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Evaluating the Financial Efficiency of the Chinese Cabbage Cultivation Model Inside and Outside the Net House in Binh Tan District, Vinh Long Province, Vietnam

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Abstract: *The study was carried out in Tan Quoi town and 3 communes Thanh Loi, Tan Binh, and Tan An Thanh. This is a locality with a lot of Chinese cabbage growing areas in Binh Tan district. Data sources used in the study include primary data from the direct survey of 80 households producing Chinese cabbage inside and outside the net house. The main objectives of the study were to evaluate the current status, financial efficiency, and factors affecting the profitability of Chinese cabbage production inside and outside the net house. The study results show that the production of Chinese cabbage has been developing following the local orientation, to contribute to protecting the health of consumers. Planting outside the net house has a higher rate of pests and diseases than growing inside the net house. In terms of financial efficiency/1,000m^2 of land for growing Chinese cabbage in the net house compared to that outside the net house, the revenue is 1.6 times higher, the profit is 2.7 times higher, the efficiency of capital is 0.70 VND and 0. 33 VND, respectively. In addition, the study also identified factors affecting the profitability of growing Chinese cabbage. The topic has also proposed groups of solutions to support and improve the efficiency of Chinese cabbage in Binh Tan district in the coming time.*

Keywords: *Chinese cabbage, cost and profit, net house, production efficiency.*

1. INTRODUCTION

Vegetables are one of the strong groups of crops in the Mekong Delta provinces [10]. However, in recent years, realizing that food safety issues in agricultural production have been concerned by ministries, agencies, and the whole of society [11]. To meet the market demand for safe vegetable production in the direction of high technology, provinces in the region have focused on investment and identified this as a key task for agricultural and rural development.

Currently, the demand for safe vegetables is increasing, realizing that the model of growing Chinese cabbage in a net house is one of the solutions to grow clean vegetables that have been deployed by the agricultural sector of Binh Tan district for many years [1] [9]. In the past, contributing to promoting the process of growing safe vegetables, clean vegetables replace traditional growing methods, to create safe products for consumers and limit the use of pesticides to the lowest level [6]. Thereby contributing to the protection of land and water resources, the long-term safety of human health, and at the same time creating a sustainable development direction for safe vegetables in the vegetable production area of the district [4].

The strength of Binh Tan district, Vinh Long province is vegetables, in which Chinese cabbage is considered a popular vegetable grown in communes located along the Hau river of the district [1]. In the current situation, products are competitive in terms of quality, prices are still limited, and products are created in terms of quantity, but the quality is not guaranteed [7]. Chinese cabbage producers rely on their experience and use a lot of fertilizers and pesticides, so the residue of pesticides in their products and unstable prices depend a lot on traders. Production is still small, and the application of scientific and technical advances to production according to VietGAP standards is too small [4], [5].

Therefore, to increase income and stability from Chinese cabbage, farmers need to change their traditional farming practices and switch to applying advanced production models such as production towards safety, VietGAP, the farming system in net houses, etc. From there, it is possible to associate with companies and businesses in providing input materials and purchasing output products. This study is essential to evaluate the effectiveness of the Chinese cabbage farming model in Binh Tan district, from which to propose and orient the development of Chinese cabbage production in the coming time.

2. RESEARCH METHODS

2.1. Research Process Framework

To conduct the research, the research team follows the research process framework (Figure 1) to solve the problems and meet the research objectives of the topic.

