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Productivity Analysis of Organic Garlic Production in Bhutan

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Abstract: The study evaluates factors affecting the productivity of organic and conventional garlic production in Bhutan. Employing simple random selection, array of information was collected from 85 organic and 175 conventional garlic farmers respectively with a questionnaire. Descriptive statistics were used for the analysis of socioeconomic, cost of garlic production, and factors influencing the productivity of garlic. Productivity analysis revealed that seed, farmyard manure, age, and experience significantly influenced organic garlic productivity. Similarly, cultivated area, seed, farmyard manure, literacy, and source of farmyard manure influenced the productivity of conventional garlic production. The study concluded that improving the productivity of garlic farming can be achieved by maximizing the use of available land, expanding the area under garlic cultivation, and using high-quality garlic seeds and farmyard manure. Furthermore, continuous re-training for experienced farmers is crucial to update their farming knowledge and retain them in production. These insights can be useful to policymakers and stakeholders in supporting garlic farmers and enhancing their economic benefits.

Keywords: conventional farming, garlic, organic production, productivity, production cost

Introduction

In Bhutan, about 70 % of the country is covered with forests; 7 % with year-round snow and glaciers; and 4 % as meadows and pastures, and only about 3 % of the area is used for agriculture (NSB 2018). Most of the agricultural land in the uneven landscape with steep slopes deters farm mechanisation and makes farming difficult in many cases. Further to this issue, of the total arable land of 250,062 acres, 21.84% of land has been left fallow which is quite useful for the economy dependent on agriculture (MoAF 2019). Due to geographical and weather conditions, the Bhutanese farmers are mostly smallholders and depend on crops and vegetable production.

The vegetable production was limited to kitchen gardening during the 1970s. Later on, with the expansion in vegetable production of new vegetable types such as asparagus, beans, broccoli, cabbage, carrots, cauliflower, peas, and onion, significantly contributed to the income as well as nutrition of the people living in rural Bhutan (Tobgay 2005, Tashi 2022). Meanwhile, the Royal Government of Bhutan (RGoB) has also initiated the policy

to balance the safety of the environment and to protect the income of the farmers, which was aligned with the increase in the agricultural production and the consumers' preference on natural products [Department of Agriculture (DoA, 2006)]. That was also the time the RGoB initiated the organic farming by instituting the National Organic Programme (NOP) as a focal agency for coordinating and implementing activities of promoting organic farming in Bhutan (MoAF 2018). Since then, organic farming in Bhutan has been governed by the National Framework for Organic Farming (NFOF) with the vision of developing and promoting organic farming among the farming communities and trade in organic food items; augmenting health, nutrition, and income of the farm households, and becoming the sole exporter of organic agricultural products (DoA 2006). Owing to Bhutan's geographical location, it has seasonal opportunities in terms of vegetable production over its neighbouring countries. The peak summer vegetable production in Bhutan are exported to India and other neighbouring countries.

Growing garlic in the kingdom of Bhutan dates back to the early history of civilization although the official records of production are available only from 2004 onward with production of 1,734 kg per acre (MoAF 2004). Garlic production output and area remained constant from 2010 to 2020 while the consumption has increased by 60.81% resulting in import of 104.86 tonnes in 2020 (MoAF 2004, Finance 2010, Finance 2020, MoAF 2020). Over the years, farmers involved in both organic and conventional production method grow garlic as prime cash crop. Organic garlic has helped in livelihood of the farmers. Though in smaller amount, farmers reported that the proceeds from organic garlic farming with other vegetable items have helped in buying essential grocery items such as salt, sugar, and oil from the market.

