PRODUCTION RISK OF PEANUT FARMING IN DRY LAND SECOND PATTERN AFTER CORN WITH BIOCHAR ON BLITAR DISTRICT, INDONESIA

Asnah\textsuperscript{1}, Masyhuri\textsuperscript{2} and Jangkung Handoyo Mulyo\textsuperscript{2,3}
\textsuperscript{1} Tribhuwana Tunggadewi University, Jl. Telaga Warna, Tlogomas Malang
\textsuperscript{2} Faculty of Agriculture, University of Gadjah Mada, Jl. Flora, Bulaksumur, Yogyakarta
\textsuperscript{3} Center for Population and Policy Studies, Jl. Tevesia, Bulaksumur, Yogyakarta
*E-mail: asnah.unitri@gmail.com, mmasyhuri@hotmail.com, JHandoyoM@gmail.com

Abstract. The reduction in land due to the transfer of functions from agriculture to non-agriculture, requires stakeholders to intensify the management of dry land and infertile land which was not originally a priority. Therefore, every opportunity for adaptive technology development needs to be utilized as well as possible to encourage increased productivity. This study aims to determine the impact of the use of biochar used in the first cropping maize farming on production and risk of production of the second cropping pattern of peanut farming in dry land. The study uses a basic survey method, by determining the location by purposive. The number of samples was 150 people determined by the proportional random sampling method. The data analysis method uses the production function model and the production risk function using the Cobb-Douglass ordinary least square (OLS) method. The results found that the use of biochar in the first cropping maize farming had an impact on the production and risk of the second cropping pattern of peanut production. As a comparison, the factors of production in peanut farming which previously had the effect of reducing production; in the second cropping pattern after maize had an effect on increasing production and reducing production risks include seeds, phosphor fertilizer, potassium fertilizer, pesticide, and labor in the family. Only workers outside the family have the effect of reducing production and increasing risk.

Keywords: Biochar; Peanut Farming; Second Pattern

INTRODUCTION

Agricultural politics is a combination of government attitudes and actions taken with the aim of influencing the course of the agricultural sector to be more productive, efficient, advanced and increase farmers' income and welfare more evenly [1]. Integration between agricultural development and agricultural politics as a policy instrument is needed, therefore, good, correct and sustainable farm management must be an important part of agricultural development activities. Agricultural development is an integral part of regional development and national development. The harmony between these developments should maintain, where regional development as part of national development must align with achieving increased
agricultural productivity, farmer welfare, suitability of agricultural land, market suitability and sustainability of production systems and environmental sustainability.

Along with the development and rate of industrial improvement, at present most of the land in Java has experienced degradation, which has an impact on decreasing soil fertility. Severely degraded land is the cause of the low productivity of plants. Referring to [2], the characteristics of degraded land base on variations in parent material. They are including: percentage of dust fraction on soil texture, type of land use / management, land slope and conservation; as well as variable chemical content, among others: soil acidity (pH), organic C, total N, availability of P, Ca, Mg, K, Na, cation exchange capacity (CEC), saturation level, Al and H. exchange. Dry land and degraded land are the same land have low fertility.

Differences in the characteristics of farming on fertile land and on dry land are clearly seen among others in the aspects of irrigation, land productivity and the extent and potential in Indonesia (Table 1). Areas with dry land have a larger amount than arable land, and as such must always look for opportunities to develop adaptive technology in their respective locations, so that they will be able to encourage increased land and plant productivity. The aim is to improve the welfare of farmers and prevent land use change, as well as avoid land abandonment, because of the transfer of the farmers' profession and migration to look for other better sources of income outside the region.

Dry land has great potential to develop, therefore efforts and strategies that can encourage increased productivity are needed. Research by [3], found that a strategy that needed to develop for peanut production in the dry land of East Sumba, East Nusa Tenggara, was to increase yields through intensive use of production factors and expansion of planting areas. In addition, intensive farming management strategies are also needed, by applying new superior varieties and planting technology, increasing business scale and cropping index.

Research conducted by the Research Institute for Bean and Tuber Crops Research Institute, [4] on acid dry land in Central Lampung, found that the assembling of cultivation technology has been able to increase peanut production by 18% to 83%. A variety of strategies in the management of dry land need to be done, especially those that are adaptive in order to be applied by farmers properly and successfully. The application of intercropping technology of groundnuts and shallots by [5], in Parigi Moutong, Central Sulawesi, found that variety had an important role in the success of farming in dry land, where the variety of Tuban and Bison peanuts, as well as Palasa local shallot varieties can produce the highest benefit with a B / C value > 1.