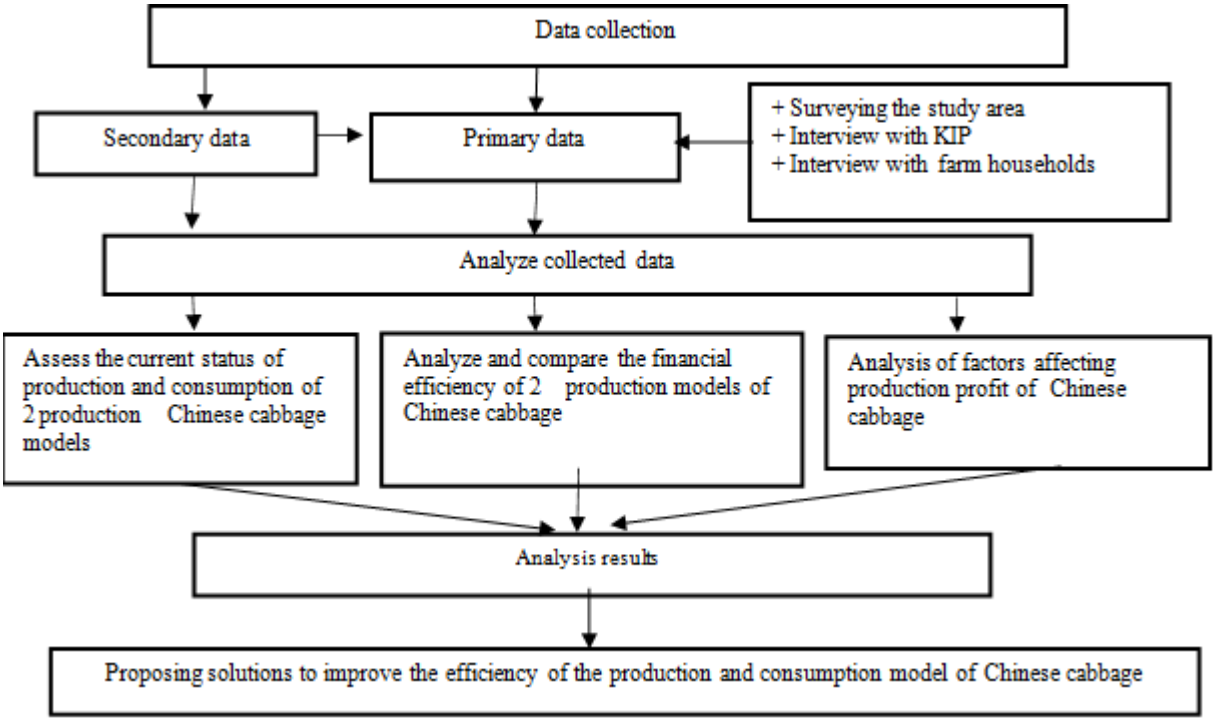

Figure1. *Research process framework*

2.2. Methods of Study Area Selection, Sampling, and Data Collection

Currently, the area of vegetable cultivation in the net houses in Binh Tan district is constantly expanding in both size and types of vegetables. The number of households cultivating vegetables is concentrated in Tan Quoi town and 3 communes (Thanh Loi, Tan Binh, and Tan An Thanh). Therefore, in the study, these sites were selected for the survey. The number of interview survey samples was selected by stratified random method (randomly selected from the list of households cultivating 2 models of Chinese cabbage in the study area), with the number of survey samples being 40 farming households cultivating Chinese cabbage inside the net houses and 40 farming households cultivating Chinese cabbage outside the net houses (without net houses) in the above communes.

Collected data includes primary data collected from interviews with KIP (Key Informant Panel) from local officials and leaders, direct interviews with households growing Chinese cabbage in 4 communes/towns of Binh Tan district, by structured questionnaires related to production, and consumption of 2 farming models.

2.3. Methods of Data Analysis

Research using analytical methods:

(1) Descriptive statistical method is used to assess household resources, the current status of Chinese cabbage production inside and outside the net house (no net house),

(2) The cost-benefit analysis method helps to evaluate the efficiency of the production profit of Chinese cabbage inside and outside the net house,

(3) Independent sample t-test to compare the evaluation criteria of 2 production models inside and outside the net house. Using the independent sample mean test method with α significance from 5% - 10%.

(4) Multivariable linear regression method to analyze and evaluate the factors affecting the profit of Chinese cabbage farmers inside and outside the net house. Selected variables used in multivariable linear regression analysis.

The multivariable linear regression model

$$Yi = \beta 0 + \beta 1X1i + \beta 2X2i + ... + \beta 9X9i + \varepsilon i$$

In there:

Y_i: profit from farming Chinese cabbage of household i (million VND/ha) β_0: Constant β_1 ... β_9: Regression coefficient of independent variables in the model.

$X_1 \ldots X_9$: Independent variables in the regression model.

From the results of analysis on production efficiency (profit) of the authors who have studied/ implemented in the Mekong Delta in recent years. The results have many variables that affect crop production profitability. However, to have a basis for selecting analytical variables, in this study, variables were selected: age of producer, education level, production experience, number of people involved in the production, and production investment costs. (Table 1).

Table1. *Variables in the multivariable linear regression mode*

Variables	Unit	Symbol	Meaning	Expectation	Reference source
Age of producer	year	X_1	Age of direct producer	-	
Education level of producer Years of experience growing cabbage Number of people involved in the production Land preparation cost Labor cost	number of years of schooling year people 1,000 VND 1,000 VND	X_2 X_3 X_4 X_5 X_6	Grade 1=1; Grade 2=2; …. Grade 12=12; High school = 15, College = 16, University = 18 Number of years experience of producer growing Chinese cabbage Number of people directly involved in the production of Chinese cabbage Cost of land preparation (plowing, harrowing, swinging, ... Cost of labor (weeding, fertilizing, spraying, harvesting...)	+ + + - -	[2], [3], [4], [5], [6], [7], [8], [10]
Agricultural materials cost	1,000 VND	X_7	Cost of fertilizers, pesticides, gasoline ,...	-	
Net house cost	1,000 VND	X_8	Net house construction depreciation expense	-	
Farming model		X_9	A dummy variable (0= model outside the net house; 1= model inside the net house)	+	

Previous studies have shown that when the level of education, production experience, and the number of domestic workers involved in production increase, producers have the opportunity to acquire and improve techniques and invest in farming, thereby promoting increased productivity/output combined with high selling prices. Meanwhile, production investment costs and the increasing age of producers will reduce profits [4], [6], [7], [8].

