

## **Factors Affecting Tea Productivity at PT. Perkebunan Nusantara XII**

Yudi Kurniawan<sup>1</sup>, Any Suryantini<sup>2</sup>, DwidjonoHadiDarwanto<sup>3</sup>

<sup>1</sup>Master of Agribusiness Management, Faculty of Agriculture, Universitas Gadjah Mada Jl. Flora No. 1 Bulaksumur, 55281 Yogyakarta,

<sup>2</sup>Faculty of Agriculture, Universitas Gadjah MadaJl. Flora No. 1 Bulaksumur, 55281 Yogyakarta,

<sup>3</sup>Faculty of Agriculture, Universitas Gadjah MadaJl. Flora No. 1 Bulaksumur, 55281 Yogyakarta,  
Corresponding Author: Yudi Kurniawan

---

**Abstract:** Tea is one of export commodities contributing to foreign exchange earnings to Indonesia. One of the tea producers owned by state plantations is PT. Nusantara XII Plantation located in East Java. The revenue in the tea sector could be increased by increasing tea productivity through increasing the most influential factors of productivity. Based on the condition, this study aims to determine what factors affecting tea productivity at PT. Perkebunan Nusantara XII. The data used in this study were secondary data, namely data that have been arranged in the form of productivity report on the crop productivity, cost, and management obtained by PT. Perkebunan Nusantara XII. These data included: data on total productivity, number of people working days (man-days) for harvest, application of urea fertilizer, TSP fertilizer, KCL fertilizer, kieserite fertilizer, PM fertilizer, land area and rainfall. Time series data were used for the period of the last ten years from January 2006 to December 2016. The Cobb-Douglas Productivity Function regression model was applied in the analysis. The results showed that the factors that significantly affected tea productivity at PT. Perkebunan Nusantara XII was the total area, the amount of urea fertilizer usage, the amount of KCL fertilizer usage, the amount of harvest labor, and rainfall, while the amount of ZA fertilizer, TSP fertilizer amount, Kieserite fertilizer amount, and PM fertilizer amount indicated a non-significant effect on tea productivity.

**Keywords:** Factors of productivity, tea productivity, Cobb-Douglas productivity function model.

---

Date of Submission: 27-01-2019

Date of acceptance: 09-02-2019

---

### **I. Introduction**

The plantation sector is one of the agricultural sectors which contributes to the country's foreign exchange earnings through export, provision of employment, fulfillment of domestic consumption needs, domestic industrial raw materials, power acquisition and sustainable optimization of natural resources. Accordingly, it is not excessive if the results of the plantation are the mainstay export trade in the non-oil and gas sector.

One of the plantation sectors which contributes to the state's foreign exchange earnings is tea commodity, where the role of tea commodity in Indonesia's economy is adequately strategic. The tea industry in Indonesia is estimated to absorb around 300,000 workers and support around 1.2 million people. Besides that, nationally, tea industry contributes to the gross domestic product (GDP) of around IDR 1.2 trillion (0.3% of total non-oil and gas GDP) and provide net foreign exchange earnings of contributing net foreign exchange of around 110 million US dollars per year. From the aspect of tea cultivation and processing business environment perspective, it belongs to a business which supports the soil and water conservation (Suprihatini and Karyudi, 2014).

Tea plantation area in Indonesia decreased from 122,797 hectares in 2010 to 119,361 hectares in 2015. The Indonesian tea productivity also declined from 151,000 tons in 2010 with the productivity of 1,230 kg/ha/year to 143,609 tons in 2015 with the productivity of 1,203 kg/ha/year, below the national economic potential of 5000 kg/ha/year. Accordingly, the Indonesian tea export also declined in 2009 as many as 93,205 tons, worth 171,628 million US dollar (IDR 2.3 trillion), in 2015 became 61,915 tons or worth 126,051 million US dollar (IDR 1.6 trillion). On the other hand, the global tea market is oversupplied, in 2015, the global tea productivity reached up to 5.2 million tons, while the global tea consumption only 4.94 million tons. Therefore, the tea price in the global market also declined (Kompas, 22 November 2016).