The use of adaptive technology in the development of peanuts on dry land, will greatly help farmers increase productivity which is expected, can take place in the long-run. The application of cultivation technology, which includes the regulation of cropping patterns, planting systems, intensive use of production factors, the use of superior seeds or a combination of these technologies, are expected to spur increased productivity and income of farmers. Therefore, this study was conducted, with the aim to determine the impact of the use of biochar as a production factor applied to maize on the first cropping pattern, on the production and production risk of peanut farming in the second cropping pattern.
RESEARCH METHODOLOGY

This research was conducted using a basic survey method [6], with the help of a research instrument in the form of a questionnaire as a guideline for data collection. Research locations in Kalitengah Village, Panggungrejo District, Blitar Regency, were selected using a purposive method, in accordance with [7]; and [8]; [9] and [10]. The number of samples was 150 people taken by proportional random sampling from 652 population members of the combined farmer groups.

The method of data analysis uses multiple regression analysis of the Cobb-Douglass OLS model. The mathematical formulation in the research data analysis method, follows [11]:

a. Production Function:
\[
\ln \text{Pro} = \beta_0 + \beta_1 \ln \text{Lhn} + \beta_2 \ln \text{Bnh} + \beta_3 \ln \text{PpkN} + \beta_4 \ln \text{PpkP} + \beta_5 \ln \text{PpkK} + \beta_6 \ln \text{PpkKd} + \beta_7 \ln \text{Pest} + \beta_8 \ln \text{TKDK} + \beta_9 \ln \text{TKLK} + e \quad \text{...} \quad (1)
\]

Information:
Formula (1) is used for the analysis of early season peanut farming (as a comparison) and the second cropping pattern (which is planted after corn with biochar).

\begin{align*}
\ln \text{Pro} & = \text{peanut production (kg)} \\
\ln \text{Lhn} & = \text{land area (ha)} \\
\ln \text{Bnh} & = \text{seed (kg)} \\
\ln \text{PpkN} & = \text{Nitrogen fertilizer (kg)} \\
\ln \text{PpkP} & = \text{Phosphor fertilizer (kg)} \\
\ln \text{PpkK} & = \text{Kalium fertilizer (kg)} \\
\ln \text{PpkKd} & = \text{the amount of manure (kg)} \\
\ln \text{Pest} & = \text{the amount of pesticide (ltr)} \\
\ln \text{TKDK} & = \text{the number of workers in the family (HKO)} \\
\ln \text{TKLK} & = \text{the number of workers outside the family (HKO)} \\
\beta_0 & = \text{intercept} \\
\beta_1-\beta_9 & = \text{estimator parameter coefficients} \\
e & = \text{error term(random / residual error)}
\end{align*}

b. Production Risk Function
\[
\varepsilon^2 = \theta_0 + \theta_1 \ln \text{Pro} + \theta_2 \ln \text{Lhn} + \theta_3 \ln \text{Bnh} + \theta_4 \ln \text{PpkN} + \theta_5 \ln \text{PpkP} + \theta_6 \ln \text{PpkK} + \theta_7 \ln \text{PpkKd} + \theta_8 \ln \text{Pest} + \theta_9 \ln \text{TKdk} + \theta_{10} \ln \text{TKlk} + e \quad \text{...} \quad (2)
\]

Information:
\[
\varepsilon^2 = \text{Residual squares of the production function}.
\]
RESULT AND DISCUSSION

Theoretically, the use of production factors expect to have a significant effect in increasing production and reducing production risk. However, in the empirical conditions, this study produced findings that were not entirely the same as the expected value as in the theory. The complete analysis result presents in (Table 2) and (Table 3).

The production risk function is obtained by analyzing the residual production function, which is squared and becomes the dependent variable, then regresses to all the independent variables by adding the production variable as the independent variable. The symbol or notation used in the analysis of the production function in the discussion of the results of this study is $f$, while the production risk function is given $h$ for the symbol.

The coefficient of determination on the results of the analysis of the production function of the first season peanut farming (as a comparison) and the second cropping pattern after corn farming with biochar, respectively 0.9821 and 0.9465. The magnitude of the coefficient of determination shows, the independent variables included in the model, namely: land area, seeds, nitrogen fertilizer, phosphorus fertilizer, potassium fertilizer, manure, pesticides, labor in the family and labor outside the family are able to explain the dependent variable first season peanut production and second cropping patterns respectively at 98.21 percent and 94.65 percent. While the remaining 1.79 percent and 5.35 percent, are explained by other factors outside the model.

