North-West Vietnam Research Symposium
23-24th November 2017, Daewoo Hotel Hanoi

PREFACE

Welcome

On behalf of the Australian Centre for International Agricultural Research (ACIAR), the Organising Committee warmly welcomes you to Hanoi for the North West Vietnam Research Symposium. This "Mountains" Symposium provides an opportunity to showcase key learnings, insights and implications from ACIAR research partnerships in North West Vietnam reaching back over ten years. The Symposium is designed to share new information, strengthen collaboration and inform government, donors, research organizations and agribusiness about the opportunities for inclusive agricultural-led growth in northern mountainous regions of Vietnam.

The North West Region – "Mountains of Opportunity"

Mountains of Opportunity is the Symposium theme. The North West region of Vietnam is indeed a region with mountains of opportunity. Opportunities exist for agricultural market development capable of delivering livelihood benefits to poor men and women, producing sought-after safe, high quality food and agricultural products to consumers, and contributing significant economic benefits to Vietnam.

The North West is rich in social-cultural diversity, unique natural attributes and enormous agro-ecological potential. Its strategic location is within reach of some of the largest and fastest growing global, regional and local agri-food markets. Yet the region is also home to persistent and high rates of poverty, food insecurity and malnutrition, particularly amongst the majority ethnic minority families. In addition, spectacular natural landscapes and untapped agricultural potential are threatened by widespread degradation of the natural land and water resources.

Research has an important role in understanding and overcoming technical constraints to agriculture in a way that secures the future of these mountainous areas and ensuring smallholders and the poor have an opportunity to participate and benefit. Over the last 25 years, ACIAR has supported agricultural research partnerships with local Vietnamese institutions in crop nutrition and soil management, livestock production, forestry and agroforestry, agribusiness and policy. Over the last ten years, much of this work has been focused in the North West mountainous region.

Symposium research themes

With a theme of “Mountains of Opportunity” the symposium looks to the future. It provides an occasion for researchers and stakeholders to share new knowledge, insights and implications in four theme areas:

1. Regional markets and trade
2. Sustainable farming systems
3. Safe food value chains
4. Inclusive and prosperous communities

We really look forward to your participation at the Symposium, starting with meeting you at the welcome function at the Sky Lounge on Wednesday afternoon at the Daewoo Hotel, the symposium venue. Over the next two days, the Symposium will feature seventeen invited technical presentations and four expert panel discussions across the four symposium themes. Over thirty five posters will be on display and presented by local and international researchers in two poster sessions. Following the poolside symposium dinner on Thursday, Creative Presentations will provide an exciting opportunity for young researchers to communicate in new imaginative ways. Finally the Symposium will conclude with some thoughtful reflections, challenges and visions for the future from stakeholder leaders.

ACIAR is proud to support this Mountains Symposium, and would like to thank the individual researchers and the Australian, Vietnamese and international partner organisations for their dedication to research and innovation that delivers positive lasting change for the men, women and children, economies and landscapes of northern Vietnam. We would also like to thank both the Scientific Committee and the Management and Implementation Team for their persistence and efforts in marking this Symposium an enjoyable, valuable and memorable learning experience for all.

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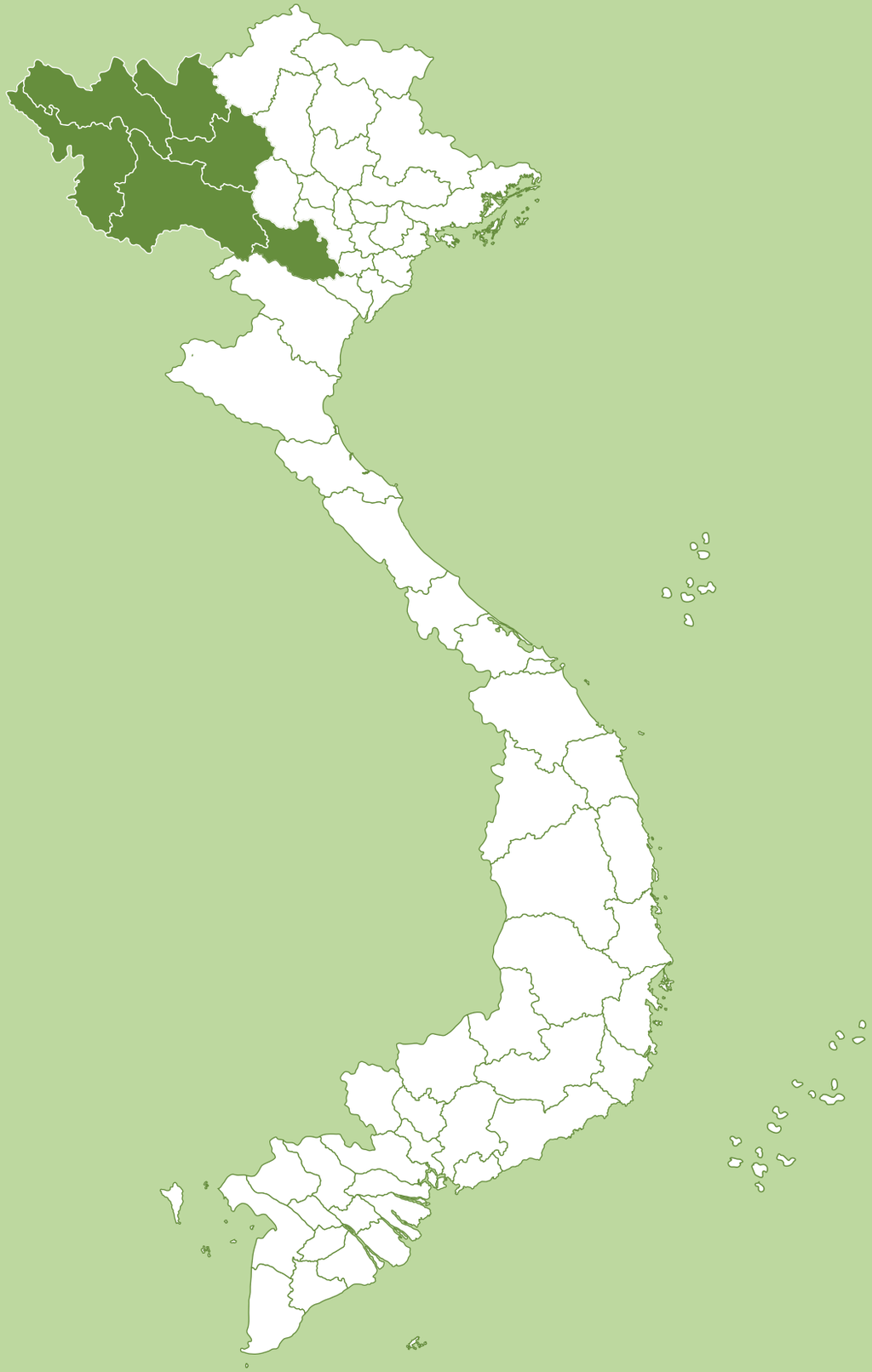

Map of Vietnam

Map of the North West

A H'mong woman using wind power to remove the rice husk. Photo: La Nguyen.

Presentation Abstracts

Consumer preferences and consumption patterns for fruit and vegetables in urban Vietnam

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Keywords

food demand, household consumer survey, credence attributes, modern markets, traditional markets

Introduction

Vietnam is a country in transition. With growing incomes and an increasingly open economy, the commercial food environment is changing. For example, the introduction of modern retail outlets such as supermarkets and hypermarkets in urban Vietnam (Reardon et al. 2012) has influenced both food expenditure and consumption behaviour (e.g. Mergenthaler et al. 2009). Understanding changes to the retail market landscape and consumer preferences and purchasing behaviours is necessary to guide agricultural producers and service industries to produce products that are in demand, differentiate product attributes to meet various consumer demands, and establish respective marketing channels (Minot et al. 2015). The objective of this study was to identify consumer preferences and buying patterns for fruit and vegetables – two high value products of increasing importance to smallholder farmers in northwest Vietnam.

Methods

The data was collected through a comprehensive household survey in four Vietnamese cities: Ho Chi Minh City, Hanoi, Lao Cai City and Son La City. The survey was adapted from that used by Umberger et al. (2015) and Toiba et al. (2015). Data was collected from approximately 2000 households from December 2016 to March 2017 (with a four-week break over Tet). Households were selected using a two-stage proportional random sampling method: (1) wards were selected based on ward-level population shares; (2) 14 households were randomly selected from each ward. The survey included questions to capture socio-demographic characteristics as well as expenditure for 93 food products, shopping behaviour, factors affecting food choices, access to food outlets, etc. The survey respondent was the adult member of the household who was responsible for most of the food purchase decisions.

Results

On average, urban households spend 8–9% of their monthly food budget on fruit and 12-13% on vegetables. More than 90% of fruit and vegetable expenditures was spent at traditional outlets (e.g. wet markets and semi-permanent stands) and, 47-52% of expenditures on fruit and 58-67% on vegetables was spent at formal wet markets. In comparison, 6-10% was spent at modern retail outlets (e.g. supermarkets, hypermarkets, mini marts and specialty stores). The main reason consumers shop at wet markets was 'food products are fresh'. When consumers were asked to indicate the most important factor influencing their decision to buy a portfolio of fruit and vegetables, the most commonly mentioned attribute was 'food safety' followed by 'freshness' (Figure 1).

Consumers were also asked to indicate whether they have seen/heard of fruit and vegetables that were marketed/sold with various claims or information (see Figure 2 for a list of the claims and/or information). Respondents were then asked to indicate whether they had ever purchased fruits and vegetables with such labels or certifications. With less than 80% of consumers stating that they have seen or heard of fruit and vegetables with these labels/certifications it is not surprising that less than 60% of consumers indicted previously purchasing any of these fruits and vegetables (Figure 2). The largest share of consumers were *aware* of products that were labelled with a safety guarantee (79%), country-of-origin (73%), and pesticide-free (72%), and had *previously purchased* products labelled with these attributes (51%, 55% and 43% respectively).

Discussion and conclusion

With increasing incomes and changing retail landscapes, it could be expected that consumers would increase food expenditure at modern retail outlets (Reardon et al. 2003). However, we show that urban Vietnamese consumers continue to buy the majority of fruits and vegetables from traditional outlets such as wet markets. Consumers

consider ‘food safety’ and ‘freshness’ as the most important factors in the decision to purchase certain fruit and vegetables. The continued importance of wet markets and other traditional outlets in the fruit and vegetable retail landscape could reflect the Vietnamese consumers’ demand for freshness and the culture of shopping daily and buying small amounts (McDonald et al. 2000). From this, and similar to Minot et al. (2015) in Indonesia, we find that smallholder fruit and vegetable farmers, currently suppling traditional markets, do not appear to be under threat from the expansion of modern retail outlets in urban Vietnam in the short term. However, relatively high food safety concerns demonstrate the need for smallholders to increasingly meet certain standards. Smallholders will need to develop new or access existing market channels that differentiate products through means such as labelling and/or certification to satisfy heterogeneous consumer demands. These markets may not exist at present as evidenced by the small number of consumers that have purchased fruit and vegetables with certain labels/certifications, but will likely become increasingly important.

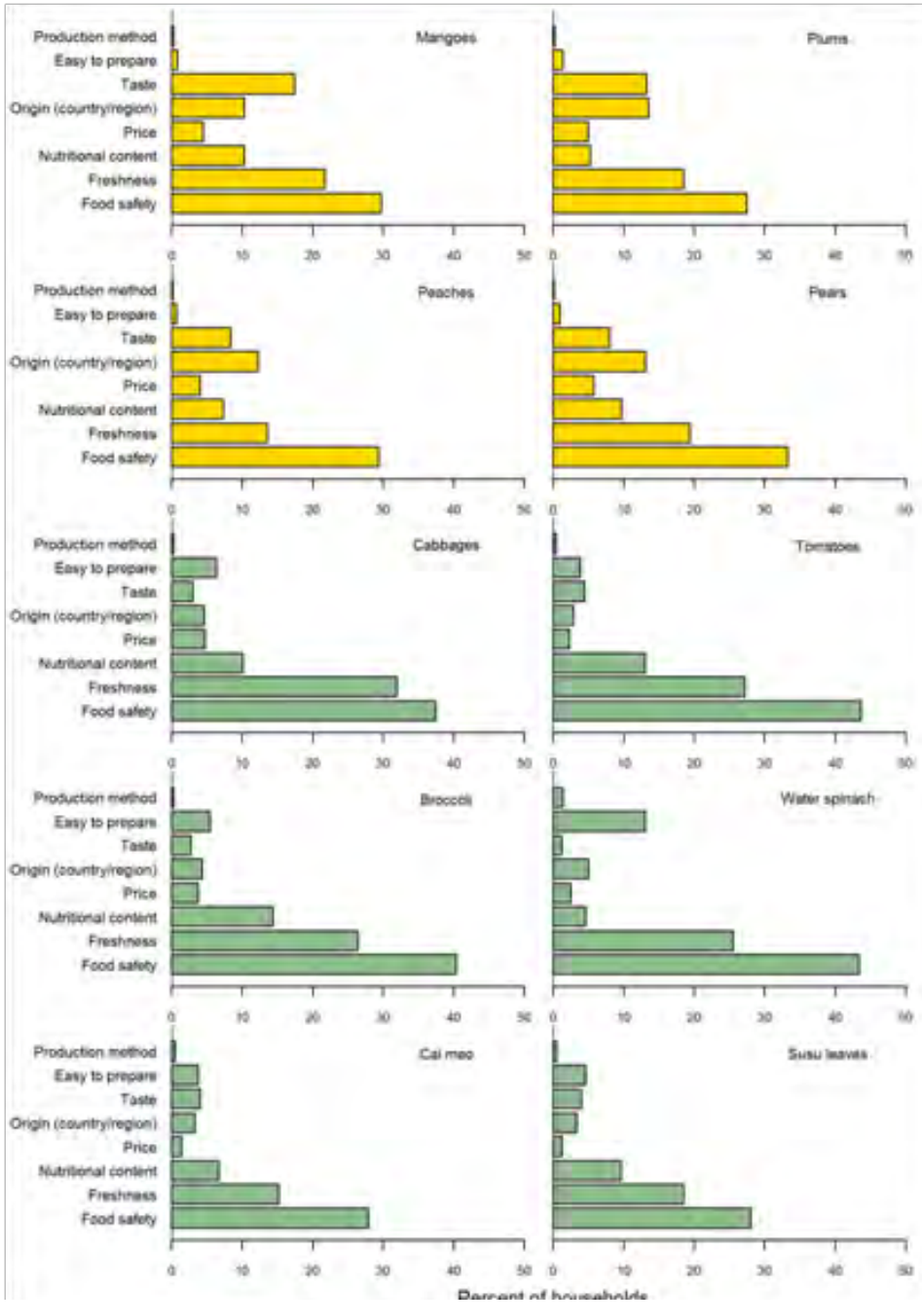

Figure 1: Percent of households that selected […] as the most important factor in their decision to purchase fruits (gold) and vegetables (green). Results are for the combined sample across cities included in the survey: Ho Chi Minh City, Hanoi, Lao Cai City and Son La City, Vietnam (n=2021).

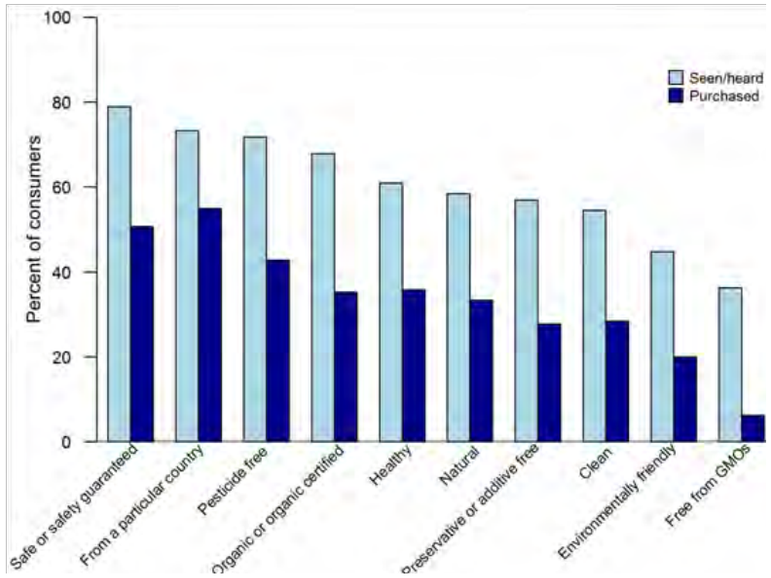

Figure 2: Percent of households who haveseen/heard of fruit and vegetables that are sold as […](light blue) and purchased such fruit and vegetables (dark blue).Results are for the combined sample across cities included in the survey: Ho Chi Minh City, Hanoi, Lao Cai City and Son La City, Vietnam (n=2026).

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The impact of development of regional value chains on smallholders: the case of cattle and beef in South East Asia and China

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Keywords

Value Chain Analysis, Spatial Price Equilibrium Modelling, regional integration, smallholder cattle production

Introduction

Beef markets and trade in China and South-East Asia are growing and changing rapidly. While per capita beef production has been increasing, thishas been outstripped by per capita consumption, leading to significant price rises and rapid increases in formal and informal trade in cattle and beef in the region.

Increased trade puts upward pressure on cattle prices for smallholders in cattle exporting areas and provides employment for other chain participants, including traders, transport operators and processors. However, increasing commercialisation also has the potential to crowd out individual chain actors such as household producers, traders and butchers.

Policy makers throughout the region are constrained by a lack of accurate data, analysis, evidence, tools and forums on which to base appropriate domestic and trade policy responses to these rapid changes in the dynamics of the sector.

This project (AGB/2016/031) is part of ongoing ACIAR research supporting policymakers to examine current and future trends in global and regional beef markets and trade and to analyse appropriate policies for trade, industry development and rural development - especially related to impacts of sector development on smallholders.

Research approach

The ongoing ACIAR project covers a very broad geographic area, encompassing South East Asia and China. However, the main concentration of research activities has been in Vietnam (experiencing rapid increases in demand and commercialisation of the sector) and Myanmar (a key live cattle supply area, currently transitioning away from a draft orientation to cattle production orientation in the Central Dry Zone).

The research has been based on (i) detailed analyses of domestic beef industries using primary data and official and unofficial data including a critical examination of statistical issues; (ii) Analysis of both formal and informal trade flows, networks and barriers to trade in the region; and (iii) the development of a Spatial Price Equilibrium model of the cattle and beef industries in the region.

The project has developed a network of researchers and key informants throughout the region that have an intricate, primary understanding of beef industries at very localised to regional levels. Key project results have been discussed and disseminated to policy makers through this network.

Results

Cattle and beef sectors in all countries in the region are developing and changing rapidly in response to changes in prices and demand - especially to increased demand for beef in Vietnam and China.

Cattle and beef industries across the region are becoming increasingly interlinked through trade. Within the Mekong Region this has resulted in the rapid development of four main value chains linking producers with consumers including one value chain of live cattle from Myanmar and Thailand through Lao PDR into Vietnam and China, another live cattle value chain from Myanmar/Thailand through Cambodia into Vietnam, one value chain of Australian fattening cattle into Vietnam as well as a value chain of Indian Buffalo Meat into China through Vietnam (Figure 1).

Theme 1: Regional markets and trade

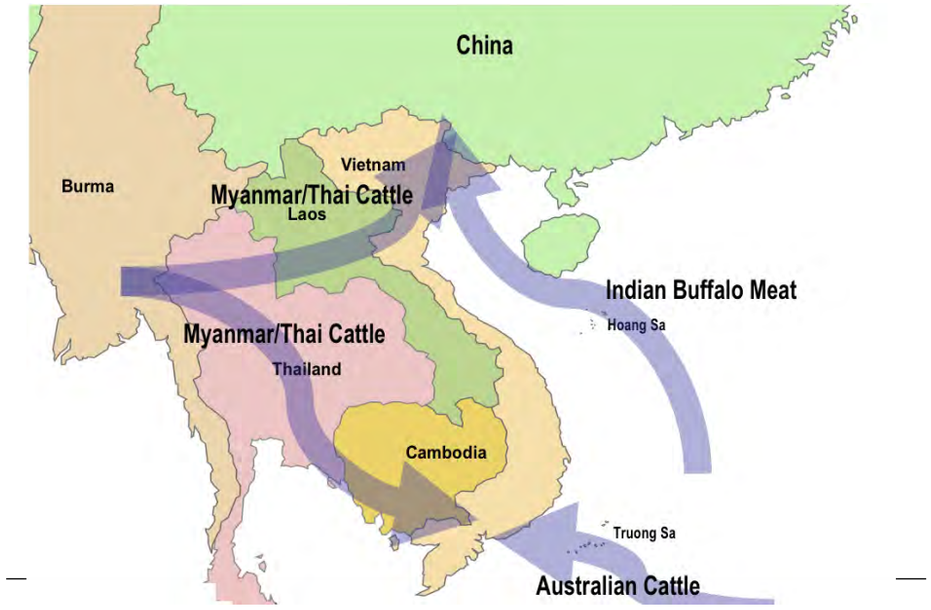

Figure 1: Major value chains of live cattle and bovine meat - South East Asia

A large proportion of trade, especially in live cattle across the Mekong region is informal or semi-formal and uncontrolled (Table 1).

Table 1: Official Trade Protocols for Live Cattle

Country	Official Protocol
China	Import Permit required. Imports from FMD-endemic countries are not approved.
Vietnam	Slaughter only. Import Permit required (?). Pre-entry Quarantine. Post-entry Quarantine 15 days. FMD & HS vaccination during post-entry Q. Test during post-entry Q for TB, Lepto, Brucella, with –ve results.
Thailand (General)	Cattle/Buffalo Breeder. Import Permit required. Imports from FMD-endemic countries are not approved.
Thailand (ex Myanmar*)	Import Permit required (?). Post-entry Quarantine 21 days. FMD vaccination during post-entry Q.
Cambodia	Import conditions not known.
Laos	Import Permit required. Specific import conditions not known.
Myanmar	Live cattle exports generally not permitted

Developments of all four value chains have the potential to lead to positive impacts for smallholders, but also expose smallholders and other smaller scale actors to increased levels of risk.

Discussion and conclusion

Four distinct value chains can be observed, each of which have differing potential impacts on smallholders.

Myanmar-Thailand-Laos-Vietnam-China Cattle value chain - categorised by the informal nature of movements of around 250,000 head of cattle per year. Smallholders are involved in cattle raising in Myanmar and the value chain generates employment in cattle transport between the countries and in cattle fattening in Thailand. There is a high degree of risk to smallholders due to informal nature of trade and the potential for China to commence purchasing directly from Myanmar.

Myanmar-Thailand-Cambodia-Vietnam Cattle value chain - this value chain also features informal movement of about 150,000 cattle per year and generates employment in cattle transport between the countries. Smallholders are involved in cattle raising in Myanmar and in cattle fattening in Thailand and in Vietnam prior to slaughter. There is a high degree of risk to smallholders due to informal nature of trade and the potential for imports to be displaced by imports of Australian cattle.

Australian Cattle value chain - Smallholders in Vietnam are not directly involved in this value chain as all cattle are fattened in commercial feedlots. However, there is some involvement of smallholders in supplying cut and carry forages to feedlots. Trade volumes are dependent on many external factors and are relatively unstable.

Indian Buffalo Meat to China via Vietnam - this value chain involves the semi-formal movement of around 600,000 tons of frozen Indian Buffalo Meat annually through northern Vietnam to China. This chain generates employment in Northern Vietnam but is very susceptible to disruption due to its informal nature, unstable Indian policy and India-China tensions.

The rapid development of cattle value chains has benefitted smallholders in cattle exporting areas and provides employment for other chain participants, including traders, transport operators and processors. However, the largely informal nature of these value chains presents increased risk for smallholders. In addition increasing commercialisation in the form of the value chain of cattle from Australia and buffalo meat from India also has the potential to crowd out smaller actors. Domestic government policies to support smallholder development and poverty reduction need to take these regional factors into account.

Trends, patterns and implications of the cross-border plum export trade from Vietnam to China

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Introduction

The initial commercial development of plum (*Prunus salicina*) production in Vietnam dates back to the early 1980s and until the late 1990s growers enjoyed a favourable market context, fetching high prices for their crop. With a significant expansion of planted areas causing a collapse in market prices in early 2000s farmers responded by reducing labour and other inputs, and by shifting to other crops. The development of unripe plum exports from Moc Chau to China, that started at scale in 2008, fundamentally changed the market landscape and has had a significant positive impact on farm-gate prices.

A study to understand the Chinese market for unripe plums, the supply chain and implications for production in Vietnam was conducted in 2015 as part of ACIAR supported projects AGB/2012/57 and AGB/2012/60.

Research Approach

Research was based on a review of the secondary data on plum production and processing in China and Vietnam and on in depth interviews with key informants including Vietnamese and Chinese traders, exporters, border trade agen ts and processors in Moc Chau production area, Puzhai border crossing area, Pingxiang city, Guangxi Zhuang Autonomous Region and Puning processing area, Guangdong province.

Results

The plum export trade in Vietnam has a short history starting with few consignments sent to China in 2007. In the following years this trade enjoyed strong growth, as more and more Vietnamese traders took advantage of the opportunity. It is estimated that some 8,000 t of unripe plums and about 2,000 t of ripe plums are now exported annually to China, equivalent to more than 40% of the total Son La plum harvest.

There are at least eight large exporters in Son La who buy unripe plums from collectors in production areas and then ship them from Son La to Lang Son-Guangxi border area in 30-40 t trucks. At the border exporters have relations with one or two bilingual border commission agents (Ta Xich), whose role is to connect Vietnamese exporters with buyers in China, negotiate selling prices, and collect payment. There are approximately 10 large Chinese traders importing unripe plums from Vietnam. Most are based in Guangxi or Guangdong. Importers collect the plums at the border. The fruit is loaded onto 5 t trucks, taken to a nearby logistical centre, and then reloaded onto large trucks for transportation to Puning in Guangdong province, some 1,300 km away from Son La. Repeated loading and unloading enables importers to circumvent taxes and fees applied to consignments over RMB 8 thousand, but has a negative impact on fruit quality.

Puning district with some 100 processing facilities is the main plum-processing centre in China. Approximately 60,000 t of plums are processed annually within the district, two to three times more than the total harvest in Moc Chau. Since 2015 the Chinese government has been implementing strict environmental protection regulations forcing closure of many smaller processing plants. This development coupled with reduced profit margin due to increase input costs could potentially negatively impact Vietnamese export by reducing demand for Vietnamese plums but at the same time they represent an opportunity since Chinese processors are now more interested to import semi-processed plums from Vietnam to manage raw material costs.

Conclusions

Vietnam enjoys a strong position in the Chinese market for unripen plum for processing on account of seasonality and variety. Having a two to three week earlier season is a major advantage. The dominant variety grown in Moc Chau, Tam Hoa, is also the preferred variety for processors, and sells for higher prices than competing varieties.

Most plums imported from Vietnam comply with their requirements: small fruits (in most cases 60 or more fruits per kg), about 70% ripened, with a hard flesh that is just starting to change from green to yellow and red, and no cracks or bruises.

The unripe plum export is particularly advantageous to poor farmers, as it provides a marketing avenue for low-quality fruit. It is estimated that around 3,000 plum farm households in Son La province, many from ethnic minorities, have seen their wellbeing improve as a result.

There is real opportunity to specialise in unripe plum production by redesigning orchards to increase planting density and crop load and increase efficiency and profitability of production. Coupled with that, the development of a processing industry in NW Vietnam that would be primarily oriented towards production of semi-processed plum for initially export to China and then potentially to Taiwan and Japan could further increase demand and have positive impact on farm-gate prices and employment.

Global markets, local implications: Understanding the drivers and implications of the cassava boom and correction

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Keywords

global trade, trade policy, market booms, cassava

Introduction

Throughout mainland Southeast Asia, cassava (*Manihot esculenta*) has become an important smallholder crop grown by millions of upland farmers. During the last decade, the area of cultivation has expanded rapidly to meet the growing demand for carbohydrates. This has included expansion in the mountainous regions of North-West Vietnam, particularly Sơn La province.

The market outlook for cassava has a long history of being influenced by changes in global markets and policies (Jackson 1968; O'Connor 2013; Henry and Hershey 1998; Sathirathai and Siamwalla 1987). This includes not only changes in the supply and derived demand for the intermediate products themselves (cassava chips and starch), but also changes in the supply and demand for a range of substitutes. In some applications, cassava competes strongly with substitutes based on superior function properties (Sánchez, T., et al. 2010). However, in many applications it competes mainly on price with commodities such as maize, sugar, wheat and crude oil. Therefore, changing agricultural and trade policies, in both production and consumption countries, have strongly influenced the cassava market and the prospect of smallholder farmers.

Research approach

To help demystify the recent downturn in the price of cassava we draw on market data that are largely publicly available. We demonstrate the need to understand global value chains beyond the local context in which production and consumption occur.

Results

The initial expansion of commercial production in Thailand (and later Vietnam), was largely driven by price support for grains under the Common Agricultural Policy (CAP) of the European Community (EC). However, with trade reform under GATT and WTO, the demand for cassava chips and pellets in Europe almost completely disappeared by the late 2000s (Figures 1a and 1b).

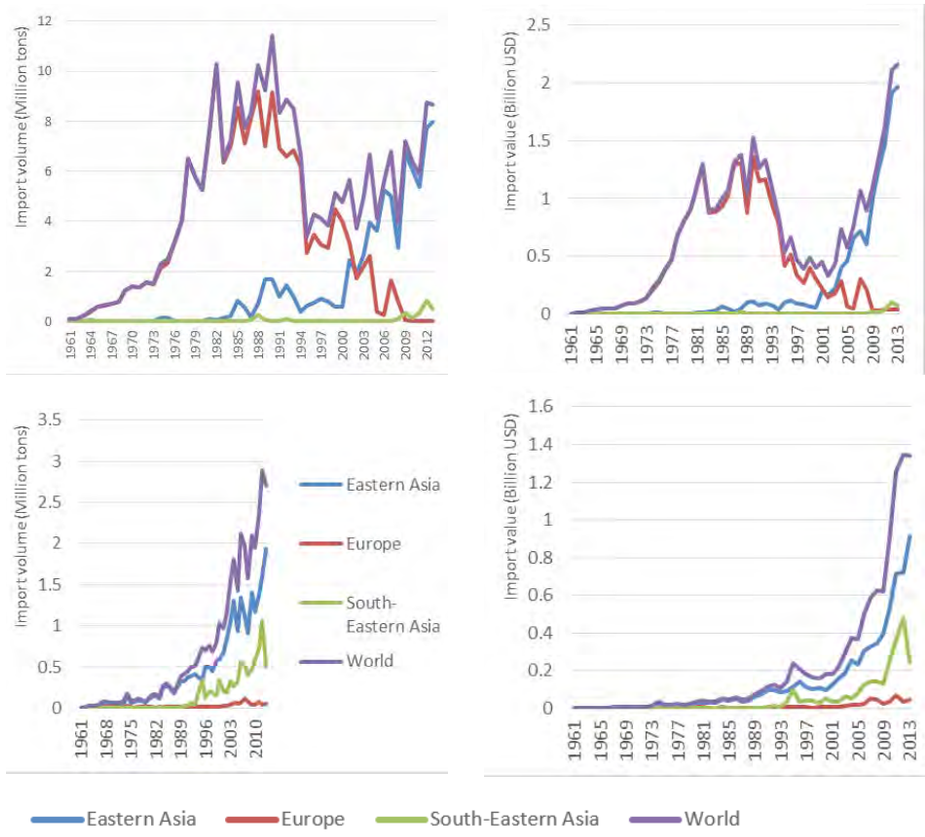
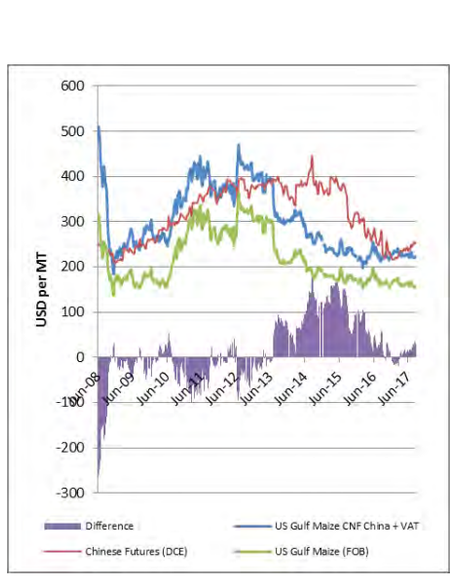


Figure 1a: Import volume of cassava chips by region; 1b – Import value of cassava chips by region; 1c – Import volume of cassava starch by region; 1d – Import value of cassava starch by region

The market was reoriented towards domestic consumption and markets in East Asia, as well as significant investment in starch processing (Curran and Cooke 2008). In the Asia-centric export market, Thailand remains the market leader when it comes to international cassava trade with Vietnam

the second largest exporter. China was the destination for 99.84% of cassava chip exports and 45% of cassava starch exports from Thailand. Vietnam's starch exports are also predominantly destined for the Chinese market.

China is the world's largest producer of maize, cultivating over 37 million ha. During 2012–13, Chinese authorities intervened in the maize market, making purchases at the support price when the country's maize market again faced downward pressure on prices. Under pressure from growing stocks, in March 2016 the Chinese government announced an end to the floor price for maize. The result was a significant fall in maize prices and imports of maize alternatives declined, with the impact being felt throughout the cassava sector. The prices of cassava chips and cassava starch have fallen to more closely reflect the world price for the main alternative – maize – and farm-gate prices throughout mainland Southeast Asia fell accordingly.



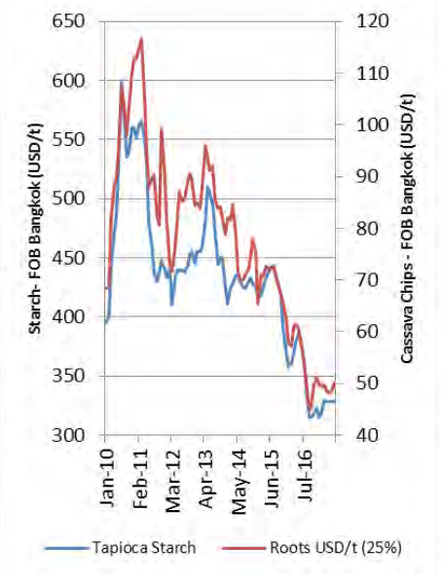


Figure 2a: Maize prices (FOB Bangkok) and Chinese Nearby Futures (DCE); Figure 2b: Cassava starch and Cassava chip price (FOB Bangkok)

Discussion and conclusion

When deciding which crop to grow, farmers do not consider factors such as: the global price of oil, sugar, wheat, or distiller's dried grains with solubles (DDGS); changes in the demand for pork, or paper and cardboard; or whether a biofuel mandate is developed. Yet as a global commodity trade, understanding the connection between cassava and these markets in essential to understanding the outlook for the crop.

The picture of a smallholder farmer growing cassava on a half hectare in a mountainous village of Son La Province may seem far removed from European feed markets, maize production in the mid-west USA and the Chicago Board of Trade. However, the movements of global markets influence the farm gate prices that these farmers will receive. An understanding of the global market context in which these localised value chains (farmer-trader-processor) operate helps recognize the market risk that farmers and processors are exposed to. This can help develop informed scenarios with farmers and government agencies regarding the potential for intensification and diversification strategies improve farmer livelihoods.

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Vegetable farming systems in North West Vietnam

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Keywords

Moc Chau, Hanoi, safe vegetables, farmer group

Introduction

High summer temperatures in Hanoi make it difficult to grow temperate vegetables such as cabbages, beans and tomatoes locally. Traders and retailers in Hanoi bring vegetables from Da Lat in the south, or import them from China from May to October to meet consumer demand. This presents a unique opportunity for the highland North West region of Vietnam with its cool climate, arable land and plentiful water, to supply vegetables to Hanoi markets during the counter-seasonal summer months. ACIAR is supporting two separate projects evaluating two different approaches to addressing this opportunity for Vietnamese smallholder farmers.

Research approach

The first approach involves the counter seasonal vegetable project AGB/2014/035 *Improving livelihoods in Myanmar and Vietnam through vegetable value chains* and its predecessor AGB/2009/053. The projects engage directly with the modern retail sector by supplying accredited safe vegetables to supermarkets and safe vegetables stores in Hanoi. There is two-way communication between the farmers and the retailers, which helps understand what they need to supply. The project teams have helped farmer groups in Moc Chau to gain safe vegetable and VietGAP accreditation, to implement best production, postharvest and marketing best practice, and to implement traceability in the value chain. In addition, the Moc Chau district government has worked with local farmer groups and authorities to register the certification trademark Moc Chau Safe Vegetables - *"Rau An Toan Moc Chau"*.

The second approach is being evaluated by vegetable project AGB/2012/059 *Towards more profitable and sustainable vegetable production systems in north-western Vietnam* and its predecessor AGB/2006/112. These projects focused on the Lao Cai region on Northwest Vietnam, near the popular Sa Pa tourist destination. The project team have adopted a more localized approach engaging strongly with local markets, indigenous vegetables, women's groups, and aiming at providing solutions to specific barriers to farmer prosperity such as soil borne disease, crop nutrition and marketing. This project examines these approaches and highlights the key farming system changes that have been achieved.

Results

The Moc Chau project was working with 68 farmers from the Tu Nhien, An Thai, Ta Niet and Van Ho villages by the end of project AGB/2009/053. Of these farmers 71% were women and the ethnicity was 90% Kinh, 10% H'Mong, Thai and Muong. In the new project, which is aimed developing a sustainable up scaling and farmer group governance model, the number of villages has been expanded to 10, with a total of 150 farmers, with higher rate of ethnic minorities.

Famers can earn 150% more income by producing accredited safe vegetables in the off season and marketing to modern retailers in Hanoi, compared to traditional vegetable production and selling on the local market (Table 1). The safe vegetable producers income data is an average of 38 Tu Nhien village cooperative farmers.

Table 1: Farmer income results for farmers from the Tu Nhien village in Moc Chau

Production system	Net income M VND (per ha per yr)	AUD equivalent (per ha per yr)
Traditional household income: Tu Nhien village	120	$7,560
Safe vegetable producers: Tu Nhien village	300 (150% more income)	$18,900
Traditional rice production	20 (or less)	$1,260
Traditional maize production	20 (or less)	$1,260

In the Lao Cai project, the newly-formed Ma Tra farmer group (Sapa, Lao Cai) started from a traditional subsistence oriented farming system with a rice, maize, and vegetable rotation. With adaptive farming system trials, farmers were able to see the benefits of off-season production and shift their farming system to produce off-season cabbages. In August, Mr. Tao from Ma Tra group earned 51 million VND from the cabbage harvested from his small plot (~500m^2).

The Di Thang Cooperative (Bac Ha, Lao Cai) has been able to diversify production into a wide array of different vegetables to supply the demand of high-end specialty shops and restaurants in Hanoi. The project worked to minimize risk and disseminate knowledge of new technologies and commodities by conducting participative farming system trials with the group.

Discussion and conclusion

The two projects have demonstrated how both approaches can be effective at improving the livelihood of farmers in the poor northwest highland region of Vietnam. The Moc Chau project has greater potential to expand and take advantage of larger markets and resources, whereas the Lao Cai model is more suited to smaller landholdings with diverse ethnic minority farmers.

The role of collaborative learning in the adoption of soil erosion management strategies in maize production and improvement of small holder livelihoods

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Keywords

agricultural research for development (AR4D), impacts, farmer field and business school (FF&BS), soil erosion management

Introduction

Son La province typifies the diverse social, economic and cultural characteristics of the Northwest Highlands and is home to various ethnic groups. Despite an annual economic growth rate of more than 10% over the past decade, the proportion of poor and marginally poor households in Son La has remained high (27.01% and 11.86%, respectively) and occurs mainly amongst ethnic minority farmers (MoLISA, 2014).

The main source of income, and also the major opportunity to overcome severe poverty in this region is maize cultivation. However, maize is often grown on steep slopes which causes considerable soil erosion and results in unsustainable production. Since the 1990s the Vietnamese government and international development agencies have funded many activities to address this serious natural resource management issue(Nicetic and van de Fliert, 2014; Nguyen, 2015). Unfortunately, even though effective erosion management methods have been developed, scaling up has been very slow and challenging (Le et al., 2003; Ha et al., 2003). This was mainly because sustainable soil management practices were developed by agricultural scientists who overlooked the fact that these practices required a significant increase in labour inputs, resulting in lower net

income to farmers in the introductory year and that there is no readily available mulching material (Nicetic et al., 2012).

