Influence of Trading Structure on Maize Seed Selection by Farmers in Vietnam: Case Study on Yen Chau District, Son La Province

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Abstract Maize is the most important cash crop in Vietnam’s northern mountainous region. It is credited with eradicating hunger and alleviating poverty. However, the continuous decreasing trend in the global maize price since 2013 has resulted in various socioeconomic problems. Yen Chau district follows a cultivation regime of annually changing maize varieties. This goes against the objectives of national test procedures for new seed. This study aimed to establish whether the annually changing seed cultivation regime is the consequence of the fierce competition between seed enterprises. We found that the maize trading structure is centered on a three-level trader network that plays a crucial role in connecting stakeholders. Strong social relationships along with weak credit/production commitments between farmers and traders have facilitated maize production throughout the region. Seed and supply enterprises target traders to promote their products and are the most important information channel for farmers. This study’s findings suggest that seed selection in Yen Chau has no scientific basis but is the result of market factors.

Key words Vietnam, local trader, maize seed, Tai Dam, Hmong, competition

Introduction

In Vietnam, maize is the second-most important cereal crop after rice, and is adopted in all eight major biological regions from the North to the South. Every maize-related production and commercial activity greatly affects the national economy (Kyeyune and Turner 2016). The Doi Moi (Renovation) program, which started in late 1986, and the 1993 Land Law brought quite a number of significant modifications to the agricultural sector. The new policies aimed to change the basic unit of agricultural development from agricultural cooperatives to farm households (HHs), allowing the freedom to make individual and household-based decisions. Farmers were permitted to freely purchase, own, and sell agricultural supplies and products (Henin 2002; Turner 2013). Commercialization along with market integration has facilitated the diversification of all agricultural crops other than rice, reducing poverty and improving the economic conditions of HHs (Minot et al. 2006; Zeller et al. 2013; Tuan et al. 2014). As a result, maize production has risen dramatically and has become the key to the development of the mountainous region (Kyeyune and Turner 2016; Zeller et al. 2013). This has contributed to the further expansion of maize production and business activities (Schreinemachers et al. 2013). The increasing demand for feed from the lowland has greatly encouraged farmers to increase the production of maize. In 2005, Vietnam prepared to join the WTO by issuing Decision 46/2005 QD-TTg to remove import and value-added taxes as well as restrictions on import quotas for maize products. This has helped to diversify external commercial maize product sources and develop domestic animal husbandry and agriculture production (Hung et al. 2016). Diversifying into new foreign seeds with supply and distribution networks was expected to bring production to a new peak (Kyeyune and Turner 2016; Spielman and Kennedy 2016). The outcome, however, was very different. Global prices for maize producers dropped each year, leading in turn to decreases in farm price since 2013. The problems of maize production have resulted in huge changes in local living conditions as well as the traditional maize cultivation regime (Vien 2003). The drop in maize price is the unexpected consequence when a Third World country like Vietnam joins the WTO. In the WTO setup, strong countries (e.g., the EU countries) often adopt neo-mercantilism for economic development, emphasizing agricultural production and export growth (Râmnicanu and Ackrill 2007). Neo-mercantilism operates through low-priced exports of agricultural surpluses generated by farm production programs to the Third World. The resultant pressure on Third World agriculture serves to protect...
the developed countries’ agricultural product markets (Ichikawa 2014).

Since hybrid seed was first introduced in Son La in 1995, farmers have given priority to readopt varieties suitable for their farms. Changing seed was considered a major decision taken only on compelling situations such as projected climate change or pest disease. However, since 2010, the smallholders in Son La have begun to change seed varieties after each season and even planted different seed types at the same time. The annually alternating seed cultivation regime has rapidly expanded throughout the community and become a popular certainty for every HH in Son La. Farmers consider it compulsory to maintain productivity. However, this view has no scientific basis, and goes against the objectives of the national test procedure (NTP) for new seed. NTP aims to optimize the evaluation standards for seed permission. A new seed variety must go through the NTP to become officially certified. The screening of hybrid varieties with high yield and considerable genotype stability when used in different environments is important for commercial maize production (Gama and Hallauer 1980; Leibman et al. 2014). Alternating seed cultivation of maize started around 2010 with the rapid emergence of giant seed enterprises. The contingent appearance of these two phenomena at the same time has raised a question about the correlation between the fierce competition and the introduction of alternating seed cultivation in maize production.

The choice of seeds is an important question that has received considerable research attention all over the world. Bio-ecologists have pointed out that seed selection without scientific evaluation might lead to serious consequences. Insufficient control over maize production has led to the extinction of many native seeds even in Mexico, the fatherland of maize diversification (Badstue et al. 2007). What seeds should be adopted by farmers is an ambiguous and tricky matter to decide since it is often related to social norms, local characteristics, and the availability of information on the quality and support for seeds (Waldman et al. 2016; Coomes et al. 2015). According to Rótoło et al. (2015), seed selection is also greatly affected by market competition. The interaction between seed enterprises might lead to the manipulation of seeds supply. Argentina is an example, with 94% of its maize area occupied by transgenic (GMO) species, while GMO maize accounts for only 31% of the maize production worldwide. In a research on the practices of maize seed supplies, Poku et al. (2018) found a positive correlation between poverty and adoption of improved maize seed, resulting from intense market competition.

