Food Resilience Through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific
Research Brief No. 6 | July 2017

Assessing Gaps between Existing Cassava and Sweetpotato Farming and Climate Smart Agriculture Practices in Quảng Bình Province, Vietnam

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Research Highlights:

- Qualitative data gathering techniques were used to assess the current cassava and sweetpotato farming practices of smallholders in Quảng Thạch and Cao Quảng communes, Quảng Bình, Vietnam; and to compare it with known climate smart agriculture practices for root and tuber crops.
- Farmers in Quảng Bình have grown cassava in the same way for generations and some of their practices may not be considered climate-smart. Major gaps in farming practice are cassava stake and row spacing, fertilizer usage, land preparation and erosion control and limited knowledge on pest and disease management.
- Sweetpotato is a household garden staple used for food and animal feed in the study site, however, poor tuber quality and yield as well as limited opportunities to sell in local markets deter farmers from expanding production. The lack of knowledge on pest management also contributes to the reduced quality and yield.

Root and tuber crops (RTCs) are traditionally grown as a staple crop for food and animal feed by generations of farmers around the world; but in regions vulnerable to the negative effects of climate change such as Vietnam, RTCs are gaining more popularity as climate-resilient crops that could ensure greater food security for smallholder farmers. In addition to being tolerant of environmental stress, RTCs such as cassava (*Manihot esculenta*) and sweetpotato (*Ipomoea batatas*) are now more in demand for their versatility. Cassava has turned into a commodity traded globally as the industry for starch and dried cassava for livestock feed and industrial uses grows (Howeler et al., 2013); while sweetpotato is becoming more popular in processed foods, and for its role in combating Vitamin A deficiency and diversifying diets in developing countries (Scott et al., 2000).

Meanwhile, climate smart agriculture (CSA) is an increasingly popular framework that allows for the sustainable intensification of smallholder farming systems while at the same time addressing evolving environmental issues in the face of climate change. While the framework is fairly comprehensive, it also recognizes the difficulties that arise in prescribing solutions because interventions must be highly location-specific and knowledge-intensive (Howeler et al., 2013).

Since it is a relatively new framework for agricultural development, there is paucity of studies about CSA for RTCs. There is, however, extensive research that has been done on sustainable cropping systems involving RTCs, mostly for cassava. Farmer trials within Vietnam have shown that no tillage planting of potatoes combined with rice straw mulch led to higher yields and lower pest incidence (Dung et al., 2012) and that intercropping cassava with peanuts and beans, as well as the use of grass hedgerows, successfully controlled erosion (Arslan, 2010) while maintaining yields (Phien & Tam, 2000). It should be noted that most sweetpotato research is focused on Sub-Saharan Africa where interest in promoting the crop to improve farming livelihood has been growing in the last decade (Stathers et al., 2013).

International organizations such as the International Potato Center (CIP), the International Center for Tropical Agriculture (CIAT), and the Food and Agriculture Organization (FAO) have also published manuals and guidebooks on the sustainable farming and improved management strategies of cassava and sweetpotato based on many years of research (Howeler et al., 2013; Howeler & Maung Aye, 2014; and Stathers et al., 2013).

Recognizing the potential of RTCs in increasing the resilience of smallholder farmers to climate change impacts in Vietnam, this research aimed to determine potential gaps in farmer knowledge on climate smart practices for cassava and sweetpotato production. The results of this research provides supplemental information to the initial FoodSTART+ scoping study that was done in Quảng Bình and Hà Tĩnh provinces (Even et al., 2016) and provides a more detailed evaluation of the RTC systems in two communes in Quảng Bình province.

About FoodSTART+

Food Resilience Through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific (FoodSTART+) is a three-year project (2015-2018) that builds on and expands the scope of the concluded IFAD-supported Food Security Through Asian Root and Tuber Crops (FoodSTART) project. It is coordinated by the International Potato Center (CIP) and implemented in collaboration with the International Center for Tropical Agriculture (CIAT) in Asia. The project is also working closely with the CGIAR Research Program on Roots, Tubers and Bananas (RTB), and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). It is funded by the International Fund for Agricultural Development (IFAD) and the European Union (EU).

