IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 13, Issue 7 Ser. I (July 2020), PP 01-11
www.iosrjournals.org

Analysis Of Sustainable Farming Of Soybeans (*Glycine max* L.) In Sukorejo, Ponorogo, East Java

Sri Sulastri[1], Ahmad Sofwani [2], Siti Farida [3]
[1]*Faculty of Forestry, Malang Institute of Agriculture*
[2]*Faculty of Agriculture, Malang Institute of Agriculture*
[3]*Faculty of Agricultural Technology, Malang Institute of Agriculture*

Abstract: *Soybeans production has not been able to meet the national demand of soybeans. For the sustainability of commodity soybeans is expected, one of its efforts is the continuous soybean farming techniques. The purpose of this research is to know: Does soybean farming has been efficient? Production factors are most influential to the production of soybean? Is allocative use production factors on soybean farming is Optimum / efficiently?. The study was conducted in Sukorejo, Ponorogo with quantitative approach, and the method used is survey method. Analysis of the data used is the following: RC ratio; Analysis function Cobb-Douglass; and analysis of the ratio between the value of marginal product (NPM) with prices of production factors (NPM = Px). The results showed that soybean farming in paddy fields and dry land are equally efficient, for soybean farming in paddy field has 2.52 levels of efficiency and in dry land farming has 1.82 of efficiency level. The factors of production or production inputs jointly affect soybean production, but as individuals who had significant input to the increase in soybean production in paddy land is land area, seed, male and female workers, while in dry land is organicfertilizer. Use of production inputs allocation in both paddy land and dry land are equally not be at optimum level, the efforts to optimize revenue soybean farming can still be done with the use of production factors (inputs) in an efficient and adapted to the conditions of land. Soybean farming in the district Sukorejo sustainable, this proved to be economically profitable, ecologically / technical use of production inputs (natural, man) is not optimal, and the social culture does not change the structure / condition of farmers who have been.*

Key words: soybeans, sustainable farming

Date of Submission: 18-06-2020 Date of Acceptance: 04-07-2020

I. Introduction

One of the agricultural commodities that is the government's concern at the moment is soybeans, where the level of public consumption of soybeans is very large while on the other hand domestic production has not been able to fulfill it so the government still has to import soybeans from abroad. The prospect of developing soybeans in the country to suppress imports is quite good, given the availability of sufficient land resources, suitable climate, the technology that has been produced, as well as sufficiently skilled human resources in farming. In addition, the soybean commodity market is still wide open.

Soybean (*Glycine max* L.) is one of the main commodities of beans that are a national mainstay because it is an important source of vegetable protein for food diversification in supporting national food security. Every year, soybean needs reach 2 million tons, while domestic soybean production is only 0.8 million tons per year, so to meet the required import of 1.2 million tons per year. In the future, soybean demand projection will continue to increase along with the increase in soybean consumption by the Indonesian people in view of several considerations such as: increasing population, increasing income per capita, public awareness of food nutrition. Per capita consumption from 8.12 kg in 2005 to 9.46 kg in 2020 or an increase of 1.02% per year. When viewed from the map of Indonesian soybean producers, the largest is produced in the East Java region, because East Java is one of the national soybean production centers and for three years East Java soybean production has increased. The increase in soybean production was supported by an increase in harvested area and productivity.

One of the soybean producing districts in East Java is Ponorogo district. in Ponorogo there are only two rapidly developing local varieties namely SmackingYellow and Green Smacking, which have become icons of agricultural products in Ponorogo Regency and have received national standard recognition from the Ministry of Agriculture as local superior products from original Ponorogo. And has obtained a certificate of registration of local varieties No. 64 / PV / 2008 December 9, 2008 (soybean varieties Gepak Kuning) and Number 63 / PV / 2008 December 9, 2008 (soybean varieties Gepak Ijo. Compared with other superior varieties, Gepak Kuning and Gepak Ijohas several advantages including: more early harvest age (70-75 days), Gepak Kuning capable of

producing 2.20 tons / ha and Gepak Ijo 2.25 tons / ha, high levels of starch and a savory taste. Soy cultivation in Ponorogo can carried out in every planting season, namely the rainy season (MH) MH and MH1, the first dry season (MK1) and MK2 in the fields.

The existence of various problems or obstacles ranging from the spread of land with a variety of commodities, narrow land ownership, fluctuating prices, policies that do not support the development of soybean farming is still difficult to be realized, this will affect the low production produced so the product efficiency is still low. Also limited soybean farmers' knowledge of environmental conditions related to the use of natural resources (forests, land, water) and human resources (production facilities) with still low intensity. Based on the description above, it encourages researchers to study the efficiency of sustainable carrot farming by taking a location in one of the soybean production centers in East Java, which may represent a picture of soybean farming in East Java, of which East Java is the largest soybean producer or production center in Indonesia. The purpose of this study is: Knowing the amount of income and efficiency of soybean farming, knowing the factors of production that affect farm production Soy and Analyzing the allocative efficiency of the use of production factors in soybean farming

II. Research Methods

Based on the problems and objectives of the study, in this study the approach used is a quantitative approach, and the method used is the survey method.

The location of the research was carried out on purpose, namely in the District of Sukorejo in Ponorogo Regency, with the consideration that the District of Sukorejo is a district that has a harvested area, and the amount of soybean production is highest compared to other districts in the Regency of Ponorogo.

Respondents in the study were determined intentionally, all soybean farmers in Sukorejo sub-district, Ponorogo district on MH-1 (Rainy season-first planting). From the survey results it is known that the number of soybean farmers (respondents) is 62 people, consisting of farmers who work soybean in paddy fields as many as 35 people and farmers who work soybean in Dry Land land as many as 27 people. The small number of soybean farmers in MH 1 according to Agricultural Extension Officers (PPL) due to the length of the rainy season so that the majority of farmers turn to rice farming.