Agricultural productivity in organic vegetable production is the measure of organic vegetable outputs from units of organic inputs. The productivity is said to be high when more output is derived from the same amount of input, or the same output is obtained from a lesser amount of input. Productivity in agriculture measures efficiency in a production system that utilises land, labour, capital, and other related resources (Ongwu *et al*, 2017; Rehman, 2004). Agricultural productivity is dependent on factors such as land, labour, experience in farming, fertilisers, accessibility, and management of water and other biological factors (Dharmasiri, 2012). Several studies have shown that crop productivity is influenced by various factors, including farm size. For instance, studies conducted by Adewuyi, Shittu et al. (2014), Ren, Liu et al. (2019) and Onogwu, Audu et al. (2017) have demonstrated the significant impact of farm size on crop productivity. A study by Patidar, Khan et al. (2018) revealed that investing in agricultural research and extension, rural infrastructure and rural development has helped in the growth of agricultural productivity. Barkai and Levhari (1973), Ainembabazi and Mugisha (2014), Oladele, Chimewah et al. (2019), and Ahmad and Afzal (2020) emphasised that experience is one of the factors that would influence agricultural productivity. Human capital like labour, ageing, and decreasing people in the villages, less interest in education and training on agriculture, limited understanding on agricultural livelihood choices, and limited capacity of the present training and education system to give pioneering understanding will have significant impacts on agricultural productivity (Nossal and Gooday 2009). Low agricultural productivity in Bhutan could be because of limited arable land, rough terrain, and loss of arable land to urbanization [Gross National Happiness Commission (GNHC, 2009)]. Neuhoff, Tashi et al. (2014) further stated that low agricultural productivity in Bhutan is also due to less soil fertility, insufficient input, lower-quality seeds, and lack of technical knowledge, inefficient farm management methods and shortage of labour. The management method involves a series of activities, including selecting appropriate crops, preparing the soil, managing pests, and harvesting, which are planned, organized, and controlled to ensure better productivity. To overcome the problems of low agricultural productivity, the RGoB has adopted some strategies. One strategy of enhancing agricultural

productivity at farmers' level was the introduction of farmers' groups and cooperatives in the 9th Five Year Plan (FYP) (2002-2007) and 10th FYP (2008-2013) by the Royal Government of Bhutan (Sonam and Martwanna 2011). These formal institutions provide a guarantee to farmers for the availability of market inputs and outputs, which serves as a motivation for them to increase both the quantity and quality of their agricultural products (Dendup 2018). Currently, there are 693 farmers' groups in Bhutan and 14 of them are in organic agriculture with majority of them in organic vegetable production [Ministry of Agriculture and Livestock (MoAL, 2023)]. The Gasa Rangzhin Sanam Detshen (GRSD) is one of the farmers' groups venturing into organic vegetable production. In this context, the productivity of organic garlic production in relation to conventional garlic farming in the country and the rest of the neighbouring countries is not known. Assessing the productivity and studying the shortfalls in the production of garlic would reduce the gap between garlic requirement and the production. Therefore, this study was aimed at analysing the productivity of organic and conventional garlic production in Bhutan.

Materials and Methods

The area of study

Bhutan is divided into 20 administrative districts. The study was conducted in two west-central regions of Bhutan, specifically the Gasa and Wangduephodrang districts. Gasa is located elevation of 1500-4500 metres above sea level (latitude 27°54'60"N; longitude 89°40'60"E). The district is bordered by the autonomous region of Tibet (China) in the North and Thimphu, Punakha, and Wangduephodrang in the South. Gasa is one of the least populated districts in Bhutan with a population of 3,952 and the area of 3,117.74 km^2 (GNHC 2019). Gasa district was selected purposively as the organic district as it was declared organic since 2004 (Wangmo and Iwai 2018). Farm households of Gasa still continue to farm without using synthetic inputs. Additionally, the district has the first certified organic farmers' group venturing into the cultivation of organic vegetables including garlic (Bhutan 2017).

Wangduephodrang district is located at an altitude of 500-800 metres above sea level (Latitude 27°48'79"N, Longitude 89°89'96"E). The district has an area of 4,029 km^2 with 11,854 acres of land under agricultural cultivation (NSB 2021). Majority of the households in the district depend on agriculture farming while few depend on livestock rearing too. Garlic is one important cash crop that is cultivated in large quantities in the district. Wangduephodrang district was selected purposively firstly due to its similar aspects to the organic district of Gasa. Secondly, Wangduephodrang district is the highest producer of garlic in the west-central region of Bhutan (MoAF 2019, MoAF 2020, NSB 2021).