Indonesia is the seventh rank tea producing country in the world after India, China, Sri Lanka, Kenya, Turkey, and Vietnam. Most of the Indonesian tea productivity (65%) is intended for the export market. The volume of Indonesian tea export is mostly (94%) still in the form of dried leaves (Sekjen Kementerian Pertanian, 2015).

The low of Indonesian tea productivity is caused by the slow rejuvenation pruning of plants and not optimal management of tea plantations. As a result, the quality of Indonesian tea is unable to compete with tea products exported from several competing countries. Therefore, it is important to increase the Indonesian tea productivity through a better understanding of the factors determining the tea productivity, in order that Indonesia can hold an important position in the tea commodity in the world (DirektoratJendral Perkebunan, 2007).

Indonesia tea is mostly produced by the state plantation with the productivity segment in 2016 was 39%, while the private plantation and people's plantations were 27% and 34% respectively (DirektoratJendral Perkebunan, 2017). One of the tea producers belongs to the state plantation is PT. Perkebunan Nusantara XII which is located in East Java or known as PTPN XII. One of the main commodities of PTPN XII is tea, besides rubber, cocoa, coffee and sugar cane. The tea productivity of PT. Perkebunan Nusantara XII in 2016 was 2,549,185 kg with the productivity of 1,619 kg/ha/year experiencing an incline compared to in 2012 as much as 2,397,953 kg with the productivity of 1,361 kg/ha/year. Almost all of the tea productivity in PTPN XII is sold to export market with the destination countries such as Singapore, Turkey, Ukraine, Malaysia, Iran, UAE, India, Egypt, Australia, and the United Kingdom.

Tea commodity contributes to the income of PT. Perkebunan Nusantara XII in 2011 as much as IDR 47.7 million and experienced an increase in 2016 as much as IDR 49.1 million, with the increase of income in the tea commodity business sector, the management of PT. Perkebunan Nusantara XII strives to improve productivity, however, in the effort, it is undeniable that the company is faced to the problems related to the factors affecting the productivity. Based on the aforementioned elaboration, then it the problems can be formulated related to what factors affecting the tea productivity of di PT. Perkebunan Nusantara XII.

## II. Method

The research method employed was an analytic descriptive method with the type of case study research. According to Syah (2010), descriptive method is a research method used to find out an extensive knowledge on the research objects in a certain period of time, while according to Setyosari (2010), he explains that descriptive method is a study which attempts to explain or describe a condition, phenomenon, objects both people or anything related to variables which can be explained well with numbers or words. This research was conducted in the tea plantation belongs to PT. Perkebunan Nusantara XII East Java, namely: Bantaran Plantation, Wonosari Plantation, Kertowono Plantation, and GunungGambir Plantation.

The data used in this research were secondary data, which were the data arranged in the form of productivity report, plantation report, financial report, and management report obtained from PT. Perkebunan Nusantara XII. The data included: the number of productivity data, number of working days for people (HKO) harvest, urea fertilizer, TSP fertilizer, KCL fertilizer, kieserite fertilizer, PM fertilizer, land area and rainfall with the data used were Time series data were used for the period of ten time series data (10) the last ten years from January 2006 to December 2016. Meanwhile, for the plant age, soil fertility, altitude, and clones assumed for all plantations were same. For the plant age, on average almost 90% in all plantations are more than 25 years, the soil type for tea agriculture is an Andisol soil type whose soil fertilities are the same, with the altitudes in all tea plantations are estimated 800 MASL – 1,200 MASL, and 90% of plant clones used the TRI 2024/2025 clone type.