The data used in this study include primary data and secondary data. Primary data were obtained directly from soybean farmers as respondents and secondary data included supporting data from primary data, obtained from relevant agencies that have relevance to the research objectives.

In accordance with the objectives of the study, the data collected is tabulated and then calculated and analyzed for efficiency, the use of production factors that affect production, and the efficient use of production inputs.

RC ratio analysis

Farming efficiency can be obtained by calculating the Return Cos Ratio (R / C Analysis), which is a comparison between total revenue and total production costs.

R / C ratio = TR / TC

Where: TR = total revenue (Rp); TC = Total cost (Rp)

This analysis shows the level of economic efficiency of soybean farming, which will be achieved if:

R / C ratio> 1 means efficient and profitable farming

R / C ratio = 1 means that farming does not lose or profit

R / C ratio <1 means that farming is not efficient and not profitable.

Analysis of the Cobb-Douglas production function (Imam Ghozali, 2009). Mathematically the Cobb-Douglas function is stated as follows:

Y = a. X1b1. X2b2. X3b3 ..... XNB. eu

For the production function above to be estimated, the equation needs to be transformed into a linear form so that it becomes:

Ln Y = Ln b0 + b1 Ln X1 + b2 Ln X2 + b3 Ln X3 + ... bn Ln Xn + U

Where: Y = soybean production (kg); X1 = Land area (ha); X2 = seed (kg); X3 = Use of inorganic fertilizer (kg); X4 = Use of organic fertilizer (kg); X5 = Use of drugs (lt); X6 = Use of male labor (HOK); X7 = Use of female workers (HOK); bo = intercept; b1, b2, b3, b4, b5 = elasticity of production factors; e = natural number (2,178); U = error

Analysis of the ratio between the Marginal Product Value (NPM) and the factor price (NPM = Px) uses the following formula:

$$\frac{NPM}{Px} = 1 \text{ or } \frac{bi.Y.Pyb1 .Y.Py}{XiP\ xi} = 1 \text{ or } \frac{}{Px}$$

$$NPM = bi \frac{Y}{X} P_y$$

Where: NPM xi = Marginal product value of the i production factor; bi = elasticity; Xi = The average use of the i-th factor of production; Y = Average production per hectare; Pxi = Price per unit of i-th factor of production; Py = Unit price for production.

III. Results And Discussion

Characteristics of Respondent Farmers

1. Respondent's Life

Farmers who work on soybeans in the study area, have different ages, where the age of farmers really determines the ability to work in carrying out farming activities. This means whether the farmers in carrying out their farming activities are still classified as productive or less productive, because it will determine the productivity produced. To see the age classification of soybean respondent farmers in Sukorejo can be seen in table 13 below.

Table 1. Age Composition of Respondents by Age Category on Soybean Farming in Sukorejo Ponorogo Regency

No	Land Type	Age Category	Number of People	Persentage (%)
1	Rice Field	Productive	24	68,57
		Non-Productive	11	31,43
	Amount		35	100,00
2	Dry Land	Productive	18	66,66
		Non-Productive	9	33,34
	Amount		27	100,00

Source: Data processed

Based on Table 1 above it can be seen that the productive age of soybean farmers as respondents both in paddy fields and Dry Land land dominates compared to the age of non-productive respondent farmers. This shows that the age of respondent farmers in the study area is mostly done by productive age, so that they have the ability to work in carrying out their farming which in the end will be conducive to productivity productivity in increasing the productivity of farming production.

2. Respondent Education.

The farmer's education level is also one of the most important factors and is one indicator in decision making and the quality of his work, especially in adopting agricultural technological innovations and farming cultivation techniques. And that certainly will affect the pattern of thinking of farmers. To see the classification of respondent farmers according to education level can be seen in Table 2.

Table 2. Classification of Education Level of Respondent Farmers atSoybean Farming in Sukorejo, Ponorogo Regency

No.	Land Type	Level of education	Numberof People	Persentage (%)
1	Rice Field	- ESL	19	54,28
		- JHS	8	22,86
		- USS	7	20,00
		- College	1	2,86
	Amount		35	100,00
2	Dry Land	- ESL	12	44,44
		- JHS	13	48,15
		- USS	2	7,41
		- College	0	0,00
	Amount		27	100,00

Source: Data processed

Table 2 shows that the respondent farmers in the study area turned out to be 100% having taken formal education. Where the highest level of education in the paddy field respondents was at the Elementary School level (ESL) that is 54.28%, and in the Dry Land land respondents the highest level of education was at the level of the Junior High School (JHS) which amounted to 48.15%. The still low level of education at the farm level is partly due to the lack of community awareness (farmers) of the importance of education, so that community resources (farmers) are less equipped with adequate education. The education level of the respondent can be an indicator of the quality of farmer's work because of his mindset and knowledge.

3. Extent of Respondents' Land

The area of arable land in the study area varied, ranging from 0.1 to 1.20 ha. For more details, can be seen in Table 3.

Table 3. Land of Respondent Farmers in Soybean Farming in Sukorejo, Ponorogo Regency MH 1

No.	Land Type	Land Area Category	Number of People	Persentage (%)
1	**Rice Fields**	- ≤ 0,5 hectare	29	82,86
		- > 0,5 hectare	6	17,14
	Amount		35	100,00
2	**Dry Land**	- ≤ 0,5 hectare	27	100
		- > 0,5 hectare	0	0
	Amount		27	100,00

Source: Data processed

Table 3 shows that the majority of respondent's arable land area is hektar 0.5 hectare, where in the paddy field this category is 82.86% or 29 respondent farmers and on Dry Land land is 100%, 27 respondents. This shows that the ownership of arable land in the study area has relatively narrow land (≤ 0.5 hectare).