ACIAR project AGB/2008/002 adopted a transdisciplinary and participatory research approach to address erosion management issues within this complex socioeconomic context by involving farmers, extension officers, and biophysical, agricultural, economic and social scientists. Through participatory research, minimum tillage coupled with use of mulch was determined as the most economically feasible and easiest to adopt erosion management strategy, leading to large scale implementation through a FF & BS program funded by the Provincial government. According to a Son La DARD report, over 6,000 farmers were trained in erosion management techniques, and approximately 4,000 farmers subsequently used these methods in the 2015 maize season.

This evaluative inquiry examined the trans-disciplinary and participatory approaches applied in AGB/2008/002 and compared them with the approaches of previous projects with the aim of establishing to what extent the active engagement of local stakeholders in research processes and use of purposeful communication with local farmers and institutions contributed to the project impact.

Research approach

Evaluative research used the holistic impact assessment framework, which was based on the sustainable livelihoods framework (Nguyen*et.al*., 2016) and employed a variety of qualitative research techniques including focus group discussions with farmers, semi-structured interviews with farmers, and in-depth interviews with key informants including local leaders, agricultural extension staff and agricultural researchers.

Results and Discussion

Past and current agricultural research and follow up extension efforts in NW Vietnam have been identified as top-down with a strong emphasis on the external technology development and then technology transfer through a variety of media including leaflets, brochures, local radio, field days and short field-based training and workshops. Little attention has been paid to local cultural identity and empowerment of local stakeholders to develop locally adapted technology and drive sustainable local development. In line with this research approach the project impact assessmentswere also externally designed, focusing on short-term economic gains and project

Theme 2: Sustainable farming systems

cost-effectiveness for donors and funding agencies rather than local sustainable livelihoods.

Evaluation of project AGB/2008/002 showed that this project was implemented in three consecutive participatory research phases: the first phase assessed needs and opportunities within the target communities, the second phase involved participatory trials to develop sustainable maize based production systems, and the third phase tested promising production systems on larger areas using adaptive trials and a model was developed to scale up successful production systems.

A high level of participation of stakeholders in the design, implementation and M&E of AR4D resulted in outcomes that were relevant to the conditions of the local people. In the process of implementation, the project team established high level collaboration with farmers and local leaders in Son La, resulting in them developing a feeling of project ownership. Active involvement of local government staff in the development of the outreach model, which included a curriculum for FF & BS, extension staff trained in evaluation of experiential learning, teaching videos and written manuals that were all tested and refined througha season long FF & BS pilot program, allowed the local government to incorporate scaling up in their plans and to secure substantial levels of funding for training of 6,000 farmers.

The holistic impact assessment framework utilised in the study provided a robust assessment tool for evaluating AR4D. The participatory research framework implemented may be used in the future AR4D project. However, level of participation needs to be adjusted to the willingness and capability of local stakeholder to engage and contribute. Similarly, institutional cultures and existing inter-institutional relationships need to be recognised and understood before deciding the level of disciplinary integration to commence at.

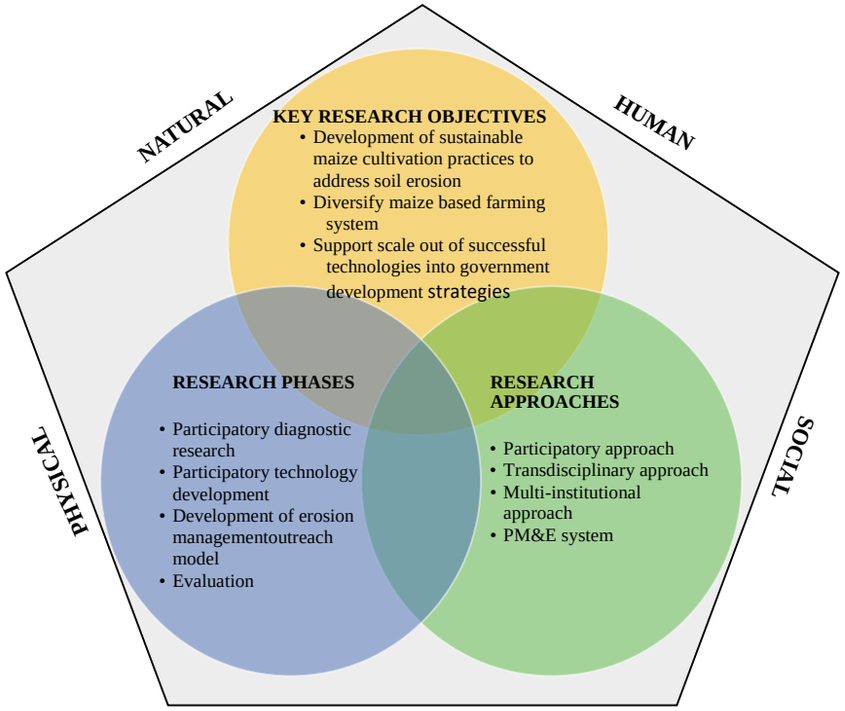

Figure 1: Key components of the ACIAR AGB2008/002 Project
Source: ACIAR Northwest Project documentation and primary data analysis

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Cassava production and sustainable livelihoods of smallholders in Son La: Preliminary results of a household survey

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Keywords

smallholder cassava production, sustainable livelihoods, household survey

Introduction

Throughout Southeast Asia, cassava (*Manihot esculenta Crantz*) is an increasingly important crop in terms of both rural livelihoods and regional economic development. Son La is one of the major cassava producing provinces in Vietnam, with production more than doubling between 2001 and 2011. Production levels remained relatively stable between 2011 and 2016 as yield declined from 12.3 to 11.7 tons per hectare while production area increased to 32,840 ha in 2016. Government policy for future development of cassava in Son La is oriented towards increasing productivity through improved cultivation and post-harvest technology.

In order to understand the livelihoods and production practices of cassava farming households a household survey was conducted in Thuan Chau and Mai Son districts of Son La province. The survey covered 8 villages including upland locations with difficult access to commune centres and midland villages close to transportation links. The results are being used to inform upcoming ACIAR supported activities including the introduction of improved varieties and cultivation practices.

Research approach

The household survey covered different aspects of cassava production, post-harvest and marketing activities. In addition to information on agronomic practices, data was also gathered on costs, labour use and revenues. Gender and ethnicity disaggregated data was also collected where relevant. The survey also included questions on livelihoods of farm households, including lowland and upland perennial cropping, tree crop production and livestock raising, as well as off-farm activities.

Survey activities were undertaken in Bo Muoi and Pung Tra communes in Thuan Chau District and Chieng Chan and Na Ot communes of Mai Son district in Son La and included one upland and one midland village in each commune. In each of the 8 villages, 32 cassava farming households to be surveyed were selected at random from household lists kept by the village head. Surveys were administered face to face in the farmer's home wherever possible. A total of 256 household surveys were completed by the survey team using the Commcare app on Android tablets.

Results

The majority of cassava farmers are still growing paddy or upland rice as a staple, with maize an important cash crop, especially in Chieng Chan and Bo Muoi communes. Some form of livestock is kept by almost all households, with large livestock (cattle, buffalo or goats) kept by more than half of households. In all communes except Na Ot, cassava accounts for a relatively small proportion of overall income (Figure 1).

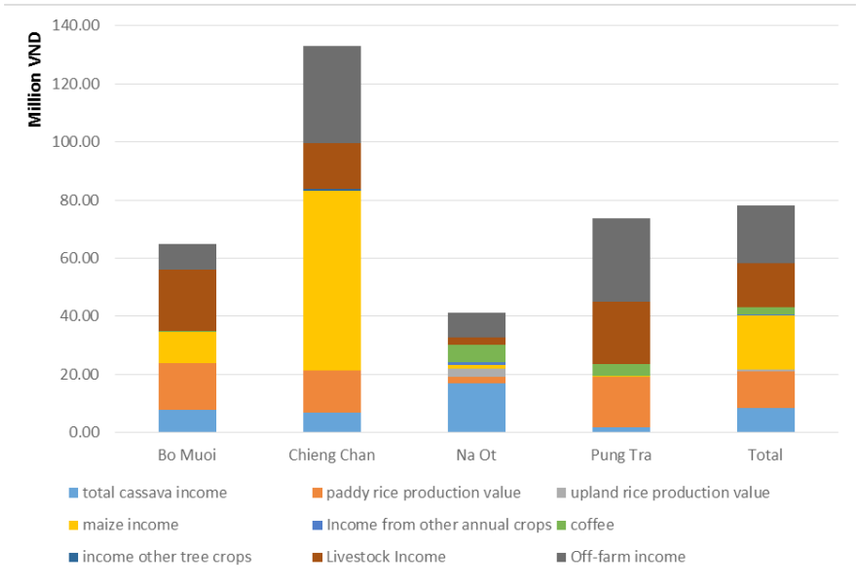

Figure 1: Annual Income by Source (Million VND/year)
note- includes imputed production value of rice

Only 1.2 percent of farmers used organic fertiliser, while inorganic fertiliser was used by almost 74 percent of farmers. Only 26.5 percent of farmers used herbicide, while 99 percent did manual weeding. More than 75 percent of farmers used manual tools in land preparation, with tractors only used by 2 percent. Field and land preparation, weeding and harvesting were the most significant labour activities for both men and women (Figure 2).

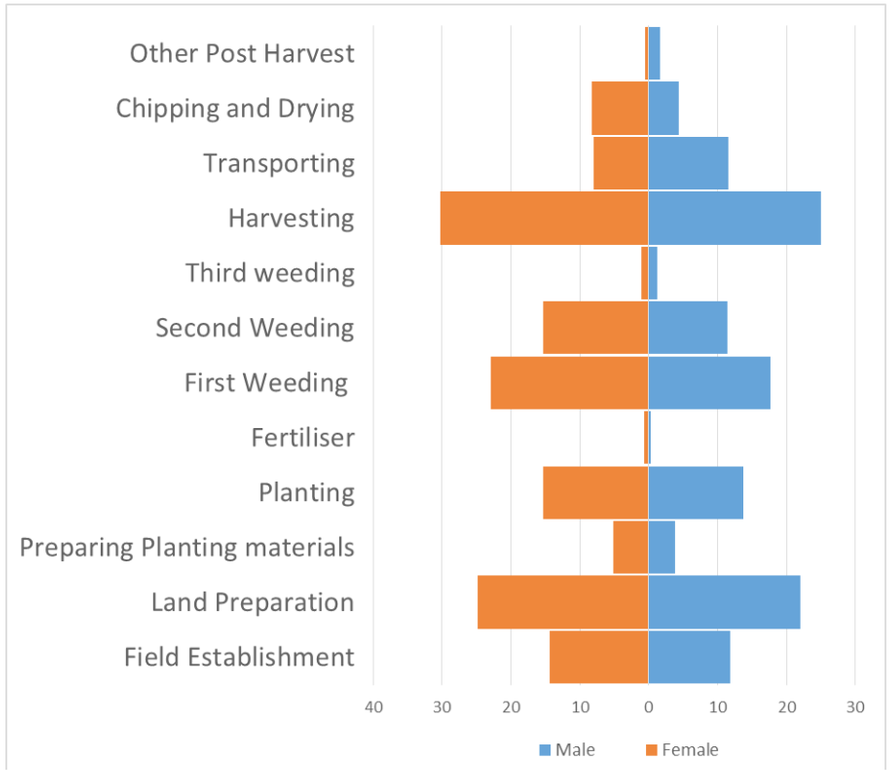

Figure 2: Household Labour Person-Days per hectare, by gender

More than 80 percent of farmers thought that weeds limited productivity, soil erosion was perceived as a problem by almost 90 percent of farmers, and almost 74 percent of farmers noted that cassava yields in their fields were declining. Almost 25 percent of farmers either would not grow cassava in the future or were unsure about whether they would grow cassava.

Discussion and conclusion

In addition to the characteristics of various technologies and the characteristics of the cassava value chain, the characteristics of farming households and communities have a significant effect on the diffusion and adoption of improved technologies – including new varieties and improved cultivation practices.

Almost none of the farmers were aware of what exact cassava varieties they were growing, but the majority did indicate that they were planting some type of improved variety. Introduction of new, higher yielding varieties may have good potential to improve farmer livelihoods and would be relatively easy to disseminate and adopt.

The steepness of the land plots used for cassava means that field and land preparation, planting and harvesting will remain labour intensive activities with limited potential for mechanisation. The significant amount of labour expended on manual weeding implies that more widespread adoption of herbicide use could reduce cultivation costs and improve profitability of production.

Only 11 percent of farmers were aware of the meaning of NPK values of fertilisers they were applying and in many cases the formulation of fertiliser used was not appropriate. Introduction of more appropriate fertiliser formulations, combined with information on use has the potential to impact positively on yields and farmer livelihoods.

Introduction of new high yielding varieties and more appropriate formulations of fertiliser as well as increased use of soil conservation practices and herbicide have the potential to improve farmer livelihoods. However, declining yields and cassava prices, and the fact that cassava only accounts for a small proportion of farmer livelihoods means that benefits of new technologies must be very significant in order to encourage any widespread adoption.

Implementing integrated research for sustainable agroforestry development in North West Vietnam

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Keywords

agroforestry, farmer demonstration trial, exemplar landscape, farm business model

Introduction

In North-west Vietnam, rain-fed crop cultivation is dominated by maize monoculture, upland rice and cassava on sloping lands. The loss of topsoil during the rainy season depletes soil fertility and reduces crop yields, so that farmers must invest heavily in chemical fertilizers for maize to remain productive. Harsh weather conditions also reduce yields and make soil and water conservation more difficult. Agroforestry offers an integrated approach that can curb land degradation and deforestation, while securing the livelihoods of rural households. We introduced trees into mono-cropped landscapes to reduce dependence on annual crops, increase and diversify incomes from tree products, while conserving the natural resource base.

The study was carried out in six districts, which belong to three provinces Dien Bien, Son La and Yen Bai in North-west Vietnam (Figure 1).

Figure 1: Study sites in Dien Bien, Son La and Yen Bai provinces

Research approach

The research approach (Figure 2) combined different activities to bring research results to application in real world situations. The agroforestry systems were designed through a participatory approach in which scientific knowledge and local knowledge are combined. These established trials were evaluated to find out suitable options. The added value for agroforestry adoption also involved research on propagation of priority agroforestry species, small-scale nursery development, research and transfer processing techniques, and facilitating links between producers and other market actors. The research findings were spread through farm cross-visits, farmer field days and training sessions held at the test sites, accompanied by regular impact assessments.

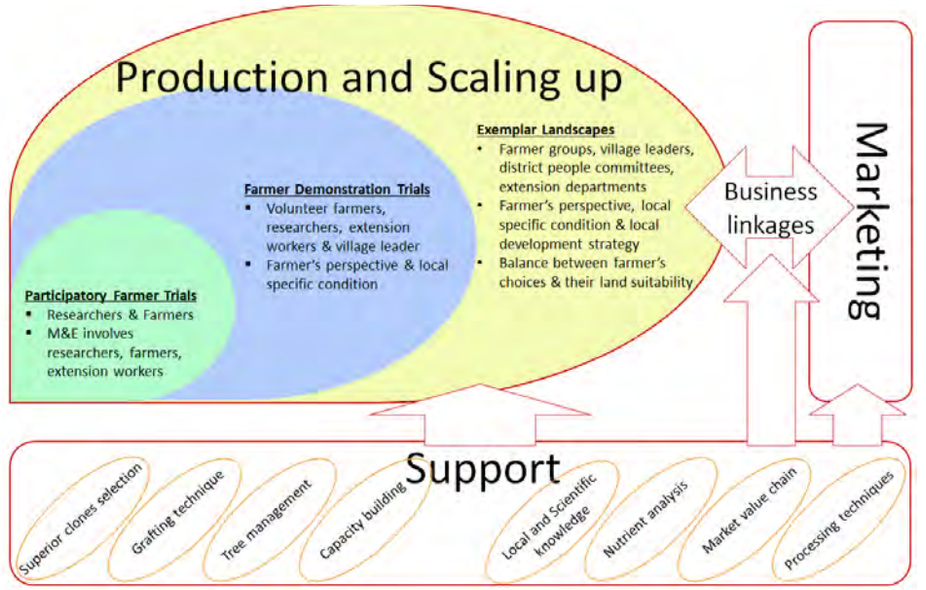

Figure 2: Conceptual framework for agroforestry research in development in Northwest Vietnam

Results

Seven agroforestry systems can be considered best-bet options for smallholder farmers based on productivity, profitability and long-term benefit are (i) Son tra-forage grass; (ii) Acacia-mango-maize-forage grass; (iii) Longan-maize-forage grass; (iv) Shan tea-forage grass; (v) Acacia-longan-coffee-soybeans-forage grass; (vi) Teak-plum-coffee-soybeans-forage grass; and (vii) Macadamia-coffee-soybean systems. Table 1 provides a summary of incomes derived by farmer co-operators from 7 trialed best-practice agroforestry systems from 2012 to 2016.

Table 1: Income of farmer co-operators from agroforestry trials (million VND/ha)

Agroforestry trial	Year of establishment	2012	2013	2014	2015	2016
Son tra-forage grasses	2013		-	93.8	96.5	110
Acacia-mango-maize-forage grass	2014			13.8	23.8	23.8
Longan-maize-forage grass	2012	37.3	26.1	34.6	41.2	47.1
Shan tea-forage grasses	2013		-	19.3	51.2	64.9
Acacia-longan-coffee-soybeans-forage grass	2014			-	23.4	53
Teak-plum-coffee-soybeans-forage grass	2014			4.9	27.2	41.3
Macadamia-coffee-soybeans	2013		1.4	2.9	25.2	25.8

Multi-strata systems were found superior in terms of controlling soil erosion, indicating a net savings of about 250 USD $ha^{-1}year^{-1}$ from procurement of fertilizer to replenish soil nutrient loss.

A series of Son tra *(Docynia indica)* studies have been conducted, including selection of superior clones, grafting techniques, tree management, market value chain, nutritional analysis and product development. 30 superior Son tra clones were identified. These mother trees are now considered source of quality planting materials for Son tra. The research results on Son tra processing techniques was transferred to Tay Bac Tea and Special Food Company Limited to produce different processed products from Son tra fruits, creating income opportunities for Son tra producers and markets for local traditional products.

The scaling up agroforestry strategy which include capacity building and co-investment scheme are on-going tested. The 49 ha Farmer Demonstration Trials and three agroforestry Exemplar Landscapes (50 ha each) have been established.

Theme 2: Sustainable farming systems

Discussion and conclusion

Encouraging farmers to adopt agroforestry in the form of training, guidance from extension workers, and/or financial support is necessary for agroforestry establishment. Organizing groups of farmers to form co-operatives and develop farm business models to assess markets, building trust and guaranteeing the quality and quantity of agroforestry products needs to be developed for sustainable agroforestry expansion. Supporting national and provincial-level governments, researchers and farmers develop aspirations for agroforestry, and enhancing local capacity to innovate and implement new market-based agricultural systems is vital for agroforestry development.

Resource and forage options for sustainable livestock production systems

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Keywords

Guatemala grass, Mulato II, VA06, TD58, stylo, yield, cattle, buffalo, crop by-products

Introduction

Livestock production in the North-West highlands of Vietnam is supported by the Vietnamese Government through the Ministry of Agriculture and Rural Development Decision 984/QD-BNN-CN (2014), "Restructuration of the livestock sector towards improvement of added value and sustainable development". This decision identifies the highland areas of Vietnam (North West and South Central Coast) as preferred livestock production areas. Cattle and buffalo production in the northern mountainous areas of Vietnam currently utilize 31% of total land area for natural grazing. However, providing additional resource and forage options for the larger ruminants has the potential to increase land competition with existing cash crops such as maize, cassava and rice. A further challenge is filling the feed gap that currently exists through cold dry winters of the northern highlands.

A study was conducted in Son La and Dien Bien provinces between 2012 and 2014, as part of ACIAR project LPS/2008/049, to quantify the productivity of introduced forages and availability of agricultural by-products as feed sources to satisfy annual feed requirements for sustainable large ruminant

Theme 2: Sustainable farming systems

production. Forages were selected based on known growth characteristics and potential for survival in the study regions.

Research approach

The productivity, availability and suitability of crop by-products was assessed through monitoring, farmer interviews and field measurements by taking five samples per site from crop production areas using a 1 m2 quadrat. Replicated field trials (randomised complete block design experiments with 3 replications) were conducted to evaluate the introduced grasses *Pennisetum purpureum* (VA06), *Tripsicum andersonii* (Guatamala grass), *Panicum maximum* (Guinea grass TD58), *Brachiaria spp* (Mulato II) and a legume *Stylosanthes spp* (Stylo). The grasses were established from cuttings whilst the legume was planted from seed. Evaluations of introduced grasses were conducted in highland (HL) H'Mong and lowland (LL) Kinh and Thai communes; Toa Tinh (HL) and Quai Cang (LL) communes, Tuan Giao district, Dien Bien province, and Long He (HL) commune, Thuan Chau district and Ta Hoc (LL) commune, Mai Son district in Son La. Pre-trial soil tests for pH, total OM, total N, total P and total K. Measured parameters included temperature and rainfall, survival rate, regeneration time, height and yield. Unfortunately, the experimental site in Ta Hoc was flooded and washed out soon after establishment. Crop by-products were only assessed in Long He commune and Ta Hoc commune.

Results

The total January (mid-winter) rainfall was 21 mm for lowland compared to 31 mm for highland communes, the average daily temperature for January was 11°C and 8.5°C respectively, and soil was strongly acidic in both highland (4.8_{H20}) and lowland areas (4.3_{H20}). Survival rate of VA06, Guatamala, Mulato II, and Stylo was 100% through winter, while the rate for TD58 was 98%. Annual dry matter production for the introduced grasses and legume are shown in Figure 1. These have been calculated from individual plot size of 100 m^2 and averaged across all four sites.

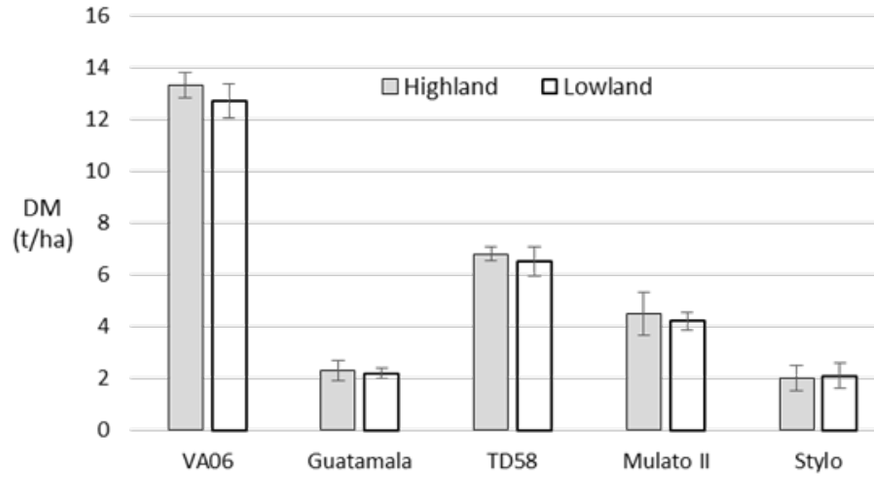

Figure 1: Annual dry matter (DM) production per hectare of Pennisetum purpureum (VA06), Tripsicum andersonii (Guatamala grass), Panicum maximum (TD58), Brachiaria spp (Mulato II) and Stylosanthes spp (Stylo) in highland and lowland areas of Dien Bien and Son La provinces.

The by-product yield per hectare is shown in Figure 2 and was calculated using field sampling estimate per unit of cropping area.

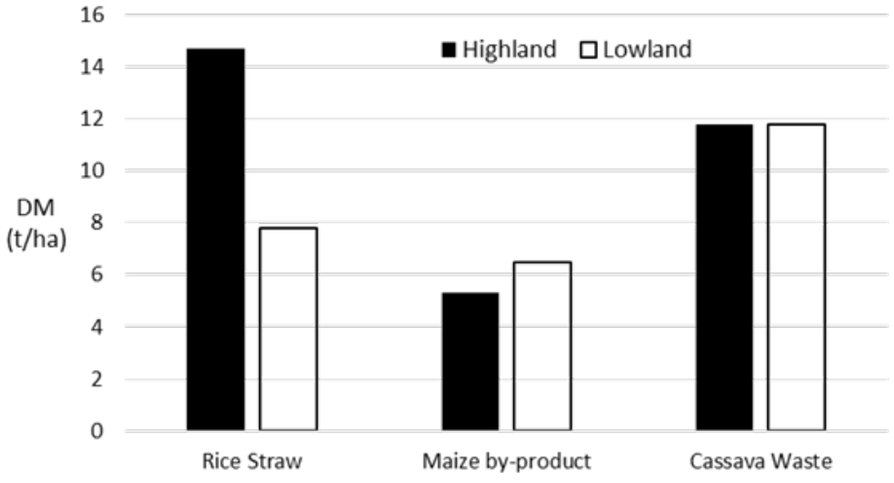

Figure 2: Annual dry matter (DM) production per ha of rice straw, maize by-products and cassava waste in Long He (highland) and Ta Hoc (lowland) communes in Son La province (n=10).

The farmer survey revealed that 100% of farmers included rice straw in their livestock diet, 13% included maize by-product and none included cassava waste. In all situations, the by-product was non-processed.

Discussion and conclusion

Live weight of the local breed of cattle ranges from females at 180 kg, to males at 250 kg (IAS, 2017). Based on a daily DM intake of 3% live weight of for maintenance (PIR, 2017), one head of cattle requires ~2.8 t of dry feed per year. This means that if a highland farmer relied on forage only to feed one head of cattle, they would need the following planted areas: 2,000 m^2 of VA06, 12,000 m^2 of TD58, 4,000 m^2 of TD58, 6,200 m^2 of Mulato II or 13,800 m^2 of Stylo. If a highland famer relied on crop by-products only, they would need the following planted areas; 1,900 m^2 of rice, 5,300 m^2 of maize or 2,400 m^2 of cassava. Despite the high availability of these by-products, their utilization efficiency was very low, and dependant on traditional practices and the local cropping condition. Further studies will be undertaken to assess the economics of using a combination of by-products and introduced forages.

Given that the Vietnamese Government has endorsed this region of Vietnam for cattle production, the results of this study have major implications for farmers wanting to introduce cattle into their farming systems or increase their cattle numbers, and sustainability of livestock production systems.

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Improving food safety along the pork value chain – lessons learned from an assessment and ways forward

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Keywords

assessment, disease burden, food borne diseases, pork value chain, human

Introduction

Pork represents the majority of meat consumption in Vietnam and production delivers significant benefits to smallholders who supply 83% of the market. Vietnamese consumers prefer fresh, un-chilled pork distributed almost exclusively through traditional markets. Consumers are increasingly concerned about pig diseases and food safety, the latter beingone of the most pressing issues for people in Vietnam, more important than education or health care (USAID, 2015). The PigRISK project (2012-2017), aims to improve the livelihoods of smallholder pig value chain actors in Vietnam by helping ensure continuing market access through addressing food safety, and builds on strong national and international partnerships to address questions of consequence: *Is pork in Vietnam safe? Are the risks serious? How best can these risks be managed?*

Research approach

Research approaches included risk profiling to prioritize food safety hazards (e.g.,*Salmonella*), risk assessment for biological and chemical hazards, value chain assessments, and cost of illness studies among others. Following a site section process, Nghe An and Hung Yen were identified as study sites. Data collection was carried out along the entire pork value chain using a farm to fork approach, using questionnaires, focus group discussions, key informant interviews and biological sampling for identified biological (e.g.,*Salmonella*) and chemical food safety hazards (e.g., heavy metals, β-agonist and antibiotics residues) using a probabilistic sampling design. Associated studies included e.g. an adoption survey of good agricultural practices, GAP (Nghe An only) using questionnaires and/or focus group discussions. Activities were designed and implemented by interdisciplinary research teams including veterinary, public health and economic experts. Surveys were supported by capacity building of research teams on risk assessment and value chain assessments.

Results

Selected results include:

- *Salmonella*, a bacterial pathogen, was found in 44% of pork sold at the markets in the study area. *Salmonella* contamination started already at farm with a market increase from farm to slaughterhouse and also from slaughterhouses to retailers mainly related to poor hygienic practices.
- Veterinary drug residues (antibiotics) or other chemicals (β-agonist, heavy metals) were only found in few samples.
- A quantitative microbial risk assessment model assessed for the first time the health impacts of foodborne disease in Vietnam. The model indicated one in five pork consumers are at risk of *Salmonella* poisoning annually.
- An economic assessment put the costs per treatment episode and per day of hospitalization due to foodborne diarrhoea at USD 107 and USD 34, respectively. This result has been also published (Van Minh Hoang et al. 2015).
- Associated studies on the adoption of good agricultural practices (GAP) found that farmers find some GAP guidelines unreasonable to achieve (e.g., use of quarantine pens), or do not follow some guidelines as concrete benefits are not clear (e.g., use of farm records or personal protective equipment).

Discussion and conclusion

Pork sold at market was found highly contaminated with *Salmonella*. This isn't uncommon as other studies have shown the presence of this pathogenin Vietnam, but we were able to estimate for the first time

the related and considerable health impact due to *Salmonella* for pork consumers (Dang-Xuan et al. 2017). Contrary to public opinion, chemical hazards (e.g. antimicrobial or heavy metal residues) were not likely to constitute a significant risk to human health (Tran Thi Tuyet-Hanh et al. 2017). The observed misperception towards chemical hazards requires action on risk communication to help policy makers to differentiate between the "vital few" and the "trivial many" food safety hazards in Vietnam. This will help devote resources to solving important problems first.

Good agricultural practices can improve food safety and have other benefits, but the current low levels of adoption and lack of perceptible evidence of immediate benefits and food safety outcomes commensurate with effort and investmentsmean that more evidence and innovative approaches are needed to make these attractive and economically viable.

While PigRISK determined the health risk for the consumer for selected food safety hazards and demonstrated the advantages of risk-based approaches to food safety,there is an opportunity to better manage these risks and understand and develop appropriate market-based approaches for improved food safety. The latter will be addressed in the new SafePORK (2017-2022) project which focuses on interventions along various pork value chains (e.g. recently emerged boutique shops selling pork, indigenous pork, or caterers providing pork to industrial zones among others).

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Safe vegetable chains and traceability - Moc Chau

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Keywords

Moc Chau, Hanoi, safe vegetables, farmer group

Introduction

The primary focus of the project has been to develop and test value chains that help vegetable producers in Moc Chau provide consumers in Hanoi with accredited safe-to-eat vegetables. Moc Chau farmers can produce temperate vegetables such as cabbage, beans and tomatoes in summer, and transport them to retailers in Hanoi, four hours away by road.

If farmers comply with the Vietnam safe vegetable standard or with the more stringent VietGAP standard, farm staff and consumers are guaranteed they will not be exposed to harmful levels of pesticide residues, heavy metals or human pathogens.

The broader project objective is to understand how smallholder farmer groups can sustainably manage their groups and supply high quality, compliant vegetable crops under the regional Moc Chau Safe Vegetable (*Rau An Toan Moc Chau*) brand. However, a key requirement for such a quality assurance system to operate successfully is traceability so that farmers can be held accountable for any violations of the VietGAP or safe vegetable protocols.

Project AGB/2014/035 is assessing how to efficiently and reliably track vegetables from the farm to the retailer.

Research approach

Four autonomous farmer groups were established in villages in the Moc Chau region since 2009 under ACIAR project AGB/2009/053, and six

new farmer groups have been recently established under ACIAR project AGB/2014/035, resulting in a total of 170 farmers participating in the trials

Under VietGAP, farmers are required to keep records of crop production (e.g. planting, fertilizer and pesticide, harvest date, packing date) for all crops produced to maintain their safe vegetable producer status.

The project is evaluating the use of QR codes and potentially, the CommCare mobile data acquisition platform www.commcarehq.org for traceability and comparing this to the current paper-based methods. The system includes a registered certification trademark (Figure 1) which implies compliance with the VietGAP standard and the product is produced in the Moc Chau region.

Figure 1: Logo Moc Chau safe vegetable developed with the support of the project AGB/2009/053

PRODUCT INFORMATION
Product Name: H'mong cabbage
Origin: Moc Chau
Packing: 0.5kg bag
Type of packaging: tied
Preservation: Normal storage
Date of planting: 09-06-2017
Harvest date: 24-07-2017
Lot number sx:
Production process: VietGAP
Planted area: 200m
Harvest: July
Date of issue VietGap: 22-12-2015
Weight: 20kg

MANUFACTURER INFORMATION
Name of Unit: Cooperative Safe Vegetable Vietnam
Representative: Nguyen Thi Luyen
Phone: 01695 438 180 or 01674 943 800
Address: Ban Tu Nhien, Dong Sang, Moc Chau, Son La
Website: www.htxrauantoantunhien.com.vn

TRANSPORTATION INFORMATION
Type: Road Transport
Vehicle: Car
Driver: Nguyen Van
Distance: 210 km

Figure 2: QR codes and the type of information stored using this approach

Results

The use of QR codes and a supporting information management platform to store crop specific traceability information are being evaluated with the Tu Nhien and Ta Niet villages in Moc Chau. The QR system is working, however, it requires separate QR codes for each crop, farmer and harvest.

Evaluation of the CommCare mobile data acquisition platform is planned for the next stage of the project and results will be compared to the QR and paper-based systems.

Discussion and conclusion

Moc Chau based farmer groups are supplying consumers with accredited safe vegetables. From 2011 to the end of the 2016 season, 1736 tonnes of accredited vegetables were supplied to retailers in Hanoi by 68 farmers, with production growing at an average of 45% per year. Farmer incomes have increased by 150% over that period. The Moc Chau farmers are using the additional income to invest in packing areas, new trucks and new houses, and more children are now able to attend school and university.

However, the traceability of the value chain relies on paper-based data recording. In western production systems, bar codes are more commonly used to manage data, but these require specialised bar code systems, software and printers - and support at retail.

The QR approach currently requires different QR codes for each crop, farmer and harvest, and this is costly and cumbersome. QR codes may be more appropriate as a consumer facing tool to inform them about the project, farmers and source of their high-quality vegetables.

The CommCare system for streamlining the acquisition and storage of the crop data required for traceability shows great promise, and will be evaluated in the current project.

Implications of policy and regulations on connecting livestock farmers to markets in isolated areas

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Keywords

socio-cultural influences, development intervention, cattle production, smallholders, Vietnam

Introduction

The north-west provinces of Vietnam are characterized by high altitudes, low levels of infrastructure, and low population densities with a diverse ethnic composition. Their socio-cultural characteristics strongly influence their lifestyle and production systems. Due in part to geographic and economic isolation, the north-west has suffered from slow development, and has the highest poverty incidence in the country. This is a real need for plausible interventions where behavioral changes of smallholders throughout local value chain development would be a critical foundation (Baulch, Chuyen, Haughton, & Haughton, 2007; Donovan, Franzel, Cunha, Gyau and Mithöfer, 2015; Wells-Dang, 2012). Thus, more studies on the dynamic of rural livelihoods, motives for farming and the relationship between socio-cultural factors and economic decisions (Firth, 1951), particularly, the nature of incentives that motivate production and marketing decisions of farmers (Emery and Flora, 2006; Harvey and Reed, 1996) are critical. In Vietnam, however, little literature has reported the

Theme 3: Safe food value chain

practices and implications of integrating socio-cultural factors into value chain development interventions, in particular with reference to the north-west highlands (see Friederichsen, 2004; Tugault-Lafleur and Turner, 2011; Turner, 2012; Wells-Dang, 2012). Studying local beef cattle value chains in such region, this paper is an attempt to fill this knowledge gap in order to support future policy design to increase market inclusiveness for smallholder farmers.

Research approach

A value chain approach (Kaplinsky and Morris, 2001) was employed in two study sites, Son La and Dien Bien provinces, in the North-west region of Vietnam. In addition to a baseline survey of 186 farmers in four selected communes, a series of group discussions and in-depth interviews were held with various chain actors (i.e. collectors, slaughterhouses, retailers, restaurants and consumers) in the region. A cost-benefit analysis was conducted with some farmer cases at the end year of the project to assess implemented interventions. The study also was concerned with smallholder farmers' behaviors that refer to their perception of values as it may relate to their culture (Harvey and Reed, 1996; Gasson, 1973). Different practices of farmers were analyzed in accordance with given approaches as assuming socio-cultural factors rather than economic incentives per se may take significant effect to local producers. Moreover, we applied an institutional approach within a value chain context (Kaplinsky and Morris, 2001) to explore the policy background where institutions are "rules of the game" and organizations are "players of the game" (Aoki, 2007; North, 1990).

Results

A local value chain in the north-west highlands often involves many smallholders from production to distribution and consumption due to its complex topography. In this context the domination of few middlemen in local value chains may result in agricultural and socio-economic disadvantages of small farmers because of market access and information disparities, hence, power asymmetry. Smallholder farmers, on the other hand, are the main producers in this region. However, their inactive involvement in value chains indicated by the infrequent sales of cattle may imply both economic and non-economic incentives; and although such reasons vary among ethnic groups in different locations, economic incentives play somewhat important role. Better understanding local value chains concerning socio-cultural aspects helped our project to

design sound technical and marketing intervention activities to improve the chain performance.

The results show that the cattle breeding activities conducted by farmers in the provinces are supported by local authorities through two different types of policies defined at the national level: (i) livestock development policies, and (ii) poverty reduction policies. Infrastructure policies also play an important role to support the cattle trade and the meat markets. The Provincial Department of Agriculture and Rural Development (DARD) with its offices and its operational decentralized services interacting with the provincial People Committee and provincial centers are in charge of the management of agriculture and livestock development policies. The study reveals two sets of institutions which are apparently useful for the development of local value chains. Firstly, institutions governing access to natural pastures seem to limit beef cattle commercialization. Secondly, contract farming may encourage cattle production and marketing, in the form of cattle confined to farmers by private entrepreneurs.

Discussion and conclusion

To develop cattle production in the remote areas, economic incentives play an important role in driving farmers' perception of cattle production. However, economic efficiency of practices needs to be demonstrated in trials involving key farmers in the community such as the village head. Villagers would be more accepting and trust on the motives for interventions and change their behavior by being engaged in the research and development process. Moreover, gathering people in interest groups also needs to incorporate a socio-cultural approach. Including village heads or good-practice farmers would help set up a broader group as well as an efficient organization for adoption and dissemination of knowledge within the community. Regarding vertical integration among farmers, slaughterhouses and retailers through networking and branding, it was very apparent that collaboration between researchers and practitioners is very important in developing a value chain.

There remains much potential for developing cattle production and markets in the North-west area of Vietnam. Diversifying cattle production within the smallholder farm system as well as introducing sound interventions using a socio-cultural approach should be considered as key tasks of policy-makers to improve the economic efficiency of cattle production and upgrade the whole cattle value chain based on local market development.

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Interprovincial trade opportunities for indigenous & conventional vegetables from Lao Cai

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Introduction

Lao Cai's competitive advantage in vegetable production and trade is not constant over time due to seasonal climate variations. This is also the case for vegetable production in all of the provinces in north-west Vietnam. To capitalise on these shifting seasonal advantages, value chains must be able to operate efficiently and link production to markets.

In this study, we examinethe geography of vegetable trade in the north-west of Vietnam. The objective of the study is to understand trade between wholesale markets in the north-west of Vietnam, and to identify potential opportunities for Lao Cai's producers and traders to expand. The research questions posed in the study are as follows:

(1) What are the interprovincial trade flows of vegetables to:

a. markets in the north-west of Vietnam

b. markets inthe Red River Delta

(2) What kind of traders are taking advantage of interprovincial trade opportunities?

Research Approach

The analysis in this study includes four key vegetables as they are representative case studies of the trade of conventional less perishable vegetables and higher value perishable vegetables. The products chosen in these categories are:

Conventional less perishable vegetables:

(1) Cabbage

(2) Chayote[1]

High-value perishable vegetables:

[1] Chayote here refers to the fruit rather than the stems of the chayote plant.

(3) H'mong Mustard green

(4) Broccoli

Primary data was gathered in the main wholesale and retail wet-markets in four provinces in Northwest Vietnam: Large Markets in Son La and Lao Cai, and Smaller Markets in Dien Bien and Yen Bai.

114 Structured interviews of traders were undertaken in these markets, interviews were split into both summer and winter seasons to explore seasonal variations in trade. Interview questions focused primarily on information regarding destination of products and volume of trade.

Results

First, our assessment of the trade volumes shows that the volume of product flowing through each of the wholesale markets varied substantially across provinces (Figure 1). The wholesale market in Son La, with a volume of trade of 107 T/day, is an order of magnitude larger than the markets in Yen Bai and Dien Bien.

