

---

**ECONOMIC FACTORS AFFECTING THE DEVELOPMENT OF  
ARROWROOT PRODUCTION IN NA RI DISTRICT, BAC KAN  
PROVINCE**

Huong Thi Dao<sup>1</sup> and Hien Thi Vu<sup>2\*</sup>

<sup>1</sup> Thai Nguyen University of Economics and Business Administration

<sup>2</sup> Department of Economics and Rural Development, Thai Nguyen University of Agriculture and Forestry, Vietnam.

**Abstract**

The development of arrowroot production in Na Ri district is an important task of the economic strategies locality. Recently, arrowroot is not only an important food crop in Na Ri, but also an agricultural plant grown widely throughout Bac Kan province. Therefore, the research of development a model of production arrowroot for processing industry, especially for producing vermicelli is extremely necessary. However, the development of the arrowroot production has always encountered certain obstacles. As a result, the research on factors having a direct impact on the development of arrowroot production to find some meaningful solutions is highly practical. This study aims to analyze and evaluate the impact of economic factors on the development of arrowroot production in Na Ri district. The findings showed that the development of arrowroot production in Na Ri is affected by direct and indirect impacts. In particular, economic factors found to be important and significant to the development of local arrowroot production.

**Keywords:** economic factors, development, arrowroot production, Na Ri district

**1. Introduction**

Arrowroot trees have been cultivated in Bac Kan for a long time and are considered to be one of the crops for the eradication of poverty for the ethnic people in Bac Kan province. In recent years, arrowroot production plays a vital role in the agricultural economy of Bac Kan province with the attention and encouragement of investors to develop the processing arrowroot products [1]. In addition, the area of arrowroot cultivation in Na Ri district has increased from 43 hectares in 2007, to 88 hectares in 2008, to 279 hectares in 2010 and 374 hectares in 2011. At first, arrowroot was grown in only two villages of Lung Vung and Ban Lai, then it has grown spreadly throughout villages in Con Minh commune, and now it was covered 22 communes and towns of the district [2].

In 2010, the acreage grown by arrowroot of Bac Kan province only had more than 270 hectares and it was mainly concentrated in two districts, namely Na Ri and Ba Be. In 2012, implementing the policy of the province to expand the area of arrowroot production, the cultivated of arrowroot in Backan increased to 1,800 hectares and was widely planted in regions of the province. In 2015, there was a good harvest of arrowroot, and it was bought with the price of 2,000-2,200 VND/kg (0.1 USD/kg). The average yield of harvested roots was about 60-70 tons/hectares. Thus, the income of farmers had obtained about 100 million VND (4,000 USD) per hectare of arrowroot. Particularly, some areas which were invested with intensive cultivation reached over

80 tons per hectare, with a value of 150-170 million VND per hectares (6,000USD). Besides, the processing households of starch and noodle also got big profits when the price of edible canna starch reached 17,000-20,000 VND/kg (0.8 USD/kg) and the price of noodles fluctuated from 65,000 to 70,000 VND/kg (about 3USD) [3].

The reason for the strong growth of arrowroot crops is that people have paid more attention to the processing of vermicelli by adopting high technologies instead of making it by hand to increase the value of products [4]. In fact, households have invested in technologies and machines to make vermicelli professionally to meet the requirement of the market. Therefore, the cultivated area of arrowroot has expanded and the product of starch and vermicelli has increased rapidly. Especially, once the technology for preserving starch is better, locals can produce vermicelli all year-round instead of depending on the harvested season of arrowroot [5].

From 2013 until now, the acreage planted by arrowroot in Bac Kan has been constantly changing. According to the report of (BKSO, 2017), the total planted area of arrowroot in Bac Kan province decreased from 2013-2016 and only began to increase again in 2017. Table 1 shows that the total area of arrowroot in the province decreased the most in 2014, reduced to  $\frac{3}{4}$  of the total the area of arrowroot in the province, particularly the area of arrowroot in Na Ri district decreased about 60%. However, in 2015 the arrowroot area of Na Ri increased again (from 455 hectares to 503 hectares). For other districts, the area of arrowroot cultivation also fluctuated constantly. The reason for the fluctuation was that the province did not have a specific plan for the area of arrowroot production. In fact, the increase or decrease above merely depended on the abnormal fluctuation of supply and demand. Since the price of arrowroot of the previous year decided the area of arrowroot in the following year. The specific plans and production plans of each locality were not close to real conditions. Thus, identifying the economic factors affecting the development of arrowroot production is necessary to seek out the limitations and provide appropriate solutions to address.