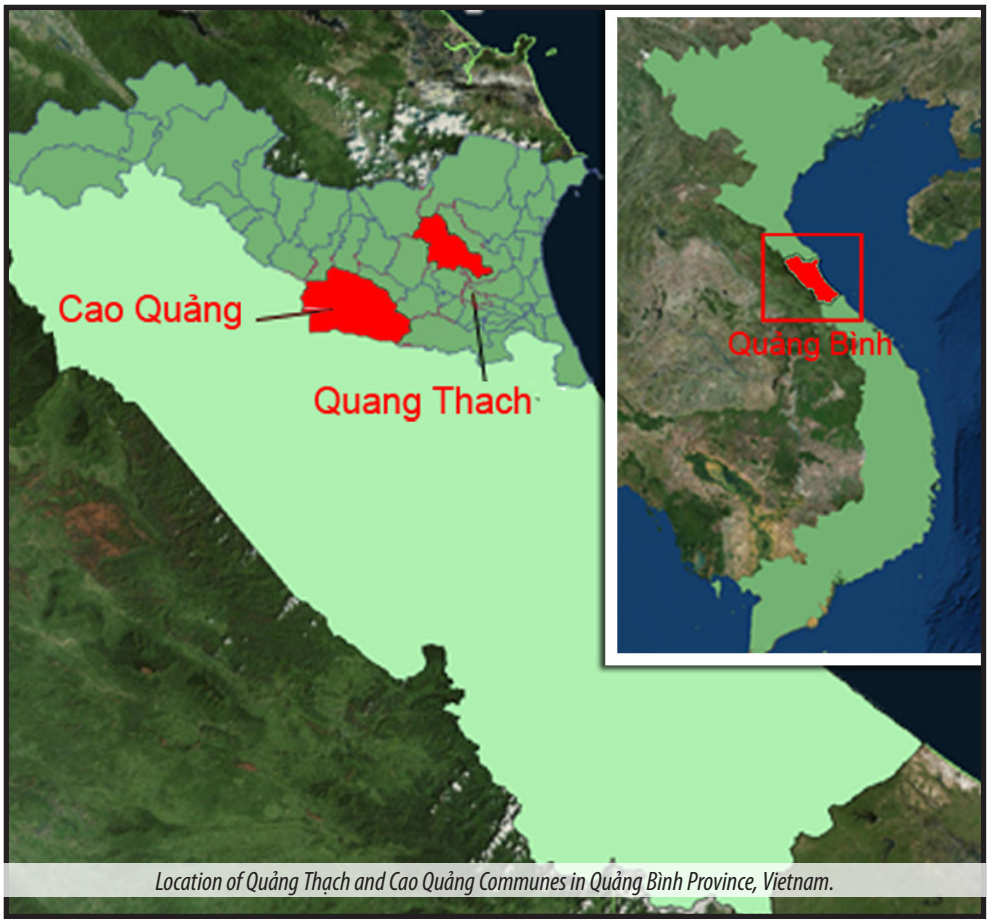
The project aims to enhance food resilience among poor households in upland and coastal communities of the Asia-Pacific region through introducing root and tuber crops (RTCs) innovations. To achieve this goal at scale, the project develops, validates and implements effective partnership strategies with IFAD investment projects to promote RTCs for food security.

The project's key components are:

1. Project start-up and scoping studies including mapping on food vulnerability of RTC production and use;
2. Research for development (R4D) partnership development;
3. Needs and opportunities analysis on gender sensitive RTC innovations;
4. R4D action planning and launching; and
5. Documentation and knowledge products development.

The first series of the FoodSTART+ Research Briefs featured the results of the country scoping studies under Component 1. This second series presents the key findings and recommendations of in-depth studies conducted by the project under Component 3 to assess needs and opportunities on RTCs innovations. These studies were carried out in the first and second year of project implementation.

CIP International Potato Center – A CGIAR Research Center
CIAT International Center for Tropical Agriculture – Since 1967 / Science to cultivate change
CGIAR Research Program on Roots, Tubers and Bananas
IFAD – Investing in rural people
European Commission



Location of Quảng Thạch and Cao Quảng Communes in Quảng Bình Province, Vietnam.

Research Site Description

Quảng Bình is a province on the North Central Coast of Vietnam with a predominantly agricultural economy. It is bordered by the South China Sea to the east, Laos to the west, Quảng Trị province to the south and Hà Tĩnh province to the north. Đồng Hới is the coastal capital with about 160,000 residents. This research focused on farmers in Quảng Thạch and Cao Quảng communes in Quảng Bình, as chosen by the Sustainable Rural Development for the Poor (SRDP) project, an IFAD-supported investment project with which FoodSTART+ collaborates.