Second, wholesale markets are not the logistics hubs that were initially hypothesised. The majority of interprovincial trade bypasses the wholesale market and is conducted primarily by a small set of large collectors (interprovincial traders) who aggregate product from farmers and transport product out of the province to sell into another market (Figure 2).

In addition, the patterns of interprovincial vegetable trade varied substantially across commodities and provinces.

Discussion and Conclusion

For conventional vegetables (cabbages and chayote):

The share of Son La's interprovincial trade is relatively stable for cabbage and chayote. About 25–35% of cabbages and 60–70% of chayote from Son La's marketed share are sent to the Red River Delta all year round. Son La is the dominant producer in the Northwest and many of the interprovincial traders appear to be operating under long-standing and seasonally stable trade relationships with buyers in Hanoi.

Lao Cai is taking advantage of the seasonal opportunities for trade in chayote in North-west Vietnam by supplying to markets in the region at key times. Lao Cai is able to supply Yen Bai and Dien Bien when prices soar, while Son La, the dominant producer in the region, does not trade much within the region.

There is very limited interprovincial trade of cabbages between the north-west provinces, but there is constant competition from Chinese cabbage imports nearly all year round.

For the higher-value more perishable vegetables (H'mong Mustard greenand broccoli):
A large share of H'mong Mustard green from the wholesale market is traded inter-provincially and these trade shares are stable across seasons. About 30–40% the wholesale trade of H'mong Mustard green from Son La and 10–20% from Lao Cai is destined for Hanoi. While H'mong Mustard green is still predominantly grown for home consumption, much of the marketed share is traded interprovincially to consumers in Hanoi. H'mong Mustard green in Dien Bien and Yen Bai markets do not leave the province. A small but substantial share of the wholesale trade of broccoli (15-25%) from Lao Cai and Son La ends up in Hanoi's markets during the on-season period. However, Chinese imports completely dominate the Hanoi market off-season.

Figure 1: Wholesale market vegetable throughput

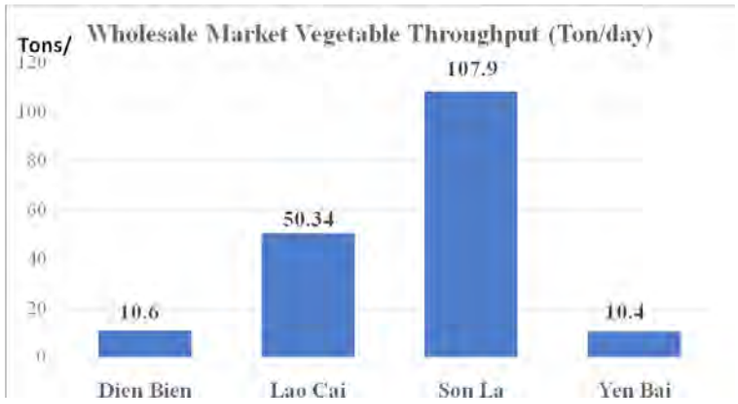
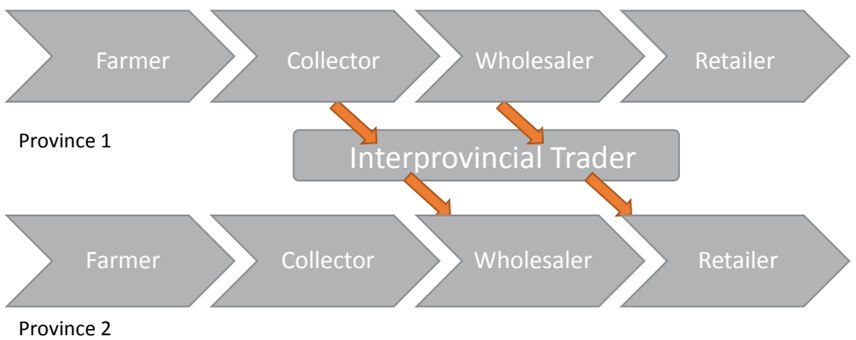


Figure 2: Interprovincial vegetable trade



Smallholder participation in vegetable value-chains in Lao Cai province

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Introduction

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.

The main research questions we look to answer are:
1. What is the structure of key smallholder inclusive horticulture value-chains in Northwest Vietnam?
2. What are the main opportunities realized by each respective chain?
3. What are the constraints to development of each chain?

This study identified examples of smallholder inclusive horticulture value-chains and examined the advantages and disadvantages of each value-chain.

Methods

Nine Focus Group Discussions (FGD) and follow-up in-depth interviews with individual value-chain actors were conducted on vegetable value-chains in Sapa and Bac Ha districts of Lao Cai, Vietnam in July and August of 2017. A discussion guide and note-taking template were used to streamline and standardize data collection, with the discussion designed to revolve around the following topics:

- development of marketing models for vegetables
- general context and structure of the production and trading system utilized by cooperatives, farmer groups, and traders
- constraints facing producers and traders
- development ambitions and plans for future expansion

Results

Smallholder inclusive chains were classified into three broad types based primarily on the method of coordination and access to markets. The three types identified are:

Traditional wet-market coordinated chains:
The survey found that this is the dominant chain used by smallholder vegetable producers in Lao Cai. Products are produced and transported by farmers to wet-markets where they are sold using spot-market arrangements. Prices are not known until arrival at the market, and farmers simply accept the prevailing price of the day. This results in over-supply during peak production season and under-supply during the off-season.

Advanced collector coordinated chains:
In this chain, a marketing intermediary (typically a collector) coordinates transactions between a small network of 20-30 producers and high-end buyers in Lao Cai. The collector develops preferred supplier relationships with restaurants, retailers, and institutions (schools & hospitals) that establish price premiums for quality and a production schedule to work around. Although the producers in the chain produce high quality and safe produce, this chain cannot supply to 'premium markets' in Hanoi because they are not certified. Farmers in this chain are dispersed across multiple districts making formal certification nearly impossible.

Cooperatives:
Cooperatives are similar to 'advanced collector coordinated chains' in that they can coordinate with producers to provide price premiums for quality. Cooperatives take it one step further by facilitating group-level certification for 'safe' vegetables. This allows them access to premium markets in distant high-end markets in Hanoi to earn higher prices.

Conclusions

In general, the dominant marketing system is unable to reward safe vegetable production 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 behaviour because farms are not fully commercial. This is demonstrated in clear over-supply behaviour during the winter and under-supply during summer.

Cooperatives and collector coordinated chains are examples of successful value-chain development. These models have the ability to coordinate with farmers to produce the most profitable commodities to be harvested when prices are peaking. They have found a way to service higher-end markets locally, and to Hanoi to a lesser extent.

Agrarian transition and social differentiation with a boom crop of cassava: A case study in Son La and Dak Lak

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Keywords

agrarian change, cash crops, smallholders, gender relations, Southeast Asia

Introduction

Cassava was once a major boom commodity in Vietnam. However in recent years, smallholder farmers have been facing serious challenges such as soil erosion and declining fertility, unstable prices, and emerging pests and disease. This raises three questions which we explore in this study: 1) how differently do farmers experience cassava production? 2) how and to what extent do men and women farmers negotiate with, and obtain information and support from, value-chain actors? 3) how do gender norms and relations influence household decisions on the deployment of family labour? This study seeks to contribute to the knowledge of boom cash crops for smallholders and to identify appropriate support for those who are in socially and geographically disadvantaged positions.

Research approach

This study builds on current literature on political ecology and agrarian transformation in Southeast Asia, in particular, the impacts of boom crops on smallholders and subsequent social differentiations (Akram-Lodhi, 2005; Hall, 2011; To et al., 2016; Cramb et al., 2017). It views smallholders' adaptation to agrarian change as a complex process embedded in gendered social norms and relationships (Nightingale, 2006 and 20011; Elmhirst, 2011) and sees social relations as a source of power to access resources (Ribot and Peluso, 2003; Lyon, 2000).

The fieldwork for this study was complementary to the other standard methods used in the on-going ACIAR project such as village focus group discussions, key informant interviews and large-scale household surveys. In-depth interviews with 55 men and 55 women from different households were conducted over a 5-week period in selected cassava villages in Son La (North West) and Dak Lak (Central Highlands) provinces of Vietnam. Ethnic groups interviewed include Thai, Xinh-Mun, Kho Mu and Ede.

Results

First, the response to the on-going challenges in growing cassava differ significantly among the ethnic groups and between the poor and better-off. The households with more access to financial resources have changed to producing other commodities such as coffee, cashews and pepper, or expanded cassava production to larger-scale and more intensive production systems. On the other hand, the poor continue to grow cassava even though prices and productivity have declined making the profit very small. For these farmers, cassava is attractive because compared to other cash crops, it requires fewer investments to produce a crop. Therefore they do not invest in new planting materials and fertilizers that may maximise their expected economic return.

Second, as off-farm and non-farm opportunities are increasing, the economic returns per unit labour is an important factor in household decisions on livelihoods and investment. In this process, gendered norms and relations are central. For example, Thai women in Son La are well educated, speak Vietnamese and ride motorbikes. However, the norms for women, such as restricted mobility, limit their off-farm and non-farm activities, while men may take occasional or seasonal work in the vicinity of the village. In this context, cassava is a very important source of income but labour and financial inputs are necessarily very limited. On the other hand, in the matrilineal Ede villages in Dak Lak, women's mobility and autonomy are high. Like the men, they have the option to work on coffee plantations outside their province. In this context, some households grow cassava with minimum input or choose to abandon their own cassava farm and sell/rent it to wealthy outsider investors. Regardless of men's absence or involvement in cassava farming, husbands tend to be the primary interactors with collectors or shopkeepers, while women tend to gain information and learn new practices from female relatives and friends.

Third, many ethnic minority men tend to perceive debt negatively and

avoid risk-taking. They prefer informal arrangements of debt with the cassava collectors or shopkeepers as they can share the risks with them. For the Thai, Xinh-Mun and Kho Mu in Son La, the support and information they receive from these local collectors and shopkeepers play an important role in men's decisions and strategies for crop choices and investment, while for the Ede in Dak Lak, both men's and women's family networks play significant roles in crop choices and options for alternative livelihoods.

Discussion and conclusion

These findings have implications for designing interventions for more sustainable cassava production and value-chains. Firstly, if sustainable farming requires higher labour and financial investments, it is less likely to be adopted by ethnic minorities, as it does not fit with their strategies, producing low economic returns per unit labour relative to other available livelihood activities. Secondly, while linking farmers to global markets with fewer actors is often seen as an ideal of many development projects, one reason why cassava is attractive for the ethnic minority farmers is that value-chain actors can share risks and offer credit. Remote and marginal men and women farmers need someone in the value chain who can offer trustworthy information as well as credit. Understanding these relationships and incentives for collectors and shopkeepers is important so that farmers can better manage production and marketing risks within their gendered norms and decisions. Providing information into these existing networks can help to scale technologies aimed at improving agricultural productivity and livelihoods.

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Theme 4: Inclusive and prosperous communities

Horticultural crops asdrivers of profitable smallholder farming

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Keywords

Moc Chau, plums, safe vegetables, farmer group

Introduction

Moc Chau district of Son La province is a plateau with an elevation of 1,050 m and temperate climate suitable for cultivation of low to medium chill temperate fruit and temperate vegetables during the summer months. This presents aunique opportunity for farmers to develop fruit and vegetable production and diversify farming systems that have been dominated by maize production since the 1990s. However, these opportunities remained unrealised until 2010 when two separate ACIAR agribusiness projects, one focusing on plum and other on counter-seasonal vegetable production, were initiated to research possibilities to capitalise on these opportunities and develop a new model for market driven horticultural production. Both projects are currently in their second phase and their main findings are presented below.

Research approach

Both projects adopted a value chain approach and have engaged directly with variety of stakeholders from farmers and local collectors to large scale traders and modern retailers. The projects conducted adaptive research to address production constraints and facilitated the formation of farmer groups in conjunction with local authorities.

Plum production is on a much larger scale (16 to 18 thousand tons per annum) than vegetables. Therefore, production and marketing models are being developed for export of unripened plums for processing in China,

Theme 4: Inclusive and prosperous communities

and for the sale of ripe plums in both traditional and modern markets. The project particularly focused on development of a high quality plum value chain for safe food shops and supermarkets in Hanoi.

As the production of temperate vegetables during summer was in a rudimentary stage at the beginning of the project, the project team focused mainly on supporting farmer groups to supply the modern retail segment and the development and implementation of best production, postharvest and marketing practices. Safe vegetable and VietGAP standards were used to guide production.

Results

At the beginning of the temperate fruit project AGB/2008/002 in 2009, the price of ripe plums was around 2000-3000 VND/kg, which was only marginally higher than the price for unripe plums exported to China for processing. This resulted in many farmers selling most of their crop unripe. As the export volume to China increased over the next few years (for both ripe and unripe plums), the supply reaching Hanoi markets was reduced and the price of ripe plums started to improve, stimulating farmer interest in plum production. In cooperation with the French-funded ASODIA project, project AGB/2008/002 supported the formation of farmer groups and worked on improvement of orchard and canopy management practices to improve overall fruit quality. At the same time, the graded plum value chain from several prime production areas in Moc Chau (Ban On, Ta Long, Co Do and Pa Khen villages) to safe-food shops and supermarkets in Hanoi was developed. Ungraded plums also started to be delivered to southern markets in large quantity. Farmers growing plums in prime production areas are now earning high and stable incomes by selling ungraded ripe plums through traditional chains to Hanoi, Red River Delta, Southern Vietnam and China (Figure 1). The yield fluctuation in the figure reflects the biannual bearing characteristic of Tam Hoa plum. It should be noticed that price in a year with high yield remains stable, mainly due to increase of exports to China in high fruit bearing years.

Farmers obtained 30-100% premiums for graded ripened plums to supply modern retail chains in comparison to ungraded plums sold through traditional markets. The higher premium occurred in the middle of the main season, when the plum price was generally low. Farmers' satisfaction with the premium obtained correlates with the amount of additional labour they need to invest in selective harvesting, which in turn correlates with the uniformity of the crop. Farmers that apply good canopy management

and have orchards with a favourable aspect are more likely to be satisfied with their engagement with modern retailers.

Over the course of the project, the supply of plums from project farmer groups to some of leading modern retailers grew from 3t in 2011 to 41.8t in 2017, however, this still represents less than 1% of Moc Chau harvest.

Farmers involved in the vegetable project have significantly increased their net income by supplying high-quality, 'accredited safe' vegetables to retail stores and urban consumers in Hanoi. In 2015, one project farmer group in Tu Nhien village recorded an average net income of 300 million dong per ha, 150% higher than incomes from vegetables of non-participating farmers.

In 2016, 87 project farmers - 71% of them women and 10% from the ethnic Muong, Thai and Hmong minority - produced about 690 t of accredited-safe vegetables in the Moc Chau villages of Tu Nhien, Ta Niet, An Thai and Van Ho. The data from one experienced farmer indicate that the safe summer grown temperate vegetable represent sustainable source of income for farmer (Figure 2).

The production volume of accredited-safe vegetables from Moc Chau grew at an average of 45% per year (from 2013 to 2016), and the area of safe, summer grown temperate vegetables has increased from 4 ha in 2012 to 30 ha in 2016. Farmers participating in safe vegetable supply chains substantially increased their income to a level of 70-150 millionVND/ha/year.

In Van Ho district, an ethnic Hmong farmer has recorded a net income from vegetables of 116 million VND (A$6,500)/ha/year, an increase of 480% on the 20 million dong (A$1,100) per ha from rice cultivation.

A current ACIAR project (AGB/2014/035) is working with new farmer groups to develop a model for scaling out to capture larger market share of around 1 million tons of vegetables consumed in Hanoi per year. The model includes equitable farmer group governance and embraces both public and private sector partners.

Discussion and conclusion

Data suggests that diversifying production with the addition of fruit and vegetables presents opportunities to increase smallholders' income. Alternative land uses, such as growing maize or rice, return a net income to the farmer of about 10 million VND (A$560)/ha/year, about 10% of

the income they could make from producing accredited-safe vegetables. Plum and potentially persimmon, pear and peach can replace maize on gentle slopes, while vegetables can be grown in flat areas with access to water. Tam Hoa plum enjoys a strong position in the domestic market due to seasonality (2-3 weeks before Chinese plums enter the market). Other fruit have to compete with Chinese imports. Similarly, temperate vegetables have to compete with Chinese imports, hence superior quality and credible safe production certification will provide a valuable competitive advantage.

Figure 1: Plum volume per ha and revenue per ha of a typical grower in Ta Long village – Moc Chau district

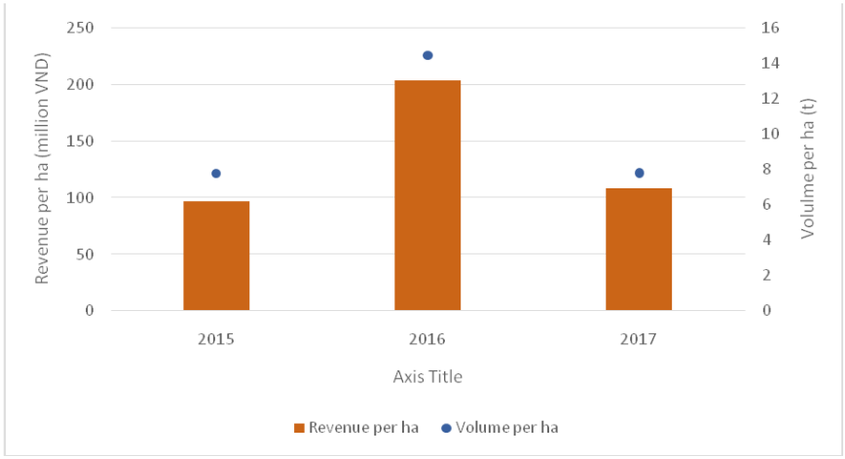
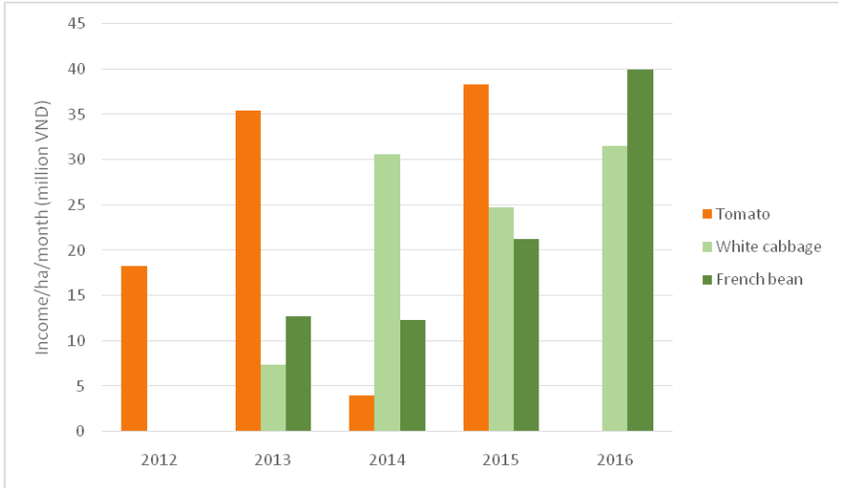


Figure 2: Average income/ha/month of an experienced farmer in TuNhien cooperative obtained from summer grown temperate vegetables



Integrating livestock production with crop systems in the North West highlands: Challenges and opportunities

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Keywords
livestock, beef,maize, pigs, cropping systems, land competition

Introduction

The North West region of Vietnam is a complex topography of steep hills and river valleys that feed into the Red River delta, and is one of the poorest and most remote regions in the country (Huyen et al., 2016). Due to its remoteness and limited infrastructure the region is less urbanised than other parts of Vietnam, with 80% of households deriving their income from agriculture and forestry (Tran et al. 2014). Increasing livestock production requires an increase in feed/forage supply, which in turn requires available arable land. This raises a land use issue in that any proposed expansion of livestock production that also involves an increase in forage production will resultin direct competition for land resources with annual food and cash crops, except for multi-purpose crops such as sweet potatoes.

Recent expansion of maize and other annual crop production areas on steep sloping land has increased soil erosion and reduced access to previously available land for free grazing and cut and carry forage for livestock. This is ultimately putting pressure on the environmental sustainability of the smallholder farming system. Three new projects are being established in the Northwest highlands; LPS/2015/037, “Intensification of beef cattle production in upland cropping systems in Northwest Vietnam”; SMCN/2014/049, “Improving maize-based farming systems on sloping lands in Vietnam and Lao PDR”; while a Pig-Maize project is in the pipeline, aiming at strengthening pig-maize systems for improved livelihoods.

Integrating activities and outcomes from these three projects will enable smallholder farmers to make well informed decisions relative to their respective farming system.

Research approach

The beef project will use a whole farm approach to enable farmers to integrate forage production with food and cash crops, and develop a year-round feed supply that supports more intensive beef production systems. This will be achieved by combining and integrating the research outputs of previous projects and undertaking participatory on-farm and community-based research supported by researchers and DARD extension staff. Livelihood analysis, appreciative enquiry and participatory impact pathway analysis will be used to identify resources, motivations, strategies, enablers and barriers to sustainable change in smallholder cattle production. Local and district working groupsof value chain stakeholders with a high interest in livestock development will be established to facilitate and drive the transition to more intensive production systems. These coalitions will also link with existing and new farmer interest groups and foster equitable knowledge exchange. A value chain management approach will be adopted to help farmers and traders understand market demands and facilitate strong linkages between all actors and the market. It will do this through identifying and characterising urban markets, developing and implementing an improved marketing model based on improved communication and more effective and efficient marketing practices, and by equipping farmers and traders to respond to market changes.

The maize project is specifically focussed on sustainable maize production systems on steep slopes in Son La province, Vietnam and in Houaphan province in north east Lao PDR. The project encompasses a range of strategies including integrating complimentary crops and livestock and developing outreach models for use by local extension authorities. The project will also include value chain analysis of identified profitable commodities to integrate into maize based systems with an emphasis on farmer led approaches to increase adoption.

The pig-maize project, currently in development, will aim at improving pig farmers’ livelihoods by identifying and testing interventions at different nodes along the value chain. Pig raising can offer significant opportunities for improved livelihoods for many households in north-west Vietnam. The first step would be to assess the demand for different types of pigs, including pigs raised under ‘natural conditions’ (with limited industrial

feeds). Based on the results of the assessment, the project will identify and test mechanisms- focusing on feeding- to improve indigenous and cross-bred pig production to match varying and differentiated market demand and to fit opportunities and constraints of various farming systems. This will include looking at alternative farm-produced feeds, for example forage legumes, which may complement maize, both for more sustainable feed production and more balanced diets. For these systems to impact household income through better market integration, new institutional arrangements to link pig farmers to markets will be required, both for inputs and services including extension, as well as for output markets. Because the strategies for improving market access, which have been successful in other locations, show various constraints, new strategies will be explored. A possible combination of a 'preferred trader' system linked to a specialty outlet in provincial and regional towns, organized around producer groups, appears to be worthwhile for investigation. Finally, to show that traditionally raised pigs can also provide safe pork, linkages to SafePORK are foreseen.

Discussion and conclusion

The anticipated outcomes of the beef project include profitable cattle feeding systems, integrated with cropping and improved environmental sustainability as farmers transition to a more intensive, market-oriented beef production system; improved gender equity and reallocation of farming tasks, with time available for non-farming activities for women and children; increased market access and understanding of market demand and opportunities by farmers and traders resulting in more market-oriented production and cash income from beef cattle production; and increased capacity of local DARD and government that maintains a regulatory and political environment conducive to continual market improvement.

The maize project will complement the beef project by developing a range of profitable farm system options that are well supported and resourced by local government and private providers, with an ultimate focus of enabling scaling up and out.

The planned outcomes for the pig-maize project include understanding the place and role of small-holder pig farming in NW provinces and of the associated value chains; increased understanding of maize and alternative

feed options to make the sector more efficient and environmentally sustainable, and targeting government, value chains actors and other stakeholders by presenting them with evidence on new options (business models) to make pig farming more profitable, socially and environmentally sustainable.

In conclusion, integrating livestock with cash crops for productive farming systems in the NorthWest region requires an integrated research approach from ACIAR and other donor supported projects. Engagement of farmers and other stakeholderswith the three projects is imperative for the success of this research, and profitability of smallholder farmers in the North West region of Vietnam.

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ICRAF's experts training for a H'Mong community on crafting and pruning Sơn tra trees. Photo: Tran Ha My

Poster Abstracts

Partnership and information flow among stakeholders in cassava value chain in Dak Lak province

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Introduction

Dak Lak is one of the biggest cassava producing provinces in Vietnam. The province's cassava growing area has been increasing rapidly over the last few years.

There are many stakeholders, including farmers, small collectors, investors, cassava firms, local authorities and supporters, involved in the cassava value chain. The information flow, and especially the quality of the information shared among the stakeholders, has an impact on the partnerships between them and consequently influences value chain development and sustainability.

This research investigates the partnership and information flow among the stakeholders in the cassava value chain in Dak Lak and the impact on cassava industry development.

Research approach

The districts of Krongbong and Eakar were selected as the research sites. They both are remote and have large cassava production areas in deforested and poor lands.

The study uses the methods of PRA and RRA with random sample.
In RRA (Rapid Rural Appraisals) observers conduct informal interviews with local people, assessing rural issues from the perspective of the local informants. The advantages of RRA are that information can be gathered rapidly.

Key disadvantages of RRA include that if the staff does not have good evaluation skills, the information gathered is often not very accurate. In addition, the conclusions and solutions only reflect the views of people inside the community, restricting the flow of outside information and ideas. This can limit the effectiveness of subsequent project implementation.

PRA (Participatory Rural Appraisal) helps people living in the community to understand more about the environment in which they live by guiding them to identify problems, find the causes of those difficulties and develop solutions and implement solutions to overcome the difficulties.

Local stakeholders are encouraged to participate through sharing knowledge, information, methods and experiences. Researchers play the role of facilitators to learn from people using their local people's indicators and assessments. Researchers are able to understand and evaluate local knowledge in the context of external ideas and information.

Results

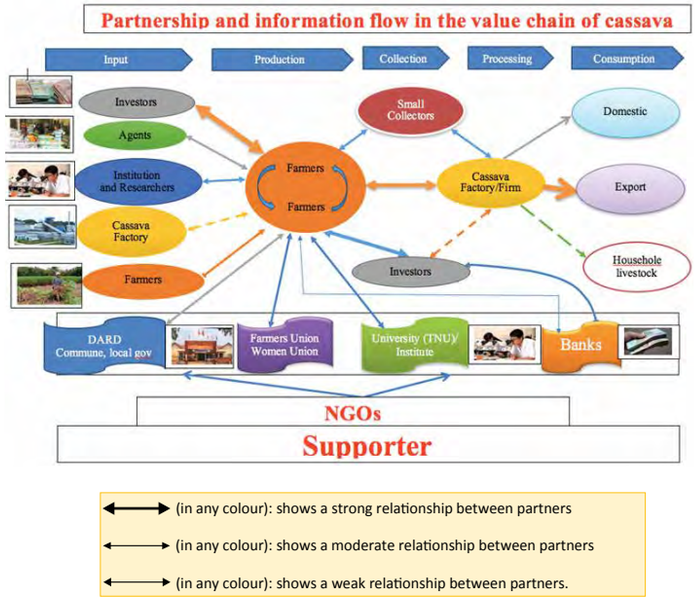

Figure 1: Partnerships and Information Flow

The partnership among farmers in a village/commune is strong in both districts. Vietnamese living in rural areas have a very high community spirit. NGOs contact wit h farmers through the university and local authorities. They have moderate relationship and good collaboration. They often hold conferences for farmers about new variety of seeds and plantation techniques, etc.

However there are some differences in the level of relationship among partners between Eakar and Krongbong.

Farmers - cassava firms: In Eakar, farmers rarely sell their cassava products to the cassava firm, and hence have weak partnership with the cassava factory because they do not communicate much. In contrast, most farmers in Krongbong sell their cassava roots directly to the Krongbong cassava factory.

Farmers - Investors: In Eakar, farmers mainly sell their cassava products to investors. They strongly believe that investors will buy their cassava products and also support them if they are in difficulty.

In Krongbong, there are just a few farmers receiving the investment from investors. The operation of investors here is extremely weak.

Discussion and conclusion

Stakeholders in Dak Lak include farmers, small collectors, investors, cassava firms, agents and supporters including NGOs, institutions, researchers, banks and the local government.

In Eakar, farmers and cassava firms have a weak relationship and poor information flow. In contrast, the relationship between farmers and investors is very strong. Farmers within a village or commune are also closely attached. Farmers usually communicate information relating to cassava plantation technologies and diseases, and exchange new or good seeds with one another.

In Krongbong, the situation is different; the partnership and information flow among value chain actors is better than in Eakar. The level of trust between farmers, and between farmers and the Krongbong starch factory as well NGOs and local governments are quite good. This is mostly because cassava farmers in Krongbong have been raw material suppliers to the Krongbong starch factory for a long time.

Yields of cassava have started levelling off due to soil fertility decline and the use of relatively low yielding varieties. Adoption of new improved varieties and improved cultivation techniques would improve both the root yield and quality of cassava. Adoption speed and depth would be enhanced by good partnerships and information exchange among stakeholders. The identification of these partnerships and their strength will be valuable for developing channels to support the future development of the cassava industry in Dak Lak.

Incentives for involvement of private sector in technologies dissemination for developing value-chain linkages to improve smallholder cassava production in Southeast Asia: the case of the Son La cassava value-chain

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Keywords

Value Chain Analysis, technology transfer, private sector, adoption of new technology

Introduction

The recent boom in global markets for cassava has created livelihood opportunities for many smallholders in Southeast Asia. Research has generated an abundance of technologies that could enhance the productivity and sustainability of these cassava producers. Many of these have been developed with farmers using participatory evaluation methods. The challenge has been disseminating these technologies beyond a projects sphere of influence.

Although national government policies have prioritised the dissemination of many of these technologies, adoption levels have remained low. We hypothesise that, in particular contexts, private-sector value-chain actors have incentives to invest in the promotion of suitable varieties, fertiliser regimes, pest control, and other production practices. In other contexts, there is little incentive for private-sector involvement, and support from public-sector or non-government actors will be required.

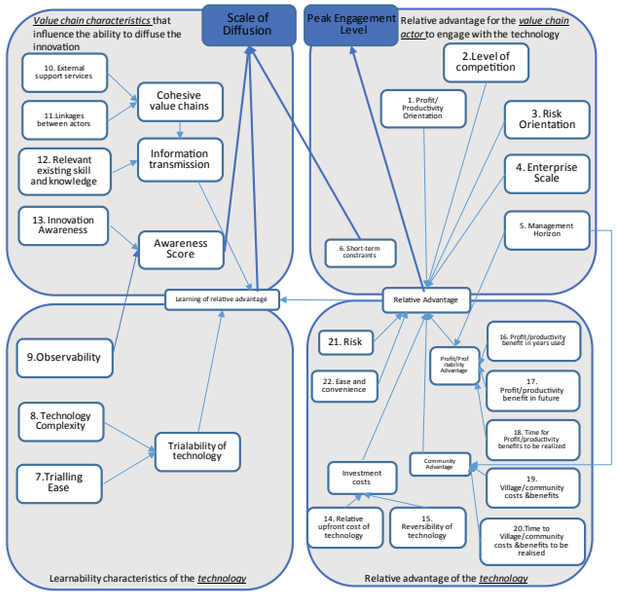
We present a framework to analyse the incentives for private value-chain actors to invest in the dissemination of different technologies and expand

this framework to include factors influencing subsequent adoption of technologies by farmers. We then test this framework through an analysis of the value chain linking smallholder cassava producers in Son La with starch factories and dried chip processors.

Research approach

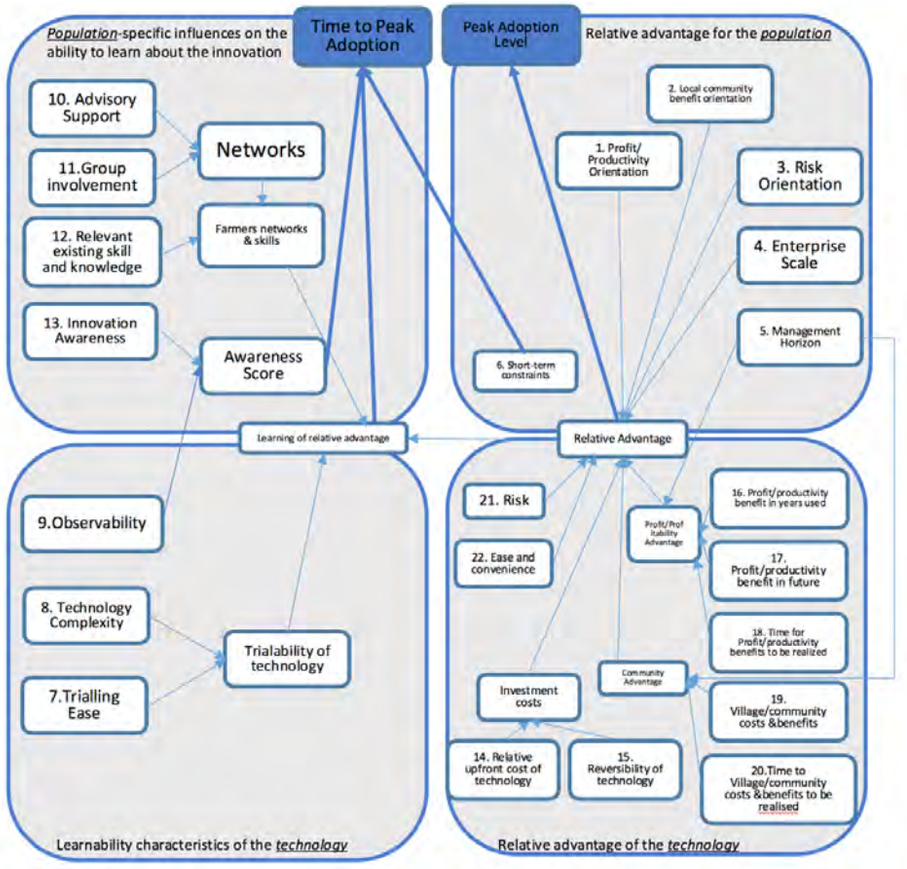
There has been considerable research into the factors that influence the adoption of agricultural technologies and innovations (Klerkx, van Mierlo et al. 2012). The following framework builds on this literature and the Smallholder ADOPT framework (Brown 2016) to analyse the incentives for private value-chain actors to invest in the promotion of different technologies, taking into account (1) the characteristics of the technology, (2) the nature of the production system, and (3) the features of the value chain, including the ability of agribusiness actors to capture the benefits of any investment in technology dissemination.

The peak level of engagement of a value chain actor with a technology is influenced by the variables and sub-variables in the right hand two quadrants (Relative advantage of the technology and relative advantage for the value chain actor to engage with the technology). The scale of diffusion is influenced by the variables and sub-variables in the two left hand quadrants (learnability characteristics of the technology and characteristics of the value chain that influence the ability to diffuse the technology).



Diffusion and Engagement Frame

Once a technology is diffused to smallholders, the peak adoption level of a technology by farmers is dependent on the relative inherent advantage of the technology and the relative advantage for the community to engage with the technology. The time to peak adoption is influenced by the learnability characteristics of the technology and population specific influences on learnability.



Adoption Frame

We test this framework for the potential diffusion and adoption of a set of different technologies through the cassava value chain in Son La.

Results

Learnability characteristics impacting on diffusion and adoption in Son La include the fact that the government extension system is not specifically oriented towards cassava, there are not many farmer-led groups and there is a medium level of awareness of problems/potential interventions.

Relative advantage characteristics observed in Son La were increasing market orientation, small scale production, high risk aversion and medium community benefit orientation.

Two main technology types were prioritised by stakeholders for introduction through the Son La value chain:
Improved varieties specifically bred for desirable characteristics including increased root production, high starch content of roots, drought resistance, pest and disease resistance. The main entry point/partner for an intervention introducing improved varieties in the cassava value chain in Son La could be the Mai Son Starch Factory.
Fertility Management - The main entry point/partner for an intervention introducing more effective fertiliser treatments in the cassava value chain in Son La could be fertiliser production companies active in Son La and their associated networks of agricultural input supply shops.

Discussion and conclusion

The technology characteristics of new varieties and the community characteristics in Son La mean that the potential peak adoption level of new varieties by farmers in Son La is relatively high.

There is a significant incentive for the starch factory to promote higher yielding varieties leading to higher raw material supply in order to more effectively use their processing capacity. However, they lack strong long-term links though the value chain. Larger traders supplying the factory have strong upstream links in the value chain back to farmers, but have little incentive to promote higher yielding varieties. Individual traders lack the ability to exclude other traders from capturing the benefits of their investment.

In order to facilitate engagement of traders and widespread dissemination of varieties, larger scale traders and associated small traders at commune level need to be incentivised to participate. Incentives could include subsidising the sale of stakes to larger traders and supporting large traders and commune level traders to multiply planting material for sale to farmers. Initial technical support could come from the project, but financial support for subsidising planting material should come from the factory. Given the factory is currently the only large processor in the Province it has a high level of exclusivity to the benefit it generates and only needs to compete with the dry chip market.

There is a significant profit incentive for fertiliser companies to promote the widespread dissemination and adoption of fertiliser as cassava producers in Son La use relatively small quantities of fertiliser and many lack knowledge of appropriate formulations and application rates. The linkages of fertiliser companies to farmers are strong due to their distribution networks through input supply shops down to the local level. There is less incentive for the starch factory to support farmers given that the benefits may be more long-term and risk of farmers using on non-cassava activities.

While the engagement and dissemination incentives are high, the potential level of adoption of fertiliser is currently low due to the non-availability of appropriate formulations of fertiliser for cassava production. One of the key investments in facilitation of the adoption of fertiliser for cassava production will be working together with fertiliser companies to develop appropriate formulations based on trial results.

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Formal and informal beef and cattle trade in South East Asia and China: Implications for the Vietnam beef industry

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Keywords

cattle, beef, beef industry, formal trade, informal trade, drivers of trade, smallholders

Introduction

Much of Southeast Asia and China has undergone sustained and rapid economic growth and urbanisation. The demand for beef has increased rapidly, as have prices. This has led to a significant increase in formal and informal trade in live cattle and beef across the region. As a result, opportunities for pro-poor rural development are created, including potential improvements to livelihoods of smallholder farmers and employment for other actors in the chain such as traders, transport operators, processors and retailers.

Localised industries have become increasingly integrated, and new value chains and cross-border trade flows have emerged. However, these changes are not clearly understood within or outside the region, and the potential benefits are constrained by several factors including trade policies, disease and sanitary risks, and the informal nature of the trade flows.

This study identifies beef and cattle trading patterns in the region, and presents some of the drivers behind regional cattle and beef trade. The study also explores the implications for beef industry development and rural development in Vietnam.

Theme 1: Regional markets and trade

Research approach

The project used a combination of methods including data collection and literature reviews, targeted fieldworks, consultations, and face to face meetings.

Production data (cattle numbers, turnoff, and beef/bovine meat production) were collected from the country sources of China and Southeast Asia countries including Cambodia, Laos, Vietnam, Thailand, Indonesia, Timor Leste, Myanmar and China, through a focal person in each country. The country data were revised where known to be over-reported (China, Indonesia, Myanmar, Laos) or under-reported (Cambodia, Timor Leste). Turnoff numbers were revised to discount for multiple sales before slaughter.

Field visits were conducted in Vietnam, Laos, Cambodia, Thailand, Myanmar, Indonesia and Timor Leste to collect primary data on formal and informal beef and cattle trade flows in the region.

The data was analysed and presented to key stakeholders including governmental officials, researchers and private sector via two workshops organised in Vietnam in 2015 and 2017.

Results

With increased incomes and urbanization, the consumption of beef in China and most of South East Asia has increased steadily since 2000. Annual increases in beef consumption between 2000 and 2014 have been particularly strong in Vietnam (4.9 percent increase) and China (0.8 percent in urban areas and 3.1 percent in rural areas).

Despite increases in beef consumption across the region, cattle numbers in production have remained relatively steady, except Indonesia and Myanmar. Over the same period there was a decline in bovine numbers in China. (Figure 1). Turnoff numbers (slaughter and exports) grew at 0.4%, while beef production increased at 1.5% per year for the region as a whole.