**Table 1.** Area of arrowroot cultivation in Bac Kan province in the period 2013-2017

Unit: ha

Location	2013	2014	2015	2016	2017
Bac Kan city	87	-	3	3	2
Pac Nam District	220	2	2	9	36
Ba Be District	786	177	131	200	289
Ngan Son District	81	4	4	2	-
Bach Thong District	302	85	60	46	86
Cho Don District	257	13	7	3	8
Cho Moi District	77	22	10	30	32
Na Ri District	1133	455	503	275	454
<b>Total area</b>	<b>2943</b>	<b>758</b>	<b>720</b>	<b>568</b>	<b>907</b>

Source: Statistical Yearbook of Bac Kan Province 2017, [6].

Accompanying the rapid development of arrowroot crops, the instability in the production of households is considered as one of the problems of arrowroot cultivation, especially when the harvest is devalued and the output price fluctuated. In order to overcome the situation in the past years, in the 2017 production year, Bac Kan government directed the processing facilities to contract with producers about consumption arrowroot products after harvest crops. Therefore, the growers are secured to produce arrowroot. In fact, there is a different picture of the production of vermicelli in the province. The production of arrowroot in Backan province during the period of 2013-2017 is expressed in Table 2. It can be seen clearly that in some districts the variation of area and output was not identical. For example, in Na Ri district, in 2015, the area of arrowroot plantations increased by 48 hectares, but the total output decreased by 1,000 tons. This was a very unusual phenomenon in agricultural production without the risk of weather and pests. These deviations were entirely due to the fact that farmers applied cultivation techniques heterogeneously. It led to differences in arrowroot productivity of each household.

**Table 2. Production of arrowroot tuber in Bac Kan province in the period 2013-2017**

Unit: tons

Location	2013	2014	2015	2016	2017
Bac Kan city	4.102	-	153	195	130
Pac Nam District	13.102	119	119	630	1.980
Ba Be District	51.090	11.505	7.795	13.000	18.785
Ngan Son District	4.050	240	240	120	-
Bach Thong district	21.165	5.100	3.900	3.220	6.020
Cho Don District	14.135	650	354	151	391
New Market District	4.887	1.426	630	2.034	2.170
Na Ri District	62.315	32.226	31.226	20.639	33.059
<b>Total output</b>	<b>174.846</b>	<b>51.266</b>	<b>44.417</b>	<b>39.989</b>	<b>62.535</b>

Source: Statistical Yearbook of Bac Kan Province 2017 [6].

Besides, according to the report on the production and consumption of arrowroot in Na Ri district in 2016, the planted area of arrowroot was reported to be 275.5 hectares, reached 45.91% of the total area with the average yield of 69.8 tons per ha; arrowroot tuber production of 19,229 tons; selling prices ranged from 2,500-3,000 VND per kg (0.1USD/kg); starch production of 3,094 tons and vermicelli production was approximately 250 tons (25% of total production in Bac Kan province) [5].

**2. Analysis of economic factors affecting the development of arrowroot production in Na Ri district**

**2.1. Resources of households**

Assessment of the impact of economic factors on the development of arrowroot production at the level of household aims to find out the causes which prevent or encourage households to develop arrowroot production. The findings are presented in Table 3.

The results indicated that factors related to machinery and equipments found to be the lowest rating, average point of 3.33 points corresponding the impact level, implying that that machinery and equipment have not shown a clear role in the development of local arrowroot production. Up to 12% of households believed that machinery and equipment are hindering factors, while 45% of households were not sure about the impact of this factor. On the other hand, only 43% of households believed that machinery and equipment facilitate the development of arrowroot production in the district.

The results also revealed that although land is considered as the most important resource in the development of arrowroot production, only 55% of respondents believed that the area of cultivated land affects the production of arrowroot. About 36% of the interviewers said that the land does not have a clear influence on the production development of households. In fact, only a few households used more than 50% of their land to grow arrowroot. In other words, the households have not yet considered the role of area in their own development of arrowroot production. Only 9% of households said that the area of land had an impact on their arrowroot cultivation (3.46 points).

**Table 3.** Evaluation of economic resources of households

Factors	Very difficult	Difficult	Normal	Advantage	Very Advantages	Average point
	<i>(Density)</i>					
Cultivated area	0.00	0.09	0.36	0.55	0.00	3.46
Self-production capital	0.00	0.01	0.49	0.46	0.04	3.53
Credit access	0.00	0.05	0.27	0.64	0.05	3.72
Labor	0.00	0.09	0.41	0.50	0.00	3.41
Machinery and equipment	0.00	0.12	0.45	0.41	0.02	3.33

Source: Calculated from survey data

For capital, basically, all households believed that there is sufficient capital to expand the production scale of arrowroot production in the coming years. In fact, the arrowroot production does not require more investment because households can re-use seeds for the next production years. The major cost for arrowroot focused on paying for labor costs because labor plays a vital role in the harvest season. Therefore, only 1 % of respondents said that capital is a difficult issue to expand production scale. However, 1% of these households are in 4% of poor households out of the total number of households surveyed. For poor households, it is difficult to maintain an amount of money available to invest. Thus, it is understandable for these households to assess capital as a factor causing difficulties for production development.

