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Factors Affecting Sugar Cane Production In East Java - Indonesia

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Abstract

Sugarcane production is influenced by various factors, including area size, production facilities (capital, labor, fertilizer, pesticides, herbicides), development factors, climate, and others. To find out what factors influence sugarcane production, this research was carried out. The research was conducted in East Java with samples from 4 locations in the districts of Sidoarjo, Tulungagung, Ngawi, Situbodo, among groups of farmers who cultivate sugar cane. Data was taken from 120 samples, 30 samples from each district. The results of the research conclude that there are 9 factors that influence sugar cane production in East Java, namely area area, production costs, labor, fertilizer, pesticides, herbicides, opportunity costs, sustainability of sugar cane farming, and the role of pentahelix development, together the same affects sugar cane production. Partially, area size, labor, herbicides, sustainability have a significant effect on sugar cane production.

Key word: Sugarcane, Factors Affecting Production, Sugarcane Production

Introduction

In a study on agricultural production, one of the influences on agricultural production is land, labor, capital and business systems in farming, Mubyarto (1986), in his research stated that agricultural production is the result obtained by farmers from the management of land resources, labor, capital, in the farming system. The size of the production produced depends on the skills of farmers as cultivators, the existence of land, capital, labor, support for production facilities (fertilizers, pesticides, herbicides) and other production factors such as climate, technology, efficiency,

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government support, stakeholders, academics . Collaboration of all inputs supports each other to form the desired production. Some inputs play a dominant role and show significance in production, while other inputs simultaneously support the production formation process.

The combination of inputs to produce production output is an input-output equation per unit time forming a production function: Y = f (K, L, R, T,....) (Nicholson, 2002) Where, Y (Yield) is the amount production produced by several types of production factors used simultaneously to produce goods. K (Capital) is the capital used in the production time period. L (Labor) is the input of labor hours, R (Raw/material) and T (Technology) used in the production process. This equation states that the level of production of a good depends on the amount of input, namely capital, labor used, amount of natural resources, and technology used. This form of notation indicates the possibility of other variables influencing the production process (Nicholson, 2002).

Research Method

This research uses quantitative methods, on groups of farmers who cultivate sugar cane. The number of samples was 120, each district had 30 samples. Data was collected through a questionnaire containing questions about production amounts, land area, production costs, labor, inorganic fertilizers, pesticides, herbicides, opportunity costs, sustainability of farming, the role of pentahelix. Analysis uses the Cobb Douglass function Y = aX1b1, aX2b2,...aXnbn) where Y= production; a= constant ; b= estimated parameter value; X1= land area (ha); X2= production costs (Rp); X3= labor (person days worked); X4= inorganic fertilizer (kg); X5= pesticide (ltr); X6= herbicide (ltr), X7= opportunity cost (Rp); X8= farming sustainability (%); X9= pentahelix role (%).

Result and Discussion

The production factors that are thought to influence sugar cane production in East Java in this research are the area of farming land, production costs, labor, amount of inorganic fertilizer, amount of pesticides, amount of herbicides, besides that it is also thought that there are 3 other factors that influence production, namely opportunity costs, sustainability of farming, and the role of coaching in pentahelix synergy.

Analysis of the Influence of Production Factors on Sugarcane Production

Analysis of 120 sample data, obtained the following results:

Table 1. Results of Analysis of the Influence of Production Factors on Sugar Cane Production

Multiple R	0,993
R Square	0,987
Adjusted R Square	0,986
Standart error	0,993
Uji F	955,526
Significance	4,4E-100

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The results of the regression analysis in Table 1 above can be explained as follows: (1). The Multiple R value is 0.993, which means that variable X (production factor) and variable Y (production) have a very strong correlation of 99%. (2) The R Square value of 0.987 indicates that variable Meanwhile, 2% is influenced by other variables not included in this research. (3) The standard error is very small (less than 1%), and the significance F value is very small (< 5%), then all production factors (land, production costs, labor, inorganic fertilizers, pesticides, herbicides, costs opportunities, sustainability of farming, the role of the pentahelix), simultaneously influence sugar cane production. The next analysis presents the Coefficient and P values as shown in the following table:

Table 2. Coefficient Value and P Value

	Coefficient	P – Value
Intercept	-8,327	1,8531E-13
Luas lahan	0,268	0,004
Biaya Pproduksi	0,524	3,222
Tenaga Kerja	0,177	0,035
Pupuk An Organik	-0,010	0,842
Pestisida	0,034	0,262
Herbisida	-0,046	0,033
Oporunity cost	0,020	0,467
Keberlanjutan Usahatani	0,317	0,019
Pentahelix	0,052	0,294
Persamaannya : Y = -8,32 + 0,27 X1 + 0,52 X2 + 0,18X3 - 0,01 X4 + 0,03 X5 - 0,04 X6 + 0,02 X7 + 0,31 X8 + 0,05 X9		

Table 2 shows that 9 production factors influence sugarcane production simultaneously with their respective coefficients as in the equation Y = -8.32 + 0.27 X1 + 0.52 X2 + 0.18X3 - 0.01 0.04 X6 + 0.02 X7 + 0.31 X8 + 0.05 X9. A negative constant (-8.32) is interpreted as equal to zero or ignored, because when the independent variable (X) is equal to zero, there is no production. The production value of Y depends on the value of So the constant will be calculated when the value of the variable X is equal to the standard cultivation needs. Meanwhile, the occurrence of negative constant values causes a large distance between variable X and variable Y.

Of the 9 X coefficients, there are negative coefficient values, namely the inorganic fertilizer variable (-0.01) and the herbicide variable (-0.04). This means that every increase in the value of the fertilizer and organic variables is followed by a decrease in sugar cane production (Y). Likewise, every increase in the herbicide variable will reduce sugar cane production. The use of inorganic fertilizers and herbicides has reached the maximum limit of technical fertilization standards. This is in accordance with the statement by Case and Fair (2007) that the increase in yield will decrease after a certain point. When additional units of a variable unit are added to the fixed input, the variable input marginal product decreases. For other variables (land area, production costs, labor, pesticides, opportunity costs, farming desires, role of the pentahelix), it shows an increase in sugar cane production.

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Observing the P-value, there are variables whose value is <0.05%, namely variable X1 (land), variable X3 (labor), variable X6 (herbicide), variable X8 (business sustainability). These four variables have a partial influence on variable Y (cane production). Land, labor and business sustainability factors significantly increase sugar cane production. Herbicides have a significant negative impact on sugarcane production.

The Significant Influence of Land on Sugar Cane Production

Based on the regression results, the P-value significance value obtained is 0.004 (smaller than (5% or 0.05). This means that the land area variable has a positive and significant influence on sugar cane production. This shows that if the land area increases, then the amount of production sugar cane also increased.

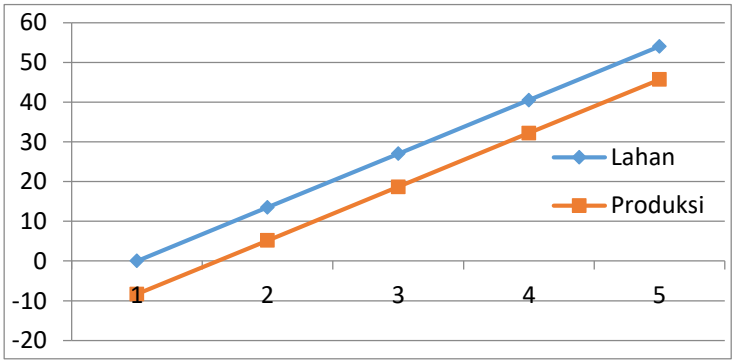
The results of the analysis show that the land area variable has a partial and significant effect on sugar cane production. The partial equation is as follows: Y = -8.32 + 0.27 The Y ordinate point is below (-8.05). If the value of:

Table 3. Effect of Land Variables on Production

Variable X	Coefficient	Variable X x Coefficient	Constant	Value Y
0	0,27	0	-8,32	-8,32
50	0,27	13,5	-8,32	5,18
100	0,27	27	-8,32	18,68
150	0,27	40,5	-8,32	32,18
200	0,27	54	-8,32	45,68

Table 3 shows the value of increased production resulting from the land variable multiplied by the coefficient, minus the constant. When the variable Furthermore, the increase in land area will be followed by an increase in production as shown in the following graph:

Figure 1. Graph of Increase in Area Area Followed by Increased Production



The area of sugarcane land can influence the amount of sugarcane production. The larger the land area, the more efficient and optimal it is, thereby increasing sugar cane production. These results

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are in accordance with research conducted by researchers as follows: (1) Apriawan (2015) that land area has a significant and positive influence in increasing sugar cane production at PTPN VII. (2) The results of Ubaidillah's research (2023) in Jember Regency show a positive correlation with a very low level of relationship between land area and sugar cane production. (3) Permata (2023) that land area has a significant effect on increasing sugar cane production in Situbondo Regency. (4) Fransiskus (2019) concluded in his research that sugarcane land area has a positive and significant effect on total sugar production in Indonesia. (5) Hadi (2019), that land variables influence sugar cane production in Karanganom District, Klaten Regency. (6) Achadin (2017), that land has a significant effect on sugar cane production in East Java in 2011 - 2015. (7) Ulum's (2022) research in Sepuliuh District, Bangkalan Regency shows that land area has a significant effect on sugar cane production. (8) Lestari (2023) stated that the land area variable significantly influences farmers' sugar cane production in the Panji sub-district, Situbondo Regency. (9) Putri (2018) conveyed the results of her research at PTPN XI that land use had a significant effect on sugar cane production. (10) Ftriyani's research (2019) in Sidoharjo in the Gorontalo Sugar Factory area, found that land variables significantly influence sugar cane production.

Significant Influence of Labor on Sugarcane Production

Based on the regression results, a significant P-value of 0.035 is obtained, which is smaller than (5% or 0.05). This means that the labor variable has a positive and significant influence on sugar cane production. This shows that if the number of workers increases, the amount of sugar cane production will also increase. The results of the analysis show that the labor variable has a partial and significant effect on sugar cane production. The partial equation is as follows: Y = -8.32 + 0.18 The Y ordinate point is below (-8.14). If the value of:

Table 4. Effect of Labor Variables on Production

Variable X	Coefficient	Variable X x Coefficient	Constant	Value Y
0	0,18	0	-8,32	-8,32
50	0,18	9	-8,32	0,68
100	0,18	18	-8,32	9,68
150	0,18	27	-8,32	18,68
200	0,18	36	-8,32	27,68

Table 4 shows the value of increased production resulting from the labor variable multiplied by the coefficient, minus the constant. When the variable Furthermore, the addition of workers will be followed by an increase in production as shown in the following graph:

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Figure 2. Graph of an Increase in the Number of Workers Followed by an Increase in Production