Sample selection

The farm households engaged in garlic cultivation were the units in this study. The records for farm households engaged in garlic production were obtained from the agriculture sector of these two districts of Gasa and Wangduephodrang. Gasa district has four sub-districts out of which Goenkhatoed and Goenkhamed sub-districts were purposely selected for this study. The two sub-districts have a total population of 156 farm households engaged in organic garlic cultivation. Similarly, out of fifteen sub-districts under Wangduephodrang, Dangchu and Nyisho were purposely selected for this study. These two sub-districts have a total population of 466 farm households engaged in conventional garlic cultivation. Since the total farm households population were known, the following Taro

Yamane formula have been used to determine the sample for the study (Chaokromthong and Sintao 2021).

$$n = N/(1 + N(e^2)) \quad (1)$$

where:
n = sample size
N = population size (622 households)
e = margin of error as a decimal

Based on the total population of 622 farm households in garlic production, the minimum required sample came out to be 243 farm households. Further, the study applied proportionate stratified sampling method to allocate a sample of 243 farm households to Gasa and Wangduephodrang districts respectively. The proportionate sample for Gasa district was 61 farm households and 182 farm households for Wangduephodrang district. Nevertheless, the study involved 85 farm households which was more than 50% of the total population of organic garlic farm households in Gasa district to represent organic garlic production perspective in the study. These 85 farm households of Gasa were randomly interviewed from Goenkhatoed sub-district spread across 14 villages and Goenkhamed sub-district spread across 18 villages. Similarly, 175 farm households from Wangduephodrang were randomly interviewed from Dangchu sub-district spread across 16 villages and Nyisho sub-district spread across villages making the total sample size to 260 instead of 243 farm households.

Semi-structured questionnaire was used to collect cross-sectional data for the 2020 season garlic from the sampled farm households. The information collected include farm household characteristics, socio-economic, area under cultivation, farm inputs, and labour for garlic cultivation. The questionnaire was pretested with a group of households who were not involved in the current study but having the similar farming system. This allowed us to refine the content and flow of the questionnaire, thus assuring reliable data collection. We also cross-checked the internal consistency through the reliability statistics tests. The survey consisted of 51 items and the value for Cronbach's Alpha for the survey was $\alpha = .82$.

Data analysis

Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to analyse the demography of garlic farm households involved in the study and the production information of organic and conventional garlic.

Cost and returns from garlic production

All the cost items in the production of garlic were collected through the structured questionnaire interview. The variables included in the analysis were the costs of inputs, such as land, labour, capital, and other resources such as seed and manure, and the returns from the sale of garlic. The secondary data on the price of garlic per kilogram was obtained from the published website of the Ministry of Agriculture and Forests. Besides the use of descriptive statistics, the independent t-test was employed to find the difference between the cost of garlic production between conventional and organic garlic farm households. The results of this analysis can be used to determine the pricing, production levels, and resource allocation in garlic farming. Understanding the cost of production can improve the productivity of garlic farm households.

Factors affecting the productivity of garlic farm households.

The Cobb-Douglas production function was used to analyse the productivity of garlic (Patidar, Khan et al. 2018). The model used was expressed as under:

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}\ldots X_n^{bn}e^{\mu} \quad (2)$$

The above function (Equation 1) is represented in the log form as below:

$$LogY_i = Log\beta_0 + LogX_1\beta_1 + LogX_2\beta_2 + \ldots LogX_n\beta_n + \mu_0 \quad (3)$$

Where:
Y= average yield of garlic produced per acre (dependent variable)
a = constant or intercept
μ = Error term.
$\beta_1 \ldots \beta_n$= estimated coefficients of the explanatory variables
$X_1 \ldots X_n$= explanatory variables

The explanatory variables considered in the study were: 1) Age of the farmers - Years, 2) Literacy, 3) Experience – Years, 4) Area cultivated - Acres, 5) Seeds - Kg, 6) Farmyard manure - Kg, 7) Source of farmyard manure, 8) Is irrigation water enough, and 9) Family labour in organic and conventional garlic production in the study area.

Measurement of variables

The explanatory variables and their expected relationship with the outcome variable are presented in Table 1. Age is hypothesized as a positive impact on the productivity that younger age would have more active in agricultural production (Saiyut, Bunyasiri et al. 2019). Dummy variable was set for literacy level as zero for illiterate or one for literate farmers. Education is expected to encourage farmers to adopt innovations (Das, Sahoo et al. 2012, Oduro-Ofori, Aboagye et al. 2014, Gowda and Dixit 2015) and make them more skilled and responsive to risk taking than illiterate farmers. Thus, literate respondents were expected to have positive impact on productivity. Similarly, better productivity was expected from households with more experience in garlic farming and larger area under garlic cultivation. Family labour was hypothesized to have positive significance on farmers productivity as family labour is considered to be more productive than hired labour (Johnston and Le Roux 2007). The farmyard manure was also expected to have positive effect on productivity as it increase the yield of the crops (Ahmad, Ghaffar et al. 2021).