3. RESULTS AND DISCUSSION

3.1. Current Status of Chinese Cabbage Production in Binh Tan District

3.1.1. Household Characteristics

Age of household head: The average age of household heads cultivating in the net houses is 42 years old, of which household heads under 45 years old account for 45%, from 46-55 years old is 37.5%, and over 55 years old is 17.5%. In contrast, the average age of the household's head cultivating outside the net house is 52 years old, of which 27.5% is under 45 years old, 47.5% is from 46-55 years old and 25% is over 55 years old. That shows, older farmers tend to choose to cultivate outside the net house to grow vegetables in general and Chinese cabbage in particular compared to households cultivating in the net house. Farmers who cultivate in the net houses think that when growing vegetables, they will save the time of spraying (especially insecticides), watering, and harvesting... Because of these advantages, they choose a farming model to look after the net house to suit their health conditions.

Table2. *Resource characteristics of households*

Numerical order	Indicators	Inside the net house (n=40)		Outside the net house (n=40)	
		Frequency	(%)	Frequency	(%)
1	**Age** <=35 years old	4	10.0	1	2.5
	36-45 years old	10	25.0	18	45.0
	46-55 years old	21	52.5	14	35.0
	>55 years old	5	12.5	7	17.5
2	**Education level** Primary school	11	27.5	16	40.0
	Secondary school	25	62.5	22	55.0
	High school	4	10.0	2	5.0
3	**Production Experience** <=5 years	21	52.5	16	40.0
	6-10 years	15	37.5	16	40.0
	> 10 years	4	10.0	8	20.0

Source: *Survey data of 80 households cultivating Chinese cabbage in 2022*

Education level of household head: The education level of the farmer shows the ability to update knowledge and handle adverse situations in the production process. The survey results show that the head of household cultivating inside the net house up to primary school accounted for 27.5% and secondary school accounted for 62.5%. This rate for households outside the net house is 40% and 55%, respectively. This shows that the level of education in both groups of households is quite low. Although the cultivation of Chinese cabbage is relatively simple due to the short cultivation time, it does not require a high level of education. However, the fact that the production households have a low level of education will make it more difficult for them to access new technologies and adapt to changing production or market conditions.

Production experience: The results of the field survey show that households cultivating inside the net house have an average of 5 years of experience (because this technique has only been popularized in the locality recently). While the experience of farming households outside the net house is 15 years on average. Combined with education level, households cultivate inside net houses to minimize risks due to pest pressure and changing weather conditions. While out-of house farming households have more experience, they are confident in their decisions. On the other hand, because the initial investment cost of the net house is quite high, it is also possible that they cannot build a net house yet.

3.1.2. Status of Production of Chinese Cabbage

Cultivation area: Both groups of households have a relatively small area for the cultivation of Chinese cabbage, averaging 0.20 ha and 0.19 ha inside and outside the net house, respectively. The cultivated area determines production efficiency, cost of investment, scientific application, and

mechanization in production. The survey shows that the percentage of farmers who want to expand the cultivation area of Chinese cabbage is quite high, accounting for 45.0% of the total number of households cultivating in the net houses. In contrast, farming outside the net house makes farmers quite worried about the expansion of production land (accounting for only 17.5%). On the other hand, when changing a farming habit according to many households, it is quite difficult because they have to prepare a lot of facilities, and initial investment costs (net house, irrigation system...)... while funding is still limited. That is the biggest difficulty of converting from a conventional farming system to a net house farming system.

Participating in training: Technical training to help farmers access scientific and technical advances, and better understand issues related to the production process (use of fertilizers, pest control, ...) to achieve high productivity and profit at the lowest possible cost. The results of the interviews with 80 farmers showed that the number of households that did not/have not attended training courses inside and outside the net house accounted for 12.5% and 60% respectively. This rate is quite high, which shows that farmers' participation in training to supplement and update knowledge for vegetable production is still limited.

Types of seeds used: The survey results of Chinese cabbage farming households in Binh Tan district showed that most of the households used the varieties of Trang Nong accounted for 72.5% and 37.5%, the Golden Lotus variety and other varieties are 27.5% and 62.5%, respectively, of households growing inside and outside the net house. Households cultivating in net houses (95%) tend to choose to buy seeds from seed production companies through agricultural supply stores (varieties with specific packaging, labels,...). For households cultivating outside the net house, the rate of using seeds meeting quality standards is quite low with only 19 households, accounting for 47.5%. This is also one of the reasons that can affect the yield of Chinese cabbage of 2 groups of farmers when harvesting.

Seed treatment techniques: Farmers cultivating in the net houses often choose to self incubate seeds in net houses. This percentage accounts for 82.5%, these are the households with experience in seed treatment, especially those who do not have much experience, they hire skilled workers to incubate right at their net house, although there are few costs, the quality of the seed before planting is always guaranteed. In contrast, outside the net house farming households choose to order seeds from outside farmers mainly for planting, this rate is quite high, accounting for 85% of the total number of households. Therefore, the quality of seedlings will not be guaranteed due to the transportation process, the impact of weather factors, etc. Since then, the amount of seeds planted by farmers outside the net house is usually higher than that of the farmers, farming in net houses.