The objective of this research was to investigate the usage level of productivity factors in PT. Perkebunan Nusantara XII. To find out the usage level of productivity factor, a table descriptive analysis was utilized. Meanwhile, in analyzing the influence of productivity factors on tea productivity, a multiple regression analysis was employed by using time series data and to find out the productivity trend, a linear trend analysis was used by utilizing least square or the least squares method. the analysis method used was a Cobb-Douglas Productivity Function regression analysis with the equation as follow:

$$Y = \alpha X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} X_8^{\beta_8} X_9^{\beta_9} D_1^{\beta_{10}} D_2^{\beta_{11}} D_3^{\beta_{12}} D_4^{\beta_{13}} D_5^{\beta_{14}}$$

Where Y is the yielded tea productivity, and X is the input (plantation area , urea fertilizer, ZA fertilizer, TSP fertilizer, KCL fertilizer, Kieserite fertilizer, PM fertilizer, harvest workers, and rainfall as well as dummy variable, which are the differentiators of productivity in each plantation (dummy of Bantaran plantation, dummy of Kertowono plantation, and dummy of GunungGambir plantation) and dummy of management differences. To simplify analysis in the aforementioned regression model, the transformation was conducted, which was aligning the above equation using classical linear regression model which is by transforming the equation in the form of natural logarithms (ln):

$$\ln Y = \ln\alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \beta_8 \ln X_8 + \beta_9 \ln X_9 + \beta_{10} \ln D_1 + \beta_{11} \ln D_2 + \beta_{12} \ln D_3 + \beta_{13} \ln D_4 + \beta_{14} \ln D_5 + e$$

Where:

Y = Total tea productivity (kg)

X<sub>1</sub> = Plantation Area (Ha)

- X<sub>2</sub> = Total Urea fertilizer (kg)
- X<sub>3</sub> = Total ZA fertilizer (kg)
- X<sub>4</sub> = Total TSP fertilizer (kg)
- X<sub>5</sub> = Total KCl fertilizer (kg)
- X<sub>6</sub> = Total Kieserite fertilizer (kg)
- X<sub>7</sub> = Total PM (kg)
- X<sub>8</sub> = Total harvest workers (HKO)
- X<sub>9</sub> = Total rainfall (mm)
- D1 = Dummy of Bantaran Plantation
- D2 = Dummy of Kertowono Plantation
- D3 = Dummy of GunungGambir Plantation
- D4 = Dummy of productivity results during the President Director of Nur Hidayat (2006-20012)
- D5 = Dummy of productivity results during the President Director of IrwanBasri (2012-20016)
- α = Constant
- β<sub>n</sub> =Regression parameter coefficient from each variable (β<sub>n</sub> = β<sub>1</sub>, β<sub>2</sub>,β<sub>3</sub>,β<sub>4</sub>,β<sub>5</sub>,β<sub>6</sub>,β<sub>7</sub>,β<sub>8</sub>,β<sub>9</sub>,β<sub>10</sub>,β<sub>11</sub>,β<sub>12</sub>,β<sub>13</sub>,β<sub>14</sub>)

### III. Results And Discussion

To find out the usage level of productivity factor, a table descriptive analysis was used. Meanwhile, to analyze the influence of productivity factors on tea productivity, a multiple-regression analysis using time series data was used. The regression analysis conducted in this research aimed at testing the hypothesis, which was to find out the used of factors in tea productivity at PT. Perkebunan Nusantara XII (plantation area, urea fertilizer, ZA fertilizer, TSP fertilizer, KCL fertilizer, Kieserite fertilizer, PM fertilizer, the number of harvest workers and the amount of rainfall). Besides that, it was also to examine whether there were productivity level differences between plantations and between the eras of Nur Hidayat dan IrwanBasri. The analysis method used to see the influence of the variable as multiple regression method.

Based on the analysis results of factors affecting the tea productivity at PT. Perkebunan Nusantara XII, namely: plantation area, urea fertilizer, ZA fertilizer, TSP fertilizer, KCL fertilizer, Kieserite fertilizer, PM fertilizer, number of harvest workers, and amount of rainfall. In the table below, the coefficient of determination value (R<sup>2</sup>) of 0.9330. This means 93.30% the variation of tea productivity level at PT. Perkebunan Nusantara XII can be explained by the variation of values from the variables of plantation area, urea fertilizer, ZA fertilizer, TSP fertilizer, KCL fertilizer, Kieserite fertilizer, PM fertilizer, number of harvest workers, and amount of rainfall. While the rest of 6.70% can be explained by other variables not included in the analysis model. The table below is the analysis results of factors affecting the tea productivity at PT. Perkebunan Nusantara XII during the period of 2006 until 2016.