In Vietnam, studies on maize focus on agricultural economic development and its influence on local living conditions, such as the economic efficiency of maize conversion from traditional crops (Minot et al. 2006); the negative impacts of maize on local communities (Kyeyune and Turner 2016); the relationship between maize area expansion and natural resource utilization (Saint-Macary et al. 2013); strategies and policies to promote maize commerce at the HH level for sustainable development (Zeller et al. 2013); and the impacts of economic development based on maize mono-cultivation on soil characteristics (Schreinemachers et al. 2013). Previous studies have not unpacked the annually alternating maize seed cultivation regime. However, there is a close connection between market factors and seed selection (Waldman et al. 2016; Rótoło et al. 2015; Swanckaert 2012), it is suggested that market factors have affected the local maize production in Son La. In this study, we thoroughly investigate the causes for the alternating seed cultivation regime and its consequences.

**Study Area and Methodology**

**Study area**

This study was conducted in Son La province, the northwestern mountainous region of Vietnam, which is one of the poorest regions in the country. Yen Chau district is a representative example of a maize production area in Son La (Figure 1). This district is home to five ethnic groups: the Tai Dam, Hmong, Khmu, Xinh Mun, and Kinh. The Tai Dam is the majority. Kinh people are open immigrant arrivals who sought job opportunities. Although the Kinh is the majority in Vietnam, they are a minority in Yen Chau.

Most Yen Chau residents work in the agricultural sector, where maize is the staple crop and accounts for over 90% of annual agricultural value (Yen Chau Statistical Office 2017). In this research, we focused on four main villages (Table 1), namely, three Tai Dam villages adjacent to National Road No. 6 (Lac Ken, Suoi Bun, and Luong Me) and one remote Hmong village (Keo Bo). The Tai Dam villages are located near major springs and on land 300 to 400 m high, while the Hmong people live at a height of 900 to 1,100 m. These villages are considered “difficult” by the government (CEMA 2017). The living conditions of all study villages are noticeably lower than the national standard. Among them, Keo Bo is the poorest village, with a poverty rate of 100%.
Data collection and analysis

Data for this research were collected through field interviews and surveys. HHs in the targeted villages were investigated through multiple interviewing methods, from semi-structured and structured interviews to group discussion. HH interviews were used to collect quantitative and qualitative data on the basic socio-economic characteristics of farmers. The first field survey was conducted in March 2016 to investigate the general socio-economic status of the region and to obtain an overview of the problems. HH data were first collected in August 2016 through interviews with the representatives of 194 HHs that were randomly selected from 486 HHs of the four villages Lac Ken, Suoi Bun, Luong Me, and Keo Bo. Of the selected HHs, 162 were from Tai Dam and 32 from Hmong. The third round of field interviews were held in

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**Table 1.** General information on the study area

|                     | Chieng Dong commune | Tu Nang commune |
|---------------------|---------------------|-----------------|
|                     | Keo Bo              | Luong Me        | Lac Ken      | Suoi Bun    |
| Ethnic group        | Hmong               | Tai Dam         | Tai Dam      | Tai Dam     |
| Total HHs (2017)    | 42                  | 242             | 86           | 116         |
| Total of interviewed HHs | 32                   | 41              | 60           | 61          |
| Number of poor HHs* | 41                  | 150             | 6            | 83          |
| Topographical height above sea level (m) | 900–1,100 | 300–400 | 300–400 | 300–400 |
| Distance to nearest Level-1 trader (km) | 21                  | 5               | 45           | 40          |
| Average upland field per capita (m²) | 10,000              | 900             | 3,900        | 2,100       |
| Average paddy field per capita (m²) | 0                   | 230             | 0            | 138         |

*a Surveyed data from the heads of four villages. Source: Authors’ survey.*

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**Figure 1.** Map of the study area. (i) The small map indicates the location of Yen Chau district in northern Vietnam. (ii) The big map roughly estimates the spatial distribution of the study villages and maize traders along National Road No. 6 in Yen Chau district.

Source: Authors’ survey.
September 2017, and the participants were the same 194 participants HHs already interviewed in 2016. During the 2016 and 2017 surveys, each HH was asked about its agricultural activities, sources of income, land use status, investment funds for production, product purchases after harvesting, source of information, seeding information, and material inputs.

The individual interview were followed by four group interviews with key farmers of the villages, usually the elders, heads of villages, or skilled farmers. The group interviews were aimed to provide information about changes in maize cultivation over time and to shed light on the customs and cultural traditions of the local communities.

To obtain an overview of the maize production and trading practices in Yen Chau, the authors also conducted 27 in-depth individual interviews with local traders in both 2016 and 2017. These interviews focused on the structure of the trading network, as well as the relationships between traders and farmers, between local traders and banks, and between local traders and seed enterprises.

Besides, data relating to the government management of maize were also collected through interviews with and surveys among the representatives of the Departments of Agriculture and Rural Development (DARD) in Yen Chau District and Son La Province.