Reasons for buying supplies at agricultural supply stores: The results of consultation with Chinese cabbage farming households show that the reason for buying at agricultural supply stores is mainly because the place of sale is reputable and can transport agricultural materials come to the farm household, buy on credit and pillow, the store has all kinds of agricultural materials when farmers needed. In general, Chinese cabbage farmers have easy access to fertilizer and pesticide suppliers. Specifically, the purchase of agricultural materials at the stores in the commune by the households cultivating inside and outside the net house accounted for 70.0% and 95.0% of the households cultivating Chinese cabbage, respectively.

Learning from experience in growing Chinese cabbage: Experience in farming is an important factor in the production process in agriculture. The results of 80 surveyed households showed that the experience of growing Chinese cabbage of farmers in Binh Tan district mainly learned from experiences from other farmers as well as from family experiences, accounting for a very high rate of 97.5% and 85% of households growing inside net houses and the rate is 82.5% and 70% for households growing outside net houses, respectively.

Pests on Chinese cabbage: Insects and diseases play a decisive role in crop yield in general and Chinese cabbage in particular. Good pest management contributes to protecting the productivity and quality of Chinese cabbage, thereby creating a competitive advantage in price compared to other similar products outside. The survey results of Chinese cabbage-growing households showed that 100% of households outside the net house were affected by jumping beetles and silkworms, 8.3% had

rot disease and 87.5% had leaf blight disease. Meanwhile, households cultivating inside the net house did not suffer from silkworms, only 2.5% had jumping beetles, 5% had rotted, and 52.2% of leaf blight disease. This result has shown that growing inside the net house the disease level is much lower than growing outside the net house. Silkworms and jumping beetles appear at almost all stages of Chinese cabbage cultivation. Regarding diseases, Chinese cabbage usually appears at the stage of near-harvest at 93% and 80% for rot and leaf blight disease, respectively.

3.2. Financial Efficiency of Two Farming Models of Chinese Cabbage

The results of Table 3 show that the average planting area of the 2 farming models inside and outside the net house is 0.19 ha and 0.20 ha, respectively, with no statistically significant difference. The result is that the yield inside the net house is 2.05 tons/1,000m^2 and outside the net house is 1.51 tons/1,000m^2 (1.4 times higher), the difference through statistical testing is at the level of $1^0/_{00}$. This shows that farming inside the net house has controlled pests, and the influence of abnormal weather changes helps to increase productivity. The survey results show that the selling price between farming inside and outside the net house is 7,215 VND/kg and 6,637 VND/kg, which is very different through statistical testing (578 VND difference).

Production costs are the total costs that farmers spend to invest during the production process from land preparation to harvesting. Production cost is one of the determining factors to the profitability of the production of households, through which to evaluate the financial efficiency of a farming model. The rational and effective use of costs will improve farmers' profits.

Land preparation cost: this cost accounts for the second largest proportion of total production costs in both models. Specifically, inside the net house model, it accounts for 16.26%, equivalent to 1.59 million VND/1,000m^2 and 1.58 million VND/1,000m^2, accounting for 19.87% of the total cost for the outside the net house model. There was no statistically significant difference (Sig(α) = 0.778). That proves, all farmers when cultivating Chinese cabbage are attentive and interested in the stage of tillage and soil treatment, whether inside the net house or outside the net house.

Seed cost: Cost of buying and germinating Chinese cabbage seeds for production. The average cost of seeds for 1,000m^2 of land for the production of Chinese cabbage by farmers inside and outside the net house is 1.17 million VND, accounting for 11.96% and 1.29 million VND, accounting for 16. 23% in production costs. This difference is statistically significant at the $1^0/_{00}$ level. The reason for the difference is that because farmers cultivate outside the net house, the rate of seedling loss is due to the influence of external conditions, high pressure from insects and diseases, and the planting density is thicker, so this group of farmers often buy the number of seeds is higher than inside the net house to replant dead or infected plants after a certain planting period.

Table3. *Financial performance by farming model inside and outside the net house*

Unit: Million VND/1,000m^2

Items	Inside the net house	%	Outside the net house	%	t-value	Significance levels (Sig. α)
Planting area (ha)	0.19		0.20		-0.81	0,422
Productivity (ton/1,000m^2)	2.05		1.51		9.63	0.000
Selling price (VND/kg)	7,215		6,637		8.34	0.000
Land preparation cost	1.59	16.26	1.58	19.87	0.28	0.778
Seed cost	1.17	11.96	1.29	16.23	-5.10	0.000
Planting cost	0.41	4.19	0.46	5.79	-8.04	0.000
Fertilizer cost	0.37	3.78	0.35	4.40	0.60	0.551
Pesticide cost	0.88	9.00	2.64	33.21	-21.20	0.000
Harvest cost	1.54	15.75	1.28	16.10	8.21	0.000
Net house cost	3.61	36.91	0.00		31.43	0.000
Other expenses cost	0.20	2.04	0.35	4.40	-7.57	0.000
Total Revenue	16.33		10.36		13.04	0.000
Total expenditure	9.78		7.95		11.83	0.000
Profit	6.55		2.41		9.39	0.000
Efficiency of capital (VND)	0.70		0.30		7.79	0.000

Source: *Survey data of 80 households cultivating Chinese cabbage in 2022*

Planting cost: Calculated based on the amount of seed that the farmer uses to cultivate in a particular season. The higher the planting density, the higher the cost of planting. Due to the use of more seeds, the net house model has a higher planting cost and is different from the net house model (0.46 million VND/1,000m^2 compared to 0.41 million VND/1,000m^2).