In the production risk function, the coefficient of determination was 0.7287 in the first season and 0.9457 in the second cropping pattern after corn. Thus, the free variable of production, land area, seeds, nitrogen fertilizer, phosphorus fertilizer, potassium fertilizer, manure, pesticides, family labour and outside family labour, are able to explain the dependent variable production risk of 72.87 respectively percent in the first season and 94.57 percent in the second cropping pattern after corn. While the remaining 7.13 percent and 5.43 percent are explaining by other factors outside the model. Simultaneously, the selected independent variables included in the model both in the analysis of the production function and production risk function of peanut farming, based on the $f$ test (simultaneous test) have a significant effect on the variable depending on $\alpha = 1\%$ or a 99 percent confidence level.

Production factors that have a significant effect on the production of peanut farming in the first season are land area, seeds, phosphorus fertilizer, family labor and outside family labor. While the factors of production of nitrogen fertilizer, potassium fertilizer, manure and pesticides have no significant effect on production. Furthermore, in the second cropping pattern of peanut farming after maize, the factors of production that had a significant effect on production included land area, pesticides, family labor, and potassium fertilizer and outside family labor. While the factors of production that haveno significant effect were seed, nitrogen fertilizer, phosphorus fertilizer and manure.

Based on the results of individual analysis of the independent variables, production has a significant effect on production risk, on the first season of peanut farming and the second cropping pattern after corn with $\alpha = 1\%$ or a confidence level of 99 percent. A sign of positive expectation, which means that the risk of production in peanut farming increases with increasing production. The expected condition is that production increases but risk decreases, however in this research, result production risk increases with increasing production. Such conditions can occur due to the operation of demand and supply mechanisms or market mechanisms. As peanut production increases, so does the number of peanuts offered in the market. Assuming ceteris paribus, if the demand for peanuts in the market is in a fixed condition, an increase in the number of peanuts offered because of increased production will drive down the selling price of peanuts in the market. This means increasing the risk of production in the farming of dry land peanuts that must be borne by
farmers. [12] states that an increase in amount of goods offered to the market due to increased production, while demand remains, it would encourage a surplus, where the amount of goods offered is more than the amount of goods demanded so that the price of goods will fall. The decline in the selling price of output causes farmer income to decrease, thereby affecting the ability of farmers to finance further of the farming which will also decline.

The results of the analysis of the production function of the first season peanut farming and the second cropping pattern have a coefficient sign on the production function is positive and the risk function of production is negative or in accordance with the signs of hope and supporting theory. Thus, the variable land area increases production while reducing production risk. In the first season peanut farming, the coefficient of land area in the production function is 1.1055 and in the second cropping pattern is 0.7861, both of which have a significant effect on production with $\alpha = 1\%$ or a confidence level of 99 percent. Each increase in land area of 1 percent will increase production of 1.1055 percent in the first season and 0.7861 percent in the second cropping pattern.

In the production risk function, increasing the area of land will reduce the risk of production in peanut farming in dry land, respectively by 20.1086 percent in the first season with $\alpha = 1\%$ and 0.0695 percent in the second cropping pattern, even though in the cropping pattern second has no significant effect. The results of the study of [13], [14], are consistent with the results of the analysis on the risk of peanut farming production in the first season, and the second cropping pattern after maize; where land area has a positive effect on production and negatively affects production risk. In other words, land area has an effect on increasing production and reducing production risk. The results of the analysis on previous cropping patterns, increasing the area of land on corn farming with biochar showed significant results can increase production and production risk, whereas in the first season peanut farming, increasing land area significantly increases production while reducing production risk, and this is in accordance with a sign of expectation.

Seed as an independent variable has a significant effect on production and production risk in the first season of peanut farming, each with a significance level of 90 percent ($\alpha = 10\%$) and 99 percent ($\alpha = 1\%$). Each coefficient has a negative sign on the production function and positive on the production risk function. That is, increasing seeds by 1 percent will reduce production by 0.0640 percent and increase production risk by 1.9698 percent. At the farm level, the amount of peanut seeds per hectare is close to the recommended dosage. However, the results of this study found that adding seeds actually reduces production and increases production risk. Previous research conducted by [15] found that seed production factors were risk reducing or reduced risk, whereas in this study the results were risk increasing or increased production risk. It can be understood that differences in location and farm management can be a differentiating factor even though the variables used are the same.