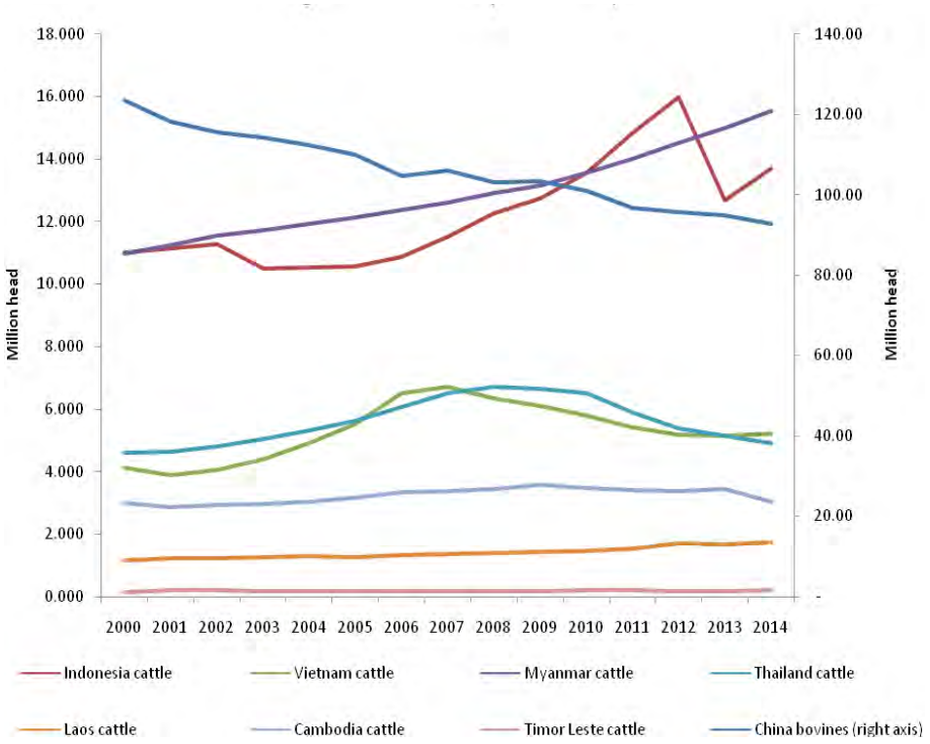

Figure 1: Cattle numbers (million head)

More rapid growth in beef consumption than production in most countries in the region has led to rapid increases in trade flows, both for cattle and beef products since 2011. The main live cattle and beef trade flows in the region are presented in Figure 2. Vietnam and China are the main markets for cattle movement. Most live cattle trade within Southeast Asian countries and between Vietnam and China has been informal in nature. The high incidence of informal trade in the region was due to traders trying to avoid trade policy restrictions between countries, particularly domestic health and food safety policies and import taxes.

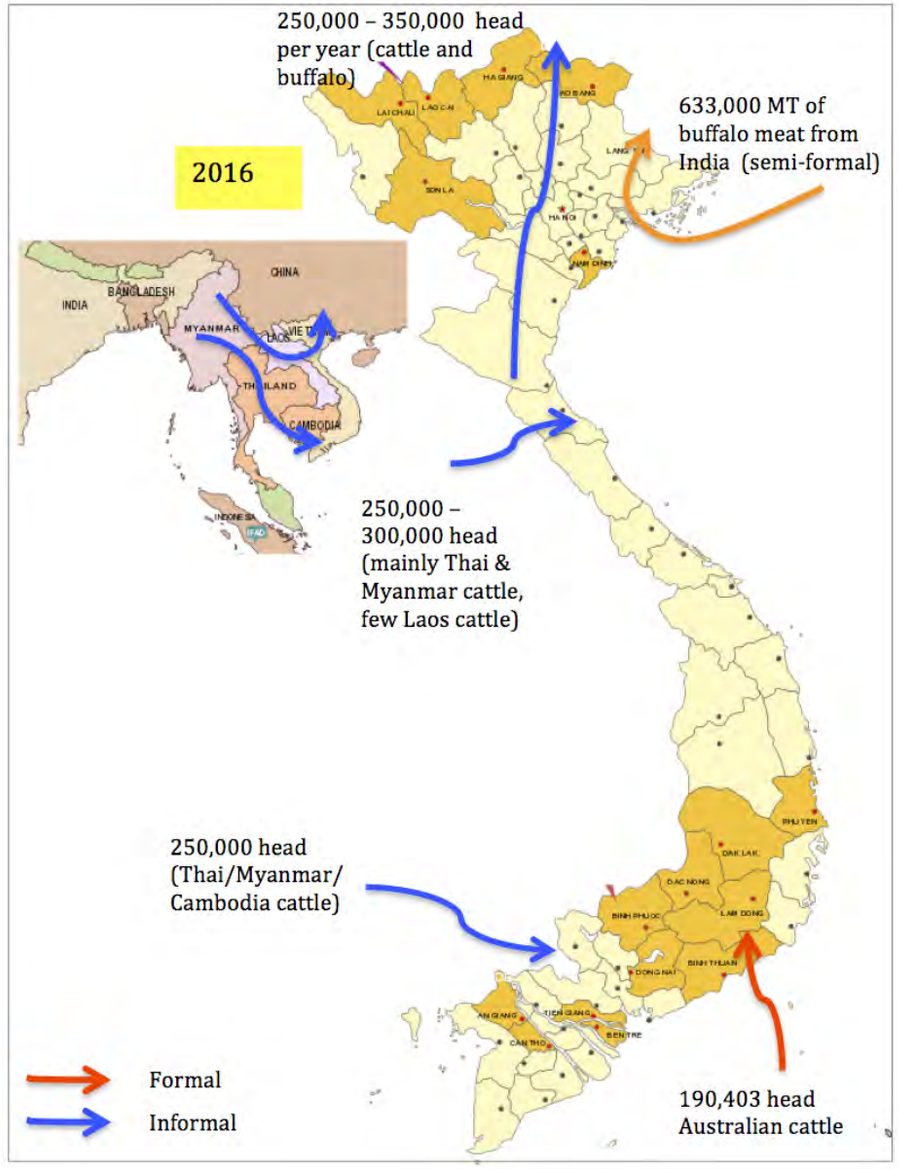

Figure 2: Formal and informal trade of live cattle and beef

Discussion and conclusion

Increased urbanisation and incomes in China, Vietnam and Thailand have led to significant increases in beef consumption and cattle prices in the Mekong region, and are driving factors for increasing formal and informal movements of live cattle across international borders.

The beef industry in Vietnam is almost entirely based on smallholder production, and this is expected to continue in the future. Regional

integration provides opportunities for smallholders in Vietnam in terms of increased opportunity to export to China, particularly in cattle fattening to generate higher prices for their cattle, and also opportunities for employment of other chain actors including traders, processers and retailers. However, increased commercialisation may be a threat to smallholders and could put downward pressure on prices from imports.

The informal nature of much of the trade also presents increased risks for smallholders and other actors in the value chains as changes in policy, changes in relative prices, inconsistent enforcement of phytosanitary standards or disease outbreaks can easily disrupt trade and have a negative impact on livelihoods.

There are many challenges to achieve sustainable development of the cattle and beef industry and to ensure that livelihoods of smallholders are not significantly adversely affected by regional integration and commercialisation. The government of Vietnam needs to assess different models for cattle development in the country, basing on comparative advantages to ensure sustainable development of the beef industry. In addition, there is a need to accurately predict the impact of policy changes and other changes of basic conditions on industry development and also on livelihoods of smallholders and other stakeholders involved in the cattle and beef sector.

Understanding goat market chains between Southeast Laos and Central Vietnam

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Keywords

goat production, value chain, agricultural marketing, agribusiness

Introduction

Goats are an important small ruminant animal for people in Laos and Vietnam traditionally. The number of goats raised in Vietnam and Laos have increased significantly since 2012 (Table 1 and Figure 3). A large portion of the goats raised in Laos south-east provinces is brought to Vietnam through the Lao Bao border gate. We are unaware of any previously published research on goat market value chains from Laos to Vietnam. This preliminary study under ACIAR small R&D activity 16-027 "Assessing goat production and marketing systems in Lao PDR and market linkages into Vietnam" investigated four issues: (i) the current level of, and trends in goat trading from Laos through Lao Bao border gate to central provinces of Vietnam, (ii) price premiums or discounts received for Laos goats in Vietnam, (iii) the reason behind any price premiums or discounts, and (iv) Vietnamese consumers' perceptions of Laos goats.

Year	Total (heads)	Consumption (heads)	Consumption (live, tons)
2012	1,250,506	706,886	16,467
2013	1,334,328	653,327	17,065
2014	1,600,275	672,467	18,057
2015	1,777,644	810,617	19,950
2016	2,021,003	791,252	21,142

Table 1: Goats raised in Vietnam

Figure 1: Laos goats being fattened in the Lao Bao region after crossing the border.

Research approach

Structured interviews were conducted in June 2017 with traders, slaughterhouse owners, villagers who raise goats, department of animal health officers and animal disease control officers in locations in central Vietnam including Lao Bao border gate, Quang Tri province and Hue City.

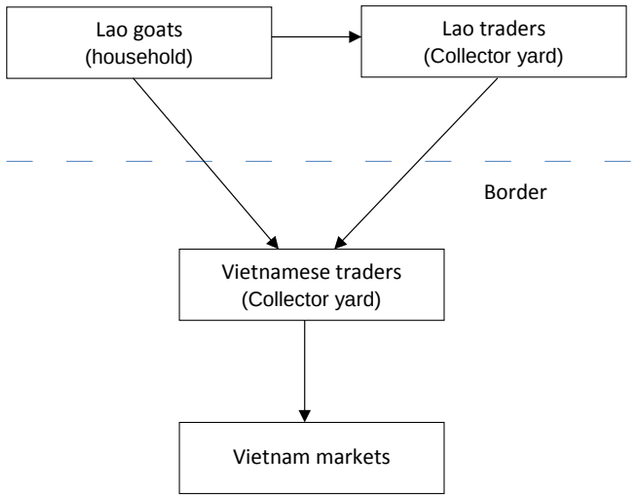

Figure 2: Market path of live goats from Laos

Results

Traders in Laos transfer goats to Vietnamese traders at the Lao Bao border crossing. Goats are then sold to middle men for fattening (figure 1) or direct sale to slaughterhouses. Meat is then sold to specialist goat restaurants and on to consumers in these restaurants.

We estimate the current number of goats imported from Laos through Lao Bao at 2400 per month including destined for Hue (1200), Quang Tri (600) and Quang Binh and further northern areas (600). This results in an annual estimate of approximately 30,000 per year which may include some Vietnamese goats from near the border. The vast majority of this trade is unofficial which is not documented and not through the border trade gate.

Laos mountain goats commanded a significant price premium in Vietnam. Both 'Laos' and 'mountain' (not cross-bred) are selling points. Laos male goats were priced at VND 135,000/kg between traders and slaughterhouse owners. Crossbreed goats (Bach Thao, Boer) are offered by traders to slaughterhouse owners at VND 80,000/kg or VND 60.000/kg in Hue and Lao Bao.

Some traditional dishes could be made only by using mountain goat meat. Cross breed goat meat is not of suitable quality to use to make those dishes. Vietnamese consumers in the region always look for dishes made from Laos mountain goats meat when they eat at goat restaurants.

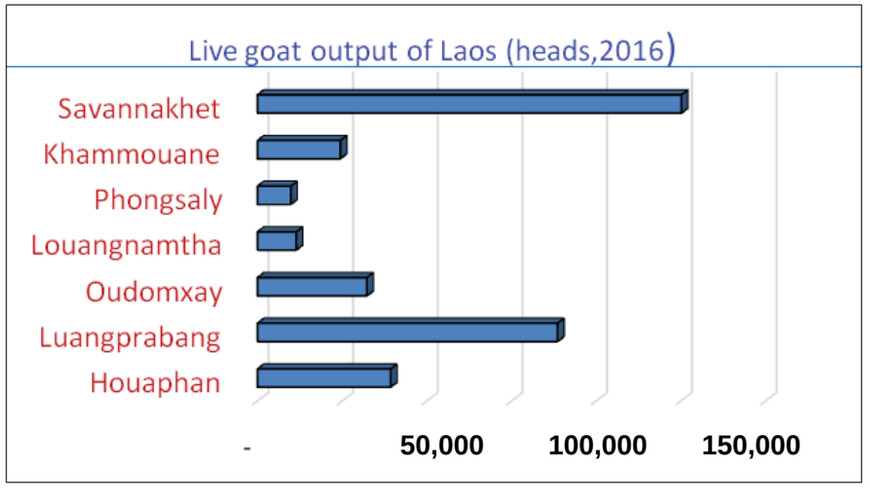

Figure 3: Goats raised in Laos, 2016

Discussion

Importation of Lao mountain goats through the Lao Bao border gate supplies only a very limited area in central of Vietnam: part of Hue, Quang Tri Province, Quang Binh Province, Ha Tinh Province. With improved supply from Laos, the areas supplied in Vietnam could expand into Da Nang and Nghe An provinces.

There was a significant price premium of approximately up to 45% for Lao goats in Vietnam. The basis of this premium appeared to involve perceptions of uncontaminated mountain rearing and excellent taste in the final product. More detailed studies are required to determine the size of the premium goat market in Vietnam and factors that might affect the price premium for Lao goats. It is hoped that this can be addressed in a future ACIAR project under development.

Goat production in Laos and market linkages into Vietnam

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Keywords

goat production, goat marketing, goat health, livestock production systems

Introduction

While there has been a worldwide increase in goat numbers and demand for their products, growth has been especially strong in Laos and Vietnam where numbers have tripled in Vietnam and increased in Laos by 60% between 2004 and 2014 (FAOSTAT, 2016). Current estimates are of 550,000 goats in Laos (DLF, 2017) and 2,021,000 in Vietnam (VNIAS, 2016). Goat enterprises are regarded as strong opportunities for farmers in these countries on the basis that a) market demand is strong, b) capital investment is low, c) diseases are few, d) they are adaptable to a wide range of feeds, and e) turn-off rate of kids is high. A significant proportion of Lao goats are exported to Vietnam where demand is strong and they command a significant price premium relative to lowland goats from Vietnam (Hoang *et al*., 2017). Goat production has formed a component of approximately 10 large international and national projects and many more small projects in Laos since the late 1990s (Hergenhan et al., 2017). The previous work has often been regionally localised within Laos and most projects had a wider livestock or agricultural focus with goats as one component of the system. With the recent growth in goat numbers it is timely to document existing goat production systems in Laos, marketing

links into Vietnam and identify constraints and researchable issues and opportunities.

Research approach

The research approach taken under ACIAR small research activity (SRA) LPS/2016/027 was as follows:

1. A workshop was held in November 2016 for researchers on four current Asia-Pacific ACIAR supported goat projects to review past research, share information on current projects and explore opportunities for common approaches and research strategies
2. A desktop review of past research on goats in Laos and other relevant regional areas was undertaken in Jan-Feb, 2017 resulting in a 58-page desktop review of 154 papers and reports
3. Field work in Laos and Vietnam incorporating a goat production and marketing survey in the northern provinces of Oudomxay, Luangprabang and Huaphan and the southern provinces of Khammouane and Savannakhet together with visits and discussions with a wide range of people and institutions was undertaken March-June 2017
4. A stakeholder workshop was held in Laos in June 2017 to present the project findings to date

Results

The desktop review revealed marked variation in goat density within Laos (Figure 1), a variety of production systems, almost totally smallholder village based, and a patchwork of prior research (Hergenhan *et al.*, 2017). It provides a useful resource for identifying constraints and opportunities for goat production in Laos.

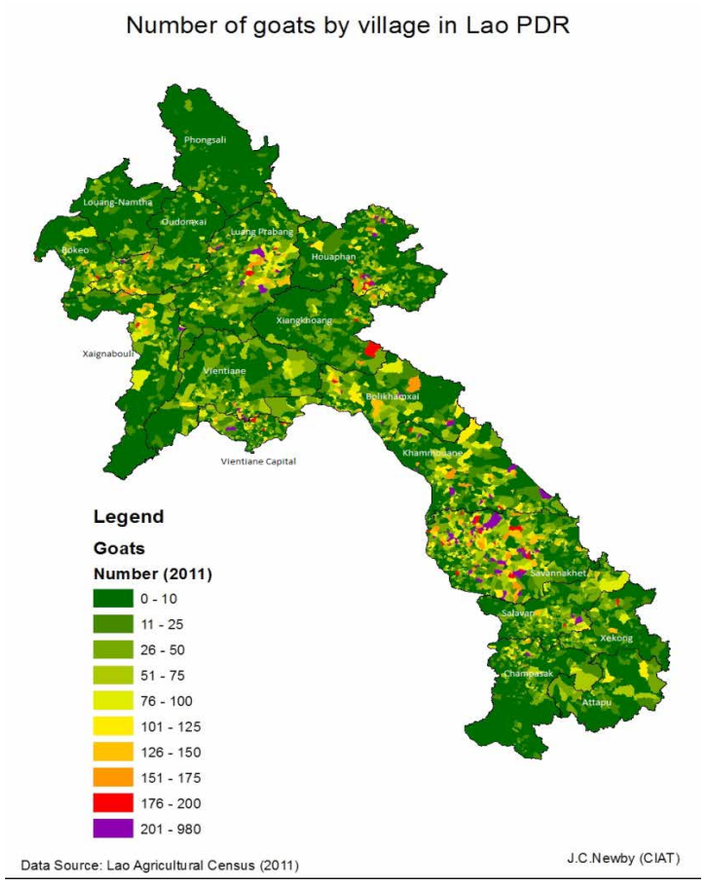

Figure 1: Map of goat distribution in Laos (Jonathon Newby, CIAT, 2016 pers. comm.)

The goat production and marketing survey revealed the importance of goats to smallholder farmers with the goats predominantly kept for sale rather than consumption and between 27 and 42% of household income being provided by goats. Production systems fell into 3 broad categories namely, free grazing year-round, semi free grazing with restricted grazing during the rice planting season (confinement, tethering or herding) and semi-commercial farm system (similar to other systems but with larger herd sizes and higher levels of inputs. In descending order of importance, diarrhoea, bloat, orf and foot and mouth disease were cited as the main disease problems. Most farmers sold to a middleman and on average middlemen passed through villages 13 times per month, searching for goats to purchase. Detailed individual interviews with 9 goat traders revealed complex variation in price both spatial (between regions) and temporal (between years) in Laos (Figure 2).

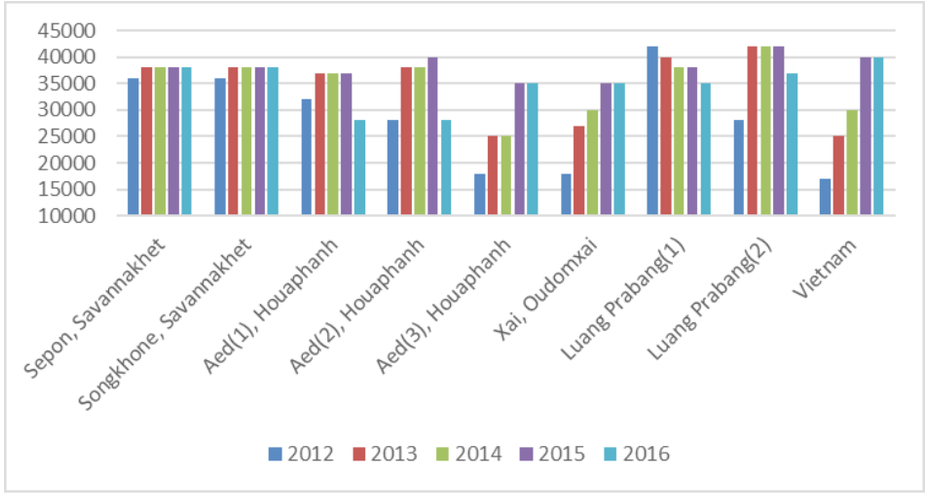

Figure 2: Goat purchase prices (KIP/kg live weight) 2012-2016 reported by 9 individual goat traders (ACIAR, 2017)

A majority of goats were exported to Vietnam via one of 3 major export market chains:

- The Southern Corridor: goats sourced in Khammouane and Savannakhet are transported east on Route 9 to Vietnam.
- The Northern Corridor: goats sourced in Luangprabang and Oudamxai are transported south east through Xieng Khouang on Route 7 to Vietnam.
- The North-East Corridor: goats sourced in Huapanh are transported north east by Route 6 to Vietnam.
- Details of the survey results can be found in the Output 3 report of the project (ACIAR, 2017).

A project workshop was held on June 19-21, 2017 in Luang Prabang and arising from this came a concept note to ACIAR for a 4-year project on goat production and marketing in Laos and Vietnam which has been accepted for further development by ACIAR.

Discussion and conclusion

The work on SRA 2016/027 has highlighted the regional variation in importance of goats in Laos and the high level of demand for goats from Vietnam which appears to be a major driver of growth in the Lao goat population. The “clean-green” appeal of Lao “mountain” goats in Vietnam appears to be a major factor in the price premium received for Lao goats. This initial investigation has identified several researchable opportunities

including development of agroforestry systems incorporating goats. With appropriate policies, technological and training inputs the current rapid growth in goat numbers in Laos can be maintained offering an important pathway to reduced poverty in selected regions of rural Laos.

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Evaluating options to reduce transport costs and improve access for small landholders in South East Asia

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Keywords

regional markets, trade, transport, supply chains, value chains, horticulture, beef

Introduction

Getting products to markets where transport networks are unreliable is a major barrier to regional agricultural development. The transformation of agrifood systems follows a predictable path: increased urbanization and higher disposal incomes; changes in diet preferences; increasing demand for higher value food products and the increased emphasis on food safety; intensification of farming systems transforming rural areas. However the increased demand for higher value food products may not translate to improved livelihoods for small-scale producers if they are unable to get their products to market in a timely manner. In Asia, increased levels of urban food demand in China, Indonesia and Vietnam and the construction of large transport infrastructure have created a large market pull, and are starting to affect traditional agricultural and food supply chains. The most notable being the 'One Belt, One Road' road initiative which seeks to create an economic and trade corridor from China to Europe.

Research Approach

There have not been many efforts to date in analyzing the transport logistics costs across post-farm supply chains and quantifying the barriers to markets that may exist for small landholders. This ACIAR project is developing case studies to understand the transport path to market, the reliability of those pathways, and the risks to small-scale landholders of disruption or loss of value in those supply chains. The project aims is to identify a research approach that contributes to identifying ways to reduce transport logistics costs to small-scale producers and inform infrastructure policy that promotes more efficient and inclusive market linkages in Vietnam, Lao PDR, and Indonesia.

The objectives of the project are to: Identify current knowledge, issues, stakeholders, key strategies and research opportunities for rural infrastructure development; critically evaluate and adapt the Transport Network Strategic Investment Tool (TraNSIT) modelling approach to the case studies in South East Asia. TraNSIT (Higgins et al 2015), originally developed for Australian agriculture, maps and optimise every vehicle, rail and ship trip between origins and destinations throughout supply chains, providing the capability to test changes to transport related logistics. It uses a ground up cost of transport related costs across the transport network, accommodating all of the variables (e.g. vehicle type, road conditions, driver costs, regulations) that impact the cost. After producing the baseline transport flows and related costs, TraNSIT is then used to test the impact of infrastructure (e.g. road upgrades, last mile improvements, vehicle upgrades) and regulatory requirements.

Results

The first stage of the project included a consultation process with stakeholders to identify candidate case studies in the beef and horticulture supply chains that illustrate key transport and infrastructure issues. In December 2016 the project team visited Hanoi to meet with Government Agencies and donors, and travelled through the north-west highlands following agricultural supply chains. Listed below are the candidate case studies:

- Domestic demand for pork, chicken, beef, and seafood may lead to demand for feed supply (maize, cassava and soy).
- There is also the opportunity to work at a commercial scale, the supply of corn, maize and soy to feed mills and at the national scale analysing issues relating to the development of agri-industry clusters.
- There is a need to understand the impact of major infrastructure investments (toll roads, intermodal hubs) on supply chains. However, the impact of those investments may not flow to more efficient transport if first and last mile issues are not considered. This is evident through the increasing demand within urban centres for perishable items and the ability for cooperative to supply to those markets, but congestion is limiting the supply and increasing post-harvest losses

- Live cattle movements including cattle imported from Australia and cattle from Myanmar and Thailand that are re-export to China.

Discussion and Conclusion

Vietnam is transforming from a developing to a developed economy, and in that transformation is dealing with food supply and security issues, as well as changing middle-class consumers demand. There will be an increased emphasis on food safety and cold chain management and an increase in exports of sub-tropical and temperate fruits as well as growing bulk commodity and processed exports (rice, tea, coffee, fish, and prawns).

For this project, there is the opportunity to build on existing ACIAR initiatives in the north-west highlands. In particular, the export of higher value perishable goods to domestic markets and the potential to increase the export of fruit and vegetables (e.g. Green Plums, Lychees, Mango and Dragonfruit) can be used as case studies. As well as improving the transport and logistics for the supply of maize and cassava to local feed mills.

The outcomes of the analysis will be presented at the symposium.

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The gap in GAPs: Some key lessons for uptake and policy

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Keywords

Good Agricultural Practices, adoption, pigs

Introduction

Good Agricultural Practices (GAPs) certification with quality labels as signals is a central component of modern consumer policy in developed agri-food market systems (Jahn et al 2005). In developing country settings where informal markets remain dominant preferred outlets for food, establishing credible GAP certification schemes pose institutional and policy challenges (Lapar and Tiongco 2011, Reardon and Farina 2002). Previous experience of GAPs in developing country settings has shown mixed results, mainly in horticulture (UNCTAD 2007; Schreinemachers et al., 2012; Ha et al. 2014; Montano et al., 2016). In Vietnam and for livestock, VietGAHP[1] has been rolled out through a development project (LIFSAP)[2]. Important policy questions remain unanswered. Are GAPs such as VietGAHP effective? Are there sufficient incentives to engender adoption and compliance? Are these transferable and scalable? We investigate VietGAHP adoption and evaluate impacts using quantitative

[1] (Good Animal Husbandry Practices), promulgated through Decision 1506 /QĐ-BNN-KHCN dated 15 May 2008. A revised set of guidelines based on the original VietGAHP but targeting household-based pig production was issued in 2011 (MARD 2011). VietGAHP includes 29 practices on which compliance for VietGAHP certification is being evaluated.

[2] Livestock Competitiveness and Food Safety Project, funded by the World Bank and implemented by MARD.

and qualitative indicators. The findings provide empirical evidence to guide strategies for uptake and scaling.

Research approach

We designed our study within a development project (LIFSAP) in Nghe An province, which provided a natural setting to study adoption and compliance with VietGAHP. We identified three groups of survey participants: VietGAHP adopters, VietGAHP non-adopters, and a control. We recruited VietGAHP adopters and non-adopters from the VietGAHP exposed sites (Dien Chau district); and control group members from a non-exposed site (Hung Nguyen district). We selected 112 respondents, 82 of which were from the exposed sites including 42 VietGAHP adopters and 40 non-adopters, and 30 control. The 42 adopters represented all households adopting VietGAHP in the district; the 40 non-adopters were randomly selected from a list of pig raising households; the 30 control were purposively selected from a list of households interviewed in the Pig Risk project baseline surveys and that were comparable with VietGAHP households, i.e., raising a minimum of 10 pigs at the time of survey. We used semi-structured questionnaires capturing information on pig production and marketing, VietGAHP practices applied, knowledge about VietGAHP, and socio-demographic characteristics. Compliance with VietGAHP guidelines was documented based on self-reported responses, cross-checked with observable indicators where available. We did focus group discussions (FGDs) of men and women pig raisers about KAP and gender issues. We assessed outcomes from adoption with VietGAHP using swine mortality as a metric for efficacy, complemented with cost-benefit measures.

Results

Overall, 40% of 42 survey adopters had high compliance[3] with VietGAHP practices. Feed and water practices had high levels of compliance by at least half of the adopters, while only 1 in 10 adopters had high compliance with keeping records and waste management practices. Incidence of mortality was higher among non-adopters, 1.3% vis-à-vis 0.7% for adopters. The control group (1.4%) exhibited similar mortality incidence

[3] Level of compliance is measured as the proportion of criteria met/practices adopted to total number of criteria/practices. A household is classified has having high level of compliance if that household las met/adopted greater than 65% of criteria/practices. Otherwise, that household is classified as having low-level of compliance.

as non-adopters. Among non-adopters, 10 out 40 respondents reported deaths in their pig herd; only 2 out of 37 among adopters reported deaths, and 7 out of 30 respondents in the control group reported deaths in their pig herd. Fewer households reported having sick pigs among adopters (17 out of 37 households) as compared with non-adopters (26 out of 40 households), and the control (23 out of 30 households). VietGAHP adopters had shorter production cycle (a week shorter), higher productivity (13% higher liveweight per head), more pigs sold (89% higher per household), and heavier pigs sold (10% heavier/head) (Table 1). VietGAHP adopters also reported that traders, the main buyers of live pigs, would generally choose their pigs over those of non-VietGAHP farmers; pig prices paid were not statistically significant, however. There were no significant differences in total production costs between adopters and non-adopters (Table 2), although there were differences in input cost shares, notably on feeds (due to increased use of purchased complete feed by adopters), veterinary inputs, and other services. Lower piglet mortality experienced by adopters also reduced their breeding stock costs relative to those of non-adopters.

Discussion and conclusion

We found positive economic gains from adoption of best practices such as VietGAHP. Thus, promotion of wider uptake could potentially redound to broader positive economic outcomes. A key finding that productivity gains from change in practice need not necessarily require adoption of the full VietGAHP package suggests that a more streamlined version of VietGAHP with relatively lower cost of adoption could encourage more uptake by a wider, more economically diverse users. We note that the cost of investment in VietGAHP may include other costs not reflected in the farm level cost-benefit analysis; these costs include expenses supported by the LIFSAP project (e.g., training and other activities aimed to build capacity of target users of VietGAHP), opportunity cost farmers' time to participate in VietGAHP training, and cost of fixed assets (e.g., pig pens). Designing and promoting a VietGAHP-lite version could reduce these costs and further boost uptake. Scalability of VietGAHP practices could be facilitated by exposure via demonstration effects. Non-adopters in exposed sites have been observed to apply practices aligned with VietGAHP guidelines that are affordable and easy to apply. Peer-to-peer learning is an effective strategy in enhancing capacity for uptake. Further investments in capacity development of target users who could transition as trainors to other potential adopters in the scaling out process could be explored. With

exposure being strongly linked to uptake, training opportunities for non-exposed groups are worthwhile to pursue. Inclusion of a training module on VietGAHP practices in national extension programs could also facilitate the scaling process. The reduced mortality from healthier pigs that are more preferred by traders translates to better profits to producers and presents economic incentives. On the other hand, market incentives from consumer demand for VietGAHP pork in fresh pork markets remains to be tapped. Future work will need to explore credible market signals for VietGAHP that consumers trust and are willing to pay for, with complementary supporting institutions to support uptake.

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Table 1: Production metrics, comparison between adopters and non-adopters, exposed site

Indicator	Adopter	Non-adopter	Remark
Length of a cycle (days)	95.0	102.5	Shorter production cycle
Kg liveweight/head produced	66.3	58.6	higher liveweight/head
Ave. no. of pigs sold/HH	12.5	6.6	more pigs sold/hh
Total liveweight pigs sold/HH	828.4	395.7	Higher volume sold
Kg liveweight/head sold	66.3	60	heavier pig sold
Selling price/kg liveweight	37.4	36	higher selling price

Source of data: ILRI-VNUA VietGAHP adoption survey, 2015.

Table 2: Production cost, revenues, and profit (calculated for 100kg gained weight)

		VietGAHP exposed		Non-exposed	
	Unit	Adopter	Non-adopter	Non-adopter	All
Breeding stock	000đ	489.94	554.22	596.25	541.37
Concentrate feed	000đ	195.20	375.80	110.74	237.08
Complete feed	000đ	1268.43	575.92	2135.70	1253.41
Rice bran	000đ	606.79	778.28	313.98	589.61
Maize bran	000đ	241.02	521.75	181.58	325.36
Other raw feed	000đ	33.63	63.67	61.00	51.69
Veterinary	000đ	43.30	29.55	26.27	33.83
Others	000đ	22.11	16.64	10.51	17.05
Total	000đ	2900.4	2915.8	3436.0	3049.4
Revenue	000đ	4554.7	4486.3	4804.8	4597.3
Profit	000đ	1654.3	1570.4	1368.8	1547.9

Notes: 1. Exchange rate: 1USD = 22,000 VND at the time of survey. 2. Production cost is calculated based on the latest production cycle.
Source of data: ILRI-VNUA VietGAHP adoption survey, 2015.

Sustainable land management practices in cropping systems based on cassava and maize in the North West of Vietnam

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Key words

Northwest, land management, conservation agriculture, soil erosion

Introduction

Maize and cassava are the two most common and important crops in the Northern mountainous region of Vietnam. This region has the largest area of maize and second largest area of cassava in the Country but also the lowest yield of these two crops [1; 2]. The market drives the large scale of production, while the low yield is due to the conventional practices of monoculture and slash and burn, which cause high levels of soil erosion. Not only has negative impacts on the crops, high level of soil erosion also causes environmental problems such as sedimentation in lakes, streams and rivers, pollution of water and increase in green gas house emission caused by chemical residues and organic matters washed off away together with soil. To improve this situation, NOMAFSI has over past years worked in partnerships with provincial DARDs and with ACIAR, CIRAD, CIAT and ICRAF to design sustainable land management (SLM) practices and to promote their adoption by smallholder farmers in the Northwest.

Research approach

Participatory research was the main approach we used. Suitable farmers were selected to conduct trials in their fields at various sites (Table 1), with guidance and support from researchers and extension officers. Research farmers participated in all the activities, including planning, establishment and evaluation of the trials, crop management, harvest and economic benefit calculation. In addition, field days, workshops and cross visits were organized for local farmers, and for extension and government officers, together with researchers, to discuss the impacts of practices as well as the difficulties facing farmers in adopting these practices.

We also supported the scaling-out of SLM practices through organizing FFSs and developing farmer networks where, in linkage with local government initiatives, larger numbers of farmers were facilitated to adopt practice(s) suited to their concrete conditions.

Results and discussions

Four SLM practices have been designed/improved, evaluated and promoted for adoption, including minimum tillage, intercropping with legumes, planting grass hedgerows and mini-terracing.

Results showed that all these practices could help reduce the level of soil erosion by 50 - 90% (Table 1) and improve soil quality; E.g. for maize in Van Chan district (Yen Bai province) the soil pH, OM, P_2O_5 and K_2O available increased by 12.59%, 7.36%, 262.04% and 89.08%, respectively while the level of Al^{3+} significantly reduced from 0.27 me/100g to 2.71 me/100g after a few years of applying the practices. This eventually lead to an increase of 15% - 50% in the yield of maize and cassava (Table 2). The extent of impacts depends on sites, crops and practices [3; 4].

However, there were also difficulties in adopting these practices, mainly increased inputs (of labour in particular), increased problems of pest control (especially when mulching or intercropping is applied at a small scale) and shortage of mulch materials. Through linking with local government initiatives we could help farmers overcome these difficulties and facilitate adoption. Reduced tillage is now applied by almost all households in Van Chan district (Yen Bai province) and Chieng Hac commune (Mai Son district, Son La province) for their maize fields, and grass hedgerows and intercropping with legumes are applied for nearly 7,000 ha of cassava in Yen Binh and Van Yen districts (Yen Bai province), and for some areas of maize on slopes in Mai Son district (Son La province). Due to the very high labour cost of making and maintaining mini-terraces, this practice has not been adopted [4].

Theme 2: Sustainable farming systems

Conclusions

The application of reduced tillage, intercropping with legumes, planting grass hedgerows and miniterracing have long-term potentially positive impacts to protect sloping land and improve crop growth and yield. However, support is necessary for local farmers to overcome problems in adopting these practices. With participatory working approach, and in particular, in linking with local government initiatives for sustainable agriculture development we have significantly succeeded in promoting the adoption of reduced tillage, intercropping with legumes and planting grass hedgerow. In many Northwest farming communities these three practices are now largely applied for both cassava and maize. Because of very high cost of labour for making and maintaining mini-terraces no farmers selected mini-terracing for their maize and cassava fields.

More research effort is nevertheless required to study the impacts of practices when they are adopted at a larger scale in order to develop the scientific basis for developing suitable policies and mechanisms supporting further adoption in the whole region.

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Table 1: Effects of SLM practices on soil erosion

Site	Crop	Amount of soil washed away(t/ha/year)					Loss relative to the control (%)
	Type	Control	With mulch	Inter-crop	Mini-terraces plus mulch	Green hedgerow	
Na Ri, Bac Kan 2004	Maize	16.4	-	-	1.0	-	93.9
Van Chan, Yen Bai 2008	Maize	106.0	-	-	12.0	-	88.7
Mai Son, Son La 2010	Maize	41.6	-	20.4 (peanut)	-	-	50.9
Muong Khuong, Lao Cai 2010	Maize	47.9	14.4	-	-	-	69.9
Son La, 2009	Cassava	17.6		2.3	-	4.9	72.2 – 86.9
Yen Binh Yen Bai 2015	Cassava	18.6	-	10.5 (black bean and grass hedgerow)	-	12.13	34.9 for black bean 43.4 for grass hedgerows

Table 2: Effects of SLM practices on the yield of cassava and maize

		Yield (t/ha)				Increase relative to the control (%)
Site	Crops	Control	With mulch	Intercropping	Mini-terraces	
Cho Don, Bac Kan 2008	Maize (LVN10)	1.9	3.3	-	-	67.2
Mai Son, Son La 2008	Maize (CP999)	6.5	8.5	-	-	30.7

Thach An, Cao Bang 2012	Maize (LVN85)	4.65	5.78	-	-	24.3
Thach An, Cao Bang 2010	Maize	4.73	-	5.49 (black bean)	-	16.1
Van Chan, Yen Bai, 2012 CV% =12.5 $LSD_{0.05}$ = 2.6	Maize (LVN85)	3.76	-	-	5.33	41.7
Cho Don, Bac Kan, 2008	Cassava (local variety La Tre Do)	18.4	26.9	-	-	46.2
Na Ri, Bac Kan 2011	Cassava (KM94)	26.3	-	30.5 (peanut)	-	15.9
Van Yen, Yen Bai, 2010	Cassava (KM94)	29.03	33.15	-	-	14.2
Yen Binh, Yen Bai 2015 CV% = 10.43%; $LSD_{0.05}$ = 7,64	Cassava (KM94)	23.18	-	31.50 (black bean)	-	25.6

Table 3: Changes in chemical properties in spring-summer season maize field in Van Chan, Yen Bai in 2008

Parameter	Value		
	Without mulch (Control)	With mulch	Compared to the control (%)
pH_{KCl}	4.13	4.65	+ 12.59
OM (%)	2.31	2.48	+ 7.36
P_2O_5available (mg/100g)	2.45	8.87	+ 262.04
K_2O available (mg/100g)	2.93	5.54	+ 89.08
Al^{3+} (me/100g)	9.01	2.57	-71.48
CEC (me/100g)	14.52	17.78	+ 22.45

Picture 1: Use maize residue of previous season to cover the soil surface (Van Chan, Yen Bai 2008)

Picture 2: Black bean as intercrop in maize on mini-terrace (Van Chan, Yen Bai 2013)

Picture 3: Grass hedgerow in a cassava field in Yen Binh district (Yen Bai province), 2015

Picture 4: A field day for farmers and local officers to discuss the impacts of SLM practices on cassava growth and yield

Impacts of conservation agriculture practices on soil and maize crops in sloping lands

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Key words

Northwest, land management, conservation agriculture, soil erosion

Introduction

Maize is one of the main crops in the Northwest Vietnam where its production has become the most important for the farmers livelihood, contributing up to 70% of their households total income (Nicetic et al., 2011). Maize is mainly produced on slopes applying conventional slash and burn practices of. Farmers slash and burn the fields before the rainy season, and plough the entire fields for sowing seeds when the first rains come in late April - May. This causes high rates of soil erosion at the beginning of the season when uncovered ploughed soils are exposed to heavy rains.

Our experiments aim to (i) study the impacts of reduced tillage on maize growth, development and yield, as well as on soil erosion and soil quality, and (ii) examine the possibilities of using intercrops for biomass production (for use as mulch materials) and refine the planting and management techniques for some intercrops.

Research approach

The experiment was conducted from 2013 to 2016 in a total area of 1.5 ha of sloping land (20 - 30 degrees of slope) in Huoi Duong village, Co Noi commune, Mai Son district, Son La province where maize was mono-cultured in a huge area of slopes applying conventional practices. The experiment was completely randomized block designed (CRB). The intercrops used were rice bean, Velvet bean, pigeon pea, stylo and rapeseed (Table 1).