4. Respondents' Work

The types of retain work of respondents in the study area are presented in Table 4.

Table 4. Types of Respondent Farmers' Work on Soybean Farming in Sukorejo, Ponorogo Regency MH 1

No.	Land Type	Type of Works	Number of People	Persentage (%)
1	**Rice Fields**	- Private	19	54,29
		-Government Employers	1	2,86
		-Farm Workers	15	42,85
	Amount		35	100,00
2	**Dry Land**	- Private	12	44,44
		- Farm Workers	15	55,56
	Amount		27	100,00

Source: Data processed

Table 4 shows that the majority of respondents' jobs both in paddy fields and Dry Land are private, which are classified as private in the study area (traders, construction workers, etc.). So in addition to being a farmer the respondent also had other jobs such as traders, construction workers and others.

5. Respondent Soy Entrepreneurial Experience

From the survey results in the study area, the experience of respondent's soybean farming was very varied. For respondents in Dry Land, the average experience of respondents in soybean farming was 25.8 years, whereas for paddy field respondents, the average experience in soybean cultivation was 26.5 years. This shows that the experience of respondents in the study area is very long, this is also recognized by respondents that the experience is obtained from their parents or from their predecessors.

C. 1. Analysis of Soy Farming

Soybean has been widely cultivated in arable land in Dry Land and Dry Land in Sukorejo sub-district, which already has local soybean varieties named Gepak Kuning and Gepak Ijo varieties that have developed rapidly in the community. However, at the time of the study the respondents used were only yellow-blown type. The technology used in soybean farming in the study area from the information obtained is still manual. In soybean farming, production facilities (inputs) that are used or utilized by farmers in farming include seeds, fertilizers, medicines and labor. In detail the results of the analysis of soybean farming can be seen in Table 5.

5. Analysis Results of Soy Farming in Sukorejo District, Ponorogo Regency MH 1 (November-January planting season)

No	Input	Amount (kg, Lt, HOK)	Price (Rp)	Input Cost (Rp)	Reception (Rp)	R/C ratio
1	Rice Fields					
	Land area	0.3728	13.875	5.172,000		
	Seeds	12.8571	6.000	77.142,600		
	An Organic fertilizer	8.6571	2.000	17.314,200		
	Organic fertilizer	88.8571	500	44.428,550		
	Drugs	1.1	14.500	15.950,000		
	Male labor	20.4285	25.000	510.712,500		
	Female workers	9.3428	20.000	186.856,000		
	Variabel Cost			857.575,850		
	Fixed cost			60.143,000		
	Total Cost			917.718,850		
	Production	386.7142	6000		2.320.285,200	2,52
2	Dry Land					
	Land Area	0.2740	13.875	3.801,700		
	Seeds	10.333	6.000	61.996,000		
	An Organic fertilizer	6.3703	2.000	12.740,600		
	Organic fertilizer	139.2592	500	69.629,600		
	Drugs	1.00	14.500	14.500,000		
	Male labor	12.0370	25.000	300.925,000		
	Female workers	8.8518	20.000	177.036,000		
	Variabel Cost			640.628,950		
	Fixed cost			34.444,000		
	Total Cost			675.072,950		
	Production	205.1851	6000		1.231.110.600	1,82

Source: Data processed

(1) Seedlings

The seedlings used by farmers in the soybean business in the study area are local seedlings, namely Smacking Kuning because according to them they have the potential to produce higher yields, short harvest age (73 days). These seeds are obtained by farmers, other than by cultivating themselves, they are also bought on the market, then good, whole seeds are selected.

According to the results of information from the respondent farmers in the field "Mr. Bambang Suseno, 55 years old and has had soybean farming experience for 21 years, that by cultivating his own seeds or buying on the market that has not been labeled will reduce production costs. And based on his experience during the soybean farming, he has not felt a failure in the soybean harvest. " Their assumptions are that even though the seeds used do not meet the specified standards (Distan), they still get a crop that they think is sufficient.

The average use of seedlings in soybean farming in research areas for Dry Land land is 10,333 kg, with the price of soybean seeds at Rp 6,000 / kg. So that the average amount of seed costs incurred by respondent

farmers is Rp 61,996,000 / work area. While the soybean farming in paddy fields the number of seeds used is an average of 12.8571 kg at a price of Rp. 6000, - / kg, so that the average cost of seedlings is Rp. 77,142,600 / cultivation area.

(2) Fertilizers

From the results of the study it turns out that all respondents use inorganic or chemical fertilizers and organic fertilizer (compost / stable). However, if seen from the amount of fertilizer used between An-organic and organic the ratio is quite large, both for respondents in Dry Land land and paddy fields. Where the use of organic fertilizer amounts more than the use of inorganic fertilizers. The average use of inorganic fertilizers in rice field respondents was 8,6571 kg with an average cost of Rp17,314,200 - / land area and organic fertilizer an average of 88,851 kg with an average cost of Rp 44,428,550 / land , and for respondents in Dry Land land the use of 6.3703 inorganic fertilizers is an average of kg with an average cost of Rp 12,740,600 / land area. While the use of organic fertilizer on respondents in Dry Land land was 139,2592 kg with an average cost of Rp 69,629,600 / land area.

(3) Medicines (pesticides)

Pest and disease control in soybean plants in the study area in general are pod sucking, grayak caterpillars and pod borer. To eradicate the respondents in the study area using Furadan, and Arivo, by spraying. The average medicine used by soybean respondent farmers in Dry Land land is 1.0 lt with an average cost of 14,500 / land area, while the respondents in paddy fields average 1.1 lt with average costs an average of Rp. 15,950,500 / land area. The low cost of the medicines used cannot be separated from the respondents' understanding of the dangers of excessive chemical drugs on their health and environment.