The nitrogen fertilizer variable in the first season of peanut farming and the second cropping pattern after corn with biochar had no significant effect on both the production function and the production risk function. While the variable phosphorus fertilizer used by farmers in the first season of peanut farming has a significant effect on production and production risk at a 99% confidence level ($\alpha = 1\%$). The coefficients respectively - 0.1461 in the production function and 3.6895 in the production risk function, which can be interpreted as the addition of phosphorus fertilizer 1 percent, will reduce the production of peanut first season by 0.1461 percent and increase production risk by 3.6895 percent. In this case, although the peanut is cultivated on the same land as corn in the previous cropping pattern, the impact of the use of phosphor fertilizer on plant growth and yield is different. The cause of the difference in response is the difference in crop needs for macro nutrients derived from phosphorus.
Adding nutrients to the soil through fertilization activities is carried out based on soil and plant, which needs for nutrients. Nutrient needs in soil and plants can be fulfilled from nature or through fertilization during cultivation. If the availability of nutrients is sufficient, then the addition is not necessary. [16] explained in a study conducted that the soil supplies 13 important nutrients, out of 16 essential nutrients needed for plant growth, especially food crops, however the presence of these nutrients does not always explain that the characteristics of the soil / land it is fertile. This indicates, land fertility is site specific or crop specific. Thus, the difference in the response of phosphorus fertilization to the two commodities cultivated on the same land, but with different seasons, can occur as the results of this study. In the second cropping pattern, the use of phosphorus fertilizer even though it has a coefficient mark as expected but does not significantly influence both production and production risk. The use of phosphorus fertilizer as a macro nutrient element, gave impacts both the soil and plants. The research of [17] in Research Institute for Agricultural Research and Development, discussed the important role of phosphorus / pospat fertilizer. It was found, the role and function of these fertilizers in the process of respiration and photosynthesis, nucleic acid preparation, formation of plant seeds and fruit producers, is stimulating root development, so plants will be more resistant to drought, and speed up the harvest so that it can avoid the risk of delay in harvest time.

Potassium fertilizer variable in the analysis of the production function of peanut farming in the second cropping pattern after corn with biochar, has a significant effect on production at a 95% confidence level (α = 5%). The regression coefficient of -0.0154 shows and increase of 1 percent potassium fertilizer will reduce peanut production by 0.0154 percent. On the other hand, the analysis of the risk function of the variable potassium fertilizer did not significantly influence peanut farming in both the first season and the second cropping pattern after corn.

In the empirical condition, potassium fertilizer is not widely used by farmers, (the dose of its use is still far below the recommended dose). Habits of farmers at the study site do not use potassium fertilizer in farming, even if using only a little. This is understandable given the relatively high price of non-subsidized potassium fertilizer so that not all farmers consider it important to use it. The research location is an area with rocky dry land conditions and topography varies from flat to hilly, and contains minerals, so that the most likely land already has potassium content naturally. Thus, the addition of doses to a certain extent will reduce production. The activity can be carried out by farmers is to add soil enhancers to increase potassium absorption. Thus, the use of biochar needs to do consistently. The average use of biochar in the previous cropping corn farming pattern is still below the recommended dosage of agronomic research results, where the average farmer uses only 1.2 tons per hectare, while the recommended dosage is 30-50 tons per hectare.

The use of variable labor within and outside the family in peanut farming has a coefficient sign in accordance with the sign of expectation. In the first season, the coefficient on the production function is -0.0633 for labor in the family, which means an increase of 1 percent of labor in the family will reduce production by 0.0633 percent. On the other hand, the coefficient for labor outside the family is 0.0484, which means an additional 1 percent of labor outside the family will increase production by 0.0484 percent, both of which have a significant influence on the level of confidence of 95 percent (α = 5%). In the second cropping pattern the coefficients in the production function are 0.0881 for the use of labor in the family and -0.0559 for workers outside the family, both of which are significant at 90 percent confidence level (α = 10%). The coefficient resulting from the analysis shows that the addition of 1 percent of labor in the family will increase production by 0.0881 percent, and the addition of 1 percent of labor outside the family will reduce production by 0.0559 percent. In the analysis of the risk function of the first season's production, the use of labor in
the family has a coefficient of 1.2146 and labor outside the family is -0.9923, significant at 99 percent confidence level ($\alpha = 1\%$). Whereas in the second cropping pattern only the use of labor outside the family has a significant effect on production risk at a 95% confidence level ($\alpha = 5\%$), with a coefficient of 0.0271. Thus, the addition of 1 percent of labor in the family will increase production risk by 1.2146 percent, but the use of labor outside the family reduces the risk of production by 0.9923 percent, in the first season. Whereas in the second cropping pattern, the addition of 1 percent of the use of labor outside the family which had a significant effect in reducing production also had a significant effect on increasing production risk by 0.0271 percent. The results of this study are consistent with the results of other studies conducted by [13], that labor increases risks both in organic and conventional farming.