Fertilizer cost: Fertilizer is one of the important factors determining the yield during crop production. If a lack of fertilizer is provided, it will lead to poor growth and development of plants, on the contrary, an excess of fertilizers, especially nitrogen fertilizers, will increase the risk of infection with pests, thereby leading to more risks of disease. crop yield and economic losses. Therefore, the rational and effective use of fertilizers will contribute to increasing productivity, thereby increasing profits for farmers. The average cost of fertilizer in the net house of farmers is 0.37 million VND/1,000m^2 and outside the net house is 0.35 million VND/1,000m^2. This cost difference in the two farming models is not too large and not statistically significant.

Pesticide cost: Pesticides play an important role in crop cultivation, contributing to protecting productivity and improving the quality of agricultural products. Farmers cultivate Chinese cabbage outside the net house due to great pressure on pests, so they often spray regularly, leading to this great cost (2.64 million VND/1,000m^2, which is the highest importance (33.21%) in production costs. In contrast, inside the net house model, because the damage of insects is not a concern, the farmers in this model mainly focus on group prevention and control. insects and diseases lead to low pesticide costs (0.88 million VND/1,000m^2). Because insects and diseases appear at the same time and last throughout the whole season of Chinese cabbage, farmers cultivating outside the net house often use many kinds of pesticides. Pesticides in a spray can both effectiveness and efficiency of pesticides, Which increased the cost of using pesticides for this group of households.

Harvesting cost: Depending on the needs of traders, farmers will divide many days to harvest. Normally, farmers harvest Chinese cabbage in an average of 3 to 4 days for a planting season. When planting in an area larger than 2,000m^2, farmers tend to hire outside laborers to perform this stage. The survey results show that the cost of harvesting the model in the net house is higher and statistically significantly different from the model outside the net house. Specifically, household farming in the net house has an average harvesting cost of 1.54 million VND/1,000m^2, which is 0.26 million VND higher than outside the net house model. The reason for this difference is that the average yield of households growing Chinese cabbage in the net house is higher than that of farming outside the net house. High productivity forces farmers to hire more labor and longer harvesting days leading to higher harvesting costs.

Net house cost: This is the amortized cost for each crop of Chinese cabbage of the farmer. Includes post, frame, and net costs. Depending on the conditions and resources, each farmer chooses to build a net house in the form of temporary, semi-permanent, or permanent. In the condition of limited capital, farmers choose the form of net house made of Melaleuca tree (temporary) to use for 2-3 years and then replace it again. However, this material net house model will be at risk of being affected by adverse weather such as strong winds and storms. In contrast to the solid model (using materials made of iron/concrete poles), although the initial investment is quite large (on average about 100 million VND/1,000m^2), farmers can use it for a long time from 5-10 years. This is the cost that accounts for the highest proportion, accounting for 36.91% of the costs that farmers cultivating Chinese cabbage in the net houses invest in farming. This is also a limitation for households cultivating outside the net house, because of the lack of initial investment capital.

Total revenue: The total amount earned from the sale of Chinese cabbage after the end of each harvest of the household. Revenue depends on farmers' productivity and market price, with each different farming model, the yield and selling price are also different, so the revenue between households in each farming model also has a large difference. Research results in Table 3 show that the average total income of households inside and outside the net house is 16.33 million VND/1,000m^2 and 10.36 million VND/1,000m^2. Research results show that there is a huge difference between households cultivating inside and outside the net house. The reason for this difference is that the productivity and selling price of households in net houses is higher than those outside. Households in the net house harvest Chinese cabbage with the rate of type 1 almost reaching 100%. While farming households do not have net houses, this rate is only 70-80%. The rest, traders buy at only half the price grade 1 of Chinese cabbage. Therefore, there is a huge difference in the revenue between the two groups of households.

Total expenditure: The analysis results show that the total cost of households cultivating Chinese cabbage inside net houses is on average 9.78 million VND, 1.83 million VND higher than that of households not cultivating inside the net houses. This difference mainly comes from the rather large net house depreciation expense.

Profit: This is considered the most important factor in analyzing the financial efficiency of the Chinese cabbage farming model of two groups of farmers. The study showed that the average profit of households in the net house was 2.7 times higher than that of the household outside the net house. Specifically, the average profit of the two groups of farmers is 6.55 million VND/crop and 2.41 million VND/crop, respectively. The profit of growing in the net house is higher than growing outside the net house due to the high yield and higher selling price. This shows that the cultivation of Chinese cabbage gives good financial results compared to other vegetables. In particular, this profit will increase even more when farming in net house conditions.

Capital efficiency: Also known as the rate of return on investment costs, it is a parameter that reflects how much profit a Chinese cabbage grower will earn. The results shown in Table 4 show that the profit-to-cost ratios of the inside and outside farming models are 0.7 VND and 0.3 VND, respectively.