(4) Labor

The workforce used by the respondent in addition to using labor in the family also from outside the family. The level of wages that apply in the study area, namely male labor is Rp. 25,000./HOK and female labor is Rp. 20,000./HOK. Activities in soybean farming include land management, planting, fertilizing, spraying, weeding and harvesting. The use of manpower used in soybean farming in the study area for Dry Land land is an average of 12.0370 / HOK manpower with an average cost of Rp. 300,925,000, - / land area and female labor, an average of 8,8518 / HOK with costs an average of Rp 177,036,000 / land area. Whereas for the respondents of men labor fields, the average is 20.4285 / HOK with an average cost of IDR 510,712,500 / land area, and female labor is an average of 9.11 HOK with an average cost of IDR 188,571,000 Land area.

(5) Acceptance

Soybean production produced by soybean respondent farmers in Sukorejo District is the result of soybean during one growing season. In the study area, the average soybean production in soybean farming in paddy fields was 386.7142kg with a market price of Rp. 6000, - / kg so that the average acceptance of respondent farmers was Rp. 2,320,285 / land. Whereas on soybean farming in Dry Land land, the average soybean production obtained was 205,1851 kg with a selling price level in the market of Rp 6000, - / kg, so that the average income of soybean farmers in Dry Land land was Rp 1,231,110 ,.

(6) Efficiency

Efficiency of soybean farming obtained to farmers from: the amount of revenue obtained divided by the total costs incurred for the production process. In the soybean farming in Dry Land land obtained the level of efficiency or R / C ratio = 1.82 and in the wetland soybean farming an R / C ratio = 2.52. From these results it can be concluded that soybean farming in the study area is equally beneficial, but in paddy fields it is more profitable than in Dry Land land.

2. Analysis of the Cobb-Douglass Production Function of Soybean Farming

To analyze how the factors of production (input) that significantly affect soybean production in Sukorejo Subdistrict, Ponorogo Regency, used multiple regression analysis with the Cobb-Douglass production function which is transformed into natural logarithm (Ln) form. And the results of the analysis are listed in Table 6.

Table 6. Results of Regression Analysis of Production Function of Dry Land Farm Soybean Farming in Sukorejo District, Ponorogo Regency MH 1

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std.Error	Beta		
1	(Constant)	3.349	1.104		3.033	0.007
	Land Area	-.037	.158	-.051	-.234	0.818
	Seeds	.078	.191	.098	.409	0.687
	An Organic fertilizer	-.200	.204	-.156	-.978	0.340
	Organic fertilizer	.377	.160	.596	2.355	**0.029***
	Male labor	.155	.086	.301	1.815	0.085
	Female workers	.299	.187	.303	1.595	0.127
	Drugs	-.211	.139	-.262	-1.513	0.147

a. Dependent Variable: Ln Y (soybean production)

The regression equation obtained from the analysis of the Cobb-Douglas function using the SPSS 16 program for Dry Land farming is as follows:

$$\mathbf{Y=3.349-0.037x_1+0.078x_2-0.200x_3+0.377x_4+0.155x_5+0.299x_6-0.211x_7U}$$

From the results of testing the Cobb-Douglas function model used F count> F table with a 95% confidence interval ($\alpha = 0.05$), then Ha is accepted. Means there is a significant influence together of all independent variables on the dependent variable. The accuracy of this model can also be seen from the magnitude of the coefficient of determination (R^2) obtained close to 1, which is 0.651 so that it can be said the model used is more precise.

The results of the analysis in Table 6 can be partially interpreted as follows:

(1) Organic Fertilizer

For the organic fertilizer variable regression coefficient 0.377, this coefficient is statistically significant at the 95% confidence level, which is indicated by the calculated t value (= 2.355) greater than t table (= 2.052). So it can be interpreted that the use of organic fertilizer has a significant and positive effect on production, which means that the addition of the use of organic fertilizer will increase the amount of production, conversely if the amount of use of organic fertilizer is reduced, the amount of production will also be reduced.

Table 7. Results of Regression Analysis of Farming Soybean Production Function in Paddy Field in Sukorejo District, Ponorogo Regency MH1

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std.Error	Beta		
1	(Constant)	4.663	.652		7.152	.000
	Land area	.469	.100	.504	4.683	**.000***
	Seeds	.268	.106	-.039	2.533	**.017***
	An Organic fertilizer	-.080	.102	-.079	-.785	.439
	Organic fertilizer	-.100	.070	-.065	-1.419	.167
	Drugs	-.067	.059	.065	-1.135	.266
	Male Labor	.385	.117	.312	3.293	**.003***
	Female workers	.233	.090	.180	2.579	**.016***

a. Dependent Variable: Ln Y (soybean production)

The regression equation obtained from the analysis of the Cobb-Douglas function using SPSS 16 for paddy farming is as follows:

$$\mathbf{Y= 4.663+ 0.469x_1+0.268x_2-0.080x_3-0.100x_4-0.067x_5+0.385x_6+0.233x_7U}$$

From the results of testing the Cobb-Douglas function model used F count> F table with a 95% confidence interval ($\alpha = 0.05$), then Ha is accepted. Means that there is a significant influence together of all independent variables on non-independent variables, so that the model can be used to explain the effects of land area production factors, seeds, inorganic fertilizers, organic fertilizers, medicines, male labor , female labor integrated to production

The results of the analysis in Table 7 can be partially interpreted as follows:

(1) Land Area

For the area of land obtained a regression coefficient of 4.663, this coefficient is statistically significant at the 95% confidence level, which is indicated by the calculated t value (= 7.152) greater than t table (= 2.031). So it

can be interpreted that the use of land area has a significant and positive effect on production, which means that with the addition of land use, production will also increase, conversely if the amount of land use is reduced, the amount of production will also decrease.