Quảng Thạch commune is composed of eight villages and located in Quảng Trạch District, 17 km North West of Ba Đồn Town. The villages are fairly homogenous in their crop production and economic activity. Village 3, 5, and 8 were selected for data gathering based on the recommendations of the commune leaders. The villages surveyed in this study have level, low-lying croplands used primarily for growing rice and sloping lands where houses and other crop fields are located.

Cao Quảng commune is in a narrow valley located in the Tuyên Hóa District. It is accessible by one paved road that parallels the Song Nan River, 33 km from Ba Đồn. Of the commune's five villages, three villages were selected by the commune leadership for data collection: Vĩnh Xuân, Phú Xuân, and Cao Cảnh. The Song Nan River separates Vĩnh Xuân and Phú Xuân from the other villages and the administrative headquarters of the commune.

Methodology

Qualitative methods for primary data gathering, including focus group discussions (FGD) and key informant interviews (KII), were used to document farmers' cropping practices for cassava and sweetpotato in the research sites in June to July 2016. FGDs with male and female RTC farmers were conducted in the six chosen villages, with a total of 32 and 29 farmers for Quảng Thạch and Cao Quảng, respectively.

For the KII, five farmers per village, five cassava traders, five input sellers, two cassava starch factory executives, and one large scale cassava farmer were interviewed. The respondents were chosen to represent both male and female farmers as well as a range of social classes from poor to wealthier farmers. All of the farmers interviewed planted either cassava or cassava and sweetpotato in the past year. However, cassava and sweetpotato are only considered major crops by farmers in Quảng Thạch, along with pepper and eucalyptus. In Cao Quảng, major crops include acacia, peanuts, and maize.

Cassava Cropping Practices

Cassava cropping practices are similar in both communes, with only slight differences. For almost all farmers, farm size allotted to cassava is small (<0.19 ha), often due to pressure from more profitable crops such as acacia in Cao Quảng and pepper in Quảng Thạch. However, it is worth noticing that majority of farmers were growing to sell in Quảng Thạch compared to very few in Cao Quảng. Cao Quảng farmers indicated that limited market access and low farm gate prices caused many of them to just feed their crops to livestock. Some also use their cassava for food.

Planting material. In both Quảng Thạch and Cao Quảng, the most commonly used variety is Sắn Cao Sản or KM94, the variety sold for starch processing. Traditional varieties are often planted alongside KM94.

Field preparation. Many farmers undertake tillage in two stages, first is the initial pass with a buffalo or cow to break up the soil and then a second tillage to kill weeds. A few farmers in Quảng Thạch reported that they sometimes rent and use a scooping machine or an excavator first, followed with animal tillage. They claim that it is best to use the excavator every couple of years to improve soil quality, but most farmers cannot afford it. To reduce soil erosion, most farmers also construct raised beds that slow down the flow of water or dig ditches around the crops to divert water around or between cassava rows.

Planting. All farmers grow cassava in monoculture, except for one who intercrops with beans. Most farmers have tried intercropping beans or corn but found it unsuccessful. While planting methods are similar in both communes, there is significant variability in stake spacing, though most farmers plant their stakes further apart in better soils. Cao Quảng focus groups reported spacing 33-60 cm apart while Cao Quảng farmers plant 40-80 cm apart.

Planting usually occurs from December to January but may be done from November through February.

Fertilization. Almost all the farmers apply fertilizers before planting and during cropping. Most use manure as well as complete fertilizers such as Đầu Trâu, while some use a mix of nitrogen, phosphorus, or potassium-based amendments; or whatever is left from other crops. Many farmers cited the high price of fertilizer for their low rate of application but expressed that they would like to use more fertilizer.

Weeding. All farmers in both communes reported manual weeding after planting cassava. During interviews, farmers explained that the timing of weeding often depends on labor availability and can be put off if the family is engaged in other farming activities.

Pest and disease management. Farmers in Cao Quảng and Quảng Thạch claim that they do not experience major pest problems and that they do not use pesticides on cassava, even as some farmers reported occasional major losses of about 20-30% from pests. Farmers did mention that the most common cassava pests are termites and crickets for Cao Quảng and Quảng Thạch farmers, respectively. Many farmers also experienced minimal losses from leaf-eating bugs. Two farmers said they use the pesticide 'Terex' to address bug problems.

At the same time, farmers in Quảng Thạch did not report any diseases affecting cassava, while root rot due to flooding was mentioned by some farmers in Cao Quảng.