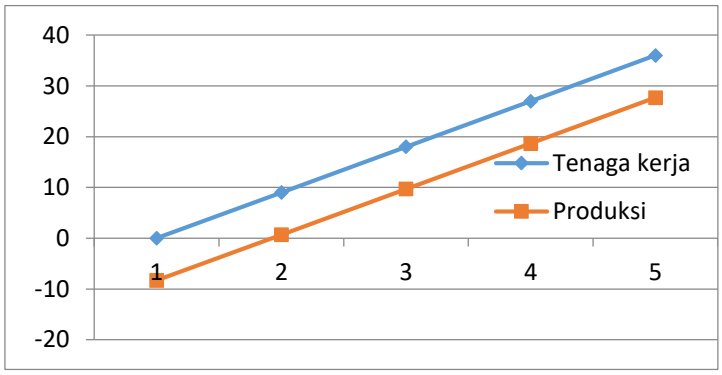

Figure 2 shows that increasing the number of workers in sugarcane cultivation can influence the amount of sugarcane production. The more labor used, the more sugar cane is produced. This is in accordance with research; (1) Lestari (2023) states that the number of workers has a positive and significant effect on sugar cane production in Panji sub-district, Situbondo district. (2) Syaithori (2020) in Dampit sub-district, Malang district, that labor has a positive effect on sugarcane farming production. (3) Research by Masyhuri (2020) in Probolinggo district, that labor influences the production of sugar cane cultivated by farmers. (4) Achadin (2017) concluded in his research that labor had a significant effect on sugar cane production in East Java in 2011 – 2015. (5) Purwati and Pandi (2011) stated that labor had a significant effect on sugar cane production in Pandji sub-district, regency Situbondo. (6) Lolita's research (2012) concluded that labor had a significant influence on sugar cane production in Canduang sub-district, Padang district. (7) Rozi (2020) stated that labor has a positive influence on the production of sugar cane farming in Ngadiluwih sub-district, Kediri district. (8) Pambudi's research (2018) concluded that the amount of labor devoted to cultivating sugarcane plants affects the amount of sugarcane production in Astanajapura sub-district, Cirebon district.

Significant Effect of Herbicides on Sugarcane Production

In accordance with the results of the regression analysis, the P-value significance value for variable 04 which shows that the use of herbicides further reduces sugar cane production. We need to be careful with the use of herbicides because if they are used incorrectly they can have an effect on other plants, staple crops, and in general have an impact on the environment through the residue left behind.

The research results show that the herbicide variable has a partial and significant effect on sugar cane production. The partial equation is as follows: Y = -8.32 – 0.04 X. This equation shows that the constant value is negative (-8.32) and the coefficient is also negative (-0.04). If the X value is 1, then the Y value = -0.04 – 8.32 = -8.36. Furthermore, if the value of:

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Table 5. Effect of Herbicide Variables on Sugarcane Production

Variable X	Coefficient	Variable X x Coefficient	Constant	Value Y
0	-0,04	0	-8,32	-8,32
50	-0,04	-2	-8,32	-10,32
100	-0,04	-4	-8,32	-12,32
150	-0,04	-6	-8,32	-14,32
200	-0,04	-8	-8,32	-16,32

Table 5 shows the value of production reduction resulting from the herbicide variable multiplied by the coefficient, minus the constant. Because the constant is negative (-) and the coefficient is negative (-), the production value (Y) is negative and continues to decrease with increasing herbicide doses. When variable X = 0, then production is at a constant value, namely -8.32. Next, increasing herbicide doses of 50, 100, 150, 200, will be followed by a decrease in production (Y) as shown in the following graph:

Figure 3. Graph of an Increase in Herbicides Followed by a Decrease in Production