At the farmer level, the use of labor in peanut farming also indicates to be excessive. Thus, what needs to be increased is the allocation of labor usage, and not the addition of the physical number of workers. The existence of farmer groups where farmers are bound to be members in it has many benefits of cooperation in various activities. Therefore, in every start farming habits in cooperation also carry over to the use of labor in farming. The release of the head of the Central Statistics Agency [18] in Tempo 5 May 2017, which was also strengthened by data from the Indonesian Central Statistics Agency (2017), stated that the number of people working in the agricultural sector was still quite large (39.68 million), albeit with lower wage rates compared to other sectors. The number of labor absorbed in the agricultural sector during the period of February 2016 to February 2017 increased by 0.12 percent. Thus, these conditions have contributed to the results of this study. The results of other studies that are consistent with this study and found that labor variables have a significant effect on production include conducted by [19]; [14]; [20]; and [21].

The use of pesticide input variable only significantly influences the production function and risk function of the second cropping pattern of peanut farming, with a 95 percent confidence level ($\alpha = 5\%$), a regression coefficient of 0.0679, which means that adding 1 percent of pesticides will increase production 0.0679 percent. While the production risk function is significant at a 90 percent confidence level ($\alpha = 10\%$), the regression coefficient of -0.1189 indicates that the addition of a 1 percent pesticide that can increase production will also reduce production risk by 0.1189 percent. This research is in accordance with the expected sign, where the addition of pesticide inputs can increase production while reducing risk.

Empirically, farmers use pesticides in amounts that are classified as low as or, even lower than the recommended dosage. Farmers are wise enough to use pesticides so that they have a good impact on farming management, this is because in addition to reducing production costs can also avoid the adverse effects of immunity on plant-disturbing organisms, predator deaths and environmental damage as a result of excessive use of pesticides. Thus, the use of pesticides in dryland peanut farming can still be increased and can increase production while reducing risk. [22], that pesticide is able to control plant-disturbing organisms (OPT) and effectively save crop losses conducted the study in accordance with the results of this study. On the other hand, [23] suggests that the use of pesticides in the field needs to follow the correct procedures to ensure safety and increase the effectiveness of use.

The variable manure only has a significant effect on the risk function of peanut farming production second cropping pattern after corn with biochar, at a 90% confidence level ($\alpha = 10\%$). The regression coefficient of -11.1189 means that the addition of manure 1 percent will reduce the risk of peanut production by 0.1189 percent. Although no significant effect, the use of manure has the potential to increase the production; it is seen from the regression coefficient that has a positive sign of hope. The need for manure in one hectare of land according to the guidelines for cultivating peanuts in agrokomplek [24], ranges from five
to 10 tons per hectare. The use of techniques was given at the same time as planting. Empirically, the use of manure can still increase; by given the dose at the farm level is still very low. [13] in their study found that the use of animal manure inputs increases the risk of organic farming, but reduces the risk of conventional farming.

Biochar was using by farmers in the previous cropping corn farming. The use of biochar has a significant effect on increasing corn production, and has the potential to reduce production risk. This shows, in the regression coefficient, which has a negative expectation sign. Although empirically the use of biochar is still far below the standards and recommendations of the results of previous agronomic research. However, the willingness and willingness of farmers to produce and use biochar in managed farms is an important positive thing to appreciate. The benefits gained in the short term can motivate farmers to obtain greater benefits in the end.

Biochar used by farmers in the previous cropping corn farming also had a good effect on the production of second cropping peanuts after corn, where there was an increase in production of 11.90 percent from 898.97 kg / hectare the previous season, to 1,005.95 kg / hectare in the second cropping pattern after corn farming with biochar. Several researchers in previous studies, both physically and biologically, have conveyed the positive impact of using biochar. The impact of the use of biochar on improving soil quality, including soil acidity (pH), cation exchange capacity (CEC) of soil physical properties and field capacity by providing biochar of more than 50 tons per hectare was found by [25]. Whereas the increase in production due to the impact of the use of biochar was reported by [26] and [27]. In his study found the benefits of biochar in improving the physical properties of the soil. Furthermore, [28] also found the use of charcoal as ameliorant to improve the physical and chemical properties of tropical soils, whereas in another study [29], reported the impact of biochar on improving soil biological properties.