Table 1 - Descriptive variables in the empirical model

Variables	Coding system	Expected sig.
X_1 = Age of the farmers	Completed years	+
X_2 = Literacy	0 = Illiterate, 1 = Literate	+
X_3 = Experience	Years	+
X_4 = Cultivated area	acres	+
X_5 = Seeds	Kg per acre	+
X_6 = Farmyard manure	Kg	+
X_7 = Source of farmyard manure	0 = Others, 1 = Self	+
X_8 = Is water enough	0 = No, 1 = Yes	+
X_9 = Family labour	Nos.	+

The presence of multicollinearity among the independent variables in the productivity analysis were checked using the variance inflation factor (VIF). The VIF measures the degree to which the variance of an estimated regression coefficient is increased due to the presence of correlations among the independent variables. VIF value of 5 or higher to be indicative of severe multicollinearity, a value between 5 and 1 to indicate moderate multicollinearity (Daoud 2017). Based on these criteria, the VIF values for all the independent variables in our model were below the threshold of 5, indicating no evidence of multicollinearity (Table 2).

Table 2 - Collinearity statistics of independent variables used in productivity analysis.

Independent variables	Tolerance	Variance Inflation Factor (VIF)
Age	.747	1.339
Literacy	.761	1.314
Experience	.926	1.080
Cultivated area	.636	1.572
Seed per acre	.784	1.276
Farmyard manure per acre	.538	1.857
Source of FYM	.948	1.054
Is irrigation water enough	.935	1.070
Family labour	.934	1.071

Dependent Variable: Kg per acre

Results

Demographic characteristics of garlic farm households

Demographic information of garlic farm households were presented in Table 3. Female represented most respondents both in terms of organic garlic (76.5%) and conventional garlic (69.1%) production respectively. The average age of the respondents were 48.86 and 47.78 years for organic and conventional garlic farmers. About 76.4% of organic garlic farmers and 80.0% of conventional garlic farmers fell in the age ranging between 20-60 years. Literacy level of the garlic farmers were low with majority (70.6% & 67.4%) of the farmers being illiterate. The average family size of organic garlic farm households was 3.73 members and conventional garlic producers was 4.62 members. The averages for family

income, land holding, and family labour were 1281.95, 2.63, and 2.04 respectively for organic garlic households. Similarly, 2191.53, 2.21, and 2.76 were the averages for household income, landholding, and family labour in the case of conventional garlic farm households. Organic garlic farm households depended on family labours and conventional garlic farmers relied more on hired labour.

Production of organic and conventional garlic

The details on the production of organic and conventional garlic by farmers in the study area were presented in Table 4. The average production of organic garlic was 111.33 kg from average area of 0.19 acres while conventional garlic was 301.14 kg from 0.26 acres of land. The average yield was higher in conventional garlic was 1263.84 kg per acre compared to organic garlic with 682.39 kg per acre. In addition to their primary goal of generating income for their family, garlic growers also saved garlic as seeds for the following season and for their own consumption.

Table 3 - Demographic information of garlic farm households

Characteristics		Organic			Conventional		
		F(%)	Mean	SD	F(%)	Mean	SD
Gender	Male	20 (23.5%)			54 (30.9%)		
	Female	65 (76.5%)			121 (69.1%)		
Age (Years)			48.86	12.66	175	47.78	13.97
	<20	0(0.0%)			2 (1.1%)		
	20-29	3 (3.5%)			14 (8.0%)		
	30-39	24 (28.2%)			36 (20.6%)		
	40-49	16 (18.8%)			42 (24.0%)		
	50-59	22 (25.9%)			48 (27.4%)		
	60-69	16 (18.8%)			26 (14.9%)		
	70>	4 (4.7%)			7 (4.0%)		
Literacy	Illiterate	60 (70.6%)			118 (67.4%)		
	Literate	25 (29.4%)			57 (32.6%)		
Family members (Nos)			3.73	1.94	175	4.62	2.24
Income (US$)			1281.95	1069.20		2191.53	1788.07
Landholding (Acres)			2.63	1.77		2.21	1.61
Family labour (No)			2.04	0.97		2.76	1.19
Hired labour	Yes	46 (54.1%)			81 (46.3%)		
	No	39 (45.9%)			94 (53.7%)		