Formation and Characteristics of the Maize Trading Network

After 1993, the new economic orientation and pressure from population growth encouraged farmers to adopt higher-productivity crops. Maize was considered the top priority in the northwestern region. In 1995, the government supported maize production in Yen Chau with seeds and guidance (Turner 2013). The surge in maize production increased the need for supplies. The intermediary HHs who resided along the main provincial road and long-distance or inter-provincial van drivers together formed the initial supply source (Turner and Oswin 2015). Since van drivers connected highland production to the lowland market, maize seeds and harvest, along with other products, were periodically collected at intermediary HHs before they were sold back to farmers and van drivers.

The new National Road No. 6, constructed in 2000, strongly promoted transportation and commercial activities. Meanwhile, most intermediary HHs had expanded their operations to a scale large enough to transform into “official traders.” Official traders both distribute seeds and purchase the harvested maize without the need of inter-provincial van drivers. The specialized maize cultivation has brought huge economic changes to the region. The growth in production drew investments from seed and supply enterprises. From 2001 to 2012, the local traders, together with seed and supply enterprises, experienced rapid and complex development. Considering the differences in their scale, extent, and influence, the traders were classified into three levels, from Level-1 to Level-3, according to the classification method originally presented by Yokoyama (2010). Level-1 and Level-2 traders are full-time professionals, similar in general features but different in the scale of operations. Level-1 traders run the largest businesses in the provinces, while most Level-2 traders operate only at the district level. Many Level-3 traders are part-time operators; they conduct maize-related trading only at the beginning and end of the crop season (Table 2).

Most Level-1 and Level-2 traders are Kinh people, whose mother tongue is the national language; this gives them an advantage in connecting with lowland markets. Despite having a wide area of influence, they are limited in number and are scattered across a small region around

| Trader     | Operation scale       | Ethnic group | Location                          | Characteristics                                                                 |
|------------|-----------------------|--------------|-----------------------------------|--------------------------------------------------------------------------------|
| Level-1    | Inter-province (Dien Bien and Son La) | Kinh         | Close to National road No. 6      | Heavy vehicles Maize dryer machines Hygrometer equipment Hold major events for new product, promotion programs |
| Level-2    | Inter-district         |              |                                   |                                                                                  |
| Level-3    | Inter-village          | Kinh, Tai Dam, Khmu, etc. | One or two agencies in a village | Small vehicles Determines products’ moisture by hand check and from experience* Depends on credit from Level-1 and Level-2 traders or bank Other income from farms and small business. |

*Level-3 traders fix the price for maize based on the sound of falling maize; the examiner lets the maize grains fall on a hard surface to hear the sound; a hard sound indicates low-humidity products.

Source: Authors’ survey.

Table 2. Multi-level traders in the northwest region
National Road No. 6, as illustrated in Figure 1. Level-3 traders are local people. They are large in number, and each trader is in charge of a village-scale area.

In Yen Chau, agricultural agreements between traders and farmers are very popular in maize production. The agricultural agreement system is very different from contract farming. Contract farming supports the legal foundation for the rights and duties between stakeholders. Contractors undertake to fund farmers with agricultural inputs and commit to buy the harvested products at a fixed price or a price based on the harvest-time market price (Eaton and Shepherd 2001; Ragasa et al. 2018). In Yen Chau district, however, agricultural agreements are often based on the strong, trusting relationship between traders and farmers. Since Level-3 traders have the closest social relationship with villagers, the agricultural agreements are often made between Level-3 traders and farmers. Through these agreements, traders lend seeds and supplies to farmers and have the privilege to purchase all harvested products, but loanees can freely sell their harvests to other buyers if they accept the penalty of an interest rate of 5% instead of the normal 3% per month. The agricultural agreement in Yen Chau contains many risks for both farmers and local traders. However, the essentials of such agreements are flexible without strict terms of mortgages, so they were rarely made between Level-1 or Level-2 traders and farmers. Hence, among the three-level traders, Level-1 and Level-2 traders are more stable and face less risk than Level-3 traders.

Maize Trading Structure

The schematic view of the maize trading structure in Yen Chau, presented in Figure 2, consists of five main components: the bank system, seed/supply companies, local traders, farmers, and feed-processing companies. These components are linked together by four flow directions, including the two-way interaction flows of capital and information and the forward flows of input and output. As this study focuses on problems related to maize production, the relationships between the supply and consumption companies and banks were not considered.

Dependence of stakeholders on credit sources

Funds for production are particularly important to the ethnic minority in northwestern Vietnam as maize production, the main source of their livelihood, requires considerable investment. The target area is, however, one of the poorest regions of the country, so capital for local agricultural production must depend on credit.