(2) Seeds

For the seed variable the regression coefficient is 0.268, this coefficient is statistically significant at the 95% confidence level, which is indicated by the value of t arithmetic (= 2.533) greater than ttable (= 2.031). So that the use of seedlings (plant population) has a significant and positive effect on production, which means that increasing the use of seedlings (* plant population) is followed by an increase in the amount of production, conversely if the number of seedlings is reduced the amount of production will also decrease. The results of soybean farming research conducted by previous researchers on guard revealed that the number of seeds or plant populations significantly influence seed production (Enyi, 1973; Ball, Purcell and Vories, 2000; Epler and Staggenborg, 2008; Rahman and Hossain, 2011; Madanzi et al., 2012; Basol and Pecinovsky, 2014; Zhu et al., 2015; Matsuo et al., 2018).

(3) Male Workers

For the male labor variable regression coefficient 0.385, this coefficient is statistically significant at the 95% confidence level, which is indicated by the calculated t value (= 3.293) greater than t table (= 2.031). So it can be interpreted that the use of male labor has a significant and positive effect on production, which means that the increase in the use of male labor will be followed by an increase in the amount of production, conversely if the amount of use of male labor is reduced then the amount of production will also decrease. In the cultivation of soybean plants, usually male labor is used in the activities of soil processing, weeding, weed control and pest, and crop harvesting. The more manpower employed means better crop management, so that the growth and yield of soybean plants is better

(4) Female workers

For the female labor variable regression coefficient of 0.233, this coefficient is statistically significant at the 95% confidence level, which is indicated by the calculated t value (= 2.579) greater than t table (= 2.031). So it can be interpreted that the use of female labor has a real and positive effect on production. Thus, the increase in the use of female workers will be followed by an increase in the amount of production, conversely if the amount of use of female workers is reduced then the amount of production will also be reduced.

3. Efficiency Analysis of the Use of Production Factors (Input)

Efficient use of inputs for optimizing soybean farm income based on Marginal product value (NPM) and input price (Px). The results of the analysis of the efficiency of the use of inputs that affect production increase and optimization of soybean farm income in Sukorejo sub-district, Ponorogo district are presented in Table 8.

8. Efficiency Analysis Results of Using Inputs for Optimizing Revenue of Dry Land Farming and MH1 Soybean Farming

No	Variabel	Lahan Dry Land		Lahan Rice Fields	
		NPM/Pxi	t-hitung	NPM/Pxi	t-hitung
1	X1=Land area	32.373	4.381	44.850367	3.996
2	X2 = Seeds	19.856	2.053	30.077778	2.214
3	X3= An Organic fertilizer	96.627	-0.885	134.0099	-0.711
4	X4 = Organic fertilizer	17.680	-2.236	52.225080	-1.155
5	X5 = Drugs	84.904	-0.133	145.47245	-0.101
6	X6 = Male Labor	4.092	1.201	4.5432167	1.409
7	X7 = Female Workers	6.954	0.991	12.417431	1.694

From the results of the analysis of the efficiency of the use of input-production in upland and paddy field (NPM / Pxi) soybean farming it turns out that the value of NPM / Pxi> 1, means that in upland economically the allocation of production factors is not yet at the optimum level, meaning that if the use of production factors plus, the addition of the total output produced will be greater than the addition of the factor of production itself. Efforts to optimize farmland soybean farm income can still be done by the use of efficient production factors (inputs) and adjusted to the conditions of the land and soybean plants.

4. Environmental Conditions (Land and Water)

a. Paddy Fields

Rice field conditions in the study area are supported by technical irrigation systems. Preparation of rice fields that were used as uncultivated rice plants (without tillage = TOT). After the rice harvest, straw is left because straw can be used as mulch and mulch is very useful in maintaining soil moisture and suppressing weed growth. Then drainage / irrigation canal is made with a depth of 25-30 cm and a width of 30 cm, the distance

between the lines 2-5 cm. This channel serves to regulate water, so that water needs will be met. With fertile rice soil conditions and water conditions that can be adjusted according to the needs for the growth of soybean plants, the growth will be good so that the results achieved will also be good. The rate of profit of soybean farming in paddy fields in the dry season is usually greater than soybean farming in rainfed uplands (Rasiah and Kohl, 1991; Joseph, Siemens and Bullock, 1999; Onwualu and Ahaneku, 2001; Agele, Adenawoola and Doherty, 2004; Karam et al., 2005; Wingeyer, Echeverría and Rozas, 2014).

b. Dry Land Land

In general, soybean cultivation in Dry Land land is carried out simply, tillage is still minimal (Minimum Soil), that is, only with a hoe, crop water needs are met from rainwater (rainfed), so that in the dry season there may be a water deficit (stress water). This results in growth and yield of soybean plants can not be maximized; in the rainy season there is often excess water (standing water) so that it interferes with plant growth. Dry Land land soybean plants are also susceptible to pest disorders so that their production yields are lower than those of wetland soils (Foroud et al., 1993; Wilhelm and Wortmann, 2004; Temperly and Borges, 2006; Bhatia et al., 2008; Lasisi and Aluko, 2009; Obalum et al., 2011)

5. Sustainable soy farming

The sustainability of soybean farming in Sukorejo Sub-district, Ponorogo Regency is seen from three (3) aspects, namely ecological, economic and social aspects. From the results of the study can be explained as follows.

1. Ecological aspects. In general, the condition of the land in the study area is rice fields with technical irrigation, meaning that water needs can be regulated in accordance with the needs of plants and dry land (Dry Land and yard) whose irrigation is very dependent on rain water. Land conditions such as in the study area allow for soybean plants, because soybean plants can grow in various agroecosystems with different soil types, soil fertility, climate, and cropping patterns. Soybean does not demand a special soil structure as a growing requirement. Even in conditions that are less fertile and slightly acidic soya can grow well, provided the drainage conditions are good and there is no standing water. (Linkemer, Board and Musgrave, 1998; Heart et al., 2006; Zhou et al., 2012; Choi et al., 2016; Prince et al., 2016; Chen et al., 2017; Rahman et al., 2017).