Table 4 - Production of organic and conventional garlic

Indicators	Organic (n=85)		Conventional (n=175)	
	Mean	SD	Mean	SD
Garlic Area (Acres)	0.19	0.17	0.26	0.18
Garlic (Kg)	111.33	126.68	301.14	415.22
Yield (Kg/Acre)	682.39	650.95	1263.84	1071.14
Price (US$/Kg)	3.78		3.78	
Revenue (US$/Acre)	1030.06	933.99	2395.26	2485.58
Garlic Sold (Kg)	80.74	112.58	232.49	364.00
Garlic Cons (Kg)	7.14	12.64	8.61	16.84
Garlic Seed (Kg)	23.56	34.60	60.86	75.71
Garlic Income (US$)	305.38	425.80	879.31	1376.71

Note: 1 US$ = BTN 76.41

Comparative analysis of production cost between organic and conventional garlic production.

The results of the comparative analysis were presented in Table 5. The tests results indicated significant differences in yield, total production cost, gross return, and net return from the production of garlic by organic and conventional farm households. Organic garlic production was costlier in terms of gross production whereas the yield per acre was significantly less compared to conventional garlic production. The findings were in consonance with low yield in organic production (Nieberg and Offermann 2003), lower input costs in conventional garlic (de Souza and Garcia 2015), low input cost and price premium (Nemes 2009), and lower profit margins in organic farming (Froehlich, Melo et al. 2018). Thus, it can be concluded that organic garlic cultivation is economically least beneficial compared to the conventional garlic production.

Table 5 - Production cost analysis of organic and conventional garlic production

Parameters	Organic		Conventional		t	df	p
	Mean	SD	Mean	SD			
Yield (Kg/Acre)	682.39	650.95	1263.84	1071.14	-4.606	258	0.000
Total cost (US$/Acre)	1403.97	1604.48	980.65	562.10	3.123	258	0.002
Gross return (US$/Acre)	2580.94	2462.06	4780.14	4051.28	-4.606	258	0.000
Net return (US$/Acre)	1176.97	2470.58	3799.50	3752.37	-5.854	258	0.000

Note: US$ 1 = BTN 76.41

Factors affecting the productivity of organic and conventional garlic farmers

The results of the determinants of productivity of organic and conventional garlic were presented in Table 6. Of the nine independent variables used for productivity, seed and farmyard manure were statistically significant at 5% level while age and experience were significant 10% level respectively in organic garlic production. Similarly, cultivated area, seed, and farmyard manure were found significant at 5% level and literacy and source of farmyard manure were found significant 10% level in terms of conventional garlic production respectively.

Table 6 - Determinants of productivity of garlic farmers

Variables	B	Std error	t-value	Sig	R^2	Adjusted R^2
Organic						
Constant	0.019	0.514	0.037	0.971	0.444	0.377-
Age	0.501	0.267	1.874	0.065**		
Literacy	0.042	0.067	0.631	0.530		
Experience (Years)	0.196	0.110	1.781	0.079**		
Cultivated area (Acre)	0.134	0.101	1.317	0.192		
Seed (kg/acre)	0.398	0.110	3.636	0.001*		
Farmyard manure (kg/acre)	0.276	0.114	2.414	0.018*		
Source of Farmyard manure	-0.035	0.073	-0.486	0.628		
Is water enough	-0.088	0.104	-0.847	0.399		
Family labour (Nos.)	0.084	0.142	0.590	0.557		
Conventional						
Constant	0.414	0.388	1.066	0.288	0.488	0.460
Age	0.016	0.163	0.100	0.921		
Literacy	0.088	0.049	1.808	0.072**		
Experience (Years)	0.087	0.073	1.193	0.234		
Cultivated area (Acre)	0.200	0.067	2.978	0.003*		
Seed (kg/acre)	0.597	0.070	8.562	0.000*		
Farmyard manure (kg/acre)	0.344	0.090	3.817	0.000*		
Source of Farmyard manure	-0.093	0.061	-1.532	0.127**		
Is water enough	-0.031	0.082	-0.372	0.710		
Family labour (Nos.)	0.070	0.106	0.664	0.508		