Before 2010, the maize price was high enough to provide a living for the local people. Conditions were favorable for maize production. A bank loan was easily accessible, and most HHs borrowed money from banks to maintain production (Zeller et al. 2013). The continuous decrease in global maize prices since 2013 hit the local economy hard. The changes in global maize price depend on the law of supply and demand, which is not controlled by any component of the maize trading structure. Therefore, maize price variation affects all related components, including farmers and local traders. Production expenditures rose higher than incomes. Most HHs faced difficulties repaying bank debts on time and therefore could not apply for new loans. A 2017 social survey indicated that less than 50% of the HHs in the study villages are eligible to access bank credit (Figure 3). Only rich HHs with mortgage assets and no history of bad debt can ask for bank loans. Hence, bank credit is limited to rich HHs and traders.
When access to bank loan is limited, trader credit is considered the main source of funds for smallholders. Trader credit is an informal credit source and depends on the agricultural agreement between traders and farmers. When conditions for maize production are not favorable, traders’ investments in farmer HHs under the agricultural agreement face high risk. Respondent traders’ D and B (Table 3) are two examples. Trader B was an experienced Level-3 trader who started a maze business in 1998. Since 2012, she has not been able to recover her investments in 47 HHs in the Chieng Hac commune. She failed to settle her bank loan (US$22,000) and credit from the Level-2 traders (US$17,590) and was declared bankrupt in 2016. Trader D is a husband-and-wife couple trading at Level 3. They began their business in 2010 around Suoi Bun village, Tu Nang commune, with a bank loan of US$13,200 plus a Level-2 trader’s credit of US$17,590. They were also driven into a desperate condition as they could not recover their money from the HHs they had funded. The trader couple lost their house after the distrain process, and the husband committed suicide in 2015. Level-1 and Level-2 traders do not directly enter into agricultural agreements with farmers, so they take less of a risk, and most of them can survive and adapt to the new situation. The cause of the risk lay in the agricultural agreement, which was made without any guarantee assets for the lender and only built on the social relationship between traders and farmers. Level-3 traders deal directly with smallholders; they are caught between a bank loan/higher-level trader debt and their original investment in smallholders. Many Level-3 traders default on their bank loans, and then face a hopeless situation; they are the most vulnerable to risk and come under extreme pressure.

Economic and transportation difficulties reflected the higher rate of credit dependence in the study villages. As illustrated in Figure 3, farmers in Lac Ken, Suoi Bun, and Luong Me villages had a lower credit dependence rate than those in Keo Bo village. Keo Bo, located in the high mountainous region, is classified as an exceptionally difficult village. All respondents in Keo Bo depend on trader credit for production. Loan interest rates differ greatly among credit sources. Although the trader credit interest rate, at 36%/year, is higher than the commercial bank’s rate of 7%/year (as of October 2017), this is still the only accessible source for many smallholders. Besides, Level-3 traders cannot always access official credit sources, so they must depend on higher-level traders according to credit capacity, which is beneficial for both sides.

### Inputs of maize production
The decrease in maize production value is reflected in the reduced maize area being projected in regional planning, from 160,000 hectares in 2016 down to 80,000 hectares by the end of 2020 (Sonla-PPC 2016). The government is attempting to change the specialized maize cultivation regime and facilitate an agricultural transformation to other crops in order to reduce the economic dependence on maize. This has intensified competition among maize supply companies to maintain sales levels in the market. The five giant seed enterprises comprise four foreign seed companies and one domestic company. Each enterprise provides its own products. These enterprises produce five different maize variety groups, referred to as M, S, P, BO, and LV, of which LV is the domestic seed.

Since 2010, maize production in Yen Chau has followed the distinctive feature of annual variation among the most popular maize varieties. Table 4 presents a consistent temporal and spatial distribution among the most popular maize varieties in the four years from 2012 to

| Trader | Level | Place of resident | Places of activity | Bank loan per household |
|--------|-------|------------------|--------------------|-------------------------|
|        |       |                  |                    | mil. VND | US$    |
| A      | Level-3 | Chieng Dong | Chieng Dong, Chieng Sang, Chieng Pan communes | 1,000 | 44,100 |
| B      | Level-3 | Chieng Dong | Chieng Dong, Chieng Hac, Chieng Khoi communes | 500 | 22,000 |
| C      | Level-3 | Tu Nang | Tu Nang, Muong Luom | 300 | 13,200 |
| D      | Level-3 | Tu Nang | Tu Nang, Long Phien communes | 300 | 13,200 |
| E      | Level-3 | Chieng Hac | Chieng Hac, Phien Khoai, Long Phien communes | 600 | 26,400 |
| F      | Level-3 | Chieng Pan | Chieng Pan, Yen Son, Chieng On communes | 1,000 | 44,100 |
| G      | Level-2 | Sap Vat | Yen Chau, Mai Son districts | 1,300 | 57,300 |
| H      | Level-1 | Co Noi | Son La, Dien Bien, Hoa Binh provinces | 2,000 | 88,100 |

Source: Authors’ survey in 2016.
2015 with the S and M variety groups. During this period, the year’s best-selling seed was also the most popular variety throughout the region. However, statistical data for 2016 and 2017 indicate a rise in the use of the domestic LV variety over the foreign seeds in Lac Ken and Suoi Bun villages. Table 4 also shows the contrast between villages regarding the consistency in their views about the most popular maize varieties. In Keo Bo, the M variety group was adopted by most HHs in four consecutive years (2014 to 2017). However, in the other three Tai Dam villages, the highest market share obtained by the most popular maize variety was only 62.2%. As Keo Bo is the poorest village where all farmers signed agricultural agreements with traders, a high consensus on the adopted maize variety reflects the influence of traders on the selection of seeds. Figure 4 illustrates the relationship between the number of HHs depending on trader credit and their compliance with traders’ consultancy for seeds. In Keo Bo village, 31 of 32 interviewed HHs received investment from traders following traders’ recommendation for seed. The only HH that did not ask for trader credit in 2017 received seed support from the government’s special social program for poor HHs.