2. Economic aspects. Economically, soybean farming in Sukorejo sub-district is profitable, this is evident from the results of the RC ratio analysis that soybean farming both paddy land and Dry Land land both have RC> 1, which means that soybean farming is profitable. In general, farmers say that soybean plants can provide additional income, because in addition to the cultivation of soybean plants that are easy also do not require large costs like other commodities in the management of their farming. Soybean crops can be grown in addition to monoculture but also intercropping with greater economic benefits (Barokah, 2011; Li et al., 2011; Hidayah, 2012; Chen et al., 2015; Yang et al., 2015; Zhu et al., 2015; Brookes, 2018).

3. Social aspects. Soybean plants in Sukorejo sub-district have been planted since decades ago and for generations. This is also supported by the results of interviews with respondents who said that the average soybean farming experience is more than 25 years. But in general the existence of soybean cultivation in Sukorejo District has been more than 50 years. The existence of soybeans is also proven by the recognition of local varieties soybean Ponorogo Smacking Yellow and Smacking Ijo that have long been cultivated by the community received recognition of national standards from the Ministry of Agriculture as native local superior products that have received a local variety registration certificate Number 64 / PV / 2008 dated December 9, 2008 (soybean Yellow Smacking variety) and Number 63 / PV / 2008 dated 9 December 2008 (soybean Smacking Ijo variety). This soybean farm has provided employment opportunities for farmers and rural farm laborers; they work in soybean farming to get income for their family life. Soybean farmer groups are usually also a group of paddy rice farmers, this social institution has implemented a good tradition in soybean farming in paddy fields and dry fields (Garrett, Lambin and Naylor, 2013; Weinhold, Killick and Reis, 2013; Heryanto, 2016; Nugrahana, 2016 Sujaya and Yusuf, 2017).

IV. Conclusion

Based on the results and discussion it can be concluded as follows:

1. Rice Fields and Dry Land soybean farming are equally efficient, for an efficiency of 2.52 wetland soybean farming and an efficiency level of 1.82 in Dry Land land farming.
2. The factors of production or input together affect production, but individually the inputs that have a significant effect on increasing soybean production in paddy fields are the area of land, seeds, male and female laborers, while in Dry Land land is fertilizer organic.
3. The use of allocation of production inputs in both paddy fields and Dry Land land has not been at the optimum level.
4. Soy farming in Sukorejo sub-district is sustainable.

References

[1]. Agele, S.O.; Adenawoola, A.R. and M.Doherty. 2004. Growth response of soybean lines to contrasting photothermal and soil moisture regimes in a Nigerian tropical rainforest. International Journal of Biotronics, 33: 49-64.

[2]. andA.SubbaRao

[3]. andA.SubbaRao

[4]. Anonymous . 2010. Berita Resmi Statistik Provinsi Jawa Timur, No. 40/07/35/Th.VIII, 01 Juli 2010

[5]. Anonymous, 2004b. Profil Kedelai *(Glycine max*). Ditjentan, Direktorat Kacang- Kacangan dan Umbi-umbian. 50 hlm

[6]. Anonymous. 2010. Pekan Kedelai Nasional Balitkabi, Malang, 28 - 30 Juni 2010.

[7]. Atman dan N. Hosen. 2008**.** Dukungan Teknologi dan Kebijakan Dalam Pengembangan Kedelai di Sumbar Jurnal Ilmiah Tambua Universitas Mahaputra Muhammad Yamin, VII (3): 347-359 .

[8]. Atman. 2009.Budidaya Kedelai lahan Rice Fields di Sumatra Barat. Jurnal Ilmiah Tambua VIII(1): 39 - 45**.**

[9]. Atman. 2006**.** Pengembangan kedelai pada lahan Rice Fields di Sumatera Barat. Jurnal lmiah Tambua Universitas Mahaputra Muhammad Yamin, V(3): 288-296.

[10]. Ball, R.A., L.C. Purcell and E.D. Vories, 2000. Optimising soyabean plant population for a short-season production system in the Southern USA. Crop Sci., 40: 757-764.

[11]. Barokah,U. 2011.Analisis Biaya Dan Pendapatan Usahatani Kedelai Di Kabupaten Sukoharjo. SEPA, 8(1) : 9 – 13.

[12]. Basol,T.L. and K.T.Pecinovsky. 2014. Effect of Plant Population and Row Spacing on Soybean Yield. Iowa State Research Farm Progress Reports. 2037. http://lib.dr.iastate.edu/farms_reports/2037

[13]. Bhatia,V.S. P.Singh, S.P.Wani, G.S.Chauhan, A.V.R.K.Rao, A.K.Mishra and K.Srinivas. 2008. Analysis of potential yields and yield gaps of rainfed soybean in India using CROPGRO-Soybean model. Agricultural and Forest Meteorology, 148(8-9): 1252-1265.

[14]. Brookes, G. 2018. The farm level economic and environmental contribution of Intacta **soybeans** in South America: the first five years. GM Crops Food. , 9(3): 140-151.