**Table:** The Analysis Results of Factors Affecting Tea Productivity at PT. Perkebunan Nusantara XII, year of 2006 - 2016

No	Independent Variables	Regression Coef.	t-count	Prob.
1.	Plantation Area	0,487***	5,534	0,000
2.	Urea Fertilizer	0,317***	3,866	0,007
3.	ZA Fertilizer	0,008 <sup>NS</sup>	2,212	0,030
4.	TSP Fertilizer	-0,009**	-2,077	0,041
5.	KCl Fertilizer	0,221***	2,886	0,003
6.	Kieserite Fertilizer	-0,002 <sup>NS</sup>	-0,571	0,570
7.	PM Fertilizer	0,003 <sup>NS</sup>	0,027	0,801
8.	Number of workers	0,640***	7,007	0,000
9.	Amount of rainfall	0,251***	2,758	0,010
10.	Dummy-1 (D <sub>1</sub> = 1 if Bantaran plantation; D <sub>1</sub> = 0 if other plantation)	-0,370***	-4,615	0,000
11.	Dummy-2 (D <sub>2</sub> = 1 if Kertowono plantation; D <sub>2</sub> = 0 if other plantations)	-0,219***	-4,096	0,000
12.	Dummy-3 (D <sub>3</sub> = 1 if GunungGambir plantation; D <sub>3</sub> = 0 if other plantations)	-0,568***	-5,517	0,000
13.	Dummy-4 (D <sub>4</sub> = 1 in 2006 -2012 Era of President Director Nur Hidayat; D <sub>4</sub> = 0 in 2013 - 2016)	0,062 <sup>NS</sup>	1,163	0,249
14.	Dummy-5 (D <sub>5</sub> = 1 in 2012 -2016 Era of President Director IrwanBasri; D <sub>5</sub> = 0 in 2006 - 2011)	0,256***	4,034	0,000
15.	Constant/intercept	5,160***	4,115	0,000
Coefficient of determination (R <sup>2</sup> )		0,9330		
F-count			72,496***	
Dusrbin Watson Test (DW)		1,9880		
Number of samples (n)			88	

Source : processed secondary data, 2018

Desc: *** = Significant on the level of 1 % error	t-table 1 % = 2,704
** = Significant on the level of 5 % error	t-table 5 % = 2,021
* = Significant on the level of 10 % error	t-table 10 % = 1,684
NS = Non-Significant on the level of 10 % error	F-table 1 % = 2,660

In the table above, it was obtained the F-count value of 72,496 and the value turns out to higher than the value of F-Table (2,660). It shows that the effect of plantation area, urea fertilizer, ZA fertilizer, TSP fertilizer, KCL fertilizer, Kieserite fertilizer, PM fertilizer, number of harvest workers, and amount of rainfall variables jointly affected significantly on the level of tea productivity in PT. Perkebunan Nusantara XII on the trust level of 99%.

To find out the effect of each variable of plantation area, urea fertilizer, ZA fertilizer, TSP fertilizer, KCL fertilizer, Kieserite fertilizer, PM fertilizer, number of harvest workers, and amount of rainfall on tea productivity level at PT. Perkebunan Nusantara XII, an individual test (t-test). From the analysis results of the above table, it shows that the level of tea productivity at PT. Perkebunan Nusantara XII is statistically affected by plantation area, urea fertilizer, TSP fertilizer, KCL fertilizer, number of harvest workers, and amount of rainfall. While the variables of ZA fertilizer, Kieserite fertilizer, and PM fertilizer statistically did not show any significant difference (non-significant) on tea productivity level at PT. Perkebunan Nusantara XII.