Table 1: Descriptions of treatments

	F1: - (N-P-K) = (115 - 85 - 60) kg/ha for 2013 & 2014 - (N-P-K) = (69 - 35 - 30) kg/ha for 2015 & 2016 - no microelements added	F2: - (N-P-K) = (115 - 85 - 60) kg/ha for 2013-2016 - microelements added in 2013
T0 (control)	Burning and tilling the entire plots. Rows were then made for basal fertilisation and maize seed sowing.	
T1	Vegetative mulch, minimum tillage (no burning, no tillage, rows were made for basal fertilisation and maize seed sowing).	
T2	Vegetative mulch, minimum tillage, and velvet bean (Mucuna): velvet bean was sown in holes (hole - hole = 40 cm) the inter-rows of maize 40-45 days after sowing maize, at the time of 2nd dressing and weeding). No additional fertilisers for velvet bean.	
T3	Vegetative mulch, minimum tillage, and rice bean: rice bean was sown in holes (hole - hole = 30 cm) in the inter-rows of maize 30-45 days before the harvest of maize (at the flowering stage). Additional fertilisers for rice bean: at the sowing time 200 kg/ha P + 50kg/ha N+ 50kg/ha K; after 30 days: 50 kg/ha N.	
T4	Vegetative mulch, minimum tillage and pigeon pea: Pigeon pea was sown at the same time with maize in the inter-rows of maize with plant - plant distance of 30 cm. No additional fertilizers for pigeon pea.	
T5	Vegetative mulch, minimum tillage and stylo: Stylo was sown in the inter-rows of maize a month after sowing maize (trenches were made to sow seeds). No additional fertilisers for stylo.	
T6	Vegetative mulch, minimum tillage and rapeseed: Like T1, but rapeseed was sown after harvest of maize. No additional fertilizers for rapeseed	

(*): P=SuperphosphateLam Thao, K=Potassium ChlorideHa Anh, N=Urea Ha Bac

(**) Microelements: (20 kg/ha $ZnSO_4$; 10 kg/ha $MnSO_4$; 10 kg/ha NeoB and 5 kg/ha $CuSO_4$)

Growth performance, yield and yield components, pest problems, labour and material input costs and economic benefits of each crop were recorded.

Results and discussions

Yield and economic benefits: We have not observed any clear trend in the yield of maize through the years. No significant difference was recorded between the 2 fertilizers levels or between the treatments. This might be due to the serious drought in 2015 and extremely heavy rains in 2016 which caused the death and washing away of many plants. Intercrops of rapeseeds, Velvet bean and rice bean gave relatively good yields except in 2014 when the winter came early and was very cold. In 2016, the yield of velvet bean was 210.5 kg/ha, of rice bean was 280 kg/ha and of rapeseeds was 782.5 kg/ha. The harvest of intercrops resulted in an increase in the total income.

Biomass and soil quality: All the studied intercrops yielded significant biomass. However, those of mucuna and rice bean quickly decayed and thus did not help accumulate volume of biomass in the field for the next cropping season. Cajanus, rape seeds and stylo stems remained undecayed until the next cropping season. The volume of biomass (measured before sowing of maize seeds) increased from 4.2 t/ha in 2013 to 6.3 t/ha for rapeseed, 5.5 t/ha for stylo and 7.0 t/ha for cajanus in 2016. Thanks to the biomass accumulated and/or decayed the quality of soil improved significantly; the bulk density reduced with 0,01 g/cm^3, the content of OM increased 0.04%, CEC increased 0.66 ldl/100g, K^+, Ca^{++} and Mg^{++} increased while pH_{H2O} and pH_{KCl} reduced for all the treatments compared to the control. This was visually confirmed by farmers and local officers who noted that the soils looked much better in term of density and colour. In addition, for F1, in 2015 and 2016, when the level of NPK was reduced the yield remained unchanged.

Conclusions

Although climate extremes affected the experimental results, it was clear that CA practices (reduced tillage alone or reduced tillage with intercropping) did not reduce the yield of maize but helped increase the total income and benefits due to additional harvests from intercrops and reduced the labour required for weeding and tillage of the field. In addition, the practices improved the soil conditions in terms of bulk density, OM, CEC, K^+, Ca^{++}, Mg^{++}, pH_{H2O} and pH_{KCl}.

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Identification of potential agroforestry interventions in North West Vietnam

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Keywords

landsat, remote sensing, cropland, suitability mapping, agroforestry, local preferences

Introduction

Annual crop cultivation provides the most significant source of food for people living in the mountainous areas of Northwestern Vietnam. However, crop cultivation has caused serious erosion on sloping land which cover most area of the region. Integrating agroforestry systems into these degraded landscapes has the potential to build more resilient livelihood systems. There are challenges with estimating the actual areas of land cultivated on slopes using existing official land use data. This study aims to identify the cropland on slopes and potential areas for alternative agroforestry options on sloping land based on biophysical factors and farmers' preferences. Local opportunities and constraints were also discussed under the consideration of different context and ethnic groups.

Research approach

This study used Landsat 8 satellite imagery, GPS ground truth points and Random forest classification algorithm to identify the probability of annual crops being present on sloping land in seven districts of Dien Bien, Son La and Yen Bai. Suitability maps were then developed for a range of potential agroforestry options. Tree species were selected from existing timber, fruit and industrial crops that are being tested under AFLI project, including local apple (*Docyniaindica*), shan tea, plum, macadamia, Arabica coffee, teak (*Tectonagrandis*), *Acacia mangium*, mango and longan (*Dimocarpuslongan*). In addition, local knowledge studies were

conducted in six villages of Kinh, Thai and H'Mong groups to understand local aspirations and preferences for agroforestry options (Figure 1).

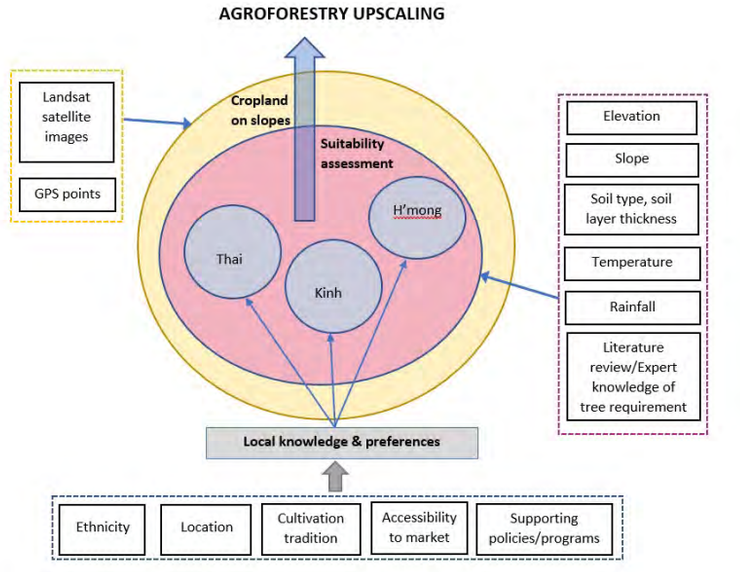

Figure 1: Framework for integrating local and scientific knowledge to support agroforestry expansion in Northwest Vietnam

Results

Targeting areas for tree integration was annual crops on slopes, which was also suggested by local farmers through local knowledge survey. Using Random Forest classification (RFC) method and Landsat data we showed that sloping land (above 15°) accounts for 70% of total land area in Northwest Vietnam. Cropland (primarily maize) covers 23% of this area (approximately 130,000 ha). This doubled existing estimates of cropland on steep slopes (above 25°) in comparison with official reported data by Ministry of Natural Resources and Environment (MONRE) in 2015. Our study suggested that 30% of actual cropland lies within forest designation suggesting forest cover was over estimated by 15%.

The biophysical suitability analysis shows that the suitability areas cover approximately 85% of total area of croplands on slopes (above 15°), presenting significant potential for tree integration and expansion of existing systems.

The local knowledge survey showed that Kinh and Thai people preferred fruit trees or coffee while H'mong people wanted to have son tra, and plum. Local people also suggested other suitable timber species such as

Manglietia, Fokienia, *Melia* which are easy to sell and can be intercropped in agroforestry systems.

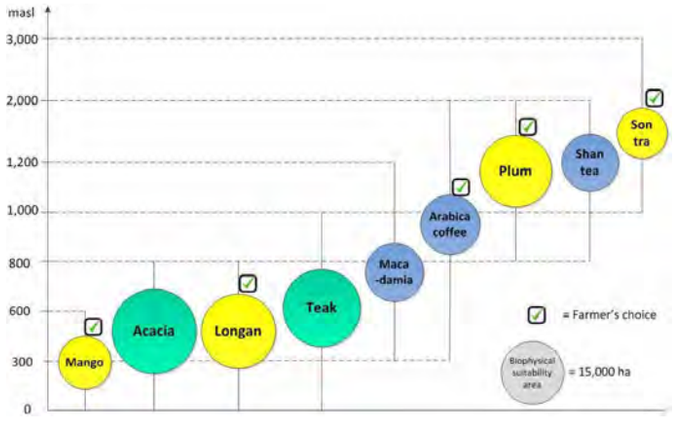

Figure 2: Potential expansion area of tree species on sloping cropland above 15° based on biophysical suitability and farmers' preferences

Discussion and conclusion

Increasing areas of cropland on slopes is an indicator of higher risk of soil erosion potential. Especially those areas in forest designation shows that there is an overestimation of forest cover in Northwest region. Government, NGOs and farmers should aware about the risk and the opportunity for more sustainable cultivation. In this context, integrating trees with crops would be a potential option.

The study identified challenges for adopting agroforestry varies among those three ethnic groups due to their location of origin, accessibility to market, and different cultivation tradition. Most of farmers are lack of high quality tree seedlings and connection to market. Kinh and Thai farmers in lowland concerned about climate change and high cost to manage systems because they prefer high value fruit trees. H'mong people concerned about system management such as pests, diseases and financial support to buy seedlings and fertilizers.

This also contributes to increase the awareness of potential agroforestry interventions in the region and supports government policies on land use planning as well as smallholder farmers' cultivation options. The findings of this study give insights into issues and variables to be considered at the micro level implementation of policies or programs. This suggests that farmers' specific social circumstances linked with their culture influence their preferences for agroforestry intervention and ignoring these elements is likely to adversely affect adoption.

Developing a farm business model for livelihood enhancement of smallholder farmers in North West Vietnam

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Keywords

business model, cooperative, collective action, agroforestry, value chain

Introduction

Shifting cultivation and monoculture crops in steep terrain and fragile land in Northwest Vietnam have resulted in several challenges on agricultural production and livelihoods of smallholders [1]. Agroforestry was identified as a viable option to address these issues, improving diversity, sustainability and resilience. Besides preventing soil erosion, sustainable agroforestry options can help farmers have a long-term income from fruit sales [2]. The establishment of exemplar landscapes (EL) in Mai Son, Son La province connects farmers' aspirations and our project's research agenda of developing and promoting market-based agroforestry and forest rehabilitation options [3]. Tree species selected for the ELs of Mai Son are fruit trees (mango, longan, pomelo, lemon and plum) intercropped with maize and forage strips [4]. With an expected sharp increase of harvest volumes in two to three years, linking smallholders to markets becomes a pressing challenge. A first building block in linking farmers to markets is understanding the status-quo. This study thus analyses current farm business models of smallholders. We visualize and identify challenges of the current smallholder farm business set-up in the Northwest, thereafter recommending on improvements for future business model prototypes to conveniently access broader markets.

Research Methods

The business model canvas approach was followed, focusing on addressing the specific constraints and opportunities for small-scale farmers to interact with modern fruit markets. A business model canvas effectively structures and visualizes how a business organizes itself and connects

to a network of partners to create, deliver and market its produce [5]. The four main pillars of the business model are: product portfolio, infrastructure management, customer relationship and financials. These elements are then further decomposed into the value proposition, target customers, costumer relationships, distribution channels, key partners, key resources, key activities, cost structure and revenue streams [6]. Semi-structured individual interviews were conducted with 29 farmers of a selected EL in Mai Son. All farmers were individually confronted with questions regarding indicators of their business model level. The business model levels were analyzed and evaluated on similarity, weaknesses and strengths. Concluding, we point out potential interventions to foster business model improvements for fruit farming and marketing in an agroforestry EL in Mai Son.

Results

The 29 farmers of the Mai Son EL show strong similarities in their fruit business model set-up. All analyzed farmers are in possession of the same key resources, costumer channels, show similar expenditure levels and production portfolios. Results of our study indicate that farmers are dependent on local traders, which act as intermediaries connecting rural markets with urban-based and external consumers. Direct access and negotiation options with the formal sector, as well as reliable market information are commonly unavailable to smallholders. Our findings further indicate a current farm business set-up which is severely limited in marketing high volumes of fruit. Local markets in Mai Son are saturated, and present linkages to bigger markets are inconsistent and informal. Further, local farmers in the Northwest, particularly ethnic minorities, lack bargaining strength and collective action. As trees move from the juvenile phase to full production face, the primary concerns of farmers are establishing new markets and higher market prices, followed by stabilizing market position and fruit supply.

Discussion and Conclusion

The business model canvas is an appropriate tool to visualize the current farm business set-up and further develop a strategy for the future. Ample opportunities for farmers to improve market linkages exist. As first recommendation we advocate farmer-initiated change by embracing collective action to solidify bargaining strength and voice in the value chain. Inclusive agricultural development for fruit farmers of the mountainous north-western Vietnam can potentially further be spurred by diversifying

the costumer base, accessing niche markets and value-addition such as certification, fruit processing, branding and contract farming. Further, it is important to take a deeper look at the long-term sustainability and impact of farmer marketing groups or cooperatives and their business model transitions. Our results highlight the importance of other stakeholders along the value-chain adopting inclusive and smallholder friendly buyer-driven business models. The study is regarded as baseline research on producer-driven business model development for smallholder farmers engaging in fruit production. Limitations of the present study relate to the restricted transferability of results to other locations due to factors such as differences in context of regions, ethnicities and transportation infrastructure.

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Forest restoration and rehabilitation for North West Vietnam

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Keywords

North West Vietnam, forest rehabilitation, sustainable management

Introduction

North-west Vietnam (NWV) is an important watershed area for Vietnam. Nevertheless, the conversion of forest to agricultural land has resulted in substantial landscape degradation (MARD, 2014). Thus NWV has become a critical area for forest rehabilitation. However, forest rehabilitation in this area has so far been very limited because of a lack of local capacity and knowledge about best rehabilitation approaches for local forest types.

Forest restoration and rehabilitation activities will be built on previous forest rehabilitation research to assess different socio-ecological forest rehabilitation options, and develop sustainable management plans, for community forests of NWV.

Research approach

The SRI is undertaking activities within two sites in NWV: Na Bai village (Son La) and Na Noi village (Dien Bien). The two sites share many characteristics, such as proximity to forest habitat and similar land-use activities (e.g. people cultivating on steep terrain). Both villages have suitable sites for afforestation, agroforestry systems and zoning for forest restoration.

The research approach includes interviews with local villagers to identify barriers and incentives to forest rehabilitation, and to determine priorities for community forests, including preferred NTFPs. Forest inventories have been conducted at each site to assess current forest structure and biodiversity.

Four different forest rehabilitation options will be tested at each site: enrichment planting, assisted regeneration, scattered plantings and NTFP planting.

Preliminary results

Forest inventory was conducted in April 2017. The results show that most of the forests in the two sites can be classified as recovering, medium quality (timber volume = 100-200 m^3/ha) forest type (based on criteria set by the Ministry of Agriculture amd Rural Development (MARD, 2009), with recorded timber volumes of 109 m^3/ha and 126 m^3/ha in Na Bai and Na Noi villages respectively. The main dominant tree species in Na Bai are *Ficus semicordata, Photinia prunifolia, Trevesia palmata, Caryodaphnopsis tonkinensiz* and *Vernicia montana, Ficus auriculata, Cratoxylum cochincinensis* and *Castanopsis chinensis* in Na Noi.

Interviews with forest communities were conducted in May 2017. The species of interest in each village were largely multi-purpose tree species that would bring early benefits for farmers, for example *Michelia mediocris* and *Canarium tramdenum* (with fruit/nuts harvestable after about five to seven years). Currently, communities mainly use the forest for firewood and the collection of NTFPs (such as bamboo shoots, mushroom and honey) for family use. The common barriers to forest rehabilitation in both villages included a lack of funding/seedlings and a lack of project support, while it was believed the provision of fast growing trees of commercial value (e.g. timber and NTFP species that produce early yields) could act as incentives for community participation in forest restoration.

In June 2017 the first plantings commenced to test the effectiveness of scattered tree plantings and enrichment plantings in contributing to forest rehabilitation. The species chosen by the community in both villages were *Michelia mediocris*, *Manglietia conifer* and *Canarium tramdenum*, while additional speies of interest included *Altingia siamensis, Schima wallichii and Acacia mangium x Acacia auriculiformis* in Na Noi and *Cunninghamia lanceolata* in Na Bai. Preliminary results indicate that two months after planting the survival rates ranged from 86-100% across species planted, with only minimal differences between the two villages. The best performing species were *Cunninghamia lanceolata* (100%) in Na Bai and *Altingia siamensis* (99%) in Na Noi.

Discussion

Forests of Na Bai and Na Noi are young forests in the process of recovering from past over-harvesting of timber for local use. Inventories indicate

that while forest recovery began at approximately the same time in each village, timber reserves were lower in Na Bai than Na Noi. This may be a result of the difference in environmental condition between the two sites, whereby Na Bai forests are situated on steeper slopes with rocks accounting for a greater portion of ground cover and show evidence of strong soil erosion, possibly caused by the low forest cover.

Nowadays, farmers no longer depend on the forests as past exploitation has exhausted most of the resources, with only low value trees and NTFPs remaining. For these reasons, the farmers in each village desire the planting of tree species which produce harvestable resources in a short period of time (e.g. *Michelia mediocris, Canarium tramdenum* etc.).

While initial seedling survival rates were high some problems were still identified, such as the death or degraded quality of seedlings due to unsuitable weather conditions (e.g. heavy rain or sun exposure), insect predation, disease and livestock trampling and grazing. Differences in the skills of the farmers that undertook plantings were also noted and improved training will be needed in the future. While current survival rates are positive, longer timeframes are needed to track the effectiveness of the forest rehabilitation trials. Furthermore, if scattered trees establish and begin to shade-out crops, future consideration may need to be given to finding methods for encouraging farmers to retain these trees in their fields.

Other socioeconomic problems that have been identified by the project so far include a lack of community interest in forest rehabilitation due to budget constraints, a lack of knowledge on techniques for planting forest trees and the absence of positive examples of the benefits of forest rehabilitation. As this project has a strong focus on community participation and capacity building, we hope to overcome these barriers and develop an effective model for forest rehabilitation that can be scaled up over time.

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Timber plantations and smallholder livelihoods in the central region of Vietnam

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Keywords

smallholder plantations, livelihoods, impacts of timber plantations

Introduction

Vietnam has emerged from being one of the poorest countries in the world to a rapidly developing middle-income economy. While policies to reduce poverty have been successful in the past decade, the nature of the poverty reduction challenge is changing with nearly all remaining poor will be members of ethnic minority groups by 2020 (World Bank, 2017). In Vietnam, commercial forestry based on plantations plays a key role in economic development and poverty reduction (MARD, 2015). A key challenge, for Vietnam and for other countries in South-East Asia, is to maximise the benefit of plantations to smallholders, the broader economy and the environment. The University of Melbourne and research partners in Australia, Lao PDR and Vietnam are undertaking a research project on "*Improving policies for forest plantations to balance smallholder, industry and environmental needs*". The project, funded by ACIAR, has three objectives: (1) to develop policy and institutional options for plantation development; (2) to understand the positive and negative social, economic and environmental impacts associated with different tree plantation development approaches and (3) to create a network for policy learning that builds capacity in plantation sector policy analysis, development and implementation.

Research approach

In Central Vietnam, there are over 450,810 ha of plantations of Acacia (Pham, 2012), an Australian tree that provides valuable timber for pulp and

paper and furniture. Much of this area has been allocated to smallholder growers[1], who grow trees on 4-5 year rotations. The wood is harvested and sold to local sawmills or exported . The sustainable livelihood framework (Scoones, 1998) was used to guide the study design. To address objective two, we used household surveys and focus group discussions. A total of 150 randomly selected household[2] surveys were conducted in six villages in Thua Thien-Hue and Quang Tri provinces. One group discussion (ranging from 15-20 smallholder's representatives) was organized in each village. The aim was to quantify livelihood 'capitals' and the contribution of plantations to household economies, community wellbeing, and the environment. This household level data is being analysed and combined with data from other project components (i.e. policy, supply chain and economy-wide analyses) to support the development of policy options and recommendations.

Results

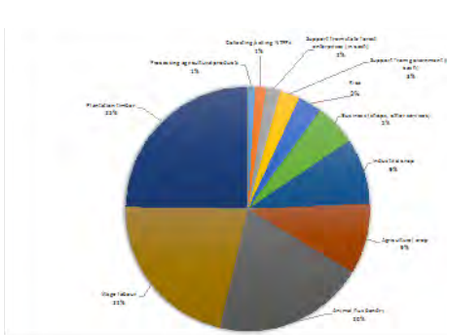

Figure 1: Household Livelihood Composition

Figure 2: Household Survey/ Interview in Nam Dong District, Thua Thien-Hue Province

Forest plantations made significant economic, social and wellbeing contributions to the livelihoods of surveyed households. On average, most households have 3-4 hectares of forest land. Timber production and wage labour from plantations were their top two income sources. On average, sale of plantation timber provided over 5 million VND/year/household (i.e. 25% of the total annual household income, Figure 1). Incomes increased

[1] The typology of smallholder's plantation is provided in the project working paper "*Tree Plantations in Vietnam: A Policy Framework*", which can be downloaded from the project website at *http://lao-vietplantation.org/*

[2] Households (HH) engaged in plantations, were randomly selected in Quang Tri (50 HHs) and Hue (100 HHs)

with the plantation area owned. Landless and/or poor households have only small areas or no plantations and hence a high proportion of their income is obtained through plantation wage labour. Approximately 90% of respondents consider that they are better off now than 5 years ago, with 82% nominating incomes from timber plantation as the main reason for livelihood improvement. For farmers with a small area of plantation the income only comes every 4-5 years. For those working in plantations the work is seasonal and could be irregular. About 26% of the households interviewed were dissatisfied with forest land allocation processes and wanted more land. Marginalised and landless poor were often excluded from plantation land allocation.

Discussion and conclusion

Plantations generally had positive impacts on livelihoods and wellbeing of surveyed households. Apart from financial capital, benefits accrued to physical capital in terms of household assets and to social capital through an enriched knowledge base and exchange among community members. Households had more financial security and secure land ownership, enabling easier access to bank loans and future access to land for their children. Interestingly, respondents reported many positive psychological effects from plantations. Hope for a better future was frequently mentioned as an inspiration from plantations and many associated plantations with enhanced self-esteem/confidence, social status and ability to positively influence other community members. On the other hand, people were concerned with inconsistent, complex and costly procedures for acquiring Red Books and the lack of transparency and absence of grievance mechanisms. In some cases, this lack of clarity has eroded trust between households, state companies and local authorities.

Recommended policy responses[3]

- The Government can support plantation development by providing platforms for improved communication between state forest companies, local government agencies and smallholders around forest land allocation and use.
- Pro-poor plantation policies need to go beyond improving incomes, and include measures to create stronger asset bases and greater decision-making capacity at household level.

[3] A full list of policy responses is available in the Project Working Paper "*Tree Plantations in Viet Nam: A Policy Framework*", which can be downloaded from the project website at *http://lao-vietplantation.org/*

This study will provide a framework to assess benefits and different impacts of forest plantations on local livelihoods, capturing the politics surrounding property rights. Such a framework could be used for other regions of Vietnam, including the North-West, where poverty and issues with asset base still exist, especially among the ethnic minorities.

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Incidence and spread of cassava mosaic disease in Cambodia and Vietnam

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Keywords

cassava mosaic disease, Sri Lankan cassava mosaic virus, diagnostics

Introduction

In 2016 Sri Lankan cassava mosaic virus (SLCMV) was reported for the first time in Cambodia (1). Until then mainland Southeast Asia had been considered free of cassava mosaic disease (CMD), unlike Sri Lanka and India where the disease has been known for many years (2,3). SLCMV is associated with CMD similar to other cassava mosaic geminiviruses, such as African cassava mosaic virus (ACMV) and Indian cassava mosaic virus (ICMV), and is transmitted by whitefly and through vegetatively propagated planting materials (4). Little is known about the effect of SLCMV on cassava yields, yet its African counterpart (ACMV) results in considerable yield losses (5). Yield losses will likely negatively affect the profitability of smallholder cassava farmers throughout Southeast Asia. Cassava areas in the northwestern highlands of Vietnam are still clean and could take advantage of the situation to specialize in clean stake production. To investigate the current geographical distribution of SLCMV

beyond the location of initial detection, we embarked on an extensive binational surveillance closely linking to seed trading survey in Cambodia and Vietnam in the cassava cropping season following the first report of the disease's presence.

Research Approach

Based on the cassava production data from national authorities 15 districts per country were systematically selected to survey SLCMV occurrence and incidence in both Cambodia and Vietnam. In Cambodia, Koun Mom district in Ratanakiri province was added because it was the place where the disease was first reported (1). For virus diagnostics nation-wide leaf sample collection linked to seed trading survey was conducted covering a total of 419 fields and 6,480 plants (basis of 15 fields per district, 16 plant samples per field). We extracted total DNA from all the samples using the modified CTAB method and ran PCR-based diagnostics detecting AC1 gene of SLCMV. Obtained DNA sequences from amplicons were aligned in MEGA7 with available DNA-A sequences of SLCMV and ICMV from GenBank. The phylogenetic tree was constructed using the maximum-likelihood method with 1,000 bootstrap trials in MEGA7.

Results

We found nine SLCMV-infected fields that were restricted to the Ratanakiri and Stung Treng provinces of Eastern Cambodia, while no infection was detected from any other large production areas (Figure 1). In the Ratanakiri province where the disease had been reported in 2015, the virus occurrence was 13.3%, whereas in Stung Treng province, next to Ratanakiri, seven fields (46.6%) were infected, and four of those fields showed field-level SLCMV incidences higher than 40%. The farthest infected field was approximately 70 km away from the first reporting site of 2015, indicating that the virus had already spread at least this distance by the 2016 cropping season.

To investigate the relationship between SLCMV isolates from this study and those available in NCBI-GenBank database, partial sequences of the AC1 gene of the virus were obtained from DNA samples corresponding to the nine individual fields in Ratanakiri and Stung Treng, and a maximum-likelihood phylogenetic tree was constructed (Figure 2). The resulting topology of the AC1-derived dendrogram showed that SLCMV and ICMV were clearly classified into two different groups, and that all encountered SLCMV isolates from our study are indeed likely to be separated from the original isolate reported in Cambodia (GenBank Accession Number: KT861468.1; 1).

Discussion and conclusion

Our study confirms that CMD occurs in Ratanakiri province and that the disease has spread up to 70 km away from the first reported location. Overall both field-level incidence and infection rates were higher in Stung Treng rather than in Ratanakiri, suggesting that SLCMV has the potential of further spread and damage neighboring production areas. It is likely that such long distance spread is mediated through stake movement as farmers renew their planting stocks. Interestingly, our seed trading survey revealed that most of virus infected fields acquired planting materials from own stock from the year before. In our surveillance we found plants showing both systemic and non-systemic (limited to upper leaves) symptoms, indicating that both planting materials and whiteflies were contributing to vector SLCMV in Cambodia in 2016. The rate of spread found in this study suggests that irradiation and control of stake movement may still be options to contain the disease. Although we haven't found the virus in the northwest mountainous region in Vietnam, once CMD occurs it might spread rapidly to smallholder farms. On the other hand, clean and relatively isolated areas like the northwest highlands could take advantage of the situation and specialize in clean stake businesses. Physical isolation and lower disease transmission rate at higher altitudes may offer a comparative advantage. Yet the development of short- and long-term management strategies is needed to keep the region clean and develop a viable and clean stake value chains.

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Figure legends

Figure 1: Distribution of Sri Lankan cassava mosaic virus (SLCMV) and its symptom. (A) Map of the current occurrence of cassava mosaic geminivirus in Asia. (B) Typical mosaic symptom of SLCMV which was observed in the national surveillance. (C) Distribution of SLCMV-infected and non-infected plants in Cambodia and South Vietnam. Each circle has a number of plants analyzed by diagnostics, orange indicates SLCMV infection, and green shows no SLCMV infection. (D) Distribution and incidence of the virus infected fields in Stung Treng province. In pie-chart orange indicates SLCMV infection and green shows no infection, the number stands for the incidence of SLCMV for each field.

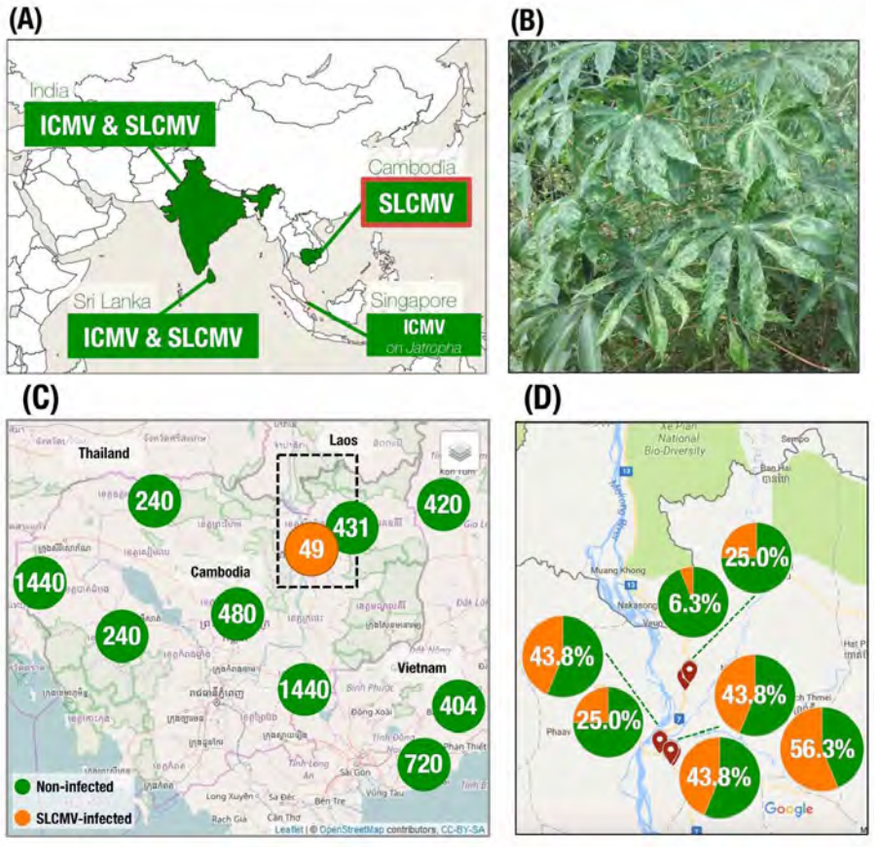
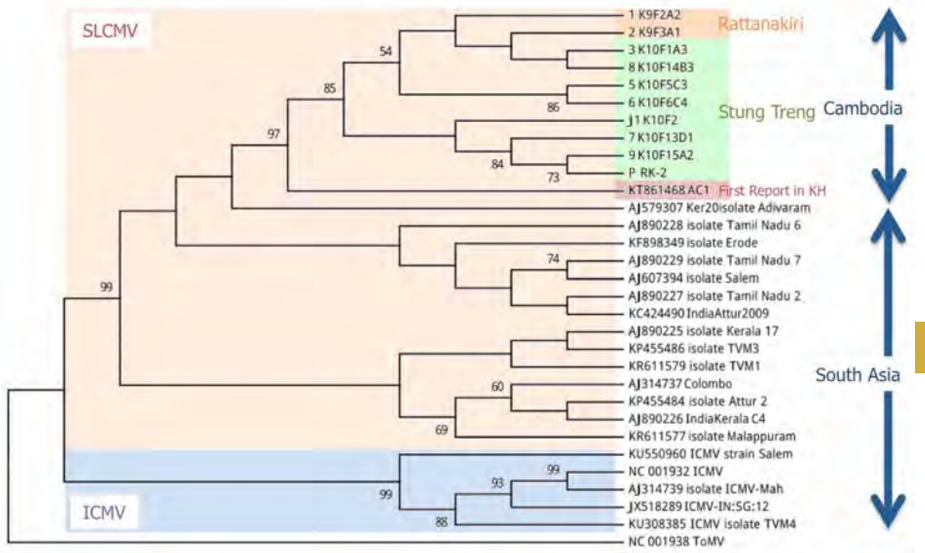


Figure 2: Maximum likelihood phylogenetic tree of AC1 (replication associated protein) gene of DNA-A of available Sri Lankan cassava mosaic virus and Indian cassava mosaic virus. The equivalent to each sequence from tomato mosaic virus (ToMV) was used as an out-group to root the tree. The sequences were aligned, and phylogenetically re-constructed by MEGA7 software with 1,000 boot strap replications, obtained by neighbor-joining method. Sequences: 1,2 are from Rattanakiri province and 3,5,6,7,8,9,P are from Steung Treng provinces from the national survey. Genbank ID: KT861468 is the equivalent sequence published by the first disease report of SLCMV in Cambodia.



Beef cattle production by smallholders in the North West region: Economic motivations to behavior change

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Keywords

beef cattle production, cost benefit analysis, forage, silage, economic motivation

Introduction

The mountainous North West remains one of the poorest regions in the country, with 80% of households deriving the majority of their income from agriculture and forestry activities (Tran et al, 2010). Although beef cattle production is a key part of the farming system and could play a role in alleviating poverty, production is still scattered and small-scale, and most cattle are grazed on common property feed resources. Many smallholder farmers keep cattle to build wealth and as an asset to sell when money is required, rather than as a production entity for income generation (Duong *et al.* 2014).

A number of cattle feeding and management solutions were identified in ACIAR project LPS/2008/049, although each of these management techniques has an opportunity cost. A cost-benefit analysis of adopting the new feed management techniques was conducted to assess the potential for adoption of those practices.

Research approach

A survey of cattle farmers was undertaken in the project research sites, Long He (Nong Coc), Toa Tinh (Hua Sa A), Quai Cang (Kha), Quai Nua (Tham and Quang Vinh) communes in Dien Bien and Son La provinces. The survey included both farmers who participated in project trial activities and neighboring farmers who did not participate in the project. The potential cost and benefit of adoption of feeding techniques was calculated. The opportunity costs of the new feed management strategies were also calculated in order to evaluate the impact on adoption.

Results

Three feeding strategies have been analysed: S1- traditional practice (controlled grazing); S2 - controlled grazing with supplementary forage; and S3 - controlled grazing with supplementary forage and silage (leave, stem, cassava root chips and straw). Costs and benefits of three different feeding strategies were calculated using a discount rate of 7.8% (Tanaka et al, 2010).

Net Present Value (NPV) of raising one head of cattle is estimated to compare profitability between different feeding practices regarding time value of money. The NPV of practice S1 is about 11898 VND while that of feeding practices, S2 and S3, are 12706VND and 14382 VND respectively.

It takes five years for farmers to fatten an animal to sale weight using practice S1, four years using practice S2 and three years using practice S3. Given prices of materials and the opportunity cost of cassava (i.e. sold direct to market instead of ensiling), NPV calculations show that controlled grazing, combined with forage and silage seem to improve economic efficiency of cattle production and shorten length of the production period.

Discussion and conclusion

Cost-benefit analysis shows a higher net benefit of intensively oriented feeding strategies relative to traditional practices. In addition, traditional practices face many challenges such as severe weather, climate change and restricted common pastures due to forestry protection regulations. Those challenges make traditional cattle production relatively more costly and risky and this results in an intensification of production practices. To intensify beef cattle production in the context of farming systems in the North-West, further research is required to develop diverse strategies for 'mixed' livestock and crop farming.

Table: Farmers' future plans for cattle production (% households)

Plan	Trial Participants	Non-Participants	Overall
Increase number of cattle	66.7	66.7	66.7
Increase forage area and keep the same number of cattle	13.3	20.8	17.9
Unchanged cattle numbers and forage area	20	12.5	15.4

Source: Survey, 2015

Most farmers (including trial non-participants) still plan to expand their beef cattle production applying new practices with forage and silage. Farmers are still interested in applying new practices even though they will need to invest more and learn new forage cropping and silage making techniques.

Intensive cattle production trials have not only shown farmers a way to bridge the feed gap in cold weather but also shown a new method of profitable cattle production, and this may be a key motivation for farmers to expand their beef cattle production. Credit support and training for forage cropping and silage techniques are needed to support the transformation from traditional cattle production to more intensive production.

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Nutrient sufficiency and management: Benefits of high quality laboratory analysis

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Keywords

nutrient surveys, quality control of soil analysis, development of plant analysis

Introduction

The nutrient status of vegetable crops in Vietnam has not been extensively studied even though there are excellent tabulations of nutrient sufficiency ranges for many crops (Bryson and Mills 2014). This has opened up a major opportunity within the Project for the Soils and Fertilizers Research Institute (SFRI) to establish high quality soil and plant analysis, not only for this purpose but also for nutrient budgeting. Demonstrably high-quality laboratory testing will be a legacy of Project AGB/2012/059 and support SFRI's role in scientific research, extension and use assessment. To achieve this goal numerous activities have been undertaken, of which a small sample is given.

Research approach

SFRI uses standard Vietnamese test methods (SFRI 1998). Each method is systematically being validated using reference samples by comparing the laboratory's results independently certified target values. The reference materials were prepared by SFRI and characterized by being circulated by the Australasian Soil and Plant Analysis Council (ASPAC) as inter-laboratory proficiency samples. There is a Red River Delta soil and a Hanoi Cabbage. The ASPAC interlaboratory medians are used as target values.

The example given for soil analysis is for soil pH in 1 M KCl, and the data are independent measurements made in 2015–17 (Fig. 1). That is, the sample is also being used for quality control (QC).

The focus recently shifted from soil to plant analysis because the results of a survey of nutrients in about 30 farmers' cabbage crops in Sa pa and Bac Ha showed that the concentrations of copper were 3-13 mg/kg and of boron were 3-23 mg/kg, i.e. many of the crops were probably deficient in both elements. These analyses were conducted in Australia because plant analysis at SFRI is in its early stages (Fig. 2). The results in Fig. 2 were obtained using a digestion in nitric acid plus hydrogen peroxide in open tubes on a temperature controlled digestion block.

Results

Laboratory practices at SFRI have been improved by regular calibration of balances, volumetric ware and of equipment such as pH meters, and the analysis of the reference materials with every batch of samples tested. The results for pH in the Red River Delta Reference soil fall close to the ASPAC median, and the scatter, even over two years, is small (Fig. 1).

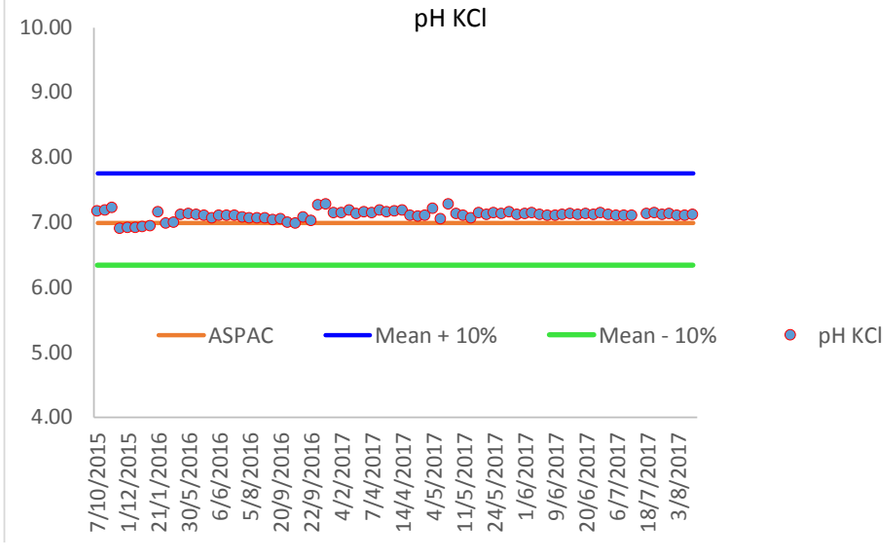

Figure 1: Data for pH_{KCl} (X-axis) on the Red River Delta Reference Soil. Measurements were made on many occasions (X-axis) from 2015-17 and a dot is the result for one occasion

Validation of plant analysis was commenced earlier this year and preliminary results (Fig. 2) are shown for digests in nitric acid and hydrogen peroxide, analysed using flame atomic absorption spectrophotometry (FAAS). Large discrepancies between the measured and target values are obvious for the elements: Mn, Fe, K, Na and Ca. The causes are under investigation.

