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The Influence of Production Factors on Carrot Farming Production and Income
(Case Study: Sugihen Village, Dolat Rakyat District, Karo Regency, North Sumatra)

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Abstract
This research aims to determine the influence of production factors on carrot farming production in the research area to determine the influence of production factors on the income of carrot farmers in the research area, to determine the level of feasibility of carrot farming in the research area; to determine the level of optimization of workforce deployment for carrot farming in the research area. The regional determination was carried out purposively in Sugihen Village, Dolat Rakyat District, Karo Regency. The research sample was set at 30 samples of farmers, where sampling was carried out using Simple Random Sampling**.** The research results show that simultaneously, land area, labor expenditure, and production facility costs significantly affect carrot farming production, with R^2 = 0.936. Partially, land area and costs of production facilities have a significant effect on production, but labor has no significant effect on carrot farming production; Simultaneously land area, labor expenditure and costs of production facilities have a significant effect on carrot farming income with R^2 = 0.900. Partially, land area and costs of production facilities have a significant effect on income, but labour has no significant effect on carrot farming income. Carrot farming has economic feasibility with an RCR value = 4.41, so carrot farming in the research area is worth pursuing. The optimal level of labour expenditure in carrot farming is -1.97. So that NPMX < 1, the expenditure of labour is not optimal, and to achieve maximum profits, the expenditure of labour in carrot farming must be reduced.

Keywords: Carrot Farming, Production Factors, Production, Income, Feasibility

Introduction

Agriculture in a broad sense is human activity to obtain results from plants and/or animals which were initially achieved by deliberately perfecting all the possibilities that have been provided by nature in order to breed these plants and/or animals. The definition of agriculture in the narrow sense is all biophysical aspects related to efforts to perfect plant cultivation to obtain maximum physical production (Mardikanto, 2011).

There are various kinds of important agricultural commodities in Indonesia, including food crops, plantations, horticulture, ornamental plants, and industrial plants. Horticultural crops have received great attention because they have proven themselves as commodities that can be used as a source of new growth in the agricultural sector. The development of horticultural commodities has its own characteristics because the main aim of production is for sale, not for consumption. Therefore, horticultural development must be carried out commercially, market-oriented, and managed

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professionally with profitable economies of scale. The types of agricultural commodities, especially vegetable horticultural crops that can support agro-industry, include shallots, garlic, carrots, kale and tomatoes (Sunarjono, 2011).

One of the horticultural crops that plays an important role is carrots because they have an important role in providing food, especially as a source of vitamins and minerals. The increase in population and improvement in people's living standards and health concerns are reasons for people to consume carrots, which has resulted in an increase in demand for carrots. The strong market demand for carrots can also be seen from the growth and development of the role of industrial companies processing carrot tubers into various types of products, including food, drinks and cosmetics. The development of carrot cultivation in Indonesia is supported by regional agroclimatological and agroeconomic conditions that are suitable for horticultural crops, especially carrots (Rukmana, 2015).

North Sumatra Province, as one of the carrot production centers in Indonesia, has large areas of land and carrot production. North Sumatra consists of several districts that have carrot production, one of which is Karo District. Karo Regency is an agricultural area in the horticultural sector and there are many residents who cultivate horticulture, such as carrots. The total production for each sub-district in Karo Regency can be seen in Table 1.

Table 1. Total Carrot Production for Each District in Karo Regency 2013-2017

No	Subdistrict	Production (Tons)				
		Year				
		2013	2014	2015	2016	2017
1	Simpang empat	4.042	6.872	15.349	15.458	151.380
2	Naman Teran	404	2	880	626	4.535
3	Merdeka	10.420	13.693	17.646	13.475	143.863
4	Kabanjahe	5.355	5.716	4.234	4.465	36.400
5	Berastagi	5.100	6.330	4.020	3.485	52.900
6	Tigapanah	2.468	491	1.354	1.573	16.531
7	Dolat Rakyat	1.284	1.305	1.014	2.484	23.180
8	Merek	420	525	656	635	14.855
9	Barusjahe	1.200	1.323	940	888	37.280
	Total	30.693	36.257	46.093	43.089	480.924

(Source: Karo Regency Central Statistics Agency, 2019)

Table 1 shows that Dolat Rakyat District is one of the carrot-producing areas in Karo Regency. In 2017, it was ranked sixth among the carrot-producing districts in Karo Regency.