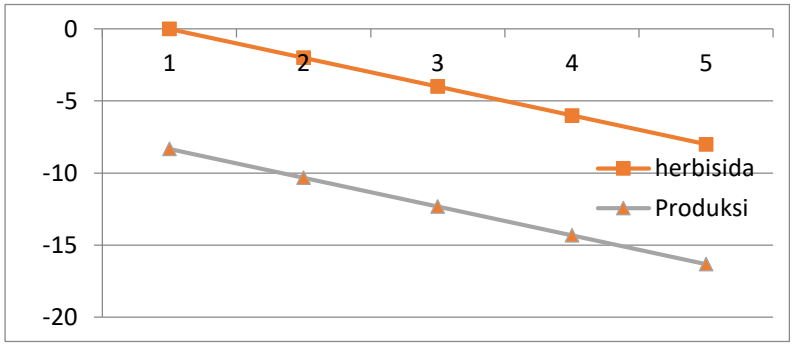

Figure 3 shows that increasing the amount of herbicides in sugarcane cultivation can influence the amount of sugarcane production. The larger the dose of herbicide used, the more significantly the amount of sugar cane production will be reduced. The diminishing returns theory applies; When production input is continuously increased, in time it will reach its highest point where production stagnates and will then experience a decline. In accordance with the opinion of Bangun and Pane (1984), the effects of herbicides can reduce nutrients in the soil. Herbicide residues can kill microorganisms, slowing down the decomposition of organic matter in the soil. According to Tjitrosoedirdjo et al. (1984), herbicide residues are the remains of herbicides and their derivatives that remain in the soil. The development of herbicide resistance is an evolutionary process where changes in the genetic composition of plants occur which results in the plant becoming resistant to certain herbicides (Rao, 2000).

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Significant Influence of Farming Sustainability on Sugarcane Production

Based on the results of the regression analysis, the P-value significance value was 0.019 (smaller than (5% or 0.05). This means that the farming sustainability variable has a positive and significant influence on sugar cane production. This shows that if business sustainability increases, then the amount of sugar cane production also increased.

Sugarcane farming continues if it fulfills the following 3 requirements for ecological, economic and socio-cultural dimensions: (1) The cultivation system is carried out without destroying the environment but rather improving, maintaining and developing the ecosystem. (2) Provide economic benefits for cultivation implementers. (3) As a cultural activity to support community welfare. These three dimensional requirements were added to 2 more dimensions in this research, namely technology and farmer institutions.

The results of the analysis show that the farming sustainability variable has a partial and significant effect on sugar cane production. The partial equation is as follows: Y = -8.32 + 0.31 The Y ordinate point is below (-8.01). If the value of:

Table 6. Effect of Farming Sustainability on Sugarcane Production

Variable X	Coefficient	Variable X x Coefficient	Constant	Value Y
0	0,31	0	-8,32	-8,32
50	0,31	15,5	-8,32	7,18
100	0,31	31	-8,32	22,68
150	0,31	46,5	-8,32	38,18
200	0,31	62	-8,32	53,68

Table 6 shows the value of increased production resulting from the farming sustainability variable multiplied by the coefficient, minus the constant. When variable X = 0, then production is at a constant value, namely -8.32. Furthermore, adding value to the sustainability of farming will be followed by increased production. This is because the value of farming sustainability contains the value of good cultivation activities; environmentally friendly, providing economic benefits, increasing welfare as capital for developing social culture, developing cultivation technology, and strengthening farmer group institutions, as shown in the following graph:

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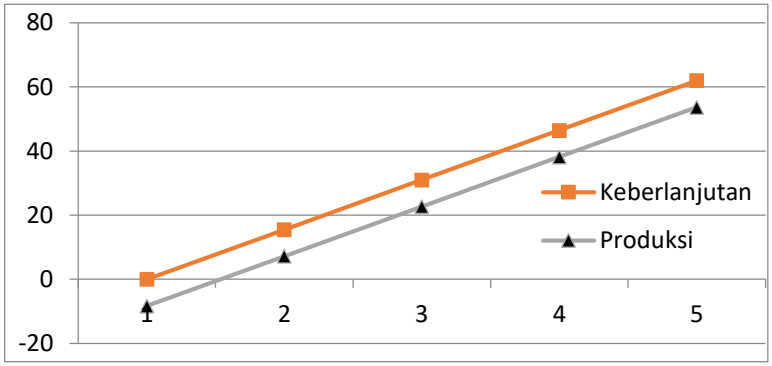
4. Graph of Increase in Farming Sustainability Value Followed by Increased Production



Conclusion

The results of research on 9 factors, namely area area, production costs, labor, amount of fertilizer, pesticides, herbicides, opportunity costs, sustainability, and pentahelix, together influence sugar cane production. Partially, area size, labor, herbicides, sustainability have a significant effect on sugar cane production.

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