3.3. Factors Affecting the Profitability of Chinese Cabbage Cultivation

In the cultivation of Chinese cabbage, there are many factors affecting the profitability of farmers. This study applies the multivariable linear regression analysis method to determine the factors affecting the profitability of Chinese cabbage production by farmers in Binh Tan district, Vinh Long province.

Analytical results with value F=50,115 with significance level Sig.= 0.000. The appropriate and meaningful regression model should accept the factors included in the model that affect the profitability of Chinese cabbage farmers. The results of the value of variance inflation factor (VIF) are quite small, indicating that the variables included in the model do not have multicollinearity.

With coefficients of determination R^2 = 0.895 and R^2_{adj} = 0.869, it was shown that 86.9% of the change in profit in the Chinese cabbage production model is due to independent factors in the model, the remaining 13,1% of the variation in profit is determined by other factors.

Of the 9 variables included in the regression model, 6 variables have a positive impact, and 3 variables that have a negative impact on model profitability. Which 5 variables: production experience, number of people involved in the production, agricultural materials cost, net house cost, and farming model have a significance level of 1% -1$^{o}/_{oo}$. The two variables education level and cost of care (invested labor), have a significance level of 5%.

Table4. *Regression model of factors affecting the profitability of Chinese cabbage*

Factors affecting profitability	Regression coefficient unnormalized	% impact/ affect	Value t	Significance level	VIF
(Constant)	8.752		2.931	0.004	
Age of producer (X_1)	-0.764		-1.516	0.164	1.653
Education level of producer (X_2)	0.465	2.41	2.642	0.011	1.184
Experience in growing Chinese cabbage (X_3)	0.482	4.29	3.039	0.003	1.665
Number of people involved in production (X_4)	0.588	9.10	2.691	0.010	1.592
Land preparation cost (X_5)	0.216		1.356	0.225	1.221
Investment labor cost (X_6)	3.513	12.56	2.248	0.024	2.807
Agricultural materials cost (X_7)	-2.756	12.93	-2.432	0.013	1.178
Net house cost (X_8)	-0.827	33.53	-3.213	0.000	1.738
Farming Model (X_9)	4.288	25.18	4.725	0.000	2.154
Value F = 50,115; Sig(α) = 0,000			Durbin-Watson = 2,74		
R^2 = 0,895			R^2_{adj} = 0,869		

Source: *Survey data of 80 households cultivating Chinese cabbage in 2022*

The results of the analysis of Table 4 on the setting of household scores, the variables of education level, planting experience, and the number of people involved in production have a significant impact on profitability. The level of impact on profit is 2.41%; 4.29% and 9.10% respectively. Due to the positive effect, when these three factors increase, the profit will increase.

Among the four variables of production investment costs that have a significant impact on profitability in the regression model, the variables with negative effects include the cost of agricultural inputs with an impact of 12.93% and the cost of a net house has an impact of 33.53%, consistent with previous research results, when these costs increase, profits will decrease. Meanwhile, the variable cost of labor and care investment has an impact on profit of 12.56%, which shows that an increase in labor investment in care will help increase the productivity of Chinese cabbage. The results of the analysis of the variable that the Chinese cabbage farming model has an impact on the profit is 25.18%, the net house farming model has a higher profit than the net house model of 3,988 million VND/1,000m^2. This shows that the net house plays an important role in pests management, limiting the weather when changing, and reducing the cost of agricultural inputs.

3.4. Advantages and Disadvantages of Growing Chinese Cabbage

3.4.1. Advantages

The results of Table 5 survey of farmers cultivating Chinese cabbage inside and outside the net house showed that when cultivating Chinese cabbage in Binh Tan district, there are certain advantages as follows:

Natural conditions: Binh Tan district is considered a district with quite suitable natural conditions for agricultural production in general and vegetable production in particular, with fresh water all year round, and quite large water reserves due to its topography, located along the Hau River. However, because they still have to face many risks due to natural disasters, tornadoes, etc., only 17.5% of inside the net house farming households and 42.5% of outside the net house farming households believe that the conditions are natural. favorable conditions for farmers to cultivate Chinese cabbage.

Stable prices: Compared with the district's main products such as sweet potatoes, green onions, etc., the price of Chinese cabbage is quite stable, ranging from 4,000 VND/kg to 10,000 VND/kg on average. In particular, there is a time up to nearly 15,000 VND/kg. Besides, the farmers growing inside the net houses always have an average selling price of 578 VND/kg higher than farmers growing outside the net house at the same time when traders buy. Specifically, 35.0% of households cultivating inside the net houses and 42.5% of households cultivating outside the net houses were satisfied with the selling price of Chinese cabbage during the survey period. This is also the reason why farmers choose Chinese cabbage for rotation with other vegetables in the locality.

Simple farming techniques: Chinese cabbage is a leafy vegetable with a short harvest time (35-40 days after planting). With 47.5% of households cultivating inside the net house and 57.5% of the households cultivating outside the net house agreeing with this statement. Especially, the farmers who have little or no farming experience. Therefore, if farming inside the net house, it will make it easier for farmers to take care of crops because they only need to care about diseases. In this study, pests almost did not affect the yield of Chinese cabbage in the net house model.