Discussion and conclusion

Clients can rely on the results of soil analysis at SFRI due to the close proximity of the observed and target pH values, and their demonstrable reproducibility. Similar quality data are available for several other key soil tests, including pH_{H2O}, OC and total N, and where the quality is less satisfactory-total and available P and K-the cause(s) are being investigated.

The preliminary plant analysis results (Fig. 2) show considerable work remains to be done to achieve accurate, reproducible results. These data also show how important it is to validate and control the methods relied upon to estimate nutrient budgets, and nutrient use efficiency, and to diagnose nutrient sufficiency.

SFRI continues to improve the quality of chemical analysis to support its own activities in research and land use assessment, and also the related activities of other organisations. For example, SFRI will look to prepare an acidic soil reference material similar to the acidic soils in Lao Cai province and assist other organisations to do likewise.

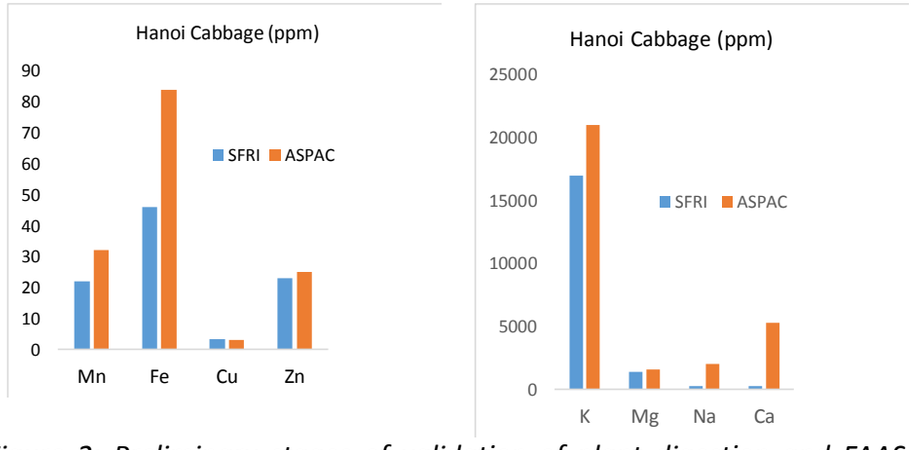

Figure 2: Preliminary stages of validation of plant digestion and FAAS analysis for key nutrients

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Vegetable responses to fertilizer in Lao Cai province

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Key words

nitrogen response, H'mong mustard, cai bap xoe, lime

Introduction

Indigenous vegetable production in Sa Pa and Bac Ha (Lao Cai) is important in contributing to small farmer livelihoods. Indigenous crops have received very little research attention and there are considerable challenges in understanding crop limitations and improving productivity. Survey data of farmer inputs suggests over application of nitrogen (N) and other nutrients is a key issue and there is visual (field observational) evidence that micronutrient deficiencies impact vegetable production. Soil and nutrient management is a key factor that requires attention particularly in relation to crop nitrogen demand, soil acidity and other nutrient limitations.

Research approach

As part of Project AGB/2012/058, N response trials were initiated to identify optimal N application rates in H'Mong mustard, choi sum and "cai bap xoe". For choy sum nine N application rates (0, 15, 30, 45, 60, 75, 90, 120 and 150 kg N ha^{-1}) were imposed. For H'Mong mustard and "cai bap xoe" eight N applications rates (0, 40, 80, 120, 160, 200, 240 and 280 kg N ha^{-1}) were imposed.

Field and laboratory lime experiments were conducted. The laboratory incubation studies evaluated equivalency lime rates of 0, 0.5, 1.0, 2.0, 3.0, 5.0 and 6.0 t ha^{-1} on soil pH for a range of 5 soils from Bac Ha (3 soils) and Sa Pa (2 soils).

A field experiment was conducted to assess cabbage response to micronutrient application. Six treatments were imposed including application of Zn, B, Mo, Cu (alone), an all treatment (Zn, B, Mo and Cu applied) and a nil treatment (no applied micronutrient). Treatments were applied as 3 foliar applications.

Results and discussion

The highest yield for H'mong mustard (about 12 t ha^{-1}) and "cai bap xoe" (about 20 t ha^{-1}) was obtained at 280 kg N ha^{-1}, however, there was no significant difference in yield at N rates from 200–280 kg N ha^{-1}. This rate is less than half the average N applied by farmers. At 50 days after planting the maximum yield of choy sum (12.5 t ha^{-1}) was achieved at an N rate of only 120 kg ha^{-1} (Fig 1).

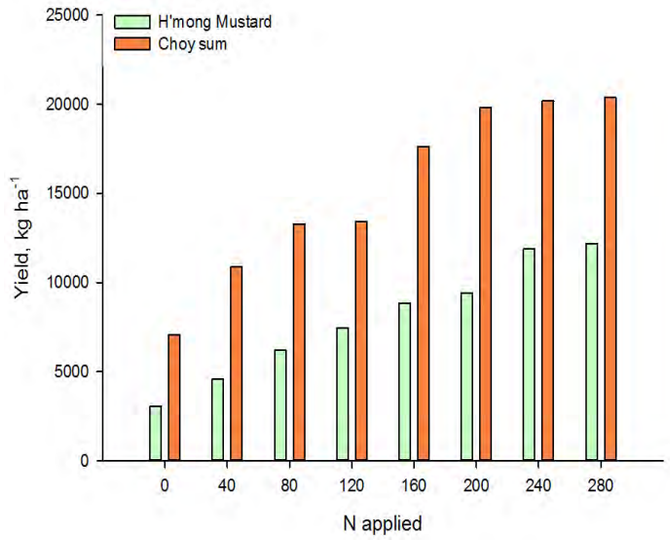

Figure 1: N responds to H'mong mustard and "cai bap xoe"

Soil pH reached near neutral at lime application equivalencies of 1-2 t ha^{-1}. This pH is optimal for reducing club-root in cabbage. The field assessment of liming evaluated lime rates of 0, 0.25, 0.5 1.0, 2.0, and 4.0 t ha^{-1} on yield of cabbage at a site in Sa Pa. Application of lime did not give a yield improvement (Fig 2).

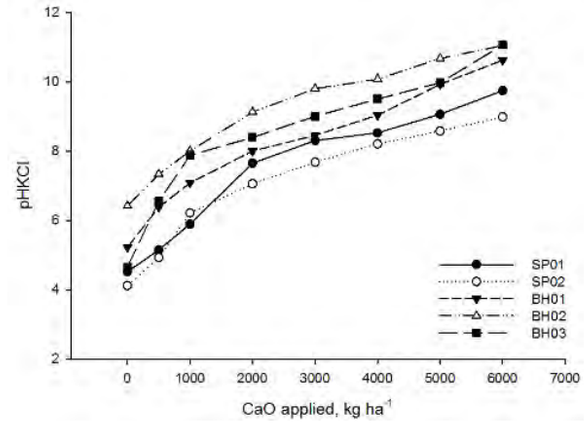

Figure 2: Response of soil pH after 15 days in three soils from Bac Ha and two soils from Sa Pa with different lime rates

Application of the micro-nutrients Zn, B and Cu particularly increased cabbage growth. In the all treatment the total plant biomass increased by 34% compared with the nil micronutrient control whilst head yield increased by about 60%.

Conclusion

The research confirms the need to optimize nitrogen inputs to ensure greatest crop productivity. Relatively low lime applications are now required to maintain a pH optimal for crop growth and responses to micronutrient application are evident.

Nutrient status of vegetable crops in Lao Cai province

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Key words

nutrient budget, nutrient deficiency, cabbage, H'mong mustard

Introduction

Vegetable growing in Sa Pa and Bac Ha (Lao Cai) plays an important role in contributing to the livelihoods of local farmers. The major types of vegetables planted in these regions are indigenous. Farmers face many challenges in improving crop productivity particularly with respect to nutrient management for which there is no information on indigenous vegetable crop nutrient requirements. Furthermore, there is little information about the general nutrient status of these upland weathered acidic soils particularly in relation to micronutrients.

The general status of fertiliser use efficiency in vegetable production in Sa Pa and Bac Ha is not well known but farmer survey data suggests that the application of macronutrients, particularly nitrogen (N), phosphorus (P) and potassium (K), is excessive. Fertiliser application represents about a third of the vegetable farmers cropping costs and losses of nutrients are a major environmental concern. There is little information about the status of micronutrients in these vegetable farming systems.

Research approach

Field surveys were undertaken to evaluate the crop nutrient and fertiliser application status of vegetable farms as part of Project AGB/2012/059. To evaluate the major nutrient status of vegetable crops a series of on-farm partial nutrient budgets was conducted in key vegetable crops including H'Mong mustard, cabbage, kohlrabi, and cai bap xoe in Sa Pa and Bac Ha.

To evaluate the general nutrient status of vegetable crops a survey was conducted of about 30 farms in Sa Pa and Bac Ha districts. The survey was conducted using cabbage as the reference crop and the youngest wrapper leaf selected. A full nutrient analysis was conducted and the data compared with reference data in the literature.

Results

Farmers use unbalanced nutrient budgets including over application of key macronutrients and deficiencies of other nutrient). As a result, a large quantity of fertiliser is wasted every year. This not only leads to financial losses but also presents a hazard to the environment. To help farmers in Sa Pa and Bac Ha, trials were initiated to help understand the importance of applying optimal nutrient rates, through which they can improve their agricultural practices and improve livelihoods. Key results of some of the nutrient trials conducted include:

The amount of macronutrient (N, P and K) applied to vegetable crops varied considerably across farms but at all farms nutrient input was much higher than the output. For cabbage the crop removal for N, P and K was similar at all farms at about 150 kg N ha^{-1}, 25 kg P ha^{-1} and about 50 kg K ha^{-1}. However, the application of nutrients was 300-480 kg N ha^{-1}, 60-120 kg P ha^{-1} and 160-240 kg K ha^{-1} (Fig 1).

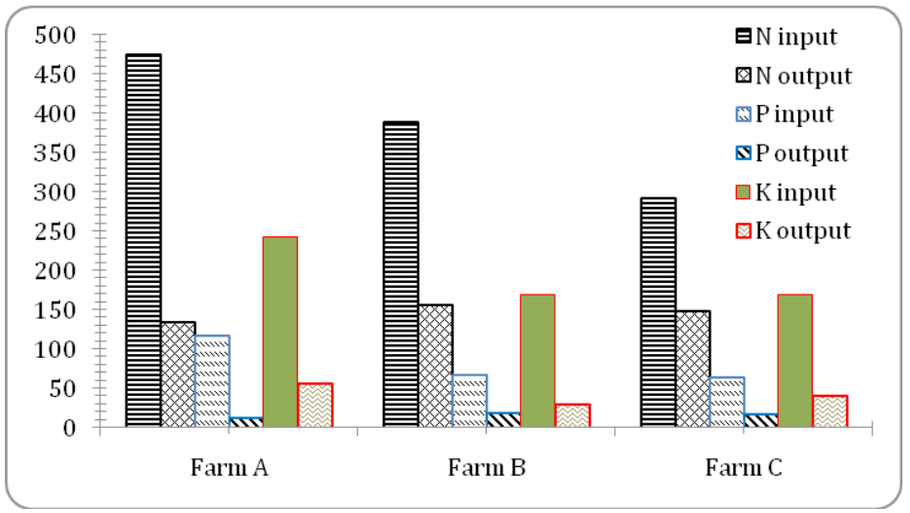

Figure 1: Partial nutrient budget for cabbage. Data were collected in three farms A, B, C in 2015; the inputs indicate the applications of N, P and K during crop growth in the field from seeding to harvesting (kg ha^{-1}), and the outputs indicate nutrients N, P and K removed from the field in the marketed products (kg ha^{-1})

For H'Mong mustard the crop removal for N, P and K varied across farms at about 90-160 kg N Ha^{-1}, 20-30 kg P ha^{-1} P and about 70-90 kg K ha^{-1} (Fig 2). The application of nutrients was 190-410 kg N ha^{-1}, 0-90 kg P ha^{-1} and 0-210 kg K ha^{-1}. For Kohlrabi the crop removal for N, P and K varied across farms at about 70-150 kg N Ha^{-1}, 10 kg P ha^{-1} and about 50-80 kg K ha^{-1}. The application of nutrients was 150-700 kg N ha^{-1}, 30-300 kg P ha^{-1} and 100-650 kg K ha^{-1}. For "cai bap xoe" the crop removal for N, P and K was about 80-130 kg N ha^{-1}, 10-20 kg P ha^{-1} and about 40 kg K ha^{-1}. The application of nutrients was 160-470 kg N ha^{-1}, 70-210 kg P ha^{-1} and 160-610 kg K ha^{-1}.

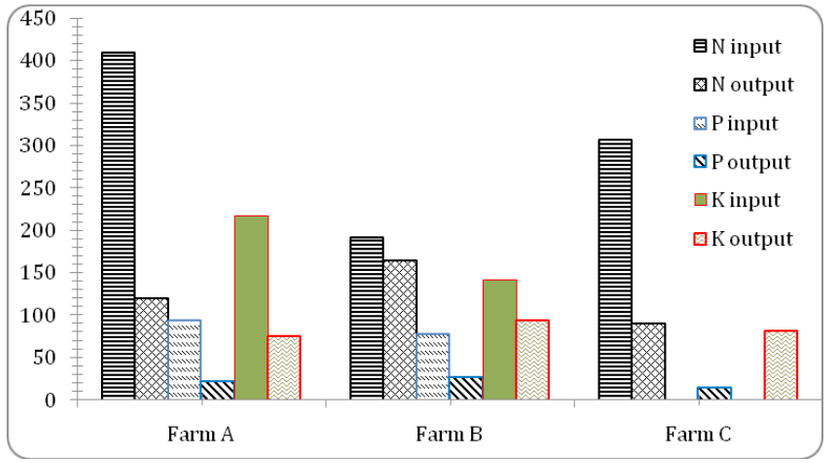

Figure 2: Partial nutrient budgeting for H'Mong mustard. Data were collected in three farms A, B, C in 2015; the inputs indicate the applications of N, P and K during crop growth in the field from seeding to harvesting (kg ha^{-1}), and the outputs indicate nutrients N, P and K removed from the field in the marketed products (kg ha^{-1})

Conclusion

Results from the survey of reference leaves of cabbage crops confirm the nutrient budget data where 96% of samples were sufficient to high in N and 100% of samples had sufficient to high concentrations of P and K. For Ca and S 100% of samples were adequate to high and for Mg about 76% of samples were adequate and about 24% marginal in Mg supply. For the micronutrients, low concentrations of most elements (Mn, Zn, B, Cu and Mo) could be observed, but B and Cu were most prevalent with more than 70% of samples being nominally deficient.

The research confirms the need to reduce major nutrient application rates whilst confirming, identifying and addressing limitations in micronutrient nutrition.

GIS-based mapping of Moc Chau district, Son La province to determine suitability for Tam Hoa plum production

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Introduction

Moc Chau is a district of Son La province, situated at 1050m above sea level. This elevation results in a temperate climate that is suitable for temperate fruitproduction. Moc Chau is well known in Vietnam for production of Tam Hoa plums. Due to the landscape diversity of Moc Chau not all areas have same potential for plum cultivation so GIS was used in combination with agro-ecological factors to identify and map areas with different levels of suitability for plum production.

Research method

Chilling units were determined using the George - Nissen model (George &Nissen, 1998). A MONRE digital map of Moc Chau was used as a foundation for the development of GIS maps. Data for temperature and rainfall was sourced from Moc Chau Meteorological Station. A survey of existing plum production areas was conducted to determine the current quality of plums produced in different areas of Moc Chau and match this quality to soil type, temperature and rainfall data. The maps were produced using GIS modelling and overlaying elevation, soil type, chilling units, administration borders of the districts and communes, andplum growth and quality.

Results

Areas suitable for plum production were divided into three levels of suitability: low, medium, and high. The main determinants were climate type and chill unit (CU). In many cases some villages within the commune that are at higher altitude are in higher suitability zone than villages on lower elevation. Similarly, within the same village orchards at higher elevation can be more suitable for plum production than orchards at lower elevation.

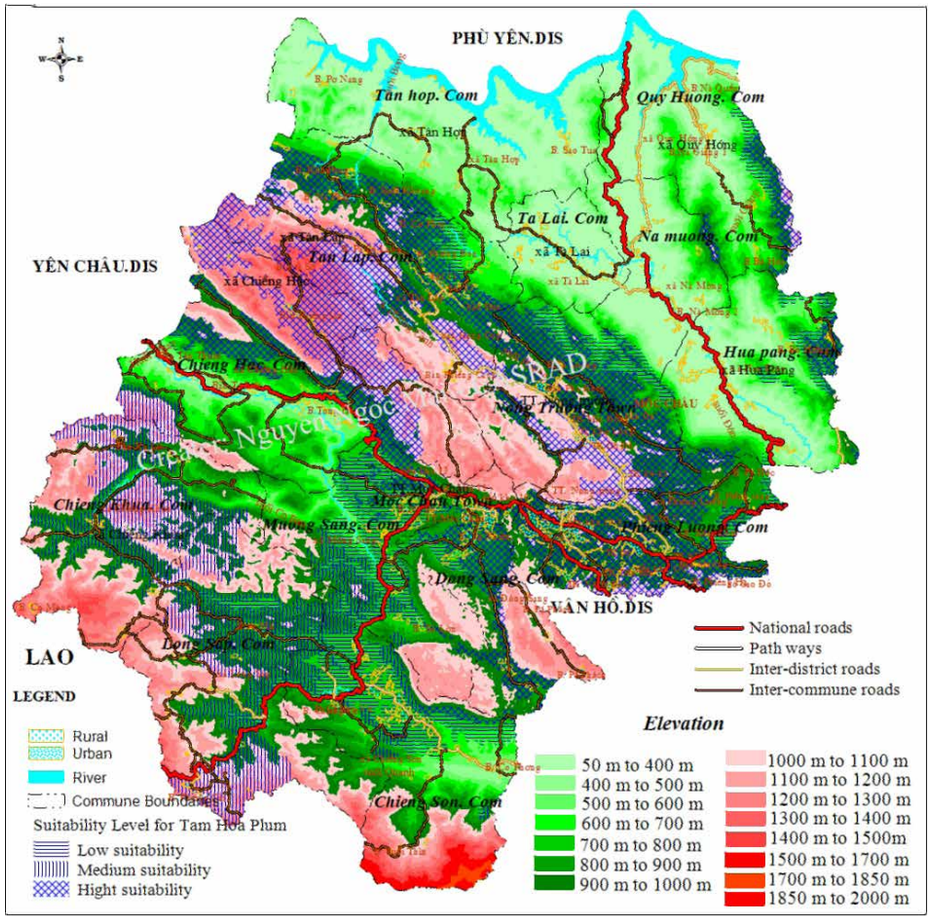

Figure: Suitability zones of Tam Hoa plum production in Moc Chau
Source: Nguyen Ngoc Mai, 2017

High suitability areas are located in the middle of Mộc Châu district at an elevation of 800m - 1300m and a chill unit measure of more than 400 CU. This climate area II is cool with an average temperature/year between 15-20°C. The cold season lasts about 4 - 7 months and there are medium to high precipitation rates between 1500 - 2500 mm/year. These areas in clude Tân Lập Commune, Nông Trường town (villagesat high elevation in cluding Pa Khen village), Phiềng Luông commune, Mộc Châu town (only villages with high elevation), Mường Sang commune (Nà Bó village), Chiềng Hắc commune (Tà Số and Phiềng Lán villages) and Đông Sang commune (Pá Phách, Chăm Cháy, Sung and Cóc villages).

Medium suitability areas are located in zones from800m - 1300m above the sea leveland 400 - 600 CU. This climate area is slightly cool with an

average temperature/yearbetween 15-20°C. The cold season lasts about 4 - 7 months and there is a low precipitation rate less than 1500 mm/year. These areas includeMường Sang (villages at higher altitude), Chiềng Sơn, Lóng Sập, Khiềng Khừa and Chiềng Hắc communes.

Low suitability areas are located in zones between 600m - 800m above the sea leveland chill factor of less than 400 CU. These areas include Mường Sang (Bãi Sậy, Lùn, TK 2, Thái Hung, and Sò Luon villages), Tân Lập (Đội 12, Phiềng Đón and Nóng Cóc villages), Chiềng Hắc (Tòng Hán village), Chiềng Sơn (Lò Lang, TK 10, TK1, TK3, TK4, TK2, TK 6, TK 30/4, TK 3/2 and Chiềng Ve villages), Phiềng Luông communes (Tám Ba village), parts of Nông Trường town (parts of Tà Lọng and Bản Ôn villages at lower altitude) and Mộc Châu town (TK14).

Conclusion

The suitability levels reflect the potential quality of plum fruit. This suitability map is intended to be used for strategic planning of plum production and marketing according to different suitability areas.

The areas with low suitability can be planned for production of processing quality plums, which under current market conditionsstill bring higher income to smallholders than most broadacre crops including maize.

Areas with medium suitability can be planted with plums for processing and for sale fresh at traditional markets. Farmers in prime areas could focus on modern retailers in urban markets.

This map can also be used to determine suitability for production of other temperate fruits.

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Food safety risk misperception – lessons learned and ways forward

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Key words

food safety, risk misperception, risk communication

Introduction

Food-borne diseases and food poisonings have attracted a lot of attention in Vietnam due to repeated occurrences of adulterated and unsafe food practices, which have been widely reported in the media. A number of food scares have occurred, including the presence of cyanide and phenol residues in seafood in the central coast of Vietnam due to the Formosa chemical spill, high pesticide residue levels in vegetables and the presence of antibiotics and banned veterinary residues in meat. The Vietnamese media has highlighted food safety issues, especially when famous people passed away at a young age from cancer. On 1st April 2016, an official program was launched on national television, called "Say no to contaminated foods". This program is broadcast daily during two primetime slots - 7:30 am and 8:30 pm [1]. In this poster, the authors wish to briefly review some aspects of communications around food safety risks and misperceptions, draw some lessons learned and propose ways forward to improve risk communication in Vietnam.

Food safety risk communication and risk misperception in Vietnam

Risk communication regarding food safety is often of poor quality and not based on scientific evidence from risk assessments. This tends to make consumers even more frightened about the foods they purchase. To communicate risk effectively, it is important to understand the psychology of risk perception. People encounter information from different sources about chemicals detected in food. Consumers normally do not think about risk in the same way that risk assessors understand risk. People filter information through a variety of lenses that affect their perceptions of the risks and what they can actually do to minimise them. For example, biological hazards in some foods can cause more sickness and deaths than chemical hazards, but consumers are usually more worried about chemical hazards [2,3].

Risk perception is complex and driven only partly by factual evidence. Food technologies often involve 'fear factors' that make them appear more worrisome than other risks. For example, eating pesticide-contaminated vegetables is (incorrectly) perceived as being riskier than riding a motorbike. Fear factors include distrust of large companies, dislike of 'unnatural' processes and uncertainty over unfamiliar dangers. People tend to worry more about risks caused by factors over which they feel they have no control, while being much less concerned about factors linked to their own behaviours. Consumers in Vietnam also usually pay more attention to chemical hazards rather than biological hazards in foods. However, recent studies in Hung Yen and Nghe An provinces showed that sulphonamide, chloramphenicol and B-agonist (Salbutamol) were present in some pork samples available at wet markets. Consumers perceived these as being extremely risky, but in reality the risks to the consumers were minimal. Conversely, high levels of *Salmonella* in cut and packaged pork (44.4%) potentially poses more potential health risks for consumers [4,5].

Lessons learned and ways forward

The marked difference in how experts and the public view food safety risks has significant consequences. People are usually concerned about hazards and confuse hazards and actual health risks. Health risks largely depend on the level and duration of exposure to a hazard. As a consequence, scarce resources are spent managing relatively minor problems, while many major issues are not addressed due to lack of resources. Thus, effective regulation of risk poses a challenge, and our natural tendencies to misperceive risk need to be countered by better evidence, not only about the risks themselves, but also on the psychology of risk perception. Risk communication that builds on empirical evidence of, and interactive

exchanges about, consumer understanding, as well as on food risks and benefits can help consumers make informed decisions. Accurate risk assessment of chemical, biological and physical hazards in foods is crucial for providing scientific information on the actual risk and informing official risk communication activities. Risk communication on food safety issues should be well integrated into the recommended risk-based food safety management system in Vietnam, as specified in the Food Safety Law 2010. In addition, involved ministries and other related agencies should develop a coordinated plan for communicating in one voice with all affected parties during food safety crises so that the public and all related stakeholders can receive timely, clear and accurate information from credible sources in order to avoid unnecessary panic.

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Systems approaches for value chain interventions targeting food safety and animal health in smallholder pig value chains

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Keywords

food safety; system dynamics; Vietnam; pigs; animal health

Introduction

In the context of animal health and food safety, economic impact assessment tools are increasingly important to quantify the probable impacts of risks and to aid in decision making in times of increasingly tight budget constraints (Rich and Niemi 2017). However, the risks and impacts associated with both food safety and animal health can take place at multiple parts of the food value chain, and have different short-term and long-term effects. This suggests a need for better impact assessment tools that take the impacts at the whole chain-level into account. This paper[1] applies a quantitative value chain approach to assess the impacts of interventions in selected pig value chains in Viet Nam, highlighting both short-term and long-term dynamic effects.

Research approach

The system dynamics (or SD) approach used maps out the complex interactions between actors and processes in value chains (Sterman 2000). They show how such structure affects system behavior, which can be influenced by external shocks. Using SD in livestock value chains has become popular in recent years (Rich et al. 2011; Naziri et al. 2015; Dizyee

et al. 2017; Grace et al., 2017). However, none of these approaches or related papers (Stave and Kopainsky 2015; Manning et al. 2006) highlight food safety issues within the value chain.

The model is based on a recent value chain survey of 420 pig producing farmers, 189 value chain intermediaries including 22 processors and 74 retailers, and 416 pork consumers in Nghe An and Hung Yen provinces in Viet Nam - the study sites of the PigRISK project. Model results focus on Nghe An, highlighting the linkages between production, marketing, profitability, and investment decisions.

Results

Two scenarios were analysed: (1) applying Good Agricultural Practices (GAP, which theVietGAHP guidelines are derived from) whereby farm costs increase 10%, leading to productivity gains of 20% and mortality losses reduced by 50% and (2) a food safety scenario where slaughterhouse margins rise 20% to cover food safety infrastructure and there is a 20% rise in consumer income due to positive health effects. Sensitivity analyses were conducted on reduced costs in scenario (1) and lowered increases in consumer income in scenario (2).

Applying GAP in the high cost scenario was not beneficial for farmers in mixed systems that combine farrow-wean and fattening activities. On the other hand, the low-cost scenario led to positive benefits in all systems. Food safety scenarios revealed higher demand for safe pork, offseting the higher prices paid in the baseline. However, in the lower income increase scenario, income and health gains by consumers are not enough to cover the higher margins and prices for safe pork.

Discussion

Model results provide several key lessons from a policy standpoint. In the GAP scenarios, for GAP to play a positive role in the value chain depends crucially on its cost of implementation. Identifying cost-effective solutions, such as a “VietGAHP lite” could positively influence adoption in the smallholder pig systems context in Viet Nam. These could include practices identified by Huyen et al. (2017) including improved feeding practices in pigpens, simple ventilation systems, drinking water through taps, and regular cleaning and disinfection. The role of extension to create awareness is critical.

The food safety scenarios highlight the potential role of the public sector in supporting value chain upgrading, especially if income gains associated with better public health do not provide adequate consumer incentives for buying safe pork. This public support could include assistance with finance and training programs to improve slaughter practices. Better capacity in the regulatory arena, in terms of inspection and compliance with standards, could further increase the returns to private sector investments in food safety.

More generally, the approach provided in this paper provides a template for decision making in value chains that could be applied in a variety of different agricultural and livestock contexts, including those in mountainous regions of Viet Nam. By considering the whole value chain and interactions that take place between different actors over different periods of time, our approach can help to overcome policy resistance that biases decision making towards immediate solutions that overlook the unintended consequences of those decisions in the future.

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Addressing food safety and animal health risks in pig value chains with economics and gender lens: What have we learned from case studies in Hung Yen and Nghe An?

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Key words

pig value chain, food safety, animal health risk, gender

Introduction

The pig sector in Vietnam, consisting largely of smallholders, is undergoing dynamic transformation, opening up new opportunities but also exposing the key actors to new challenges. Food safety risk is an increasingly important concern driven by emerging demand for food quality attributes by a growing, highly urbanized consumer class with increasing purchasing power. In response, food systems change. However, the likely gendered implications of these changes, particularly on the health and food safety risks to different actors in the pig value chain, are as yet not well understood. This study aimed at characterizing the pig value chain in Vietnam, using a gender lens which provides important insights for the targeting of animal health and food safety options.

Research approach

We assessed pig value chains in Hung Yen and Nghe An provinces, in the Red River delta and North Central coast, respectively. In comparison, Hung Yen is a more developed rural area undergoing faster industrialization and urbanization, whereas Nghe An is more rural. Three districts were selected as study sites in each province on the basis of pig population density (high, medium, and low). Within each district, three communes were selected based on pig density and share of smallholders. Focus group discussions (FGDs) were organized in these 18 communes to map and characterize

the pig value chains. Baseline surveys were implemented to collect detailed information about value chain actors, their roles and functions, and information to evaluate value chain performance. Where applicable, FGDs and survey tools were gendered to understand men and women's involvement in the pig value chain. A total of 420 pig producers, 11 pig traders, 51 slaughter entities, 22 meat processors, 74 meat retailers, and 416 consumers were interviewed in 2013 during the baseline surveys. Descriptive statistical analysis was used to analyze the data.

Results

Overall the results showed that the smallholder pig value chain involves a range of actors from producers, pig traders, slaughter house operators, meat retailers, meat processors, to consumers. Women were involved in each of the nodes and represent half of family labor playing the main role; they also comprise more than 90% of meat retailers. At home, food and meat purchasing and cooking is handled mostly by women. Both men and women work in slaughterhouses, performing different tasks, although men dominate this node; men are also dominant in pig trading. Women farm at relatively smaller scale and have lower production costs, and women-led pig production also exhibited relatively less sick pigs and lower pig mortality. On average, women contribute about 1.5 times more labor than men in performing tasks related to breed selection, feeding, cleaning barns, and keeping records.

Discussion and conclusion

Our results are consistent with other studies that found higher participation of women in pig production (Lapar et al., 2012; Tisdell, 2010); women's dominance in home-based work and men in far-away-from-home work, as well as women's significant participation in processing and distribution (Birungi & Ouma, 2017). The relative importance of women was found disproportional to production scale (Tisdell, 2010; Pham, 2011). Oxfam (2016) also found that men take on more responsibility for technical and heavier work such as vaccination and treatment of sick pigs.

Given their dominant presence and various roles in production, processing, and retailing meat, as shown in the research, women have important roles to play in managing risk. Understanding these risks and impacts will be useful in guiding and targeting interventions. To do this well, will mean understanding women's communication means, incentives, social networks and languages to deliver appropriate information on the roles and responsibility of producers, retailers and consumers for safe pork.

Better risk communication to all actors in the chain is crucial to better manage risks and engender food safety outcomes. Though this research provides us with more insights, our knowledge on gendered perception and practices of chain actors on animal health risks and food safety is still limited. Nor do we fully understand the likely gendered risks that emanate from food safety misperceptions, or how these vary by gender. This presents a rich area for future research within the Safe Pork project.

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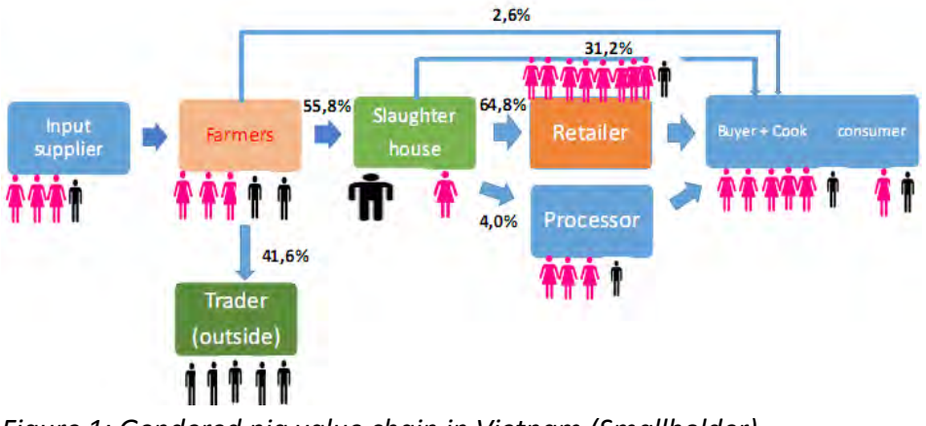

Figure 1: Gendered pig value chain in Vietnam (Smallholder)

Climate sensitive diseases in Vietnam: Aflatoxin B_1 in maize and zoonotic diseases in pigs

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Key words

leptospirosis, Japanese encephalitis, awareness

Background

Vietnam is a tropical country with high temperatures and precipitation which may provide good conditions for climate sensitive diseases. Limited studies have been conducted to evaluate the level of aflatoxin B_1 in maize and zoonotic diseases in pigs in Vietnam. In addition, no previous studies have been conducted to evaluate the perception and knowledge of aflatoxins in Vietnam. Therefore, the main objective of this study was to determine the prevalence of aflatoxin B_1 in maize and two zoonotic diseases (Japanese encephalitis and leptospirosis) in pigs, as well as to evaluate perceptions and knowledge of aflatoxins among people in the study areas.

Methods

Maize and pigs samples were randomly collected from six provinces based on high maize production to represent six agro-ecological zones; Son La, Hanoi, Nghe An, Dak Lak, Dong Nai, and An Giang. Samples per province were collected using multi-stage sampling (province-district-commune). The KAP survey was conducted among people in 5 provinces.

Maize was tested for aflatoxin B_1 with direct ELISA (Helica Biosystems Inc, Santa Ana, CA. USA), and calculated the mean, median and range

for each district, with only samples exceeding limit of detection (1µg/kg) included for calculation. All maize and pig samples were analyzed at the Plant Protection Research Institute (PPRI) and the National Institute of Veterinary Research (NIVR), respectively.

To evaluate the sero-prevalence of Japanese encephalitis (JE) and leptospirosis in pigs, direct ELISA and MAT (microscopic agglutination test including 15 serovars: Australis, Autumnalis, Grippotyphosa, Hardjo, Javanica, Tarassovi Mitis, Hebdomadis, Icterohaemorrhagiae, Canicola, Bataviae, Panama, Pomona, Pyrogenes, Saxkoebing and Semaranga) respectively were used. In addition, a semi-structured questionnaire collected information from households about their knowledge, attitude and practice related to mouldy maize. A multivariable logistic regression model was employed to evaluate the association between the demographic variables and awareness of aflatoxins using STATA (version 14.0, StataCorp, College Station, TX, USA).

Results

A total of 2,370 maize samples were collected from six provinces and analyzed. Among collected samples, 799 samples (33.71%, 95% CI: 31.81%-35.66%) were above 5 µg/kg, and 687 samples (28.98%, 95% CI: 27.17%-30.86%) were above 20 µg/kg and concentration ranged from 0 to 34.81 µg/kg, median: 4.59 µg/kg and mean: 0.46 µg/kg. A total of 1,959 sera samples were collected from five provinces and analyzed. Overall, the sero-prevalences of leptospirosis were 8.17% (95% CI: 6.99-9.47) and serovar Tarassovi Mitis (2.19%) had the highest prevalence followed by Australis (1.94%), Javanica (1.68%) and Autumnalis (1.17%) using a cutoff titer of ≥ 1:100 while 3.98% (95% CI: 3.16-4.95) for JE was detected.

A total of 551 people were interviewed from 6 provinces. The survey showed that awareness of aflatoxins (question: "*Have you heard about aflatoxins?*") in southern Vietnam [An Giang (25%), Dak Lak (23.23%) and Dong Nai (6%)] was relatively higher than provinces in northern [Hanoi (1.25%), Son La (1.09%) and Nghe An (0%)] Vietnam.

Discussion and Conclusions

This is the first large scale screening study for Aflatoxin B_1 in maize and leptospirosis and JE in pigs in Vietnam and the results are useful to better understand the level and epidemiology of aflatoxins, Japanese encephalitis and leptospirosis in different provinces. This study also suggests potential

risk to humans and animals in Vietnam as well as to identify demographic factors (such as gender and level of education) significantly influencing knowledge of aflatoxins. Further investigation is needed in each region into the possible role of environmental conditions and different wildlife species in contributing to infection.

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The role of market research in agricultural development for North West Vietnam: The case of fruit and vegetables

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Keywords

food expenditure, credence attributes, consumer behaviour, market opportunities, smallholders.

Introduction

Agricultural development has and continues to play a significant role in Vietnam's economic growth strategy (OECD 2015). In 2016 agriculture (value added) accounted for 36.4% of GDP in Vietnam (World Bank 2017). As the economy has grown and become increasingly open, agricultural and food industries and their roles have changed (OECD 2015). For smallholder food producers to remain competitive and maintain or increase profitability they must continuously adapt. Research can contribute to this task by providing information about, for example, market opportunities and developing and introducing new technologies. The objective of this study was to fill an information gap concerning household shopping behaviour, food consumption patterns, expenditure on foods, and the relative importance and value of varieties, attributes and information (e.g. provenance or safety certification). This information is necessary to identify profitable and sustainable market opportunities for smallholders supplying into an increasingly diverse and competitive market.

Methods

Consumer food preferences, expenditure and shopping behaviour were elicited in a comprehensive household survey in four Vietnamese cities: Ho

Chi Minh City, Hanoi, Lao Cai City and Son La City. The survey was adapted from that used by Umberger et al.(2015) and Toiba et al. (2015). Data was collected from approximately 2000 households from December 2016 to March 2017 (with a four-week break over Tet). Households were selected using a two-stage proportional random sampling method: (1) wards were selected based on ward-level population shares; (2) 14 households were randomly selected from each ward. The survey included questions to capture socio-demographic characteristics as well as expenditure for 93 food products, shopping behaviour, factors affecting food choices, access to food outlets, etc. The survey respondent was the adult member of the household who was responsible for most of the food purchase decisions.

Results

On average, the surveyed households spend 1,505,000 VND (67.52 USD[1]) on food per person each month. Meat and eggs account for the greatest percentage of the monthly food budget, across cities, meat and eggs costs account for 38-40% of food expenditures. Following this, vegetables account for 12-13% of monthly food expenditure and fruit accounts for 8-9% of monthly food expenditure. The majority of expenditures on these items are spent at traditional outlets such as formal wet markets, traditional family shops, semi-permanent shops, informal street markets and peddlers (Figure 1). The key factor affecting consumers' choice to shop at wet markets, informal street markets and semi-permanent stands was 'food products are fresh' (Figure 2). Food items dominating expenditures at modern retail outletssuch ashypermarkets, supermarkets, minimarts and specialty shops, include milk and milk products, processed foods and beverages (Figure 1). The key factor motivating consumers to shop at hypermarkets/supermarkets was "food is safe to eat" (Figure 2). "Good food product information" was rarely cited as a motivation to shop at any of the traditional outlets (less than 1% of consumers) but was mentioned as a motivating factor to shop at modern retail outlets by up to 5% of consumers (Figure 2).

Discussion and conclusion

This study is providing insights to food market dynamics in urban Vietnam. We show that urban Vietnamese consumers buy the majority of their food from traditional outlets such as wet markets. The importance of wet

[1] 22,291 VND = 1 USD on 1 December 2016.

markets in the meat, vegetable and fruit retail landscape could reflect the Vietnamese consumers' demand for freshness when buying these food items (Maruyama & Viet Trung 2009). However, the consumers' association of modern retail outlets with safe food and good product information could threaten the future of food shopping at some traditional outlets such as wet markets. Though the fraction of the sample (up to 5%) shopping at modern outlets for "good food product information" is relatively small, it is likely to be a growing fraction as consumers are increasingly concerned about food safety and health outcomes (e.g. Mergenthaler et al. 2009). If this pattern continues, outlets (as well as their supplying farmers)not currently providing food that is safe (or perceived to be safe) or well labelled could be at risk of losing market share. Our market research has identified potential opportunities and threats for farmers supplying food to rapidly changing markets in Vietnam. Importantly, this information can give farmers (directly or indirectly, through development projects) the capacity to be proactive rather than reactive to change in the agricultural industry and wider Vietnamese economy.