Harvesting. Farmers growing cassava for animal feed harvest at different time intervals than farmers growing for starch processing. Harvesting can be done by either the farmer or laborers hired by the trader. Plants used for livestock feed are pulled up by farmers a few at a time, as needed, while the remaining are left in the ground for up to two years. Some farmers may harvest a large amount at once and then chip and dry the roots to store for later use. On the other hand, farmers planting cassava for starch will harvest their field in a day or more and then sell the lot by weight or, alternatively, a trader will pay the farmer for the cassava in his field and then hire laborers to harvest.

Yield. Farmers growing cassava for animal feed reported yields that were higher and more variable (7-80 t/ha) than farmers growing cassava to sell (25 t/ha in Quảng Thạch and 60 t/ha in Cao Quảng). It should be noted, however, that most farmer estimates are significantly higher than official data on average cassava yields in Quảng Bình at 18.5 t/ha (QBSO, 2015 as mentioned by Even et al., 2016). This could mean that farmers, especially those who do not sell cassava, tend to overestimate yields.

Gaps between current practice and CSA

Farmers in Quảng Thạch and Cao Quảng have grown cassava in the same way for generations and some of their practices may not be considered climate smart. In both communes, the major gaps in practice are the following:

Crop spacing. Cassava stakes are planted too closely, while recommended spacing between plants is about 80 cm to 1 meter (Howeler & Maung Aye, 2014). It was also recommended that plants should be grown closer together in poor soil to maximize yield per area, however, farmers tend to space stakes widely in poor soils and more closely in fertile soils. This crop spacing may have contributed to the farmers' lack of success in intercropping cassava, even though this practice has been proven successful in many trials throughout Vietnam (Howeler et al., 2013).

Fertilizer use. Some farmers do not apply the optimal mix of fertilizers and generally apply too much phosphorus and too little potassium, while many of the average or wealthier farmers report using fertilizers at higher rates than recommended. Many farmers also either use compound fertilizers or nitrogen and phosphorus-based fertilizers alone. CIAT recommendations for the sustainable management of cassava suggest increasing nitrogen and potassium inputs and decreasing phosphorus applications over time (Howeler & Maung Aye, 2014), something that farmers do not report doing. Supplemental fertilization of nitrogen or potassium should be provided for healthy plant development.

Land preparation. Many farmers in the study site have issues with poor drainage during the rainy season as well as erosion in sloping crop fields. However, while it is recommended to use a sub-soiler to improve drainage and reduce potential for cassava root rot, an excavator dramatically alters soil structure and may create a hard pan layer below the surface (Howeler & Maung Aye, 2014). In flood areas, these machines could reduce water infiltration and cause soil waterlogging, erosion, and increase the potential for root rot disease. Moreover, while farmers use ditches to channel water around cassava fields, a more climate smart strategy would be to use hedgerows or other living barriers to slow water and reduce erosion.

Pest and disease management. Generally, pests are not considered a major issue in both communes. Farmers seem willing to accept crop losses because they do not have the time, manpower, money, or interest in reducing damage from pests; as well as sufficient knowledge about pests and diseases and how to manage them.

Sweetpotato Cropping Practices

While cropping practices are similar for both cassava and sweetpotato, there is a stark difference in that sweetpotato is primarily planted for household utilization as food or animal feed rather than for the market. In fact, many farmers were not able to specify the exact size of their land allotted to sweetpotato, unlike with cassava. Majority of those who answered had less than 500 m^2, especially in Quảng Thạch. In Cao Quảng, there were more farmers who said that they do not know or are planting only in their home gardens.

Only four farmers in Quảng Thạch and none in Cao Quảng regularly sell their sweetpotatoes at the local markets. Those who do not sell explained that whatever produce left from pest damage were eaten by the household while the damaged parts are fed to livestock.

Planting material. Common varieties grown in both communes are Khoai Chiêm dâu and Khoai Đỏ. Some farmers also plant a variety that they refer to as "cổ truyền", or traditional, but the exact variety is unknown. Almost all farmers grow a small patch of sweetpotatoes near their home where they take shoots for planting material as needed.

Field preparation. In both communes, farmers always till their fields before planting sweetpotatoes, similarly to cassava. They then make raised beds and plant shoots at the top of each bed which make weeding easier because farmers generally weed based on the length of vines down the sides of the bed. Because of its short production cycle, sweetpotatoes are often planted in the few months between rice cropping seasons and are rotated with corn or beans.

Planting and harvesting. In Quảng Thạch, common planting times are July to August and harvest is September to December while in Cao Quảng, limited data show main planting in May or September and harvesting in October or December. Outside of these growing periods, sweetpotatoes are often grown in home gardens for household use and planting material. Crop leaves and small roots are commonly fed to animals while young leaves and larger roots are eaten.