Table5. *Advantages of growing Chinese cabbage*

	Household type			
Advantages of growing Chinese cabbage	**Inside the net house (n=40)**		**Outside the net house (n=40)**	
	No. households	**% of households selected**	**No. households**	**% of households selected**
-Suitable natural conditions	7	17.5	17	42.5
-Stable price	14	35.0	17	42.5
-Simple farming techniques	19	47.5	23	57.5
-Little labor investment	40	100.0	19	47.5
-Easy to buy production materials	40	100.0	40	100.0
-Large rotation coefficient	40	100.0	40	100.0

Source: *Survey data of 80 households cultivating Chinese cabbage in 2022*

Less labor investment: This study shows that Chinese cabbage farming households inside and outside the net house perceive labor as less labor in cultivation, farmers tend to use family labor to perform all stages during cultivation. Farmers can only hire more labor to transport to the place of purchase by traders if the location of the place is relatively far from the cultivation site. Because it does not take too much labor, the cultivation of Chinese cabbage is quite suitable for local conditions and local resources of farmers.

Easy-to-buy production materials: Input materials for cabbage cultivation are simple and easy to buy. Currently, Binh Tan district has nearly 100 establishments selling agricultural materials. With an average density of 10 establishments/commune, this is a favorable condition for farmers to choose reputable and quality agricultural supply stores to supply fertilizers, pesticides, etc. On the other hand, these stores all have door-to-door delivery services, so farmers will also be more convenient. With the number of business establishments in the same locality, it will help farmers to access the most reasonable prices.

High rotation coefficient: The rotation coefficient is the maximum number of crops that can be cultivated for a certain type of crop on an area of land in a year. In this study, 100% of households in both models said that cabbage is a crop with a high rotation coefficient compared to other crops, with an average of 6 crops per year. When growing in greenhouse conditions, this coefficient can be up to 7 crops/year. Actual production shows that, when farmers cultivate inside the net houses, they will easily arrange the sowing of Chinese cabbage at different times from which they will be proactive in harvesting based on actual prices. That helps farmers minimize the risk of price. For example: When the price is high, they can harvest Chinese cabbage earlier than expected, or when the price is low, they can extend it from 1 to 2 weeks by adjusting the fertilizer regime and technique. This is considered the most important favorable factor in the process of farmers choosing Chinese cabbage growing inside the net house to cultivate in recent years.

3.4.2. Disadvantages

Besides the advantages, in the process of cultivating Chinese cabbage, farmers also faced certain unfavorable (Table 6).

Lack of capital: Capital is an indispensable factor in production investment and investing in the construction/expansion of the net house area. At the time of the study, in general, households cultivating inside and outside the net house did not receive the support of the local government in terms of infrastructure construction policy to serve clean and safe agricultural production towards high-tech agriculture. Farmers still face many difficulties in accessing loans, including preferential loans with low-interest rates... Survey results show that up to 20% of households cultivate inside and 87.5% of households cultivate outside the net house lacking of investment capital to build net houses. This was a major difficulty at the time this study was conducted.

Insects and diseases: Despite the short harvest time, insects and diseases pressure are still an obstacle for households cultivating outside the net house. Because intensive farming is in too many crops in the same cultivated area, favorable conditions for insects and diseases to arise, develop and cause damage, affecting the yield are getting bigger and bigger. This is the main reason for the decrease in the yield of Chinese cabbage reaching the grade 1 standard in this group of farmers. Households cultivating outside the net house said that up to 72.5% of households were affected by the pest attack. Especially the group of insects, in which the two main pests are jumping beetles and silkworms.

Transport and transportation system: The study shows that 64 households accounting for 80% of the total number of households growing Chinese cabbage think that the transport infrastructure is not yet complete. The reason is that the rural transportation system is still limited, so traders cannot buy from the fields of Chinese cabbage farmers, and farmers have to hire labor to transport goods to places where two-wheelers can circulate. This stage makes the price of the product increase, directly affecting the income of Chinese cabbage growers.

Lack of quality seed sources: In parallel, the lack of quality nurseries/seeding facilities is also a common difficulty of farmers both inside and outside the net house farming models. After buying seeds from agribusiness establishments, farmers must hire skilled workers to carry out this stage. In

fact, in the study area, if you want to hire farm labor, farmers must contract for at least 1-2 weeks before they can have labor. It is that hinders the process of agricultural production in general and Chinese cabbage cultivation in particular.

Table6. *Difficulties in growing Chinese cabbage*

Difficulties in growing Chinese cabbage	Household type			
	Inside the net house (n=40)		Inside the net house (n=40)	
	No. households	% of households selected	No. households	% of households selected
-Lack of investment capital to build and expand net house	8	20.0	35	87.5
-Pests occur a lot	-	-	29	72.5
-Limit transportation system	30	75.0	34	85.0
-Lack of quality seed sources	25	62.5	32	80.0
-No training in science and technology	4	10.0	10	25.0

Source: *Survey data of 80 households cultivating Chinese cabbage in 2022*

No scientific and technical training: scientific and technical training, dissemination, and transfer of the process of growing crops in the net houses, ensuring productivity, output, and quality are essential in the current period. The survey results of 80 households cultivating Chinese cabbage in the study area showed that 14 households (17.5%) had not been trained in science and technology in production. In which, 4 households (10%) cultivate inside the net houses and 10 households (25%) cultivate outside the net houses without training.

