of members in the Di Thang co-operative and in-depth interviews with local traders, it was found that expansion and development in the sector is driven by a small set of forward-thinking actors. Cooperatives like the Di Thang co-op and collectors' coordinated chains are examples of successful value-chain development in Lao Cai, especially for off-season vegetable production and selling. These chains have the ability to coordinate with farmers to ensure they produce the most profitable commodities and that vegetables are harvested when prices are peaking. They have found a way to service higher-end markets by securing price

premiums for quality produce and coordinating production of high quality products.

3.4. Problems in vegetable production and marketing

Perceptions of difficulties in vegetable production and marketing depended quite a lot on the respondents' level of understanding. Some could not figure out their problems in production and marketing. Therefore, not all farmers could answer this question.

Weather, pests, and marketing were indicated as the most important problems faced by vegetable farmers in Bac Ha. The marketing of vegetables is difficult and farmers could not sell all their produce or were forced to sell at a low price, especially for cabbage and bap cai xoe. About half of the farmers reported this issue. Marketing was also perceived as the most serious problem in cabbage production as stated by about one-third of the respondents.

Pests and diseases were also serious problems, and were identified by about 14% to 43% of respondents, depending on the crop. As pointed out in interviews with farmers, extreme weather conditions, such as tropical storms, hail, and drought, have recently caused difficulties for vegetables farmers. This was considered as one of the most serious problems, especially in farming bap cai xoe.

In order to address the problems, farmers applied various measures. For weather problems, less than one-third of farmers (who faced the problem) irrigated and covered their vegetables, but about 50% of them said they could solve the problem. To address the pests and diseases problem, the majority of farmers used pesticides.

Other measures to address pests and diseases were manual methods such as the manual catching of pests, removing the plants attacked by pests, and applying lime powder, or farming practices such as increased plant density. Only half of them could solve the problems. To solve the difficulties in selling vegetables (mostly for cabbage), farmers sold vegetables along the roadside or/and sold them at lower prices. Some cut down their production area or changed the timing of the crop season (planting and harvesting). However, farmers again reported that only some of them could solve the problems.

In addition, despite growing market opportunities, horticulture value chains in Northwest Vietnam continue to face numerous challenges and have been unable to respond to changing demand conditions. To improve the competitive position of the NW horticulture industry, value-chains must move from supplying bulk-products for local wet-markets to producing products with assured attributes demanded by the larger regional market.

To be included in the development of horticulture value-chains, farms must be able to effectively coordinate with the market to decide what to produce, when to produce, and how to assure quality.

3.5. Measures and policies for improving vegetable production systems and marketing in Bac Ha district

From the analysis of the findings of the study, it is clear that in order to make more profitable vegetable production and marketing systems in Bac Ha, the key following measures should be taken into account.

Table 9. Most serious problems in vegetable production & marketing (% respondents)

Problem	Cabbage	Cai meo	Bap cai xoe
Bad weather	20.7	3.7	21.7
Pests	35.4	22.2	13.0
Selling	57.3	3.7	47.8
Production	1.2	0.0	0.0
Fertilizer	11.0	3.7	8.7
Other	6.1	0.0	0

Table 10. Key control measures applied to address the problems & rates of success
(% farmers having problems)

Problems	Solution	Cabbage		Cai meo		Bap cai xoe	
		Apply	Success	Apply	Success	Apply	Success
Weather	Watering	31.3	50.0	50.0	100.0	75.0	100.0
	Covering plants	6.3	100.0				
Pests/diseases	Pesticides	77.8	38.1	60.0	20.0	50.0	16.7
	Manual methods	14.8	50.0	40.0	13.3	0.0	0.0
Soil & irrigation	More fertilizer	25.0	50.0	0.0	0.0	50.0	25.0
	Watering	12.5	0.0	0.0	0.0	0.0	0.0
Selling/marketing	Sell at low price	8.9	0.0	20.0	10.0	11.1	3.3
	Decrease production	2.2	0.0	0.0	0.0	0.0	0.0
	Sell at road side	15.6	0.0	0.0	0.0	11.1	3.3
	Change timing of crop season	4.4	0.0	0.0	0.0	0.0	0.0