In other Tai Dam villages whose economic conditions were better, the percentage of HHs depending on traders’ credit and accepting their recommendation on seed was smaller than in Keo Bo. Even for Tai Dam villages with relatively similar economic conditions, the most adopted varieties tended to be different. Luong Me had the highest adoption percentage for the M variety group while LV seeds were more popular in Lac Ken and Suoi Bun. About 70% of Suoi Bun’s HHs depended on traders’ credit, but with large cultivation lands, they were forced to adopt much cheaper seeds to reduce the cost. They did so also to avoid the risk of adopting only expensive seeds. Since 2016, only a small portion of farms have adopted foreign seeds. Most farms replaced foreign seeds with the domestic LV varieties (Table 4). Lac Ken village also had a large area under maize, but its adaptation strategy differed from that of Suoi Bun village. Most HHs in Lac Ken have begun to gradually replace their maize farms with fruit trees. Maize was inter-cropped with fruit trees for the first three years, until the trees had fully grown. Most HHs in Lac Ken cannot tend to both fruit trees and maize at the same time, so they prefer the cheaper domestic LV seed variety groups. With poor economic conditions, the short geographical distance has greatly influenced farmers’ seed preferences. Since Keo Bo is the poorest village, all of the Hmong HHs depended on local traders for agricultural inputs. Traders also influenced seed selection in the Tai Dam villages, which generally enjoy better economic conditions. However, the extent of influence varies according to the geographical distance between the villages and the Level-1 traders. Indeed, when the Luong Me village is closer to a Level-1 trader (5 km) than Lac Ken and Suoi Bun villages (about 45 km), its HHs tend to select foreign instead of domestic seeds in contrast to the finding just mentioned.

### Table 4. Percentage of most popular maize variety groups in Yen Chau from 2012 to 2017

| Village  | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------|------|------|------|------|------|------|
| Keo Bo  | N/Aa | N/A  | 100.0 (M) | 95.5 (M) | 97.6 (M) | 96.9 (M) |
| Luong Me | 50.0 (S) | 57.6 (S) | 57.5 (M) | 62.2 (M) | 60.0 (M) | 60.6 (M) |
| Lac Ken | 58.8 (S) | 60.0 (S) | 46.4 (M) | 42.5 (M) | 48.4 (LV) | 40.0 (LV) |
| Suoi Bun | 43.9 (S) | 49.2 (S) | 47.1 (M) | 37.8 (M) | 50.6 (LV) | 43.2 (LV) |

* N/A: Not available.
Source: Authors’ survey.
motorbike. In return, the harvest is sold exclusively to the investors. These activities strengthened the bonds between traders and local people not only in agricultural activities but also in daily life. With those positive activities, the connection between farmers and traders has become even stronger.

Among the three levels of traders, Level-3 traders accounted for most of the maize collection. Level-3 traders fixed the price for maize using a simple hand check method. Meanwhile, Level-1 and Level-2 traders use hygrometers to determine the price of maize collected by Level-3 traders. The type of maize seed adopted was irrelevant to the evaluation process. The fluctuation of maize prices depended only on the level of scarcity and market demand. Maize purchased by traders is transported to Hanoi City, where the finest products are often sold to the feed-processing companies at a high price. Lower-quality maize is sold to other buyers in the surrounding provinces. Although maize is the second-most popular crop, demand for maize as feed is still much greater than the capacity of Vietnam’s domestic production. Standard maize prices in the domestic market have changed daily along with global maize prices, which are determined by the purchasing price offered by the foreign-affiliated feed-processing company. Maize prices are decided only according to level of humidity, and not according to the variety of maize seed. Hence, annually changing seed varieties do not benefit the farmer, regardless of the price paid.

The supply and distribution chain for maize products in Son La is based on the strong credit connection between stakeholders. Agricultural inputs move from seed and supply companies to Level-1 traders then from Level-1 traders to lower-scale Level-2 and Level-3 traders. Level-3 traders, the smallest component of the three-level trading structure, play the main role in connecting the suppliers with farmers. They receive both supplies from higher-level traders and yield from farmers, and then distribute them back to the stakeholders. Feed-processing companies receive maize products from Level-1 traders; they are the last stop in the supply chain.

**Sources of maize seed information**

A timely and accurate flow of information is one of the decisive factors in the success or failure of any product, including maize (Miyata et al. 2009). It is important for the farmer to decide which type of maize seed to grow after the season begins. In Yen Chau, the information on seeding and crop calendar can be accessed from various sources. Table 5 shows the feedback from interviewed HHs regarding the information sources they referenced during the 2016 and 2017 crop seasons. The first source is the state’s top-down agricultural promotion network. The Yen Chau Department of Agriculture and Rural Development (DARD) annually publishes Guidelines on Seeds and the Crop Calendar, which provide essential information related to seeds and timing. However, only 6 out of 194 respondents of this study referred to DARD guidelines to find the necessary information before seeding in 2017. These guidelines have proven ineffective in reality and failed to provide instructions to farmers. The two maize varieties P-X and BO-X, belonging to the P and BO groups, respectively, are examples. P-X is not recommended by DARD but can easily be bought in Lac Ken village while the BO-X variety has stayed on the list since 2010 but is difficult to find on the market. This suggests that the supply chain has governed its information channels in a different way, without interacting with DARD.