Based on surveys that have been carried out, in the Dolat Rakyat sub-district, there are a number of farmers whose livelihood is farming carrots. Carrot farming has turned out to be profitable for farmers, so to this day, they still prioritize carrots, even though in the period 2000 to 2016, there was relatively little production due to the lack of enthusiasm among farmers to cultivate carrots. The high enthusiasm to return to cultivating carrots occurred in 2017, and until now, it has become a significant source of income for farmers. From a business perspective, carrots are a commercial vegetable which is currently the mainstay of traders and farmers who grow them because carrot plants are relatively easy to handle and care for, and the results can be doubled because, in handling, they can be intercropped with other vegetable plants, so they have quite good potential for development. And have a positive impact on increasing farmers' income, improving community nutrition, and expanding employment opportunities.

Literature Review

Carrot plants come from temperate climates (Subtropical). This plant was discovered around 6,500

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years ago, growing wild in the Central Asian islands (Punjab, Kashmir, Afghanistan, Tajikistan, and the western part of Tiam San) and the near eastern region (Asia et al.). From the Asian region, carrot plants were first cultivated around the Mediterranean Sea. Then it spread widely to Europe, Africa, America, and finally to various countries, including Indonesia, which has a hot (tropical) climate. Carrots are an annual plant in the form of grass. The stem is very short, almost invisible. The taproot changes shape into a tuber. Side roots are very few and arise in the tuber. The better the quality of the tuber, the fewer side roots there are, except at the tip of the tuber. Nutrient uptake from the soil is only carried out by the tap root (Sunarjono, 2011).

According to Keliat (2008) in Anwari (2013) the parts of carrots consist of leaves, stems, roots, flowers and tubers. Carrot plants require cool and humid air temperatures. Optium root and leaf growth at temperatures of 16ºC – 21ºC. The ideal soil for carrot production is deep, crumbly, fertile, sandy clay or peat soil with good drainage (Hanum, 2010).

The types of climate that are suitable for carrot plants are climate areas A, B, and C. Rainfall is between 2000–7000 mm/year with dry months <4.5 months/year. Most carrot crops require around 30 – 50 mm of water per week or from 450 to 600 mm during one growing season (Andarwulan, 2010).

Based on previous research (Tobing, D., 2009) entitled "Feasibility Analysis of Carrot Farming in Sukadame Village, Tigapanah District, Karo Regency, North Sumatra". The results of this research show that carrot farming in Sukatani village during the rainy and dry seasons is profitable. This can be seen in both the strata 1 and strata 2 farmer groups in both seasons. The R/C ratio value for total costs is more than one. The difference in income obtained by carrot farmers is only due to the difference in carrot prices between the rainy and dry seasons. The high price during the dry season is due to the reduced supply of carrots from other areas. Production factors that have a significant influence on carrot production are land area, seeds, TSP fertilizer, KCL fertilizer, and labour. Fertilizer use in Sukatani Village is too high, far exceeding the threshold limit for urea fertilizer for carrot plants. The use of labour is very large, both within the family and outside the family. Excessive use of labour occurs in wedding activities.

Based on previous research (Pohan, A. R., 2008) entitled "Analysis of farming and factors influencing the income of carrot farmers in Gajah Village, Simpang Empat District, Karo Regency, North Sumatra". The results of the research show that carrot farming is economically profitable; namely, the average R/C ratio per farmer and per hectare is 2.58. Production, land area, fertilizer, and labour simultaneously have a significant effect on carrot farming income. The net income of carrot farming in the research area is higher than the provincial minimum wage (UMP).

Research Method

Determining the research area method was carried out "purposively". The research area is in Sugihen Village, Dolat Rakyat District, Karo Regency. The basis for selecting this research area was because, in the village, there were farmers who cultivated carrots, and because of the farmers' enthusiasm to cultivate carrots, this area was considered to have the potential to meet the requirements according to the research objectives. The sample farmers selected were 30 samples from 50 populations. Because the population is quite small, the method used is "Simple Random Sampling".

The data collected in this research are primary and secondary data, and primary data was obtained from direct interviews with farmers. Secondary data is obtained from literature studies in the form of books, journals, research results and statistical data from relevant agencies related to the research topic, such as BPS North Sumatra and BPS Karo Regency. The data analysis method uses multiple non-linear regression analysis tests, analysis of the feasibility of farming Revenue Cost Ratio (RCR), and the level of optimization of the use of production inputs.

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Results and Discussion

1. Influence of Land Area, Deployment of Labor and Production Facilities on Production Carrot Farming

To find out or analyze the magnitude of the influence of land area, labor and production facilities on carrot farming production, hypothesis testing was carried out using the Multiple Non-Linear Regression test.

Using the Cobb-Douglas function formula is $Y= b_0X_1b^1X_2b^2X_3b^3$. The results of the Multiple Non-Linear Regression Test on the influence of land area, labor expenditure and costs of production facilities on carrot farming production can be seen in Table 2.