With the current small scale, the self capital of households is sufficient to maintain and develop production at a small level. For the production of several thousand square meters of arrowroot, it is possible to rely on their own resources such as capital and labor, manure sources, etc.

However, to increase the cultivated areas up to several tens of hectares, accessing credit sources is being essential. Therefore, the findings showed that 64% of respondents agreed that credit access had a positive impact on the development of arrowroot production. The role of credit access on agricultural production was investigated by studies of Chaovanapoonphol et al. [7], Duy [8] and Majumder et al. [9]. These studies were indicated that there was a positive correlation between credit access and the efficiency of agricultural production.

**2.2. Market and production plan**

The evaluation of factors related to marketing activities, including production and product consumption activities in Na Ri district is expressed in Table 4. The findings illustrated that there are four factors that received the rating with an average score of fewer than 3 points. In other words, these factors tend to cause difficulties in developing arrowroot production in the district.

The factor that receives the lowest rating is the activity of linking consumption of products between businesses and households growing arrowroot. The results show that linkage between business sectors and producers in agricultural production as well as arrowroot production is very weak. In fact, to improve the efficiency of arrowroot production in Na Ri district, local policies should focus on enhancing the linkage between businesses and growers in producing, processing and seeking the output market for arrowroot products. The results showed that it is very difficult to develop the arrowroot production without the linkage between enterprises and farms (with the agreement of 18 out of 26 respondents).

The development of arrowroot production in the study area are also affected by the selling prices of fresh tubers. In fact, the prices changes over the years which lead to changes in economic efficiency of farms and affecting on households’ investment decisions in the following year. Regarding this factor, there are 11 managers who do not make the correct judgment that the selling price of tubers is currently causing difficulties or creating favorable conditions for the production of arrowroot in Na Ri. Meanwhile, the remaining 15 officials all commented that the current price is the main factor hindering production development in Na Ri. This is completely understandable when the price of arrowroot was reduced by more than 1,000 VND / kg in 2017 compared to 2016.

**Table 4.** Evaluation of market and production plan

Factors	Very difficult (Frequency)	Difficult	Normal	Advantage	Very Advantages	Average point
Consuming market	3	5	12	6	0	2.81
Selling price	7	8	11	0	0	2.15
Production scale of households	0	3	6	12	5	3.73
Economic efficiency of arrowroot	0	2	5	13	6	3.88
Local production plan	0	0	15	5	6	3.65
Associated production activities	0	6	17	3	0	2.88
Associated consumption of products	7	11	7	1	0	2.08

Source: Calculated from survey data

The factors related to economic efficiency and production scale of arrowroot are good evaluation, the average rating of 3.88 and 3.73, respectively.

Finally, the local production development plan received a positive assessment when no officials thought that the local development plan hindered development of arrowroot production in Na Ri district. In other words, local production development plan had a positive impact on the development of arrowroot production in Na Ri district (average point of 3.65), implying that the economic efficiency of arrowroot farms would improve if Na Ri district applied a suitable production plan.

### **3. Solutions to develop arrowroot trees in Na Ri district, Bac Kan province**

#### *Planning stable material areas associated with improving product quality*

The planning of major material areas plays an important role in the development and management of arrowroot production. It helps to manage product quality of material areas better. In addition, cultivation together on the same area will help households save resources by utilizing of resources among households. The proposal is to build Con Minh commune in Na Ri district as the center of material areas and the powder and freeze processing facilities. The other communes such as Quang Phong, Lam Son, Hao Nghia, Duong Son, Dong Xa, Xuan Duong, An Tinh, Huu Thac, Cu Le, Lang San, Kim Lu, Luong Ha and Van Minh are material areas.

Besides, the expanding scale production of farms should be conducted by converting inefficient paddy land to arrowroot cultivation.

In addition, households should adopt new techniques in arrowroot production to increase productivity, especially high-land techniques in field land that are being studied and tested locally. Utilizing available waste products as arrowroot residue as organic fertilizer to save costs, reduce environmental pollution and improve soil is considered as a new method in production.