Besides the DARD guidelines, traders’ recommendations are a reliable information source that farmers use when purchasing seeds and supplies. Information from traders is passed down from Level-1 and Level-2 traders to Level-3 traders, and then to farmers. Traders can consult farmers directly or indirectly through intermediaries such as key farmers whose opinions and skills greatly influence the community. Even when a seed is approved to enter the market, after passing through the NTP, its producer will continue to adopt it in several pilot farms to demonstrate its quality to farmers. The farms selected for pilot farming would be fully funded by the seed enterprise. This is one of the strategies used by seed enterprises to market their products. The local traders usually recommend key farmers who already have some influence

| Village | Year | DARD guideline | Key farmer | Trader | Communication media |
|---------|------|----------------|------------|-------|---------------------|
| Keo Bo  | 2016| 0.0            | 62.5       | 100.0 | 15.6                |
|         | 2017| 0.0            | 65.6       | 96.9  | 21.9                |
| Luong Me| 2016| 4.9            | 73.2       | 75.6  | 24.4                |
|         | 2017| 7.3            | 75.6       | 70.7  | 22.0                |
| Lac Ken | 2016| 0.0            | 75.0       | 73.3  | 30.0                |
|         | 2017| 1.7            | 70.0       | 66.7  | 35.0                |
| Suoi Bun| 2016| 3.3            | 73.8       | 68.9  | 32.8                |
|         | 2017| 3.3            | 75.4       | 67.2  | 39.3                |

Source: Authors’ survey.
in the community to seed enterprises for pilot farming. To further popularize the product, the companies hold an agriculture workshop after pilot farming, which will be attended by local farmers. One unique characteristic of rural society in Vietnam is the strong bonds between villagers. This factor speeds up information circulation (Donovan et al. 1996: 163–200). Table 5 illustrates how farmers in Yen Chau trust key farmers’ views on seed selection. In 2016 and 2017, about 62.5–75.6% of the respondent HHs consulted key farmers before making their decision. Hence, information on seeds is updated and broadcast quickly, and it incorporates the social–credit relationship between farmers and traders, which magnifies the key farmers’ influence. Key farmers are often the targets of pilot fields, and seed enterprises use their influence in the local communities to develop business.

Communication media is another information source for farmers but less important than traders and key farmers. Communication media, including mass and print media, constitute the most often-used channels of agricultural information. Mass media seems ineffective as the information is often diverse and multi-purpose but lacks detail. The printed poster is the most popular form of agricultural advertising. In Yen Chau, advertising posters are replaced annually with the most prevalent variety, which is usually the variety recommended by traders and key farmers. Although the information sources from traders, key farmers, and communication media differ in appearance, they are actually similar in content. Key farmers and communication media are tools that traders use to sell products. This finding supports our assumption on the major role of traders in the development of maize production in Yen Chau. The trader is the most important factor in seed enterprises’ efforts to advertise their products and maintain their sales.

**Operation and feature of maize seed information flow**

As many seed enterprises have entered the market, traders have become the most important targets of marketing strategies. The traditional cultivation techniques in Yen Chau have remained virtually unchanged over the past 20 years (Ha et al. 2004: 16–24); they cannot fully exploit the potential of even the best maize seeds and thus generate similar productivity levels each year (Saint-Macary et al. 2013). Since product and service quality cannot lead to clear advantages for maize producers, they are competing most intensely to use the local trader.

Table 6 illustrates the benefits that seed enterprises have given traders and the promotion programs that they have conducted for the sale of some popular groups of maize varieties in 2017. Among all varieties, the M variety groups benefited traders the most. The varieties that most benefited traders are consistent with the most popular maize variety groups indicated in Table 4. This coincidence has raised concerns about the motivation of traders when persuading farmers. The business strategies and marketing direction of traders change annually depending on the promotion campaigns of the seed enterprises. Competition between enterprises resulted in chaos in the maize seed market, as traders focused on the products that benefit them the most. They tend to provide information to and encourage farmers producing the cultivars that most benefit them, even if they are more expensive than existing cultivars. This kind of competitive race between seed enterprises using traders requires good strategy making and a huge economic foundation. Weak

| Variety group | Date entered the Yen Chau market | Capital | Benefitsa for traders (VND/kg) | Retail priceb (VND/kg) | Promotion programs |
|---------------|----------------------------------|--------|-------------------------------|-----------------------|-------------------|
|               |                                  |        | Level-1 | Level-2 | Level-3 | For traders | For farmers |
| M             | 2011                             | Foreign| 1,000  | 1,000  | 3,000  | 120,000    | An all-expenses abroad/domestic tourc | N/A |
| S             | 2009                             | Foreign| 500    | 500    | 1,000  | 120,000    | A lucky draw ticketd | N/A |
| P             | 2004                             | Foreign| 1,000  | 1,000  | 3,000  | 95,000     | N/A | N/A |
| BO            | 2000                             | Foreign| N/A    | N/A    | N/A    | N/A        | N/A | N/A |
| LV            | 1995                             | Domestic| 1,000 | 1,000  | 2,000  | 37,000     | N/A | N/A |

aThe benefits for Level-1 traders are calculated as the differences between their buying price and the price they sell to Level-2 traders. Benefits for Level-2 traders are the differences between the Level-1 traders’ price and the selling price to Level-3 traders. Benefits for Level-3 traders are determined from their retail price to farmers. bRetail prices are the prices fixed for farmers by seed enterprises. Farmer can buy seeds from any trader, but the price is unchanged. cA trader with total sales of more than 3,000 kg of seed per year is rewarded with an all-expenses-paid foreign/domestic tour. dA farmer purchasing more than 20 kg of the M variety group from a Level-1 trader is given a lucky draw ticket. A public event for drawing lots is held in May every year by the seed enterprise producing the M variety group. All farmers named in the purchasing list are invited to the event. The awards from drawing lots are usually valuable items for farmers, from a cow to agriculture equipment. eN/A: Not available.