Table 2. Regression Test Results of the Simultaneous Effect of Land Area, Deployment of Labor, and Production Facilities on Carrot Production

No	Independent Variable	Regression Coefficient	T-count	T-table	Sig.	F-count	F-table	Sig.
1	Constant	5,774	4,788	2,05	0,000	126,770	2,98	0,000
2	Land area	0,902	7,231					0,000
3	Labour	-0,164	-1,371					0,182
4	Cost of Production Facilities	0,318	4,565					0,000

Source: Processed Primary Data

b_0* = 5,774
b_0 = anti Ln 5,774
= 2,725,774
= 322,998

Based on the results of the Multiple Non-Linear Regression Test, the following regression equation is obtained:

$$Y= 322,998X_1^{0,902}X_2^{-0,164}X_3^{0,318}$$

From the regression equation obtained, the following interpretation can be made:

a. If the land area is increased by 100% (deployment of labour and costs of production facilities ceteris paribus), then carrot farming production will increase by 90.20%.

b. If the expenditure of labour is increased by 100% (land area and costs of production facilities ceteris paribus), then carrot farming production will decrease by 16.40%.

c. If the cost of production facilities is increased by 100% (land area and labour expenditure ceteris paribus), then carrot farming production will increase by 31.80%.

d. If the land area, expenditure of energy and costs of production facilities are jointly increased by 100%, then farming production will increase by 105.6%.

The R^2 coefficient of determination obtained was 0.936, which means that 93.60% of carrot farming production is influenced by land area, labour and production facility costs, while the remaining 6.40% is influenced by other factors not analyzed in this research.

The Influence of Simultaneous Production Factors on Carrot Farming Production

Simultaneous test by comparing F-count with F-table obtained F-count = 126.770 and F-table = 2.98 F-count value (126.770) > F table at 95% confidence level, so H_0 is rejected and H_1 is accepted.

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Thus, it can be concluded that land area, labour expenditure, and production facilities costs have a significant effect on carrot production.

The Influence of Partial Production Factors on Carrot Farming Production

1. Effect of Land Area (X_1) on Carrot Farming Production

Partial test by comparing the t-count with the t-table, the t-count for the land area is 7.231, and the t-table is 2.05, so the t-count value (7.231) > T-Table (2.05) at the 95% confidence level, so that H_0 is rejected and H_1 is accepted. This shows that the partial land area has a real effect on carrot farming production.

2. Effect of Deployment of Labor (X_2) on Carrot Farming Production

Partial test by comparing t-count with t-table obtained T-Count of workers (-1.371) < T-Table (2.05) at the 95% confidence level so that H_0 is accepted and H_1 is rejected. This shows that the partial outpouring of labour has no real effect on carrot farming production.

3. Effect of Production Facilities Costs (X_3) on Carrot Farming Production

A partial test by comparing the t-count with the t-table obtained a t-count value (4.565) > T-Table (2.05) at the 95% confidence level so that H_0 was rejected and H_1 was accepted. This shows that the cost of production facilities partially has a real effect on carrot farming production.

Based on the results above, hypothesis 1 which states that land area, production facilities and labor allocation have a significant effect on carrot farming production can be accepted with a 95% confidence level.

2. The Influence of Land Area, Deployment of Labor and Production Costs on Carrot Farming Income

To find out or analyze the magnitude of the influence each factor has on carrot farming income, hypothesis testing was carried out using the Multiple Non-Linear Regression Test.

By using the following formula:

$$Y= b_0X_1b^1X_2b^2X_3b^3$$

The results of the Multiple Non-Linear Regression Test on the influence of land area, labour expenditure and costs of production facilities on carrot farming income can be seen in Table 3.

Table 3. Regression Test Results on the Effect of Land Area, Deployment of Labor and Production Facilities on Carrot Income

No	Independent Variable	Regression Coefficient	T-count	T-table	Sig.	F-count	F-table
1	Constant	15,995	8,775				0
2	Land area	1,31	7,045				0
3	Labour	-0,463	-2,573	2,05	77,927	2,98	0,016
4	Cost of Production Facilities	0,249	2,388				0,024

Source: Processed Primary Data

b_0* =15,995
b_0 = anti Ln 15,995
= $2,72^{15,995}$

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= 8.931.607,301

Based on the results of the Multiple Non-Linear Regression Test, the following regression equation is obtained:

$$Y = 8.931.607,301X_1^{1,310}X_2^{-0,463}X_3^{0,249}$$

From the regression equation obtained, the following interpretation can be made:

a. If the land area is increased by 100% (deployment of labour and costs of production facilities ceteris paribus), then carrot farming income will increase by 131%.

b. If the expenditure of labour is increased by 100% (land area and costs of production facilities ceteris paribus), then carrot farming income will decrease by 46.30%.

c. If the cost of production facilities is increased by 100% (land area and labour expenditure ceteris paribus), then carrot farming income will decrease by 24.90%.

d. If the land area, expenditure of energy and costs of production facilities are jointly increased by 100%, then farming income will increase by 109.60%.