#### *Build and consolidate linkages in production, processing and consumption of arrowroot products*

Government need to promote the linkage between four components, namely Farmers - State - Scientists - businessmen, from the stage of planting, processing to consumption via the product value chain. This is one of factors affecting the development of scale production of arrowroot in the future. The lack of these linkages makes households' production decrease efficiently, makes bad effects on the value chain, and makes the livelihood of arrowroot producers not guaranteed. Besides, the role of the linkage between enterprises and farmers in improving the economic efficiency of agricultural production in Vietnam was investigated by Dung [10].

#### *Developing cooperative models to increase productivity and competitiveness for district products*

In order to maintain the development of stable and sustainable products, the People's Committee of District needs to direct the relevant agencies and the Arrowroot Association to establish Cooperative Arrowroot. This Cooperation aims to reorganize production and manage the product quality of vermicelli, associate consumption market, and improve competitiveness in the market. In addition, the development of this cooperative model is also a solution to handle the problem related to small scale production of households. Therefore, the cooperative model is a reasonable solution that can be applied immediately in the future.

#### *Improving the quality of arrowroot root from breeding selection*

Arrowroot has been cultivated by locals in Bac Kan province since the 1960s. However, production mainly based on experience and traditional methodologies. As a result, the efficiency of arrowroot is low and the quality and fresh tuber yield are low and unstable. In addition, the re-using over the years lead to the degradation of seed sources.

Therefore, to improve the economic efficiency of arrowroot cultivation, Bac Kan province should provide policies focusing on research, selection of new seeds with high yield, crop restructuring and technical investment in cultivating, caring, etc.

*Combining the development of other crops to create a comprehensive economic effect*

Taking advantage of the land fund, the intercropping arrowroot with other crops should be applied to create income locals. This solution has been successfully implemented in Con Minh commune in Na Ri. Farmers intercropped Stylo grass with arrowroot. As a result, the grass reduces soil erosion as well as providing animal food, fish food. It also provides protein enrichment in the soil. In addition, the farmers can use the grass for fish or cattle when the grass is about 60-80cm high. If the grass did not use in livestock, it could be used as organic fertilizer for arrowroot. Thanks to apply this solution, the productivity of arrowroot reached 650-700 quintals per hectares. Another method is that arrowroot was intercropped under the canopy of forests for the first 2-3 years. This method has just taken advantage of cultivated land, time to take care of crops, increase of economic efficiency per 1 unit area.

#### **4. Conclusion**

Basically, the factors related to household resources are favorable for the development of local arrowroot production. For factors related to the market, such as selling prices, consumer markets, or activities of linking production and consumption of products, they have not really created favorable conditions for the development of production arrowroot. Therefore, the local government should provide policies or plans to develop arrowroot production and policies should pay more attention to improve the seed quality, economic efficiency, and stable output market.

#### **References**

- [1] Vu, T.-H., K.-C. Peng, and R.H. Chung, *Evaluation of Environmental Efficiency of Edible Canna Production in Vietnam*. Agriculture, 2019. **9**: p. 242.
- [2] Backan People's Committee, B., *Technical guidance on planting arrowroot*. 2011, Backan province: Department of Agriculture and Rural Development in Bac Kan province.
- [3] BKSO, *Backan Statistical Year book 2017*. 2018: Hanoi: Statistical Publishing House, Hanoi.
- [4] Le, T.L.V., et al., *Production and processing of canna vermicelli in Hung Yen province toward sustainable development*. Proceedings of Scientific Research Results-Institutional University Cooperation Program 2008-2012, 2013: pp.156-166.
- [5] Nguyen, K.Q. and V.H. Truong, *Process of processing household-scale rice*. 1995. Vietnamese Institute of Agricultural Science and Technology, Hanoi.
- [6] BKSO, *Backan Statistical Yearbook 2018*. 2019, Hanoi: Statistical Publishing House, Hanoi.
- [7] Chaovanapoonphol, Y.K., G.E. Battese, and H.-S.C. Chang, *The impact of agricultural loans on the technical efficiency of rice farmers in the Upper North of Thailand*, in

- Productivity, Efficiency, and Economic Growth in the Asia-Pacific Region*. 2009, Springer. p. 279-295.
- [8] Duy, V.Q., *The role of access to credit in rice production efficiency of rural households in the Mekong Delta Vietnam*. Center for Asian Studies Discussion Paper, 2012(284).
- [9] Majumder, S., B.K. Bala, F.M. Arshad, M.A. Haque, and M.A. Hossain, *Food security through increasing technical efficiency and reducing postharvest losses of rice production systems in Bangladesh*. Food Security, 2016. **8**: p. 361-374.
- [10] Dung, L.T., *Efficiency economic linkage between Enterprises and farmers in the Southeast region: Current situation and affecting factors*, in *13rd IFEAMA Conference*. 2015: Ulabantar, Mongolia.