Source: Authors’ survey.
companies who cannot follow the race are discarded. The BO variety group is an example; it entered the Vietnam market very early in 1992 and was widely adopted in Yen Chau. According to local traders, the famous BO seeds have gradually disappeared from the market since 2012. This evidence supports the doubts about the fierce competition between seed enterprises.

**Competition between Seed Enterprises and the Annually Changing Seed Variety Cultivation Regime**

The explosion in the maize market in 2010 has led to fierce competition between seed enterprises. The fight for market domination has grown even stronger after the peak period of maize production. Figure 5 indicates the number of workshops for different maize variety groups held by three seed enterprises in Yen Chau from 2015 to 2017; their locations are shown in Figure 6. Although the total maize area has been reduced continuously since 2013, the number of maize seed workshops and the number of invited farmers seem to remain stable each year (Yen Chau Statistical Office 2017). This shows the efforts of seed enterprises to extend their influence in the market. When domestic seeds could not position themselves in the maize market, foreign seeds, especially the S, M, and P variety groups, competed in the market. The huge investments of seed enterprises for the S and M variety groups have been evident from the workshops and seed distribution activities.

![Figure 5](image1.png)

**Figure 5.** Number of workshops for different maize variety groups held in Yen Chau from 2015 to 2017.

Note: Data for 2017 are based on the record for 10 months, from January to October.
Source: Authors’ survey.

![Figure 6](image2.png)

**Figure 6.** Location and scale of maize seed workshops held in Yen Chau from 2015 to 2017.

Source: Surveyed by the authors using GPS, Yen Chau Statistical Office (2017) and an internal report of the Yen Chau District Agricultural Extension Centre.
groups have shown their effectiveness as these two groups have occupied the lion’s share of the market since 2012 (Table 4). Although all 15 administrative regions of Yen Chau district were targeted by seed workshops (Figure 6), the majority of the workshops were concentrated in the northeastern part of the province, which is not only closer to the Level-1 traders in Mai Son district but also has more Level-2 traders. Besides, the communes having large maize cultivation areas were also the main targets of the workshops. This finding also justifies the vital role of traders in the business strategies of seed enterprises. Opposed to the findings of this study, Waldman et al. (2017) discussed the different factors in maize seed choices in his recent research in Africa. Waldman et al. (2017) have pointed out the importance of information flow in the choice of maize seed, as well as the influence of the increasing trend in extreme weather events. maize seed choices in Africa changed after the flow of information on seed quality between seed companies and farmers was discontinued. The information content in this flow is often conflicting. It led to wrong seed selection and seriously affected the economic condition and food security of the vast region. However, unlike the discontinued information flow in Africa, the two-way information flows in Yen Chau connects seed companies, local traders, and farmers. The phenomenon of annually changing seed varieties in Yen Chau started in 2010. Farmers believe that they need to change seed varieties in order to maintain productivity. However, the annually alternating seed cultivation regime is antithetic to the purposes of the NTP. This important input information has been hidden or falsified by seed enterprises and the local trader. The NTP can generally determine seed quality at a mesoscale region, but it sometimes cannot cover all the micro-climate areas that appear alternately between complex topographic regions. Even an authorized seed, when adopted in an unfavorable micro-climate area, can lead to a failed crop. For example, the P-X variety has delivered high productivity and quality harvests in the northeastern region, but it provided mediocre quality in Yen Chau in 2015. Alternating seed varieties have carried more risks for farmers. In Yen Chau, the price of LV is usually a third to half the price of foreign products (Table 6). As neither foreign nor LV maize had significantly better nutrients (Son et al. 2009), the only advantage of costly seeds is their potential for higher productivity. Table 7 compares the actual and potential yields of the most popular maize seeds in the four study villages in 2017. Local Yen Chau farmers adopted the same pesticides, chemical fertilizers, and herbicides for different seeds and still used the same underdeveloped agricultural techniques for all seeds. This kind of cultivation method thus ignores the special considerations associated with the use of different seeds, such as resistance to pests or the higher percentage of germination. This cultivation method is considered inadequate for modern agriculture and supposedly cannot make the best use of any seed, whether domestic or foreign. The average actual yields of all maize varieties were lower than expected, reaching only 25 to 50% of the potential yield. The productivity of LV (3,400 to 4,000 kg/ha) was comparable to that of other seeds (3,500 to 4,800 kg/ha). The same maize yield range was found for all seed types at all locations. This result indicates that, in the same meteorological and soil conditions, the traditional cultivation methods of the local people cannot make the best use of any maize seed.