The effect of plantation area variable showed a positive correlation pattern and statistically showed a significant effect on tea productivity at PT. Perkebunan Nusantara XII on the trustworthy level of 99%. The regression coefficient value from the plantation area variable was 0.487. it means that when the plantation area experiences an increase of 1%, while the other factors are considered stable, then the tea productivity level at PT. Perkebunan Nusantara XII will encounter an increase of 0.487%.

For the variable of urea fertilizer also statistically showed there was a significant difference or significant on tea productivity at PT. Perkebunan Nusantara XII and showed a positive correlation pattern on the trustworthy level of 99%. The regression coefficient value of the total amount of urea fertilizer was 0.317. this means that if the dosage use of urea fertilizer was increased as much as 1% with the assumption that other factors are stable, then the tea productivity at PT. Perkebunan Nusantara XII will experience an increase of 0.317% in each hectare. Therefore, the level of urea fertilizer dosage use needs to be optimized in its usage until the optimal level.

The variable of the amount of TSP fertilizer statistically showed there was a significant difference or significant on tea productivity at PT. Perkebunan Nusantara XII and showed a negative correlation pattern on the trustworthy level of 95%. The regression coefficient value from the variable of the amount of urea fertilizer was -0.009. It means that if the use of TSP fertilizer dosage was increased as much as 1% with the assumption that other factors are stable than the tea productivity at PT. Perkebunan Nusantara XII would experience a decrease as much as 0.009% in each hectare. Therefore, the usage level of TSP fertilizer dosage needs to be lowered until the optimal level.

Besides that, the variable of the amount of KCL fertilizer also showed a positive correlation and significant with the tea productivity at PT. Perkebunan Nusantara XII on the trustworthy level of 99%. The regression coefficient value of the KCL fertilizer amount variable was 0.221. it means that when the dosage use of KCL fertilizer was increased as much as 1% with the assumption that other factors were stable then the tea productivity at PT. Perkebunan Nusantara XII would experience an increase of 0.221%. this type of KCL fertilizer is one of the fertilizer types which is massively imported so that this KCL fertilizer's price is significantly determined by the exchange rate of Rupiah to US dollar. Seeing from the analysis results that the significant use of KCL fertilizer on tea productivity at PT. Perkebunan Nusantara XII gave guidance for business management that the plantations whose usage is still below the optimal standard, they need to increase the used dosage until the optimal level.

For the variable of the number of harvest workers also showed a positive correlation pattern and significant on tea productivity at PT. Perkebunan Nusantara XII on the trustworthy level of 99%. The regression coefficient value from the harvest worker variable was 0.640. It means that on average the use of harvest workers in each hectare was not optimal so that the allocation of resources (harvest workers) which are owned needs to be observed because if the use of workers was increased by 1% with the assumption of other factors were the same, then the tea productivity at PT. Perkebunan Nusantara XII can increase as much 0.640% in each hectare.

Another variable affecting the increase of tea productivity at PT. Perkebunan Nusantara XII was the factor of rainfall amount. Based on the analysis results on the table above, it shows there is a significant difference (significant) on the increase of tea productivity at PT. Perkebunan Nusantara XII on the trustworthy level of 99%. The contribution of those variables in increasing the tea productivity at PT. Perkebunan Nusantara XII for each hectare was 0.251%. This shows that when the amount of rainfall increased in 1% with the assumption of other factors were the same then the tea productivity at PT. Perkebunan Nusantara XII

experienced an increase of 0.251%. The provision of sufficient water for the plants so that the fulfillment of water which is sufficient significantly needs to be a concern for the management at PT. Perkebunan Nusantara XII.

From the analysis of differences in levels of inter-plantation tea productivity at PT. Perkebunan Nusantara XII statistically showed that there was a significant difference, for instance, Bantaran plantation compared to other plantations (Gunung Gambir plantation, Kertowono plantation, and Wonosari plantation) on the trustworthy level of 99%. The average difference value of tea productivity was -0.370. the regression coefficient value from the dummy variable ( $D_1$ ) with the negative value, it means that the level of tea productivity at Bantaran plantation was lower compared to the tea plantation at PT. Perkebunan Nusantara XII (Gunung Gambir plantation, Kertowono plantation, and Wonosari plantation).