3.5. Proposed Solutions

From the results of the assessment and analysis of the advantages and disadvantages of Chinese cabbage farming households, the local leaders' comments on the Chinese cabbage production model. On that basis, basic solutions are proposed:

Expanding the farming model in the net house: 100% of the households cultivating Chinese cabbage in the net house and 92.5% of the households cultivating outside the net house think that it is necessary to build a net house to improve financial efficiency and increase income. That shows that the role of the net house is very important in today's vegetable cultivation. It helps to manage pests well, thereby improving grade 1 yield and selling at a higher price compared to outside the net house farming. On the other hand, building a net house is a necessary condition because it helps to shorten the harvest time compared to outside. In the current climate change situation, the net house is a solution to help farmers minimize the risks of natural disasters that may affect crops in general, and Chinese cabbage in particular.

Upgrading the rural transport system: Rural transport plays an important role in transporting goods, especially agricultural products. Research results show that over 80% of households growing Chinese cabbage said that when traffic conditions are favorable, it will help to transport Chinese cabbage products easily and save a lot of money in the process. transportation process, improving the value of Chinese cabbage products for farmers. In difficult economic conditions, local authorities need to do a good job of socialization to mobilize people to contribute to the common good of the community to build more rural transport routes to help the community. convenient households in agricultural cultivation.

Capital support for the construction and expansion of net houses: Capital plays an important role in investing in building infrastructure to serve the needs of agricultural production. Research results show that up to 90% of the households cultivating Chinese cabbage inside and outside the net house need financial support with preferential policies to build and expand the net house. Therefore, in the coming time, it is necessary to help farmers access preferential loans with low-interest rates to help farmers have resources to invest in net houses to improve production efficiency and increase profits per unit area.

Seed quality: Cultivation in conditions that meet quality standards is a prerequisite for healthy plants right from the beginning of the crop. In which, the stage of nursery/seeding plays an important role in creating a good seed source. Therefore, it is necessary to establish a reputable and quality vegetable breeding site/group for farmers to easily access. At the same time, the training and transfer of scientific and technical advances, especially training on seed quality, need to be paid attention to by the specialized branches. From there, helping farmers raise awareness about choosing quality seed sources for cultivation.

Establishment of cooperatives, and cooperative groups: The model of growing vegetables in net houses brings very high financial efficiency. However, the small and fragmented production leads to a decrease in the added value of this crop. In today's agricultural production, the establishment of cooperative groups towards building cooperatives is an inevitable trend. As a result, up to 70% and 65% of farmers cultivating Chinese cabbage inside and outside the net house proposed the need to form cooperative groups and cooperatives. This will be an effective production and consumption condition, favorable for advertising and trade promotion to diversify output and consumption markets for agricultural products. However, the most important issue is the effectiveness brought to each participant, avoiding the participation situation to have the "form" as it is today.

Providing market information: Nowadays with the very fast development of science - technology, it is easy to find information to serve the needs and tastes of people. However, farmers have not yet grasped the demand for standards, quantity, and designs of goods. Most of the time, farmers cannot decide the price of their agricultural products but must go through traders. Therefore, it is necessary to limit the intermediary stages from the producer to the consumer. Therefore, providing information, developments, and market needs to farmers to help farmers take the initiative in arranging a reasonable crop, and avoiding the situation of "oversupply" is considered one of the solutions. improve the production efficiency of Chinese cabbage in the coming time.

4. CONCLUSIONS AND RECOMMENDATIONS

Research results show that the cultivated area is small, and the education level is quite low. average 5 years of farming experience in greenhouses (due to the popular new model). Younger households choose the farming model in the net house higher than those outside the net house.

The production cost of Chinese cabbage inside the net house model is higher than that of outside the net house farming model. However, the net house model's profit is 2.7 times higher than the net house model.

Five factors are positively correlated with the profitability of farmers in the Chinese cabbage farming model, including education level, production experience, number of laborers involved in the production, cost of care, and investment labor costs. Meanwhile, two factors have a negative impact on the profit of Chinese cabbage cultivation, including agricultural materials cost and net house cost.

A high rotation coefficient: and relatively stable price are the most favorable factors of the Chinese cabbage farming model. While the lack of capital to build and expand the net house is limited and the rural transportation system is the two biggest difficulties for Chinese cabbage farmers in Binh Tan district.

The result of this study is a basic assessment of the current status of two Chinese cabbage cultivation tissues in Binh Tan district. For more in-depth assessments need:

- Expand the survey on the cultivation areas of Chinese cabbage in Vinh Long province and other provinces with similar conditions to Binh Tan district, Vinh Long province.
- Research and evaluate the production efficiency (technical efficiency, allocative efficiency, and economic efficiency) of Chinese cabbage and other vegetables under the conditions of cultivation inside and outside the net house.
- The State should have the policy to support preferential capital for farmers to build and expand the area of net houses in the coming time.

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