The alternating seeds cultivation regime, potentially increasing the seed varieties in the market rapidly, benefits the seed enterprises. The more seeds available in the market, the better the companies’ chances of increasing their reputation, operating scale, and competitive advantages. According to our survey, 2 out of 194 respondent HHs received investments from a foreign seed company to grow GMO seed in 2017. In the first year, they got 4 kg

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### Table 7. Actual and potential yields of some maize variety groups in study villages in 2017

| Maize variety group | Average of actual yield (kg/ha)* | Potential yield (kg/ha) |
|---------------------|---------------------------------|-------------------------|
|                     | Keo Bo  | Lac Ken  | Suoi Bun | Luong Me |                     |
| M                   | 4,400   | 4,800    | 3,900    | 4,500    | 12,000–14,000       |
| S                   | N/A     | 3,900    | 4,400    | 4,800    | 12,000–14,000       |
| P                   | N/A     | 4,800    | 3,500    | 4,200    | 12,000–14,000       |
| LV                  | N/A     | N/A      | 4,000    | 3,400    | 8,000–12,000        |

*The average actual maize yield statistics collected from respondent HHs that adopted only one maize variety in 2017. HHs that adopted more than one variety often collected the harvest together and could not distinguish between the yields of different seeds. N/A: not available; this indicates that the data cannot be calculated due to the limited number of HHs that satisfy the criterion (a) or because the number of HHs that adopted the seed was too small for reliable statistics.

Source: Authors’ survey.
of GMO seed free along with technical support and 30 kg of fertilizer and herbicide. The expansion of GMO seed might lead to dependence on foreign inputs of seed, fertilizer, and other agricultural materials for maize production. When domestic productive materials cannot meet the needs of production, foreign companies will seize the market. The annually alternating seed cultivation regime has provided the lion's share of the benefits to sellers rather than farmers. Farmers are worse off when they gradually become more dependent on traders for production. The changing seed variety cultivation regime has resulted from the influence of traders and seed enterprises. A similar finding was reported in Le Buanec's study on the situation of seed companies occupying the market in the world (Le Buanec 2007). Several decades ago, the 10 biggest companies in the world had taken over 13% of the global seed market. The remaining 87% was controlled by small companies and farmers (Dalle Mulle and Ruppanner 2010). Today, five seed giants control 35% of the global share (Le Buanec 2007). This study articulates our concerns over the fierce competition between seed enterprises, which has resulted in the annually changing seed cultivation regime in maize production in Yen Chau.

**Conclusion**

Maize is by far the most important cash crop in northwestern Vietnam, but maize production is very risky for most local farmers. This study examines the problems of maize cultivation in Vietnam against the backdrop of the annually alternating seed cultivation regime followed in the country. The results of our analysis reveal that the fierce competition between seed enterprises led to the annually alternating maize seed cultivation regime in Yen Chau. The three-level trader network is not only the main target of seed enterprises but also the core of the maize trading structure and plays the most important role of connecting all the stakeholders. The maize trading structure comprises five main interconnected components: (1) seed and supply enterprises provide materials for maize production; (2) the local traders deliver both productive materials and information from agricultural producers to (3) farmers; the harvested maize is collected by the local traders and then transported to the (4) feed enterprises in the lowland; and the (5) bank system constitutes the major credit source for the operation of maize production and businesses. Furthermore, maize production has been heavily influenced by the strong credit dependence between stakeholders, in which traders depend on the bank system for operational funding, Level-3 traders rely on Level-1 and Level-2 traders for credit, and most of the farmers borrow money from traders for maize production. Level-3 traders work on the smallest scale but have the greatest influence on farmers since most are district natives and have close social relationships with them. These relationships, along with the agriculture agreement, are the methods used by traders to maintain their influence on farm production.

With five giant seed enterprises and over 35 varieties available in the market, there has been fierce competition between seed enterprises for market share. However, the quality of seed and services cannot bring competitive advantages to producers, as farmers' outdated traditional cultivation methods can achieve only 25–50% of the potential yield of any seed. Seed enterprises have focused their business strategies on the local traders, utilizing their influence over farmer production. Traders' concentration on products that bring them the greatest benefits has resulted in a cultivation regime of alternating seed varieties in Yen Chau. This cultivation regime is both unnecessary and a risk to farmers. Although this study has described the structure, working methods, and problems of maize trading in Yen Chau, it has not proposed any strategy to allow the local people to adapt to a new cultivation regime. Further studies on issues related to livelihood strategy, such as crop structure transformation, will be conducted. Such analyses will require a more detailed and extensive exploration of the economic resources of the local region.

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**Notes**

1. Global price dropped from US$333 in 2012 to US$135 in 2017; US$=VND22,745 (January 2018).
2. The NTP performs preliminary experiments through VCU (Value of Cultivation and Use) and DUS (Distinctness, Uniformity, Stability) trials for several consecutive crops in a specific growing environment. Vietnam's national standards for maize seed are stipulated in QCVN01-56:2011/BNNPTNT (VCU) and QCVN01-66:2011/BNNPTNT (DUS), which focus on productivity, quality, economic value, and agronomic characteristics. This test requires any maize seed to consistently perform better than existing cultivars for at least two to three consecutive years. It guarantees stable productivity for a long time in the absence of abnormal weather events.
3. The total import quota in Vietnam was 7,600, 8,440, and 7,860 million kg in 2015, 2016, and 2017, respectively.

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