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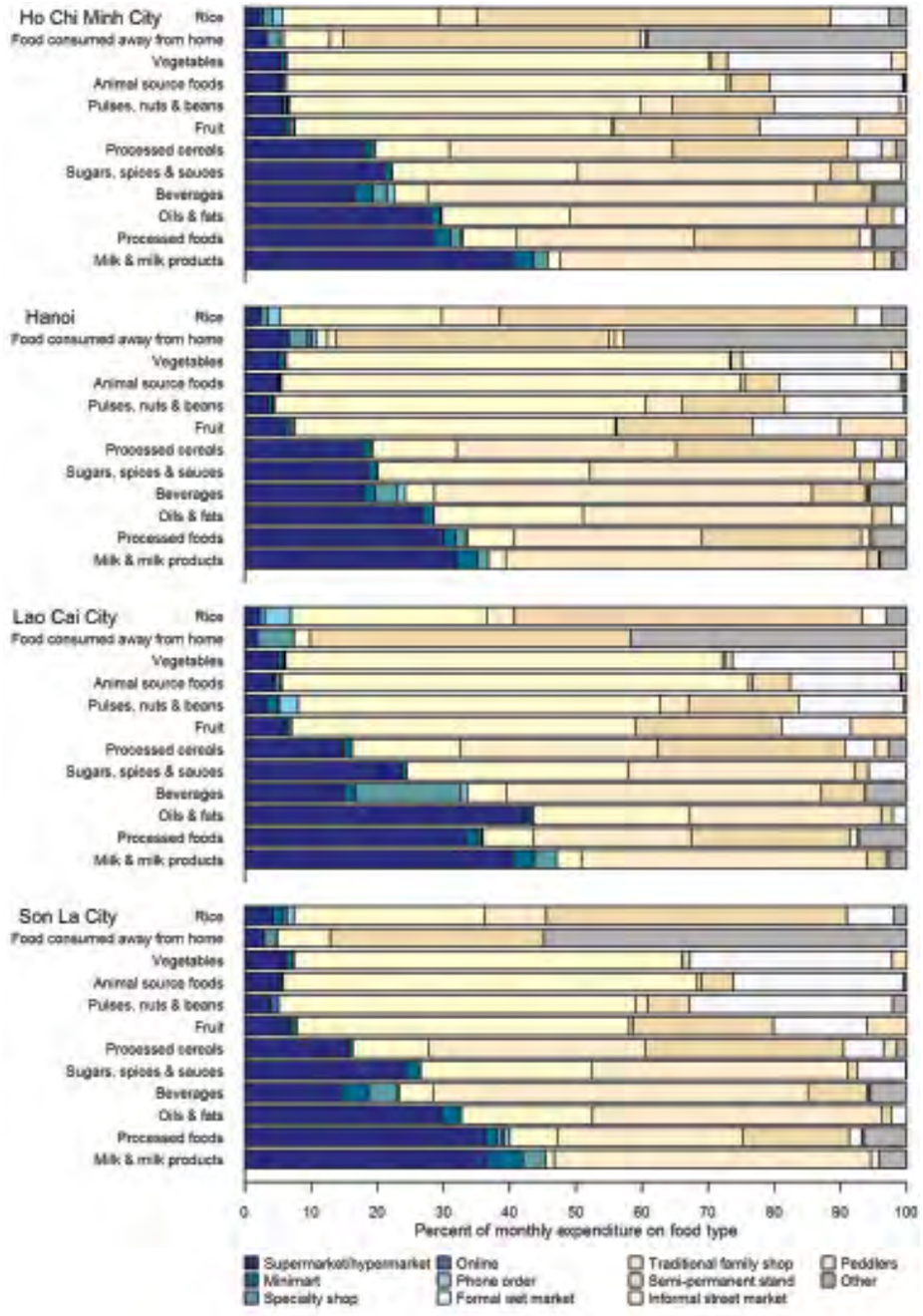

Figure 1: Percent of monthly food expenditure on different food types by outlet in Ho Chi Minh City, Hanoi, Lao Cai City and Son La City, Vietnam. Blue shading is used to depict modern retail outlets and traditional retail outlets are indicated by neutral shading.

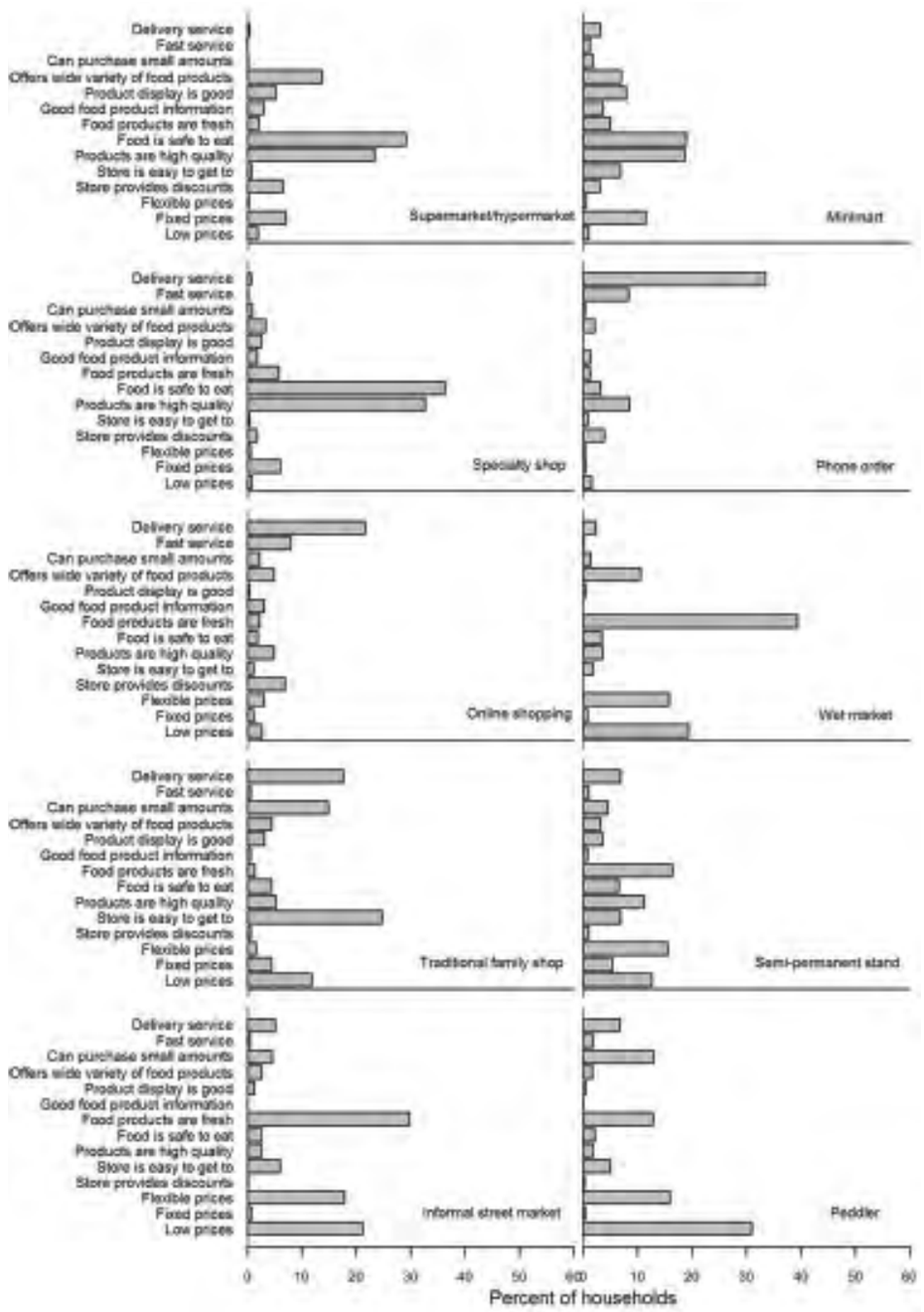

Figure 2: Percent of households that nominated [reason] as the main reason they shop at each different retail outlet (if they said they shop at the particular outlet) in Ho Chi Minh City, Hanoi, Lao Cai Cityand Son La City, Vietnam.

Food market modernization and diet-related health outcomes: Evidence from urban Vietnam

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Keywords

supermarket revolution, modern outlets, food consumption, overweight, BMI

Introduction

The retail food system in Vietnam has been rapidly transforming over the last decade. The increasing penetration of modern retail outlets (e.g. hypermarkets, supermarkets and minimarkets) is having a profound and multi-faceted effect on consumer welfare (e.g. Gorton et al., 2011; Wertheim-Heck and Spaargaren, 2015; Stephens et al., 2016). Although this change may have positive implications for urban consumers, such as increased shopping convenience and improved access to certain types of food products, one concern is that modern food retail outlets can result in unintended diet-related non-communicable diseases (e.g. obesity, Type II diabetes) if increasing penetration of modern food retailers introduces or increases access to unhealthy foods that are less nutritious but energy-dense (Toiba et al., 2015; Umberger et al., 2015). Empirical evidence, however, is rather limited. The objective of this study was to fill this data gap, and understand the impact of food market modernization on diets in urban Vietnam.

Methods

Data were collected through a comprehensive survey of 1,700 representative households in Hanoi and Ho Chi Minh City. The survey was conducted from December 2016 to March 2017. The survey sample included 4,073 adults and 1,596 children. The following regression model was used to estimate the impact of food expenditure share at modern retail outlets (i.e. the percentage of food expenditures spent at modern outlets such as supermarkets) (β) on the body mass index (BMI) z-scores of surveyed children, while controlling for both household- (H) and child-specific (X) characteristics.

$$BMI = constant + \beta Modernmarket + H\gamma + X\delta + error$$

Econometric estimation was conducted for a variety of subsamples broken down by gender, age and household income.

Results

On average, 10-11% of monthly food expenditures are destined for supermarkets in Hanoi and Ho Chi Minh City. The average BMI for surveyed adults was 22.13 (13.1% were overweight - defined as BMI > 25), and that of children was 18.6 (5% were overweight, defined as weight-for-height z-score > 2 standard deviations).

The regression analysis using the whole sample suggests no statistically significant impact of food expenditure shares at modern retail outlets on the BMI z-scores of children. However, a statistically significant subsample impacts exists for girls aged 6-9 and girls from upper-middle income households in terms of changes in both BMI and overweight status. Such impacts are positive, i.e. the greater the household's percentage of monthly food expenditure spent at a modern food retail outlets, the higher the BMI or more likely the girl is to be overweight. Specifically, a one percentage point increase in supermarket food expenditure share raises the probability of being overweight by 0.003. These impact estimates are robust according to a variety of alternative econometric settings. Specifically, such impacts remain in the model with binary overweight outcomes.

Discussion and conclusion

The current study investigates the possible relationship between food market modernization, as manifested in household supermarket food expenditure share, and the weight outcomes of both adults and children in urban Vietnam. It was estimated that girls aged 6-9 and girls from upper middle income households may be at risk of 0.11-0.12 kilogram of weight increases for each extra 1 percent of food expenditure their households spend at supermarkets. While these impacts may seem small, they are significant for individuals at the margin of weight groups, because the impacts persist when we use the binary indicator of overweight status. Following these results, it appears that the increasing presence of modern food retail outlets in urban Vietnam could increase overweight

rates. Such information is of interest to policy makers as they decide on appropriate actions (or not) to minimize the public health risks associated with a changing food retailing landscape in urban Vietnam.

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To market, to market: Does smallholder vegetable production lead to increased children dietary diversity? Empirical evidence from North West Vietnam

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Keywords

child dietary diversity, market engagement, women empowerment, vegetable production

Introduction

In this paper, we examine the relationship between smallholder vegetable production and children's dietary diversity as a proxy for diet quality. We explore this relationship for female and male children between 6 to 60 months and between >5 to 17 years of age. At the household level, these relationships could be a result of one or a combination of three main factors: (1) consumption of own food production, (2) consumption of more nutritious and diverse food due to agricultural income from selling produce to food markets, and (3) gender-related factors pertaining to women's social status and empowerment in agriculture. Recent studies have found positive correlations between children's diets in Africa and Asia, and measures of farm production diversity, access to market, and agricultural income. However, the literature exploring whether a specific causal linkage exists between smallholder vegetable production and consumption is very limited, especially with respect to remote rural farming households in Asia. This paper helps bridge this gap in the literature using cross-sectional data collected in 2016 in the northwest mountainous region of Vietnam.

Research approach

We use data from a rural household survey collected in July-August 2016, which included a 2-non-consecutive day dietary recall. Smallholder farming households were selected using a stratified multistage sampling strategy. In total, we have 364 households with children aged 6 months to 17 years. For dietary diversity, we use child dietary diversity score (CDDS) as proxy for diet quality. CDDS is the mean unweighted count of the number of unique food groups consumed by the child in the two reference period using 14 food groups. We use the generalized linear models Poisson estimator to assess the associations between smallholder vegetable production and CDDS, controlling for potential confounders. We estimate nine regressions: pooled sample of children, by age group (children 6 to 60 months, and >5 to 17 years old), by gender, and by age group and gender.

Results

Overall, the average diet is relatively diverse, comprising staples, vegetables, meat, and nuts and beans. Our results suggest that market access and market participation are more important than vegetable production diversity in improving the diet quality of children aged >5 to 17 years. Similar to other studies, market participation is positively associated with child dietary diversity, while market access is negatively correlated. The latter indicates a decline in child dietary diversity the farther a house is to the nearest food market. In terms of women's empowerment in agriculture, we only find a positive association between group membership and CDDS for older girls, and a negative association between access to credit and CDDS for older boys. No association is found for children under 5 years.

Discussion and conclusion

This study was carried out to investigate how smallholder vegetable production in the rural areas can improve child diet quality through dietary diversity. To improve the dietary diversity of children, market engagement is a key step. Market access, and the income derived from market participation can significantly improve the dietary diversity of children, especially boys >5 to 17 years of age. Households that are in close proximity to food markets have more access to diverse food that only food markets can provide. In addition, the income derived from the sale of vegetables to the nearest food market are used to purchase other diverse and nutritious food. This means creating and/or improving market

linkages between smallholder vegetable producers and markets. The type of linkage will depend on the specific conditions in each locality: farmer-to-trader linkages, farmer-to-retailer linkages, creation of farmer groups or cooperatives, etc.

For children under five years, our results suggest that agricultural interventions which focus on: (1) the promotion of income-generating opportunities to increase their households' access to diverse and nutrient-rich food; (2) improvement of the nutritional knowledge of the Mong people; and (3) targeted intervention on the low-lying and low vegetable per capita density areas, are more likely to improve diet quality. However, our data is only limited to one season. Secondly, we are also aware of potential issues with endogeneity with respect to household.

Concerns and valuation of food quality and food safety in urban Vietnam

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Keywords

food safety, food quality, consumer valuation, credence attributes, urban Vietnam

Introduction

The food system in Vietnam has undergone a series of rapid changes in recent years, including the emergence and expansion of modern food retailing and a shift in consumer preferences toward higher value food products (Mergenthaler, Weinberger & Qaim 2009). Food quality and food safety are becoming more important to consumers, thus generating a need for actors along the supply chain to adapt to changing market conditions (Cadilhon et al. 2006; Wertheim-Heck, Vellema & Spaargaren 2015). Understanding the value consumers place on food quality and food safety attributes as well as why they might value these attributes is essential in order to inform smallholder farmers and other stakeholders of market requirements and potential market opportunities to supply products that satisfy heterogeneous consumer demands.

Methods

The data was collected from a representative sample of 2,000 urban consumer households in four Vietnamese cities: Ho Chi Minh City, Hanoi, Lao Cai City and Son La City from December 2016 to March 2017. The survey instrument was adapted from that used by Umberger et al. (2015) and Wahida et al. (2013). Households included in the sample were selected using a proportional random sampling method. In each city we selected wards based on ward-level population shares from official statistics. From the selected wards, a constant number of households were randomly chosen. In addition to understanding urban consumers' food purchase and consumption patterns, the survey also obtained information on consumers' perceptions and attitudes regarding food safety and quality issues, preferences for certified safe food products, and their willingness-to-pay for certified products.

Results

The results indicate a high level of concern about food safety and demonstrate that Ho Chi Minh consumers are relatively more nutrition-conscious (Figure 1). Consumers are relatively more concerned with food safety issues, including heavy metal, bacterial or pesticide contamination compared to nutrition issues such as high sugar or salt content. Consumers in Hanoi and Ho Chi Minh City appear to be more concerned about food safety compared to consumers in the smaller regional cities, Son La and Lao Cai.

Consumers were also asked to identify the type of organisation or agency (e.g. government or industry organizations) that they would most trust to certify quality and/or safety of food products. The majority of consumers, in general, trust certifications or verifications from the Central Government and other public organizations (Figure 2). Independent third-party certification (TPC) is an important source of certification in developed countries, however, in Vietnam, it appers that consumers have both low awareness and trust in TPC (Figure 2).

Consumers were then asked to indicate the importance of certain food standards and certifications. Overall, the highest mean level of importance across all cities was for "Certified Safe", followed by "Organic" and "VietGAP". On average, 50% of consumers have previously purchased "Certified Safe" products and these figures were even smaller for "Organic" and "VietGap" (< 30%).

For a sub-group of foods that were of interest to ACIAR agribusiness projects, and also susceptable to food safety concerns (e.g. fruits, vegetables and beef), we asked whether consumers would be willing to pay more for a certified 'safe' product and how much more they would be willing to pay. The majority of respondents (>67%) indicated they would be willing to buy certified 'safe' products if the price was right. The average premium these consumers were willing to pay was about 20% extra for a certified product.

Discussion and conclusion

Although the Vietnamese government regards provision of safe and healthy food as important policy (Wertheim-Heck, Vellema & Spaargaren 2014), consumers' concerns about food safety issues are still growing. The preliminary results from this study give us evidence to support many anecdotal suggestions of food safety and nutrition concerns that are increasingly influencing consumer decision making in Vietnam. With growing incomes more urban consumers are willing to pay and have ability to purchase higher value food products with safety assurances. From a research for development perspective this information allows us to consider interventions in the food supply chain that can benefit producers and consumers. For example, knowing that consumers are concerned about pesticide, bacterial and heavy metal contamination we must think about ways to build trust between producers and consumers on these issues. This could come in the form of improved food labelling, establishing food standards, and/or by building institutional arrangements in certification programs (e.g. Good Agricultural Practice programs such as VietGAP).

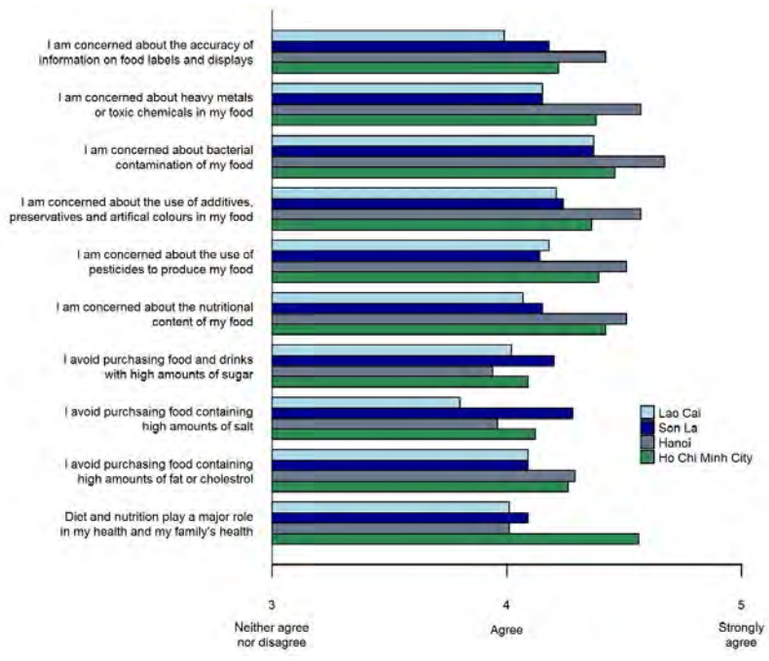

Figure 1: Average response to statements about food safety and nutrition concerns by consumers in Lao Cai, Son La, Hanoi and Ho Chi Minh City in Vietnam. Results were obtained using a Likert scale as follows: 1 = Strongly disagree; 2 = Disagree; 3 = Neither agree nor disagree; 4 = Agree; and 5 = Strongly agree

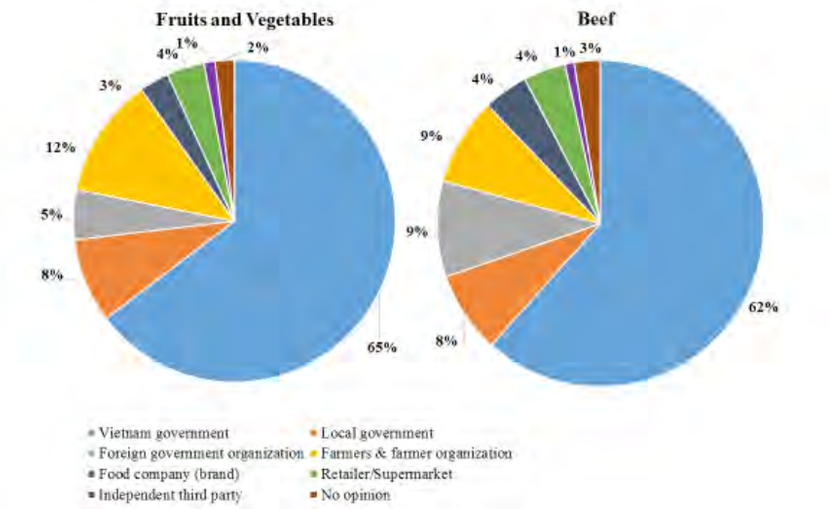

Figure 2: Percent of respondents that selected each source of certification as the 'most trusted' for product safety and quality for beef, fruits and vegetables in Vietnam. Results are the average responses from survey respondents in Lao Cai, Son La, Hanoi and Ho Chi Minh City, Vietnam

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Pig and maize interactions: Lessons for strengthening pig farmers' livelihoods and improving maize farmers' land use

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Keywords

rural livelihoods, crop-livestock interaction, institutional arrangements

Introduction

Pig raising can offer significant opportunities for improved livelihoods for many households in north-west Vietnam, one of the poorest and most remote regions in the country (Huyen et al, 2016). Traditionally, pigs are a key component of the agricultural systems in this region, and are fed with wild leaves and crop residues to produce a product at a low cost yet of perceived high quality. In recent years, intensified production systems have evolved with the introduction of new pig breeds and hybrid maize varieties grown as animal feed. This has led to maize becoming a dominant crop in these mountainous areas, grown on steep slopes and in monoculture, leading to considerable soil erosion and a decline in soil fertility (Nguyen et al., 2016). This research aims at identifying major constraints and opportunities in the improved integration of pig and maize production, to improve smallholders' income while making the system more environmentally sustainable by investigating more diverse and profitable crop rotations as well as improvements to soil fertility through cycling of nutrients and organic matter. The results will form the basis for more in-depth research on the most promising options.

Research approach

As a starting point, a broad systematic literature review of peer reviewed publications and grey literature on maize and pig production in Vietnam in general and in the north-west in particular was implemented. This was followed by a collection of primary data in March 2017 from 4 communes in Son La and Hoa Binh provinces. These provinces were selected because they have the largest area of maize and population of pigs in the north-west. Hoa Binh is also a study site of SafePORK a planned ACIAR initiative to support safer pork production. Within each province, we selected one commune with low and one with high market access. Data were collected using four different tools: i) Value chain mapping with local stakeholders; ii) Key informant interviews on value chains; iii) Focus groups discussions with farmers; and iv) Individual interviews with farmers. A total of 165 actors were interviewed, with between 39 to 44 actors in each of the four communes.

Results

Pork remains an important animal-source food in the Vietnamese diet. Demand for pork has increased over time, largely attributed to population growth and rising income (Nga et al., 2015). There is also an increasing demand for higher quality pig products in urban centres, including for "naturally raised" pigs (Gautier et al., 2009; Lapar and Toan, 2010). However, so far pig production in the study area seems to be slow in responding to such opportunities. Results from the field work show that the integrated maize–pig system is widely practiced by farmers in the four communes. The main advantages of this system over a specialised pig farm relying on purchased concentrates were listed as (i) better control over timely availability and quality, as maize feed is available on farm; (ii) reduced feed costs by avoiding transport and transactions; and (iii) potentially producing a product for supplying a niche meat market for perceived high quality pigs and/or meeting the demand for "naturally raised" pork based on non-commercial feeds. Yet, several disadvantages were also identified during the survey, including: (i) high labour demand of maize production; (ii) difficulties in maize storage, prevalence of aflatoxins in maize; (iii) higher fat content of pork produced with maize-dominated feed; (iv) longer production cycle of pigs fed predominantly with maize compared to balanced commercial feed. The study results highlighted the difficulties the smallholders in these communes have in regard to accessing inputs and services as well as more profitable markets for their pig products. Various options for value chain improvements such as producer groups (Huyen et. Al. 2016), contract farming (Lapar et al. 2007) and a "preferred trader" system (Scholl et al. 2016) were discussed with the value chain stakeholders. They agreed that collective

action allows smallholders to access lucrative markets. However, these organizations tend to deteriorate once external support is withdrawn. On the other hand, contract farming has by design a strong private sector component and tends to be economically sustainable, but often fails to integrate small scale farmers in more remote locations.

Discussion and conclusion

This study has looked at mechanisms to support the improved integration of pig and maize activities to improve smallholders' income while making the system more environmentally sustainable by looking at alternative feed production and feeding strategies. With the main farming systems in north-west Vietnam still being traditional smallholder production, pig producers in this region can take advantage of their relatively 'natural' production practices that have been increasingly valued by specific types of consumers in specific markets. To be able to support such evolution and given the existing maize-pig integration advantages, more research is needed on alternative farm-produced feeds, for example forage legumes, which may complement maize, both for more sustainable feed production and more balanced diets. For these systems to impact household income through better market integration, new institutional arrangements to link pig farmers to markets are required both for inputs and services including extension, as well as for output markets. Because the strategies for improving market access, which have been successful in other locations and were discussed in this study, show various constraints, new strategies have to be explored. A possible combination of some of the discussed approaches, for example a preferred trader system linked to a specialty outlet in provincial and regional towns, organized around producer groups, appears to be worthwhile for investigation. Finally, to show that traditionally raised pigs can also provide safe pork, linkages to SafePORK are foreseen.

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Theme 4: Inclusive and prosperous communities

Gender matters in agricultural innovation: A case study from Central Vietnam

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Keywords

feminization of agriculture, rural masculinities, agency, innovation, Vietnam

Introduction

Rural agriculture in Central Vietnam has been rapidly changing with booming cash crops and increasing migration opportunities in both rural and urban areas. In this process, women came to be a major provider of farming in the absence of men who are involved in rural-rural, rural-urban or international migration. While gender roles in agriculture have profoundly been changed, conventional rural masculinities persist and men remain as 'a pillar of the house' who sustains their decision-making power in agriculture. Rural agricultural planning without understanding gender relations runs the risk of supporting interests of men than women, thereby sustaining patriarchy and impeding overall rural development. Drawing upon social theories of rural masculinities and gender relations, this article addresses questions of how men and women benefit from agricultural innovation within the prevailing gender structure; and how rural masculinities and femininities are negotiated in the processes of agricultural innovation. We seek to contribute to knowledge for more inclusive agricultural development that facilitates agricultural innovation for women as well as men.

Research approach

This study views the processes of agricultural innovation as gendered construct (Wacjman, 2010). To explore gendered processes, it employs social concepts drawn on critical social theory, such as masculinities (Connell, 1995; Campbell and Bell, 2000), gender relations (Connell, 2009) and gendered agency and power to change (Kabeer, 2000).

A case study was conducted in two villages in Ha Tinh and Quang Binh provinces in 2016. The villages were selected from the potential project sites for roots and tuber crops. This study was part of comparative qualitative research, the global gender norm study of CGIAR (GENNOVATE, 2014). The study consists of 12 focus groups, 16 in-depth interviews (eight innovative men and women and eight disadvantaged men and women) and eight key informant interviews (famers' union and women' union leaders at commune and village levels). The study explores the processes of innovation for men and women to identify gendered opportunity structures within the restricted gender norms and relationships.

Results

The findings show that men and women have different ways to access the resources on which a particular innovation depends, and therefore have different opportunities of benefitting from it. Men's notion of power is associated with material and economic assets. The purchase/use of machinery and increased incomes from the adoption of new varieties are directly associated with men's success, increased power and confidence. On the other hand, women feel empowered and confident when they play a supportive instead of a central role in economic activities, as being independent from their husbands is not a socially desirable situation. The flows of knowledge and information are also highly gendered. Women tend to learn agricultural innovation from their female relatives and female friends, while men use their formal networks such as farmers' association, government officers and private companies. Despite the persistence of patriarchal structures that limit women's innovation opportunities, women do have a small space for taking up innovation within their own domains in everyday agricultural activities such as small livestock and home garden where they have autonomy over changing current practices and taking risks, shaping women's and men's different interests in and opportunities for benefitting from agricultural innovation. These findings question assumptions that technologies are evenly benefitted by men and women within the household.

Discussion and conclusion

Key insights for more inclusive interventions are discussed. First, interventions that bridge formal institutions and informal social networks are very helpful, as they can open up new opportunities to those who have had few chances to participate in past projects. Transforming the dissemination of technologies from using a formal school-like teaching

method to embracing informal networks and informal learning practices can be a first step for expanding target populations to the marginalized groups. Evaluation and monitoring also need to be redesigned by moving beyond examining the impact on the primary target to toward tracing how technologies are disseminated through informal networks.

Second, innovation activities that fit well with the context-specific expectations and wants of women farmers are more likely to be adopted. If the innovation fits with gendered social expectations, it can strengthen women's and men's perceptions of their own power, and thereby increase their self-confidence, and hopefully encourage them to seize further opportunities for innovation.

Third, identifying women's and men's autonomous domain can be an entry point to facilitating their participation in agricultural innovation under the restrictive patriarchal structures.

Finally, a family or community is not a homogenous unit of agricultural innovation. Without understanding the social power dynamics at play, innovation supports only those who already have significant power, potentially creating jealousy and tension among the family and the community. Considering the social power dynamics helps us to think about how and to whom new technologies are introduced.

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Main barriers to adoption of technical innovations for temperate fruit production by smallholder farmers

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Key words

barriers to adoption, temperate fruits, strategic planning

Introduction

Temperate fruits are an important income source for many farmers in the North-west of Vietnam. Between the late 1980s and the early 2000s, plum and to a lesser extent apricot and peach contributed a large proportion of household income for many farmers in Son La and Lao Cai provinces. During that time new plantings were developed at a very fast pace but productivity per unit area was low due to poor orchard management. This unsustainable development led to a major correction in the early 2000s when over-production resulted in the price of plums and apricots plunging, which let to many farmers chopping down temperate fruit trees. (DARD Lao Cai, 2011; DARD Son La, 2011).

To address the problem of low productivity and lack of varietal diversification the Vietnamese government and international donors have funded over 40 projects and invested heavily in extension efforts to promote the adoption of technical innovations. Despite all these efforts a very limited number of new varieties were introduced and the yield and quality of fruit remains low due to poor adoption of developed orchard management practices by growers.

A study to understand barriers of adoption was conducted as part of the ACIAR project AGB/2012/060 with the aim to help government institutions develop better research and extension approaches.

Research approach

Research was based on a review of the Vietnamese government past, current and planned temperate fruit related policies, programs and plans and on a comparative case study of 5 selected projects implemented in NW Vietnam. Information was collected from project documents and from key informants and farmers.

The 5 selected projects were different in terms of implementing institutions, target technologies and target communities. Key informants included the projects' leaders, coordinators and main researchers, local DARD staff involved in the projects, and the projects' target communities' leaders and extension officers. Information from farmers was collected through focus group discussions (FGD), which were organized in both project and non-project villages, with 5-6 farmers per group. For each of the selected project 3-5 FGDs were organized.

Results and discussions

Results show that the main barriers to adoption of improved production practices are related to the following factors (i) lack of consultation with local stakeholders during the design phase of the project, (ii) lack of participatory approaches to facilitate involvement of stakeholders, especially the local authority, extension officers and farmers in project implementation, (iii) inappropriate communication strategies, (iv) poor linkages to local government initiatives and lack of follow-up activities after project completion, (v) inappropriateness of techniques in the local context and high cost for their adoption, and (vi) poor and unstable supply chains.

The main barrier to introduction of new varieties is an undeveloped nursery industry that suffers from lack of autonomy from government institutions, over-reliance on projects, a lack of entrepreneurship and international contacts and inability to collect royalties resulting in limited access to new varieties.

The lack of participation of local stakeholders including government institutions, farmers, input suppliers and traders in project formulation and implementation is the main underlying cause of poor adoption of project

outputs. Because research institutions work in isolation, project teams usually make improper selection of sites and/or households, improper identification of priorities, improper planning and implementation of activities and finally the technologies developed are unsuitable for the local socio-economic and/or environmental context.

After project completion local institutions (which were not involved in the project implementation) do not have the necessary human and financial resources to support adoption of project outputs through necessary technical training of farmers or building farmer capacity. The local institutions also are unable to support farmers to access finance to enable the implementation of new technologies. Lack of capital is often the main barrier hindering farmer adoption, even when they understand well and know how to apply new practices.

Conclusions

In order to promote the adoption of technical innovations for temperate fruit production by smallholder farmers in the North West, research priorities should be based on national and provincial level strategic plans for development of the temperate fruit industry. Design of research projects should be a consultative process involving a broad range of industry stakeholders and should be aligned with local government priorities. Monitoring and evaluation of project implementation should be a participatory process involving local institutions, the private sector and farmers. Development of support mechanisms for adoption of new technologies should be coordinated with the project implementation.

To facilitate these processes, project AGB/2012/060 is developing provincial and interprovincial forums as the platform for dialog between stakeholders involved in the temperate fruit industry and is currently working with the provincial governments of Son La and Lao Cai provinces on development of strategic plans for temperate fruit industry development based on potential supply capacity and market demand. Strategic plans will also identify research priorities and capacity building needs of local government institutions, private sector stakeholders and farmers.

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Market prospects for Vietnamese pear and implications for government intervention

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Introduction

Pear has been recently added to the portfolio of priority fruits for the mountainous northwest region. Encouraged by successful on-station trials of VH6, a Taiwanese variety, the Lao Cai government started providing farmers with seedlings and other inputs for orchard establishment. As a result, planted areas in the province have expanded considerably since the late 2000s, reaching 540 ha in 2017 (*personal communication*, Lao Cai Plant Protection Sub-Department). According to the provincial plan, an additional 250 ha will be planted by 2020. Production will increase significantly over the coming years as young trees reach productive age.

In the past, fruit growers in the northwest have suffered from an excessive expansion of planted areas and a consequent collapse of market prices. Is pear likely to undergo a similar boom and bust cycle? Market size and market seasonality data can help us answer this question. Are current government interventions aligned with market conditions? Is there scope for further expansion of planted areas? The strategic implications of research findings are discussed.

Data and methods

The analysis presented is based on supply and price data from Long Bien Market, the main wholesaling point in Hanoifor fruits grown domestically or imported from China. This is the main market channel for fruits in Hanoi and a source of supplies for other urban markets as well, especially in northern and central Vietnam.

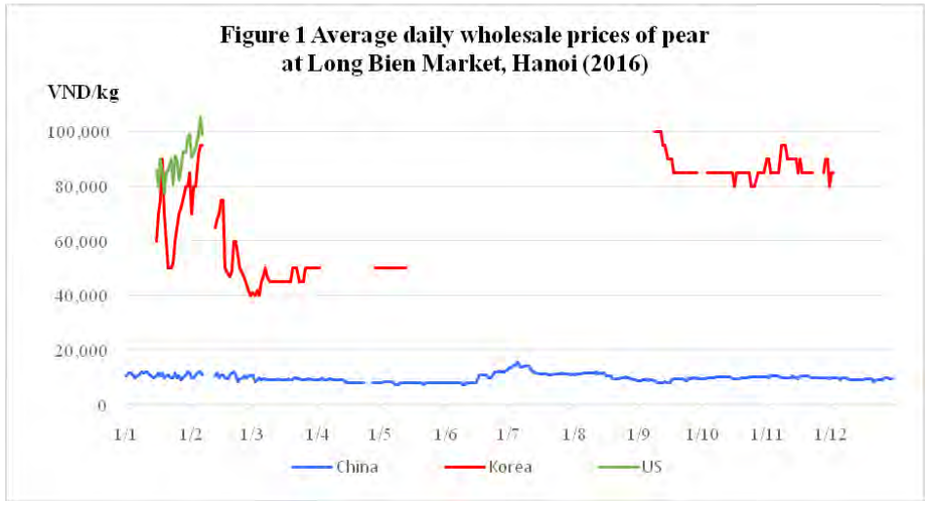
In 2016 one market staff was responsible for recording estimated pear volumes delivered every day to wholesalers, discriminated by variety and origin, based on direct observation of incoming trucks. Every night the same staff also collected information from six selected pear wholesalers on the selling price of different varieties and origins at 1-2 am, a peak trading time.

Results

In 2016 an estimated 31,424 tons of pear were wholesaled in Long Bien. China accounted for 99.9% of market supply, South Korea and the United States for just 0,1%. No Vietnamese pear was sold in Long Bien, as the harvest is currently too small.

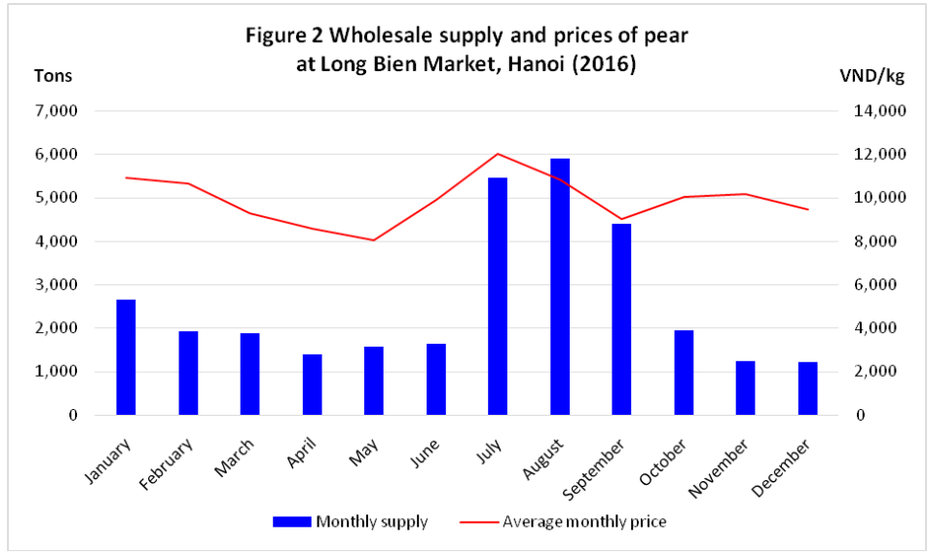
China's market dominance can be largely attributed to price. At Long Bien market Chinese pear was four to ten times cheaper than pear from South Korea or the United States (Figure 1).

Figure 1 Average daily wholesale prices of pear at Long Bien Market, Hanoi (2016)



Supply was concentrated during the July-September months (Figure 2). Half of the Long Bien pear trade was conducted during the third quarter. Surprisingly, there was no clear correlation between supply and prices, an issue that merits further research. Prices peaked in July and August, which were also peak-supply months. While relatively stable intra-annual pear prices are likely to reflect price patterns in China, a significant increase in imports at a time when prices were relatively high may have been a consequence of lower availability of competing local fruits compared to other times of the year.

Figure 2 Wholesale supply and prices of pear at Long Bien Market, Hanoi (2016)



Pear from China was of the Asian, round-shaped type. Chinese yellow pear, as it is known in the trade, dominated supply, accounting for 62% of the wholesale trade. Unlike other varieties, it was available throughout the year.

Discussion and Conclusion

The emergence of Lao Cai as a pear producer will have a strong impact on domestic supply. It is projected that from 2025 onwards 4,500 tons of pear or more will be harvested every year within the province. Most of the crop will be marketed within a very short, three to four week period, spanning from mid-June to mid-July. For comparison purposes, about 3,000 tons were wholesaled in Long Bien market between 15 June and 15 July 2016.

Lao Cai farmers will face strong competition from China domestically. This will intensify as the local harvest progresses. In late June 2016 the daily supply of Chinese pear at Long Bien market ranged from 50 to 60 tons, but tripled over the following two weeks, reaching 175 tons on 15 July. On a more positive note, the pear harvest in Lao Cai coincides with a period of relatively low competition from other local fruits and there may be opportunities to export pears across the border to Yunnan, especially during the early harvesting stages, an off-season period in China.