*Note: * and ** show the values that are statistically significant at 5 percent and 10 percent levels respectively.*

Discussion

The majority of garlic farmers constitute female due to the fact that male population are out for other off-farm activities (Fund 2019). Study by Razia and Ghazala (2011) also showed higher number of woman participation in agricultural activities. Female participation in general is high although their contribution go unrecognized in agriculture as evident from Doss, Meinzen-Dick et al. (2018) and (Otieno 2019). Majority of the garlic farmers were in the age group of 20-60 years which is considered as active working age indicating the ability to meet physical required in the agriculture. The finding agrees with Tauer (2019) where the productivity of age is peak in the midlife.

Majority of the sampled households have only 1-2 family labour working for garlic production. This has led to the labour shortage and lead to rely on hired labour or labour exchange. The cause of having lesser family labour might be attributed to rural-urban migration (Bureau 2018) and this agrees with the study by Karim and Muhammad (2018).

In the productivity analysis, area cultivated has significantly influenced the productivity of garlic in conventional cultivation system. The findings were in consonance with the

studies by Ren, Liu et al. (2019), Adewuyi, Shittu et al. (2014), and Onogwu, Audu et al. (2017). The average cultivated area under garlic production was 0.26 acres from the total household landholding of 2.21 acres. Thus, maximizing the use of available land and expanding the area under garlic cultivation can significantly improve the yield for farmers, leading to economic benefits. Garlic seeds significantly influenced the productivity.

Farmyard manure is another factor that significantly influenced garlic productivity. Being in mixed farming community, farmers have easy accessibility to farmyard manure either from self or from the neighbours. Similar findings were obtained by Bandyopadhyay, Misra et al. (2010) and Ren, Liu et al. (2019). There are opportunities where farmers can increase the area under garlic cultivation and increase the output thereby influencing the overall productivity.

Age and experience of organic garlic farmers have significantly influenced their productivity. The average age of sampled farmers was 48.86 and 47.78 years for organic and conventional garlic farmers respectively. These findings were in line with the results of Tauer (2019) where the sampled farmers fall in the prime working age. Organic garlic farmers received various training on organic production since the conversion to organic practices. The respondents emphasized that many years of experience in organic production compounded by training from the government had enhanced their skills in farming and ultimately impacted on the productivity. Similar findings on the experience having significant impact on productivity were reported by Barkai and Levhari (1973); Ainembabazi and Mugisha (2014); Oladele, Chimewah et al. (2019); and Ahmad and Afzal (2020). However, experience did not impact the productivity of conventional garlic farmers. In conventional garlic farms, garlic is grown on smaller scale compared to other crops and farmers' reluctance to adopt newer approaches to production methods are reported as the probable reasons for experience having no impact on conventional garlic farmers' productivity. However, it is pertinent to provide continuous re-training for the experienced farmers to update their farming experience as well as to retain them in the production.

There are several limitations to this study. Firstly, the data collected was based on self-report, which may not always be accurate as households do not keep daily records of farming activities. Secondly, productivity could be impacted by external factors that were not considered in the study, such as weather conditions or pests and diseases. Thirdly, the study was conducted in specific locations and may not be generalizable to other areas. Additionally, the study did not examine the economic aspects of garlic farming, such as market demand and access to credit, which could also impact productivity.

Conclusion

This study has highlighted the important factors that significantly influence the productivity of garlic farming, both in conventional and organic cultivation systems. The study found that the majority of garlic farmers are female. The scarcity of family labour due to rural-urban migration has led to a reliance on hired labour or labour exchange, which has affected the productivity of garlic farming. Maximizing the use of available land and expanding the area under garlic cultivation, as well as using good quality garlic seeds and farmyard manure, can significantly improve the yield for farmers. Additionally, the age and experience of organic garlic farmers have a significant impact on their productivity, while experience did not impact the productivity of conventional garlic farmers. It is crucial to provide continuous re-training for the experienced farmers to update their farming experience and retain them in the production. These findings can be helpful to policymakers and stakeholders to support garlic farmers in improving their productivity and ultimately enhancing their economic benefits.

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