[15]. Chen, P., Q.Du, X.Liu , L.Zhou , S.Hussain , L.Lei, C.Song, X.Wang, W.Liu, F.Yang, K.Shu , J.Liu , J.Du , W.Yang , T.Yong. 2017. Effects of reduced nitrogen inputs on crop yield and nitrogen use efficiency in a long-term maize-soybean relay strip intercropping system. PLoS One. , 12(9): e0184503

[16]. Chen,G.R., W.Y.Yang , G.H.Zhang , L.M.Wang , R.P.Yang , T.W.Yong , W.G.Liu . 2015. Effects of potato/soybean intercropping on photosynthetic characteristics and yield of three soybean varieties. Ying Yong Sheng Tai Xue Bao, 26(11): 3345-3352

[17]. Choi D.H., H.Y.Ban, B.S.Seo, K.J.Lee and B.W.Lee. 2016. Phenology and Seed Yield Performance of Determinate Soybean Cultivars Grown at Elevated Temperatures in a Temperate Region. PLoS One, 11(11): e0165977.

[18]. ClimateChangeImpactsonRainfed

[19]. ClimateChangeImpactsonRainfed

[20]. Colby, M.E. 1990. "Environmental Managemen in Development: The Evolution Of Paradigms". World Bank Discussion Paper Number80. . The International Bank for Reconstruction and Development/The World Bank. Washington DC. U.S.A.

[21]. Darmawan, A. 1999. Analisis Pendapatan Usahatani Kedelai Serta Nilai Tambah Industri Tahu Dan Tempe (Kasus Desa Sindangratu Dan Situgede Di Kabupaten Garut Serta Kotamadya Bogor) Theses Fak. Ekonomi dan Manajemen IPB. Penerbit IPB (Bogor Agricultural University)

[22]. density in narrow row systems. Crop Management

[23]. density in narrow row systems. Crop Management

[24]. Dernberg, T.F. 1992.*Konsep Teori dan KebijakanMakroekonom*i,penerjemah Karyaman Muchtar, Erlangga, Jakarta

[25]. Enyi,B.A.C. 1973. Effect of plant population on growth and yield of soya bean(*Glycine max*). 81(1): 131-138

[26]. Epler, M., and Staggenborg, S. 2008. Soybean yield and yield component response to plant

[27]. Epler, M., and Staggenborg, S. 2008. Soybean yield and yield component response to plant

[28]. Epler,M. and S.Staggenborg. 2008. Soybean Yield and Yield Component Response to Plant Density inNarrow Row Systems. Crop Management, 7(1): 1-15.

[29]. Foroud,N.; Mundel, H.H.; Saindon, G. and Entz, T. 1993. Effect of level and timing of moisture stress on soybean yield components. Irrigation Science, 13: 149-155.

[30]. Garrett,R.D., E.F.Lambin and R.L.Naylor. 2013. Land institutions and supply chain configurations as determinants of soybean planted area and yields in Brazil. Land Use Policy, 31: 385–396.

[31]. Ghozali, I. 2009. Ekonometrika, Teori, Konsep dan Aplikasi SPSS 17. Penerbit Universitas Diponegoro. ISBN 978-979-704-761-0.

[32]. Gonzales,L.A., F.Kasryno, N.D.Perez and M.W. Rosegrant. 1993. Economic Incentives and Comparative Advantage in Indonesian Food Crop Production. Reseacrh Report 93. Int. Food Polycy. Resch. Inst.Washinton.DC.

[33]. Gunawan, H. dan R.Asnita. 2009. Peningkatan Keuntungan Usahatani Kedelai Melalui PTT di ojonegoro. Balai Pengkajian Teknologi Pertanian Jawa Timur

[34]. Hati,K.M., K.G.Mandal, A.K.Misra, P.K.Ghosh, K.K.Bandyopadhyay. 2006. Effect of inorganic fertilizer and farmyard manure on soil physical properties, root distribution, and water-use efficiency of soybean in Vertisols of central India. Bioresour Technol., 97(16): 2182-218.

[35]. Heryanto,R. 2016. Potensi dan Strategi Pengembangan Kedelai Mendukung Swasembada Berkelanjutan di Sulawesi Barat. Agros, 18(1): 24-32.

[36]. Hidayah,I. 2012. Analisis Kelayakan Finansial Teknologi Usahatani Kedelai Setelah Padi Rice Fields Di Desa Waekasar Kecamatan Mako, Kabupaten Buru. AGRIKA, 6(1): 1-11.

[37]. J.Somasundaram,R.Saha,R.K.Singh,R.S.Chaudhary,

[38]. J.Somasundaram,R.Saha,R.K.Singh,R.S.Chaudhary,

[39]. Karam, F.; Masaad, R.; Sfeir, T.; Mounzer, O. and Y.Rouphael. 2005. Evapotranspiration and seed yield of field grown soybean under deficit irrigation conditions. Agricultural Water Management, 75: 226-244.