Improving awareness and capability for producers: Attention should be paid to improving production techniques, especially production techniques for off-season vegetables, to meet increasing demands for high quality vegetables in both local and external markets like Hanoi, Son La, and Dien Bien. Although three vegetable farming systems, namely V-R, V-V, and TF-V, are currently practiced by local farmers, we recommend that the V-V system should be expanded where farmers have available labor, capacity to invest, and sufficient knowledge and skills to produce off-season vegetables. This recommendation is based on the fact that the V-V system is more diversified in types of vegetables, produces a larger volume of vegetables, and is more focused on high-value crops such as off-season vegetables like stem kohlrabi with higher profitability. However, improving technical capacities for farmers in producing off-season vegetables is vital for the development of a more diverse and profitable vegetable farming system.

In addition, as Bac Ha is home to minority groups such as the H'mong, Tay, and Nung, gender and ethnicity issues along value chains of vegetable production should be carefully addressed to engage the most disadvantaged groups in joint decision-making processes, especially in vegetable production planning.

Developing indigenous vegetables like bap cai xoe, *cai meo*, and stem kohlrabi in both the FT-V and V-V farming systems can help to not only utilize local resources for vegetable production, but also to improve income for farmers.

Expanding markets: Current local vegetable production has been led mainly by traditional wet-market coordinated chains but there have been new chains to high-end niche markets such as supermarkets and specialty shops in both Lao Cai and Hanoi (Yi *et al.*, 2017). These chains help farmers earn higher profits, especially for off-season and indigenous vegetables. However, these chains need to build capacities for farmers to apply safe production techniques such as VietGAP or organic vegetable practices toward achieving high quality vegetables to service modern niche markets. More attention should also be paid to establishing strong linkages among the actors of vegetable production: farmers, co-operatives, local traders, and external buyers such as Big Green, Bac Tom, and Five-mart in Hanoi.

Enhancing the roles of co-operatives: It is definite that the establishment of cooperatives of vegetable producers is very important for small vegetable producers, especially ethnic minority women, to expand both their production scale and marketing so that local vegetables can reach niche markets. Raising the

awareness of farmers in the efficiency of collective activities in production and marketing of vegetables through cooperatives and farmer groups should be well integrated with any extension intervention schemes. The building capacity for existing co-operatives' leaders and members is also very important for their making better business and management decisions leading to more profitability.

Policy support for intensive vegetable farming systems: Local governments should make long term plans for concentrated vegetable production with priorities for the development of high quality off-season and indigenous vegetables. The application of VietGAP and other safe vegetable production techniques can not only help farmers improve the quality of vegetables, but also give farmers access to better local and external markets such as specialty shops, supermarkets, and restaurants. Branding and promotion of local vegetables through mass media and tourism should also be effective ways for increasing production and marketing of vegetables in Bac Ha as well as in the Northwest region.

4. CONCLUSIONS

Vegetable production is important for the livelihood development of small farmers in Bac Ha district. Making use of local natural favorable conditions, vegetable production, especially off-season vegetable production, can help the province develop the livelihoods of small farmers. The opportunities for vegetable development can be identified in several key aspects such as the high demands of both local and outside markets, advantageous soil and climate conditions for high quality and off-season growing, and a variety of indigenous vegetables with high nutrient profiles. However, current small holders' vegetable farming systems of the province are not economical in regards to production scale, intensification, and linkages among the actors of the vegetable value chains. Occurrences of extreme weather events, outbreaks of pests and diseases, and weak marketing systems are seen as the most serious

problems for the majority of farmers. Therefore, the major challenges to vegetable production in Bac Ha as identified by the study are a limited capacity of farmers for production, the farmers' lack of market based production knowledge, limited access to market information, and weak strategies in responding to extreme weather events. Therefore, in order to develop efficient vegetable farming and marketing systems in the district, adequate attention should be paid to strengthening both the production and market capacities for farmers, having appropriate measures to deal with extreme weather and diseases, and strengthening linkages among the actors of the vegetable value chain. These technical and market interrelated problems could be addressed not only by local farmers but also from leaders in the Bac Ha district, Lao Cai province, research institutions, and development agencies. Future research intervention should therefore focus on improving the value chains of vegetables in Bac Ha, especially off-season and indigenous vegetables, with careful attention to local sustainable livelihoods.

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