In addition, if Kertowono plantation compared to other plantations (Bantaran plantation, Gunung Gambir plantation, and Wonosari plantation) statistically showed there was a difference on tea productivity average at the trustworthy level of 99%. The regression coefficient value of dummy variables ( $D_2$ ) which has a negative value, which means that the level of tea productivity at Kertowono Plantation was lower than the other tea plantations at PT. Perkebunan Nusantara XII (Bantaran plantation, Gunung Gambir plantation, and Wonosari plantation). Gunung Gambir plantation compared to the other plantations (Bantaran plantation, Kertowono plantation, and Wonosari plantation) statistically showed there was a difference in the tea productivity on the trustworthy level of 99%. The regression coefficient value of dummy variable ( $D_3$ ) which has a negative value means that the average level of tea productivity at Gunung Gambir plantation was lower than the other tea plantations at PT. Perkebunan Nusantara XII (Bantaran plantation, Kertowono plantation, and Wonosari plantation).

Furthermore, the tea productivity at the plantation of PT. Perkebunan Nusantara XII in the management era (president director) Mr. Irwan Basri 2012-2016 period was higher than the previous period (2006 until 2011). This is shown in the Table above where the regression analysis results of dummy variables which statistically showed a significant difference on the trustworthy level of 99%. The value of productivity difference was 0.256. on the other hand, during the era of Mr. Nur Hidayat (2006 – 2012) statistically did not show any significant difference. It means that the tea productivity at PT. Perkebunan Nusantara XII before and during the era of Mr. Nur Hidayat had the same average level of productivity.

Meanwhile, the variables of the amount of ZA fertilizer, amount of Kieserite fertilizer, and amount of PM fertilizer statistically did not show any significant effect (non-significant) on tea productivity at PT. Perkebunan Nusantara XII.

#### **IV. Conclusion**

The tea productivity owned by the plantations at PT. Perkebunan Nusantara XII is affected by plantation area, urea fertilizer, ZA fertilizer, TSP fertilizer, KCL fertilizer, Kieserite fertilizer, PM fertilizer, number of harvest workers, and amount of rainfall. Meanwhile, the total amount of ZA fertilizer usage, the total amount of TSP fertilizer usage, the total amount of Kieserite fertilizer usage, and the total amount of PM fertilizer usage statistically did not show any significant difference (non-significant) on tea productivity.

#### **V. Suggestion**

The efforts to increase tea productivity of PT. Perkebunan Nusantara XII can be performed by expanding the plantation area, adding the number of harvest workers, and adding the use of urea and KCL fertilizers which have a significant effect.

#### **References**

- [1]. Direktorat Jendral Perkebunan 2007. *Standar Ekspor Teh Indonesia (serionline)* <http://www.disbun.jabarprov.go.id/>.
- [2]. Direktorat Jendral Perkebunan, 2017, Statistik Perkebunan Indonesia Teh 2015-2017.
- [3]. Kompas tanggal 22 November 2016. Ekspor Teh Indonesia Terpuruk.
- [4]. <http://www.pressreader.com/indonesia/kompas/20161122/281964607313899>
- [5]. Suprihatini, R. dan Karyudi. 2014. Indonesia country report of tea. Proceeding and abstracts. *Inter-national Tea Symposium 2014 (ITS 2014)*. Innovation and Development. November 10-13. Hangzhou, China.
- [6]. Hidayat Syah, 2010. *Pengantar Umum Metodologi Penelitian Pendidikan Pendekatan Verivikatif*. Pekanbaru : Suska Pres.
- [7]. Punaji Setyosari 2010. *Metode Penelitian Pendidikan dan Pengembangan*. Jakarta : Kencana

Yudi Kurniawan. " Factors Affecting Tea Productivity at PT. Perkebunan Nusantara XII. "IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS) 12.2 (2019): PP- 66-70.