[40]. Lasisi, D. and O.B.Aluko. 2009. Effects of tillage methods on soybean growth and yield in a tropical sandy loam soil. International Agrophysics, 23: 147-153.
[41]. Li, Z.X., J.W.Wang, W.T.Yang, Y.H.Shu, Q.Du, L.L.Liu, L.Shu. 2011. Effects of reduced nitrogen application on the yield, quality, and economic benefit of sugarcane intercropped with soybean. Ying Yong Sheng Tai Xue Bao, 22(3): 713-719.
[42]. Linkemer,G., J.E.Board and M.E.Musgrave. 1998. Waterlogging effects on growth and yield components in late-planted soybean. Crop Sci., 38(6): 1576-1584.
[43]. M.Mohanty,NishantK.Sinha,SangeetaLenka,K.M.Hati,
[44]. M.Mohanty,NishantK.Sinha,SangeetaLenka,K.M.Hati,
[45]. Madanzi,T., C. Chiduza, S.J. Richardson Kageler and T. Muziri. 2012. Effects of Different Plant Populations on Yield of Different Soybean (*Glycine max* (L.) Merrill) Varieties in a Smallholder Sector of Zimbabwe. Journal of Agronomy, *11: 9-16.*
[46]. ManagementStrategiesThrough
[47]. ManagementStrategiesThrough
[48]. Matsuo,N.,T.Yamada,Y.Takada,K.Fukami and M.Hajika. 2018. Effect of plant density on growth and yield of new soybean genotypes grown under early planting condition in southwestern Japan. Plant Production Science, 21(1): 16-25.
[49]. Nugrahana,G.,D.H.Sujaya, M.N.Yusuf. 2017. Analisis Usahatani Kedelai (Glycine Max) (Studi Kasus pada Kelompok Tani Harapan Maju Desa Cigugur Kecamatan Cigugur Kabupaten Pangandaran). Jurnal Ilmiah Mahasiswa AGROINFO GALUH, 4(2): 182-187.
[50]. Obalum,S.E., C.A.Igwe, M.E.Obi, T.Wakatsuki. 2011. Water use and grain yield response of rainfed soybean to tillagemulch practices in southeastern Nigeria. Sci. Agric. (Piracicaba, Braz.), 68(5): 554-561.
[51]. Onwualu, A.P. and I.E.Ahaneku. 2001. Conservation and conventional tillage effects on soil properties and soybean production. Agro-Science, 2: 26-36.
[52]. Prince,S.J., M.Murphy, R.N.Mutava, Z.Zhang, N.Nguyen, Y.H.Kim , S.M.Pathan, G.J.Shannon, B.Valliyodan, H.T.Nguyen. 2016. Evaluation of high yielding soybean germplasm under water limitation. J Integr Plant Biol., 58(5): 475-491.
[53]. Rahman, T., X.Liu , S.Hussain, S.Ahmed, G.Chen, F.Yang, L.Chen, J.Du, W.Liu, W.Yang. 2017. Water use efficiency and evapotranspiration in maize-soybean relay strip intercrop systems as affected by planting geometries. PLoS One, 12(6): e0178332
[54]. Rahman,M.M. dan M.M.Hossain. 2011. Plant Density Effects on Growth, Yield and Yield Components of Two Soybean Varieties under Equidistant Planting Arrangement. Asian Journal of Plant Sciences, 10(5): 278-286.
[55]. Ramlan. 2008. Strategi Pengembangan Komoditas Kedelai di Propinsi Bengkulu. Thesis Institut Pertanian Bogor. Master Theses from MBIPB / 2010-08-13 14:45:28
[56]. Rasiah,V. and R.A.Kohl. 1991. Water use by soybean in two soils with and without irrigation. Soil Technology, 4: 159-165.
[57]. SimulationModelling
[58]. SimulationModelling
[59]. Soekartawi, 1990. Teori Ekonomi Produksi dengan Pokok Bahasan AnalisisFungsi Cobb-Douglas.Rajawali Press, Jakarta.
[60]. Soekartawi.1995. Analisis Usahatani.Penerbit Universitas Indonesia. Jakarta
[61]. SoybeanYieldofCentralIndia:
[62]. SoybeanYieldofCentralIndia:
[63]. Subandi. 2007**.** Lima strategi pengembangan kedelai. Koran Sinar Tani Edisi 30 Mei-5Juni 2007.
[64]. Temperly, R.J. and R.Borges. 2006. Tillage and crop rotation impact on soybean grain yield and composition. Agronomy Journal, 98: 999-1004.
[65]. Weinhold,D., E.Killick and E.J.Reis. 2013. Soybeans, poverty and inequality in the Brazilian Amazon. World Development, 52: 132–143.
[66]. Wilhelm, W.W. and C.S.Wortmann. 2004. Tillage and rotation interactions for corn and soybean grain yield as affected by precipitation and air temperature. Agronomy Journal, 96: 425- 432.
[67]. Wingeyer,A.B.,H.Echeverría and H.S.Rozas. 2014. Growth and Yield of Irrigated and Rainfed Soybean with Late Nitrogen Fertilization. AJ., 106(2): 567-576
[68]. Yang, J.B., D.H.Peng, L.D.Qin, Y.X.Xing, Y.R.Li, L.T.Yang. 2015. Effects of sugarcane-soybean intercropping on cane yield, quality and economic benefit under low nitrogen condition. Ying Yong Sheng Tai Xue Bao, 26(5): 1426-1432.
[69]. Yusuf, R.I.; J.C.Siemens and D.G.Bullock. 1999. Growth analysis of soybean under no-tillage andconventional tillage systems. Agronomy Journal, 91: 928-933.
[70]. Zainul,M.A. 2010. Kelayakan Usahatani kedelai (Glycine max Merr) Sebagai Alternatif Upaya Peningkatan Keuntungan Petani di Jawa Timur. Theses Fak.Pertanian Universitas Jember. penerbit GDLHUB / **2010-07-21 10:51:27**
[71]. Zhou,Q., Y.Dong, Y.J.Bian, L.L.Han, Y.D.Tian, H.Xing, H.D.Jiang. 2012. Influence of different duration of waterlogging on the growth and C and N metabolism of soybean at seedling and flowering stages. Ying Yong Sheng Tai Xue Bao., 23(6): 1577-1584.
[72]. Zhu, Y.G., F.J.Gao , P.P.Cao , L.Z.Wang . 2015. Effect of plant density on population yield and economic output value in maize-soybean intercropping. Ying Yong Sheng Tai Xue Bao, 26(6): 1751-1758.
[73]. Zhu,Y.G., F.J.Gao, P.P.Cao and L.Z.Wang. 2015. Effect of plant density on population yield and economic output value in maize-soybean intercropping. Ying Yong Sheng Tai Xue Bao, 26(6):1751-1758.

Sri Sulastri, et. al. "Analysis of Sustainable Farming of Soybeans (*Glycine Max* L.) In Sukorejo, Ponorogo, East Java." *IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS),* 13(7), 2020, pp. 01-11.