Fertilization. Similar with cassava, farmers also make use of leftover amendments for fertilizing sweetpotato but generally apply less amendment than on cassava. The most common commercial fertilizer used in the Cao Quảng villages was Kali (phosphorus-based) and Đạm (nitrogen-based). In Quảng Thạch, farmers apply urea and/or phosphorus amendments. Most farmers add supplemental fertilizer of urea or Kali, 20 to 30 days after planting or after the first weeding. Sometimes, additional fertilizer use is dependent on the type and amount of amendment left from other crops.

Weeding. Most farmers in both communes weed their sweetpotatoes once, usually at the same time with adding supplemental fertilizer. While some farmers claim they weed an additional time, many are constrained by labor or do not consider it necessary.

Cassava Monocrop Farm in Quảng Bình. (Photo by Georgina Smith/CIAT)

Pest and disease management. Several Cao Quảng and a few Quảng Thạch farmers reported sweetpotato pest issues, specifically leaf and root eating bugs, which caused a drastic decline in yield in their area. Crop damage from stem borers were also reported by some farmers, as well as a variety of other insects which cause more damage the longer the crop remains unharvested. Despite this, very few in both communes use pesticides to control pests because they are either unaware of available pesticides or hesitant to spray because of the perceived negative health implications.

In terms of diseases, some reported that their sweetpotatoes have crinkled or yellowed leaves, but do not know the cause. Other farmers also experienced diseases but could not describe specific symptoms, however, nothing is done to prevent or treat the symptoms.

Gaps between current practice and CSA

In both communes, poor root quality and yield, as well as limited opportunities to sell in local markets, deter farmers from expanding production. There is, however, a difference in the attitude and the needs of farmers in improving production.

In Cao Quảng, poor quality and inconsistent supply lead to poor public perception towards produce coming from local farmers. Because of this, none of the farmers sell their sweetpotatoes at the local market even though there is local demand and competitive prices. Although the exact cause of the problems are unknown, this study found gaps in terms of poor-yielding varieties and the lack of pest management. The farmers are also either not aware of any alternative or better management techniques or believe that there is nothing that can be done to improve their current practice. Even if they were aware of an improved technology, like an appropriate insecticide, farmers may be trapped in a vicious circle and refrain from using it as long as the quality stigma persists. More intensive research on the root cause of the low yield and quality decline are needed to provide sustainable and long term solutions.

In Quảng Thạch, some farmers can and do sell in local markets, albeit in small quantities and only when there is extra supply or high seasonal prices. Farmers expressed a desire to improve production through high quality varieties, increased fertilizer use, and more effective pesticides. Despite these, only a few farmers expressed interest in selling or increasing the area for production, and many would rather consume their sweetpotato or use as livestock feed because of competition from other crops and the limited market.

Conclusions and Recommendations

To close the aforementioned gaps, farmers need interventions to help them change into more climate smart cropping strategies. However, it can also be concluded from the results of this research that the most significant gap in RTC cropping in Quảng Thạch and Cao Quảng is not information, but rather access to markets and varieties. Improving market access and farm gate prices could encourage farmers to expand production of RTCs, invest in improved practices, and participate in markets. This intervention should be coupled with the introduction of more performing and resilient varieties.

Farmer participants and the researchers during the FGD in Quảng Thạch commune. (Photo by Kate Wilkins)

It is also recommended that any intervention for improving RTC production should be made site specific and based on more rigorous examination of the actual needs of farmers. This is to overcome the social and structural barriers to change in cropping practices and entry into markets that are unique to each of the study sites, including:

- Inaccessibility of Phú Xuân and Vĩnh Xuân villages in Cao Quảng due to seasonal floods, which limits the ability of farmers and traders to transport their crops.
- Low buying prices in the cassava processing trade center in Cao Quảng, likely driven by the limited number of local traders and high transportation cost to factories.
- The mindset of farmers in Cao Quảng, wherein cassava is not treated as an income generating crop, which deter farmers from making changes to their cropping system.
- The limited willingness and interest of farmers in both communes to embrace new technologies and innovations due to lack of perceived benefits, except for a call for more fertilizers.
- Low yields and pest problems in sweetpotato from Cao Quảng that leave farmers with limited marketable product and a stigma for low quality.
- The low interest of Quảng Thạch farmers to sell their sweetpotato, since they would rather consume it or use as livestock feed.
- The competition from more profitable crops and the limited market in both communes that deter farmers from expanding sweetpotato production.

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