While on-going market research will improve current understanding of market opportunities and future scenarios, the risk of over-supply is

real. No clear negative correlation between supply and prices was found, but such a surprising pattern cannot be taken for granted in a context of dynamic markets. A more cautious government strategy, less focused on subsidized expansion of planted areas and one single variety with a short harvesting season, is therefore recommended. Key sources of competitiveness should be prioritized. The development of nurseries with diversified portfolios of productive and marketable varieties is one example. The transfer of critical technical know-how to farmers, so that they can achieve high yields and harvest good-quality fruit that meets consumer preferences in Vietnam and
neighboring China, is equally important.

Supply seasonality and competitive advantage: The case of plums in Vietnam

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Introduction

Plum is the most important temperate fruit in North West Vietnam. After years of decline, the crop has regained its importance as a major source of income for many households due to improved market conditions: farm-gate prices have been rising for a decade following adjustments in planted areas and the development of a cross-border export trade with China inunripe plums for processing and in ripe plums for fresh markets (Bonney et al., 2016, Wandschneider et al., 2016).

Vietnam's competitive position will have a major influence on the future growth of the plum sub-sector. While farm productivity and fruit quality are commonly cited determinants of competitiveness, this research focuses on a third source of competitive advantage: seasonality. Three questions are addressed: What origins and varieties are available in domestic markets and what is their respective market share? Are domestic and imported plums marketed at the same time or at different periods? What are the seasonal price patterns for different origins? The implications for market competitiveness and government policy are also discussed.

Data and methods

The analysis presented is based on data collected during 2015 and 2016 at Long Bien market, the main wholesaling point for fruits in Hanoi and the Red River Delta. Based on direct observation of all trucks arriving at Long Bien, one market staff was responsible for recording estimated plum volumes delivered every day to market wholesalers, discriminated by variety and origin. Every night the same staff also collected information

on the wholesale selling price of different varieties and origins at 1-2 am, a peak trading time. Price data was collected from a selected group of six traders. The prices reported were for ungraded fruit as there is no clear plum grading system at the wholesale level.

Results

Nearly all plums sold in Hanoi are from Vietnam or China. Volumes imported from the United States, a third origin, have no statistical expression. In 2015 China accounted for 86% and Vietnam for 14% of the Hanoi wholesale market. In 2016 China had a 69% and Vietnam a 31% share.

Despite their dominant position, Chinese plums did not displace domestic production, as there was little overlapping in the marketing of the two origins. In Vietnam most plums are picked from late April to late June, whereas Chinese plums start being imported as the Vietnamese harvest is coming to an end (Figures 1 and 2).

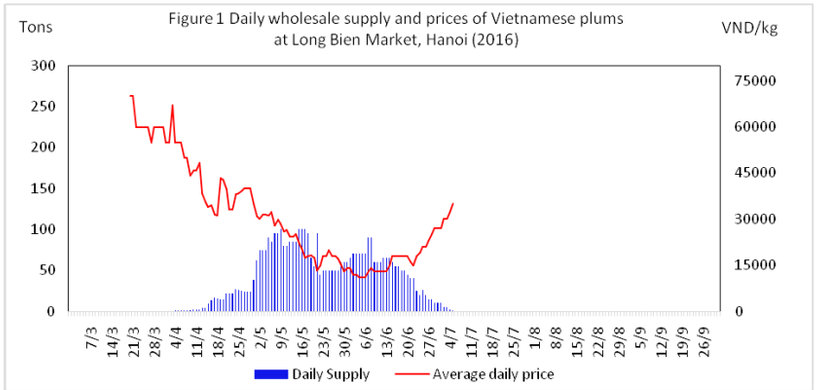

Figure 1 Daily wholesale supply and prices of Vietnamese plums at Long Bien Market, Hanoi (2016)

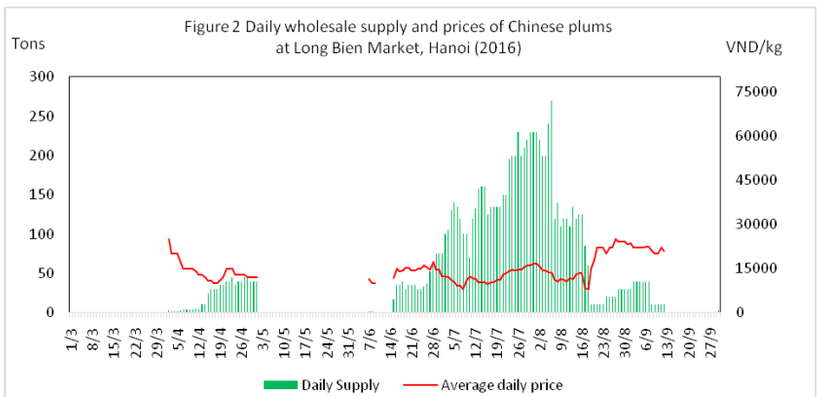

Figure 2 Daily wholesale supply and prices of Chinese plums at Long Bien Market, Hanoi (2016)

The price of Vietnamese plums is much more sensitive to changes in supply than the price of Chinese plums, dropping significantly during the peak marketing weeks (Figures 1 and 2). Lack of varietal diversification is a major reason why the northern market for Vietnamese plums is much smaller, or "thinner", than for Chinese plums. Tam Hoa variety accounts for 90% or more of the supply from Vietnam, whereas supply from of China is spread between eight cultivars.

Discussion and Conclusion

Having an early crop is Vietnam's main competitive advantage. At harvest time farmers have a largely captive domestic market. They are also able to export to China at a time when local supply cannot meet demand from Chinese processors and consumers (Wandschneider *et al*, 2016).

While current market conditions favour an expansion of production within Vietnam, future growth trajectories should rest largely on farm productivity gains, not area expansion. This is critical for increasing farm profitability and farmers' resilience to negative price shocks.

Government should avoid subsidizing new plantings of Tam Hoa plum. Instead, resources and efforts should be channelled towards enabling adoption offarm management practices with potential to increase yield, fruit quality, or both. Government also has an important role in the selection and dissemination of new varieties and in enablingthe emergence of a thriving private nursery sector. Close collaboration between researchers, extension officers, farmers and private industry players will be important.

Introduction of new varieties should be pursued in order to diversify and spread supply over time. This would mitigate the negative price impacts from increased production and reduce farmers' exposure to production and market risks. New cultivars need to be evaluated on the basis of agro-climatic suitability and consumer preferences and demand in Vietnam and China. Earlier varieties should be favoured in order to minimize competition from Chinese growers, both in domestic markets and across the border.

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Linking plum farmers to modern retail chains in Hanoi: Rationale, emerging outcomes and development potential

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Introduction

Plum is an important fruit in the mountainous Northwest region of Vietnam, with Son La being the highest-production province (28,000 tons in 2016) and Moc Chau the main production district (16,700 tons in 2016). The local crop is distributed to consumers all over Vietnam through traditional market channels. Until recently Vietnamese plums have been considered a low-value fruit, attracting little interest from modern retailers.

Since 2010, ACIAR has funded action-research to test the potential for involving supermarkets, safe food shops and high-end fruit retailers in the marketing of quality plums from Moc Chau. For the past two years, the current project has been linking two local collectors to modern retailers in Hanoi.

Research Approach

Results from the last two seasons are presented and discussed, as part of on-going research on the outcomes and impacts from farmers' participation in modern plum retail chains. Volume and price data was gathered from participating farmers, collectors and retailers. Quality data is also reported based on fruit samples purchased throughout the season from all retailers involved.

Results

In 2017 the two collectors delivered 41.8 tons of plum to modern retailers. This equated to an 83% rise over the previous year. The number of retail

chains serviced increased in number from 10 to 12, while average sales per retailer increased from 2.3 tons to 3.8 tons.

Sales were unequally distributed between retailers: in 2017 Fivimart accounted for 45% and Vinmart 14% of the volume of plums sourced from the two collectors. One collector who focussed largely on these two supermarket chains supplied 72% of the total volume. His sales to modern retailers expanded by 162%. The other collector concentrated on smaller safe food retail chains. He experienced an increase of just 11%.

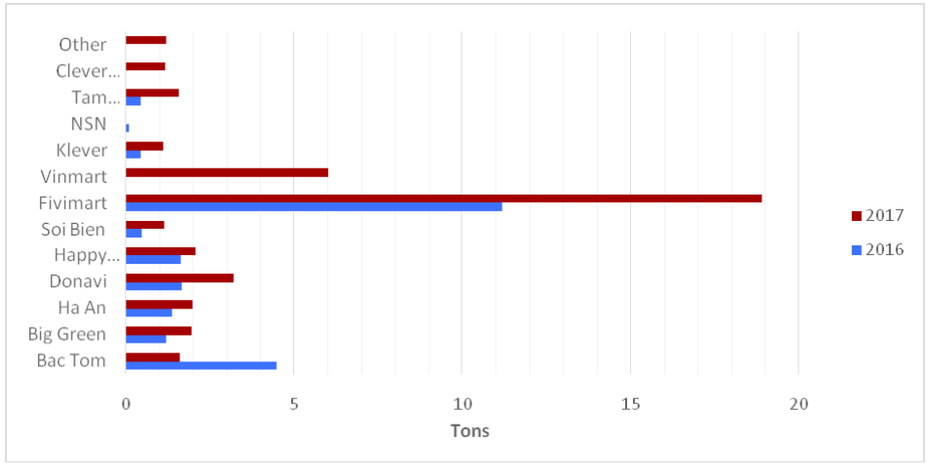

Figure 1: Plum sales by two collectors in Moc Chau to modern retailers in Hanoi in 2016 and 2017

Retailers pursued very different marketing and food safety strategies. Klever Fruit stood out from all the other retailers in that their plums were significantly larger (42.18 mm diameter) and sweeter (13.3 Brix). These plums retailed for two to four times the price set in the other outlets. At the other end of the spectrum, Fivimart prioritized cost-competiveness and sales volumes, offering the smallest (36.32 cm diameter) and less sweet (12.5 Brix) but most affordable (40-60,000 VND/kg) plums. While some smaller retailers relied on trust to guarantee the safety of products, larger retailers like Fivimart requested food safety certification while Vinmart conducted their own testing in the orchard and had a representative present at harvest time.

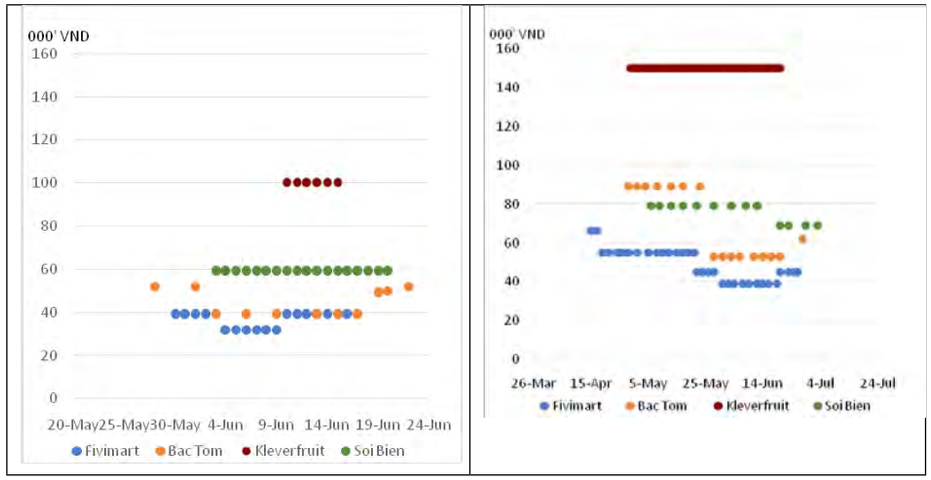

Figure 2: Price of Moc Chau plums from different participating retailers for 2016/2017

The two collectors sourced plums from 15 farmers. Although supplies for the modern retail channel represented a very small share of their harvest, farmers received relatively high premiums (30-100%) during the peak-harvest period, when market prices were low. At the end of the season, when market prices were high, the premium paid dropped to as little as 10%, with many farmers withdrawing from the modern retail channel as a result.

Discussion and Conclusion

The modern fruit retail segment is very heterogeneous. Retailers differed considerably in terms of size, marketing strategy and sales performance. Suppliers in production areas will need to develop differentiated product and pricing strategies in order to meet retailer requirements and maximize the benefits to farmers and their own businesses.

In 2017, transactions between the two collectors and modern retailers represented less than 0.2% of the Son La harvest. While direct income impacts will remain relatively modest over the foreseeable future, there is much scope for growth.

Other potential outcomes and impacts should also be considered. The presence of Vietnamese plums in modern retail outlets is changing the perception of local plums as a low-status fruit, which may lead to increased consumer demand. The fact that Klever Fruits, a very exclusive fruit retailer, has added Moc Chau plum to a portfolio that consisted

exclusively of imported fruits is noteworthy. The status of plums has also been assisted by strong tourist promotion, whereby plum orchards together with tea gardens represent a major attraction in Moc Chau. In 2017 the plum harvest festival attracted more than 7,000 visitors to the district and received a high level of media coverage.

The growing involvement of modern retailers should also result in a more enabling technical-upgrading and quality-upgrading environment. This could have spill over effects on plum farmers supplying traditional market segments, while quality assurance systems or product branding strategies developed for plums may be applied to other smallholder farm products.

The role of certified quality vegetables in the sustainable development of Moc Chau farming communities

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Keywords

livelihoods, Moc Chau, VietGAP, food safety

Introduction

Around 1 million tons of vegetables are consumed annually in Hanoi. This volume exceeds that produced and supplied by producers in Hanoi and nearby provinces. The market window is especially big during the summer when it is too hot in Hanoi and Red river delta region for the production of temperate vegetables. This has created opportunities for poor quality vegetables with unclear origin to dominate the Hanoi market during summer and increasing concern about vegetable safety [1].

Meanwhile Moc Chau region in Son La province has suitable agroclimatic conditions for temperate vegetable production and also has ease of market access to Hanoi. Since 2011, ACIAR projects AGB/2009/053 and AGB/2014/035 have supported Moc Chau farming communities to take advantage of their land, climate and geographical conditions to produce and supply safe and VietGAP accredited vegetables to the Hanoi market to improve livelihoods and income.

Research approach

The projects started with a market study for identifying the possibilities for Moc Chau vegetables to be supplied in Hanoi market and the potential stakeholders of the supply chains, as well as for benchmarking the requirements of Hanoi consumers. Based on the study results strategies for developing inclusive and sustainable supply chains of vegetables from Moc Chau to Hanoi were developed in a participatory manner with

the involvement of all stakeholders. In implementing these strategies, the ACIAR projects have mainly played the role of a facilitator and a catalyst to mobilise investments from all stakeholders, including farmers, local government, local traders and retailers in Hanoi, and to link all of them together in supply chains. The projects have also facilitated the establishment of farmers' organizations and development of these organizations into accredited quality vegetable producers and suppliers.

Results and discussions

Ten farmers' groups have been developed in both Moc Chau and Van Ho districts, with 170 members in total (Table 1), which produce vegetables in nearly 51 ha of lands to supply to Hanoi markets under the certification mark of Moc Chau safe Vegetables (Rau An Toan Moc Chau, Picture 1), which has been developed with the support from the project AGB/2009/053 during 2011 - 2015. The volume of vegetables produced and supplied to Hanoi by these farmers' organizations increased from year to year, and reached 1,734,983 tons in total in 2016 (Table 2). Nowadays more and more consumers in Hanoi know about and can recognize accredited safe vegetables from Moc Chau, and an increasing number of retailers are involved in the supply chains, most notably Metro, FiviMart, BigC, AEON, VinEco, BigGreen and Bac Tom.

As recorded by farmers, following the projects' technical guidance (in all the steps, from variety selection to seedling production, cultivation, crop management to harvest and packaging complying with VietGAP requirements) they could increase their vegetables yield and quality. For example, the yield of tomato increased from 30.7 t/ha to 36.8 t/ha, of cabbage from 13.2 t/ha to 23.1 t/ha and of green bean from 10.6 t/ha to 18.4 t/ha. The project also supported farmers to increase the diversity and rotation of vegetables.

As a result, farmers participating in the supply chains could send increasing volume of vegetables with high prices to gain higher profit and income. On average, from each hectare of vegetable land farmers could earn 70-150 million dong/ha/year, depending on vegetable type, year and farmer skills. (This can be compared to the 5-8 million dong/ha/year for rice or maize grown on the same land). With increased income

farmers could improve their houses and afford better conditions for their children's education and health care. In addition, many households are also investing more in vegetable production including building net houses, and irrigation systems.

Conclusions

The production and marketing of accredited quality vegetables has contributed greatly to improving the income and livelihoods of Moc Chau farmers. However, the figures of 170 farmers and 51 ha of land are relatively small compared with the Son La government's target of total 497 ha of safe vegetable production in Moc Chau region. The projects will therefore continue to work closely with the People's Committees of Moc Chau and Van Ho districts, and with local extension and agri-products' quality control networks to support the scaling-out process.

Reference

1. *Market study and consumers analysis report of the project AGB/2009/053, 2013.*

Table 1: Farmers' organizations developed in Van Ho and Moc Chau districts

Name of group	Address	Number of members	Land area (ha)
Tu Nhien cooperative	Moc Chau district	38	13.8
Ta Niet cooperative	Moc Chau district	10	6.0
An Tam cooperative	Moc Chau district	19	4.6
Bãi Sậy group	Moc Chau district	27	6.2
Bản Áng group	Moc Chau district	18	3.2
Bản Búa group	Moc Chau district	17	1.7
Bản Áng 1 group	Moc Chau district	11	8.6
Vân Hồ cooperative	Van Ho district	20	5.0
Hang Trùng group	Van Ho district	6	0.65
Bó Nhàng 2 group	Van Ho district	4	1.15
Total		**170**	**50.9**

Table 2: Volume (tones) of vegetables produced and supplied to Hanoi retailers market

Year	An Thai cooperative	Ta Niet cooperative	Tu Nhien cooperative	Van Ho cooperative	Total
2012			30,739		30,739
2013	25,304	9,799	197,409		232,512
2014	40,069	77,219	243,525		360,813
2015	27,285	78,343	310,653	3,486	419,767
2016	37,462	159,462	448,534	45,694	691,152
Total	**130,120**	**324,823**	**1,230,860**	**49,180**	**1,734,983**

Picture 1: The logo "Rau An Toan Moc Chau - Moc Chau Safe Vegetables"

Picture 2: A range of vegetables are produced and rotated by each household member of the safe vegetables cooperative

Developing a sustainable vegetable value-chain model for smallholders in Moc Chau and Van Ho

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Keywords

vegetable value-chain, smallholder in Moc Chau, smallholder in Van Ho

Introduction

In 2011, vegetable producers in Moc Chau sold their product through local traders or directly to local markets (especially the Nong Truong market). At that time, many of the farmers had informal contracts with local traders for the production of French bean and chayote. After making a contract with the trader, the farmers purchased seeds, fertilizer and pesticides through the trader and made payment at harvesting time. In many cases, the effective interest rates were relatively high. Farmers had not been trained in cultivation techniques or GAP. Farmers relied on information from local traders and agricultural suppliers, often using the wrong pesticides and not following any pre-harvesting withholding period or using protective equipment.

The key aims of the ACIAR supported projects AGB/2009/053 and AGB/2014/035 are to link Moc Chau safe vegetable farmers with markets in Hanoi and develop a sustainable vegetable value-chain model for smallholders in Moc Chau and Van Ho, in order to maximize profits of farmers.

Research approach

During 2012, the project undertook an assessment of market demand for vegetables in Hanoi, including qualitative and quantitative requirements, certification, traceability, and packaging. Based on the results of the market

research, field staff supported farmer groups to make production plans and forecast the potential weekly volume required by Hanoi retailers. All farmers within the project received extension advice from agronomists and participated in training, field trials, and technology trials. Together with field activities, the project also took a lead in creating and developing the Moc Chau safe vegetable brand.

From 2014, the activities that the project is carrying out have been progressively transferred to the farmer groups and local authorities people, in order to encourage local ownership and build capacity to prepare for project phase-out.

Results

A sustainable vegetable chain with close integration and communication between the components of the chain has been built up with the support of the project (Figure 1).

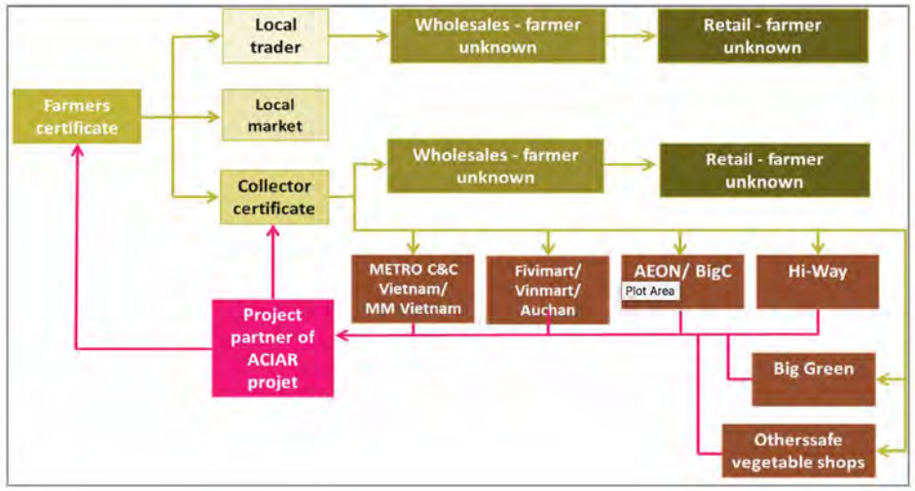

Figure 1: Moc Chau Vegetable Value Chain

In 2012, Metro supermarket accounted for 10% of total product sales, and no sales were made to Fivimart. Since 2012, the variety of outlets for off-seasonal vegetables has increased and the volume to Hanoi outlets, including Metro and Fivimart, has increased rapidly. The increased sales to modern Hanoi outlets is associated with farmers producing according to safety standards (Figure 2).

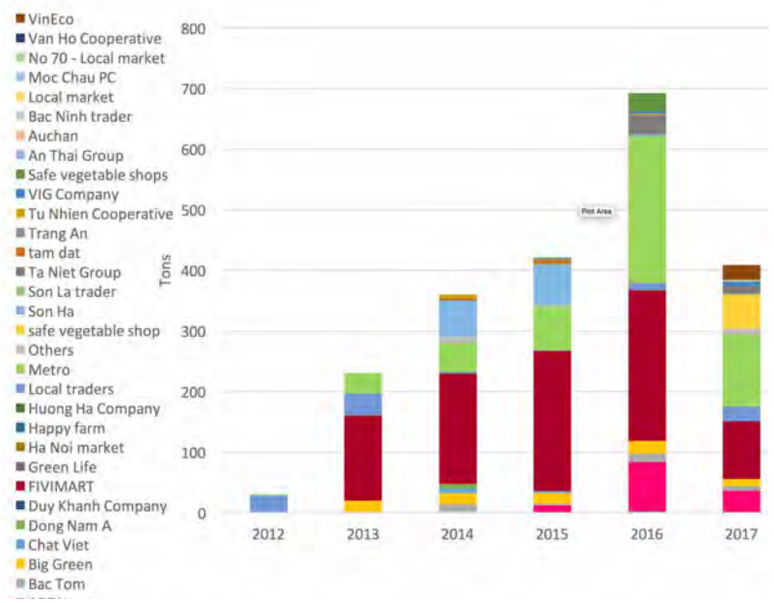

Figure 2: Volume delivery of project farmers from 2012 to August 2017

An increasing number of farmers are interested in joining the safe vegetable groups, with numbers growing from 32 farmers in 2012 to 170 farmers in 2017. The net income per hectare of farmers from vegetable is around five to ten times higher than would be gained from rice or maize alone (Figure 3), due to higher crop yields, optimal production costs, and stable product prices.

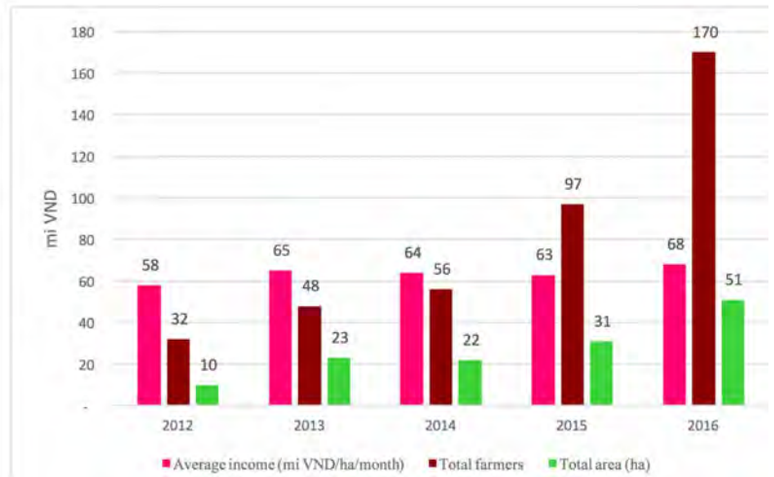

Figure 3: Average Incomes of Farmers Participating in the Project

Figure 4: The first vegetable farmers get Certificates

Figure 5: Marketing and promotional activities in Hanoi

Figure 6: Vegetable are delivered to Hanoi by farmer own truck

Discussion and conclusion

The total potential area for safe vegetable production in Moc Chau is about 40,000 ha. Expansion of safe vegetable production areas could bring benefit to a significant number farmers (including ethnic minorities) in Moc Chau and Van Ho. In order to achieve expanded production, the most important prerequisite is to identify new market opportunities for vegetables produced by smallholders.

Together with the establishment of more farmer groups/cooperatives to produce safe vegetables, it is necessary to strengthen the cooperation and exchange of information among the groups in order to coordinate to meet market demand. In order to further increase farmer incomes, new technology in agricultural production should be applied, e.g. growing plants in a substrate, or using hydroponic techniques.

At the same time, existing and new farmer groups need to limit potential negative impacts on the environment through reducing and optimizing fertilizer and pesticide use by following the recommendations in the project protocol document.

Managing clubroot disease of cabbage in Sa Pa

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Keywords

cabbage, club root, Plasmodiophora brassicae, lime, fluazinam

Introduction

Cabbages are an important vegetable crop in the Lao Cai Province of Vietnam where they suffer from clubroot disease. Clubroot is caused by the fungus-like pathogen *Plasmodiophora brassicae*, and is the most important disease of vegetable brassica crops worldwide (Donald et al., 2006). It forms large tumor-like swellings on roots which prevent the uptake of moisture and nutrients.

Plants are stunted, fail to form a head,wilt and die in warmer weather. Resting spores of this pathogen can survive in soils for more than 15 years so rotating crops is not a viable management option (Wallenhammar, 1996). This project aims to test and optimize interventions before offering them to the farming systems team for evaluation by farmers.

Research Approach

Trials were established on avegetable farm in Sa Pa that have previously suffered from club root in two successive crops in 2015. Beds of 12 plants were formed in a latin square design for each trial plot with 5 replicates for each of the following five treatments:

Treatment 1: Untreated control;

Treatment 2: Agricultural lime (target pH 7);

Treatment 3: Fluazinam drenched seedlings immediately after transplanting;

Treatment 4: Either chopped spring onions at 5kg/ha (experiment 1) or flusulfamide drenched seedlings immediately after transplanting (experiment 2);

Treatment 5: Lime (target pH 7) + fluazinam.

Plant roots were rated for disease severity (0-5 rating, from no disease to dead). A disease index (DI) was calculated for each treatment based on the method of Donald et al. (2006). and heads were weighed to obtain marketable fresh weights. Economic analysis was conducted for each treatment based on the input costs and income per sao (360m²).

Results

Experiment 1: The most effective treatment at reducing disease was the fluazinam and lime combined with fluazinam, resulting in a 15% to 20% reduction in disease compared to the control plants. There was no significant difference on marketable cabbage weight with the application of lime, compared with the control. There was a significant result however with the application of fluazinam and fluazinam+lime (Figure 1a,b).

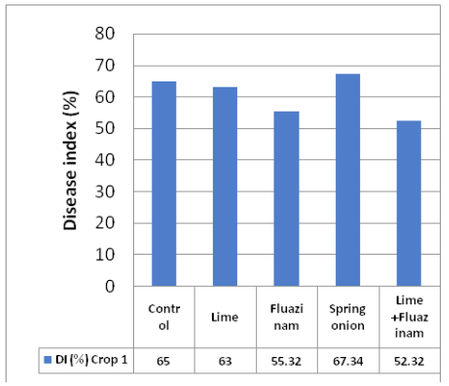

Figure 1a: Disease index of treatments for control of cabbage clubroot in experiment 1

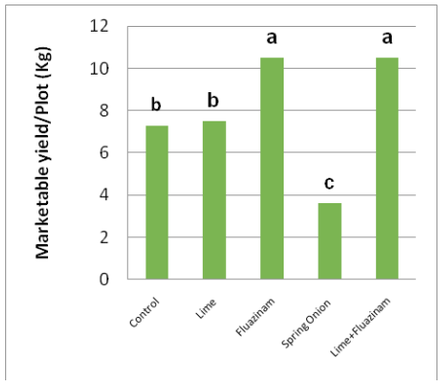

Figure 1b: Average cabbage head weight of treatments for control of clubroot in experiment 1

Experiment 2: The most effective treatment at reducing disease was the lime combined with fluazinam, reducing the DI to 45. This is a 44% reduction in disease compared to the control plants. There was a significant improvement in cabbage weight with the applications of lime, fluazinam and flusulfamide compared to the control however the combined application of lime + fluazinam showed the most significant result (Figure 2a,b).

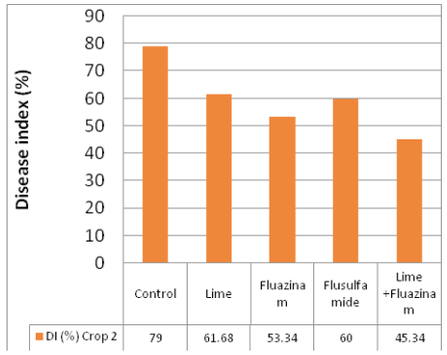

Figure 2a: Disease index of treatments for control of cabbage club root in experiment 2

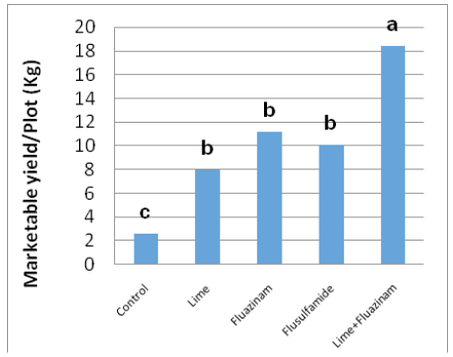

Figure 2b: Average cabbage head weight of treatments for control of clubroot in experiment 2

Economic analysis for Experiment 2 showed that cabbage growers would get most income from fluazinam + lime, followed by fluazinam then flusulfamide with approximately VND 18.3 milions, VND 11.6 and 10.8 milions respectively excluding the input cost for lime and fungicides.

Discussion and conclusion

The application of fluazinam at planting successfully controled the clubroot disease by reducing the disease severity and improve the marketable weight. This fungicide in combination with lime application was recommended for vegetable farmer's adaptive trials with a large field scale in Sa Pa, resulting in their successful cabbage harvest in 2016. Application of lime with a target of increasing pH to 7 contributed to the suppression of disease as the pathogen was more active in acidic soil.

The application of spring onions was not effective but it is suspected that this is a function of the timing of application. Better results were seen with a delay of a several weeks between application of the onions and planting, however in this instance planting occurred too soon after the spring onions were applied.

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Do farmers reap what they sow? Impact of smallholder vegetable production on child nutrition in rural Vietnam

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Keywords

child nutrition, market access, market participation, vegetable production

Introduction

This paper examines the link between smallholder vegetable production and child nutritional outcomes. We use a unique data set to study 223 children aged 6 to 60 months from 183 rural households in North West Vietnam. We adapt the UNICEF conceptual framework that is commonly used to explain the causes of child malnutrition. In this framework, poor diets and diseases are the immediate determinants of child undernutrition. These factors, which often occur together, are caused by several underlying factors like lack of access to food either physically or economically, poor maternal and child caring practices and an unhealthy environment, due largely to income poverty. Since majority of the sample households are engaged in smallholder vegetable production, and vegetables are high in micronutrients, we hypothesise a positive relationship on child nutritional outcomes. At the household level, the link between vegetable production and child nutrition outcomes could be a result of consumption of more nutritious food from own production, or consumption of more nutritious and diverse food either due to higher agricultural income from market participation or proximity to food markets.

Research approach

We use data from a rural household survey collected in July-August 2016. Smallholder farming households were selected using a stratified

multistage sampling strategy. In total, we have 183 households with children aged 6 to 60 months. Six nutritional outcome measures are used: child height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) Z-scores, and the prevalence of stunting, underweight, and wasting, each modelled separately. The HAZ, WAZ, and WHZ z-scores are continuous variables, and the prevalence of stunting, underweight, and wasting are binary based on z-scores below -2 standard deviation. Smallholder vegetable production is measured using four indicators: vegetable production diversity, market access (travel time to market), and market participation (two dummy variables that indicate household selling to traditional markets, and to modern channels). We first estimate each nutritional outcome as a function of smallholder vegetable production controlling for confounding factors using Three-stage Least Squares (3SLS) to estimate a system of simultaneous equation models to account for potential endogeneity of vegetable production diversity and market participation. We compare our results with ordinary least-squares (OLS) for the HAZ, WAZ, and WHZ z-scores, and Logit for the prevalence of stunting, underweight, and wasting.

Results

Our results suggest that smallholder vegetable production, via market participation (either selling to modern channels or traditional markets), is important in improving child nutrition outcomes, specifically child's linear growth (HAZ) and underweight (WAZ). We also find selling to modern channels as significant in reducing the predictive probability of a child being stunted and underweight. This inverse relationship is strong at the 1 percent level of significance, while relatively weaker for underweight at the 10 percent level. Our results are robust to the use of different estimation methods. Results of the 3SLS regressions show similar results with larger coefficients, and statistically more significant positive effects of market participation, especially if household sells to modern channels, on HAZ and WAZ at the 1- and 5-percent levels of significance. Similarly, we also observe a strong and negative effect of market participation on stunting and underweight outcomes. Overall, smallholder vegetable production do not have any significant effect on WHZ and wasting in the OLS, Logit, and 3SLS estimators. The association between vegetable diversity and market access, and child nutritional outcomes is also not significant in all regression models.

Discussion and conclusion

This study investigated the positive association between smallholder vegetable production and child nutritional outcomes in North West

Vietnam. Our findings suggest positive and significant associations between market participation, and child linear growth and underweight as initially hypothesized. Wasting (WHZ), which is an indicator of current nutritional status due to starvation or severe disease, is less desirable in cross-sectional data due to its sensitivity to seasonal fluctuations, which is not accounted in our model. This might explain why we do not find any association between wasting and all indicators of smallholder vegetable production. On the other hand, this might be captured by underweight (WAZ) which is a composite measure that reflects both acute (WHZ) and chronic (HAZ) undernutrition.

While vegetables are high in micronutrients, we do not find any evidence that suggests it is sufficient to improve nutritional outcomes. Similarly, proximity to food markets does not indicate more healthy children as compared to those in remote rural areas. What is crucial is market participation, which implies households that earn more income from selling vegetables to either traditional or modern channels are able to purchase more nutritious and diverse food that eventually trickles down to improved nutritional outcomes for children aged 6 to 60 months in the long-term. Future agricultural intervention that aims to address child undernutrition could be effective if it incorporates creating linkages between farmers and markets.

Acknowledgement

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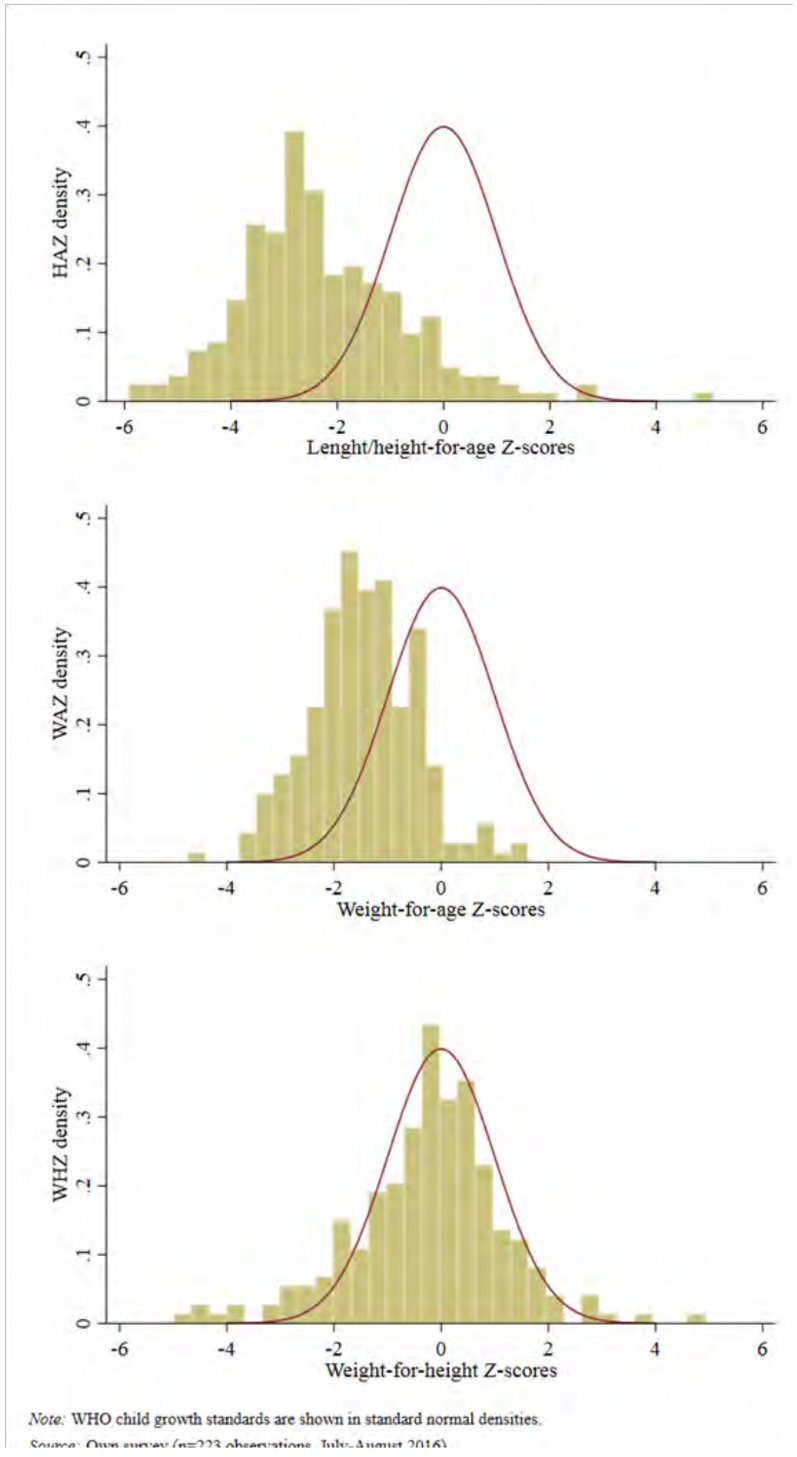

Figure 1. HAZ, WAZ, and WHZ Z-scores of sampled children in Lao Cai province

Table 1: 3SLS estimation of the impact of smallholder vegetable production on child nutrition outcomes (n=223)

	Z-score			Prevalence of		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**HAZ**	**WAZ**	**WHZ**	**Stunting**	**Under-weight**	**Wasting**
VegDiversity	-0.244	0.193	0.264	0.173	0.078	-0.103
	(0.409)	(0.253)	(0.353)	(0.134)	(0.113)	(0.077)
TimeMarket	0.065	0.276	0.253	0.053	-0.138	-0.053
	(0.565)	(0.344)	(0.481)	(0.177)	(0.155)	(0.102)
ModMarket	0.649**	0.387**	0.003	-0.249***	-0.137*	-0.029
	(0.273)	(0.172)	(0.241)	(0.083)	(0.078)	(0.051)
TradMarket	0.700*	0.353	0.098	-0.211*	-0.152	0.036
	(0.388)	(0.250)	(0.348)	(0.124)	(0.112)	(0.075)

Notes: Standard errors are indicated in parentheses, and are clustered at the household level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. All models include controls for child, mother and household characteristics, women empowerment, and geographic classification.
VegDiversity, number of vegetables cultivated in the last production cycle; *TimeMarket*, one-way travel time to the nearest food market in hours; *ModMarket*, dummy for household selling to modern channels; *TradMarket*, dummy for household selling to traditional retail outlets.
The excluded instruments for the 3SLS are the percent of surveyed neighbours in the same village that sold to traditional markets excluding household for *TradMarket*, and the total cultivated area in hectares for *ModMarket*.
Source: Own survey (July-August 2016)