The coefficient of determination R^2 obtained is 0.900, which means that 90% of carrot farming income is influenced by land area, labor and costs of production facilities, while the remaining 10% is influenced by other factors.

The Influence of Simultaneous Production Factors on Carrot Farming Income

Simultaneous test by comparing F-count with F-table obtained F-count = 77.927 and F-table = 2.98 F-count value (77.927) > F-table at 95% confidence level, so H_0 is rejected, and H_1 is accepted. Thus, it can be concluded that land area, labour expenditure, and production facilities costs have a significant effect on carrot income.

The Influence of Partial Production Factors on Carrot Farming Income

1. Effect of Land Area (X_1) on Carrot Farming Income

Partial test by comparing the t-count with the T-table, the t-count for the land area is 7.045, and the T-table is 2.05, so the t-count value (7.045) > t-table (2.05) at the 95% confidence level, In so In that In H_0 In is rejected and H_1 is accepted. This shows that partial land area has a real effect on carrot farming income.

2. Effect of Deployment of Labor (X_2) on Carrot Farming Income

The partial test by comparing the t-count with the t-table shows that the labour t-count (-2.573) < T-table (2.05) at the 95% confidence level so that H_0 is accepted and H_1 is rejected. This shows that the partial outpouring of labour has no real effect on carrot farming income.

3. Effect of Production Facilities Costs (X_3) on Carrot Farming Income

Partial test by comparing t-count with t-table obtained t-count value (2.388) > T-table (2.05) at the 95% confidence level so that H_0 is rejected and H_1 is accepted. This shows that the costs of production facilities partially have a real effect on carrot farming income.

Based on the results above, hypothesis 2, which states that land area, production facilities and labour allocation have a significant effect on carrot farming income, can be accepted with a 95% confidence level.

3. Carrot Farming Business Feasibility

The feasibility of carrot farming describes whether carrot farming is economically profitable or not.

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The feasibility of carrot farming in the research area is measured by calculating the Revenue Cost Ratio (RCR) as can be seen in Table 4.

Table 4. Carrot Farming Business Feasibility

No	Description	Unit	Per Farmer	Per Hectare
1	Production Value	Rp	10.688.333,33	54.708.670,03
2	Production Cost	Rp	2.312.592,04	13.430.229,94
3	**Revenue Cost Ratio**	**-**	**4,41**	**4,41**

Source: Processed Primary Data

From Table 4, it can be seen that carrot farming is feasible for farmers in the research area RCR > 1 (4.41 > 1), which means that carrot farming provides economic benefits. The RCR value = 4.41 illustrates that by spending Rp 1, you will get Rp 4.41 in revenue, so you will get Rp 3.41 in net income. This shows that carrot farming is feasible.

Based on the results above, hypothesis 3, which states that carrot farming is feasible, can be accepted.

4. Optimization Level of Labor Utilization in Carrot Farming

An optimization level analysis was conducted to see the level of optimization of labour outpouring in carrot farming. The functions obtained are:

$Y = 11{,}065X^{-0{,}296}$
Ep = MP/AP
= -48,377204/163,4365
= -0,296
Where the AP value can be estimated from the Y/X value
Y/X = 506.269,12 Kg / 3.097,65 HKP = 163,4365 Kg/HKP
MP = EP x AP = -0,296 x 163,4365 = -48,377204
NPM = Py x Mp, Py = Rp. 3.266/Kg
= 3.266 x -48,377204
= -157.999,948264

Optimization Level = NPM/Px
= -157.999,948264 / 80.000
= -1,97

Conclusion

Based on the results of the research and discussion, a conclusion can be drawn, namely that simultaneously, land area, labour expenditure and costs of production facilities have a significant effect on carrot farming production with $R^2 = 0.936$. Partially, land area and costs of production facilities have a substantial effect on carrot farming production, but labour has no significant effect on carrot farming production. Simultaneously, land area, labour expenditure and costs of production facilities have a significant effect on carrot farming income with $R^2 = 0.900$. Partially, land area and costs of production facilities have a significant effect on carrot farming income, but labour has no significant effect on carrot farming income.

Carrot farming has economic feasibility for farmers to cultivate with an RCR value = 4.41. So, carrot farming in the research area is worth pursuing. The optimization level of labour expenditure in carrot farming is -1.97. So that NPMX < 1, then the allocation of labour is not optimal. Thus, to achieve maximum profits, the expenditure of labour on carrot farming must be reduced.

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