CONCLUSION

The use of biochar as a soil amendment in the first cropping maize farming has a positive impact on the farming of the second cropping peanut after maize. The positive impacts in question include increasing peanut production 11.90 percent, increasing the quality of nutrient uptake so that the variable use of fertilizer production factors, which initially had a significant effect on reducing production, in the first season of peanut farming, changed to increase production, on peanut farming the second cropping pattern after corn farming with biochar. Manure which initially had no significant effect on production risk,
turned into a significant effect reducing production risk in the second cropping pattern after corn farming with biochar. The pesticides, which were initially having a significant effect on increasing production risk, have changed to significantly reduce production risk. There is a substitution of land production factor with seed that leads to intensification, where in the first season increases production, but in the second cropping pattern after maize farming with biochar turns into a significant effect in reducing production. However, there is a change in production risk from the initial significant effect of increasing risk, to reduce risk, although not significant. On the other hand, the seed, which initially had a significant effect on reducing production, changed to significantly increase the production, so that the substitution of adding seeds did not need to be followed by additional land, due to the functioning of biochar as an amendment, resulting in intensification of the use of seed inputs. Likewise, the use of labor in families substituted with workers outside the family, so there is no need to increase the physical number of workers, but it is necessary to increase the allocation of use.

REFERENCES

[1] Hanafi Rita, *Pengantar Ekonomi Pertanian*. Yogyakarta: Andi, 2010.

[2] B. S. dan O. H. Sitorus, S.R., “Kriteria dan Klasifikasi Tingkat Degradasi Lahan di Lahan Kering A Preliminary Criteria and Classification of Land Degradation Level on Dryland Study : Dryland in Bogor Regency ) Degradasi lahan adalah proses penurunan produktivitas Proses degradasi lahan,” *J. Tanah dan Iklim*, vol. 34, 2011.

[3] F. Rozi and I. Sutrisno, “Peluang Pengembangan Kacang Tanah Di Lahan Kering Nusa Tenggara Timur,” *Bul. Palawija*, vol. 14, no. 2, pp. 71–77, 2016.

[4] BALITKABI, “Hasil Kacang Tanah di Lahan Kering Masam Meningkat Hingga 80 Persen. Retrieved from https://balitkabi.litbang.pertanian.go.id/berita/hasil-kacang-tanah-di- lahan-kering-masam-meningkat-hingga-80-persen/,” p. 1, 2009.

[5] A. I. dan S. Syafruddin, “Adaptasi bawang merah dan kacang tanah pada lahan kering di parigi moutong, sulawesi tengah,” *J. Pengkaj. dan Pengemb. Teknol. Pertan.*, vol. 21, no. 1, pp. 25–35, 2018.

[6] Sugiyono, *Metode Penelitian Bisnis*. Alfabeta, 2008.

[7] Masri Singarimunb dan Sofian Effiedie, *Metode Penelitian Survei*. Jakarta: LP3ES, 1989.

[8] S. Arikunto, *Prosedur Penelitian, Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta, 2010.
[9] M. Nazir, *Metode Penelitian*. Jakarta: Ghalia Indonesia, 2011.

[10] B. Bungin, *Metodologi Penelitian Kuantitatif*, Edisi Kedu. Jakarta: Kencana Prenada Media Group, 2005.

[11] R. E. Just and R. D. Pope, “Production Function Estimation and Related Risk Considerations,” *Am. J. Agric. Econ.*, vol. 61, no. 2, pp. 276–284, 1979.

[12] N. Gregory Mankiw, “CONSUMER DURABLES MD THE REAL INTEREST RATE,” vol. 1148, no. 1148, p. 240, 1983.

[13] M. D. C. and A. O. L. Gardebroek, Cornelis, “Analysing Production Technology and Risk in Organic and Conventional Dutch Arable Farming Using Panel Data,” *J. Agric. Econ.*, vol. 61, no. 1, pp. 60–75, 2010.

[14] J. dan S. Rinaldi, “Analisis Risiko Produksi dan Faktor yang Mempengaruhi Pada Usahatani Kakao di Bali,” in *Prosiding Seminar Nasional : Kedaulatan Pangan dan Pertanian*, 2014, pp. 637–642.

[15] K. E. Sularso, “Usahatani kentang dengan teknik konservasi teras bangku di dataran tinggi di kabupaten wonosobo jawa tengah (,” *J. Pembang. Pedesaan*, vol. 10, no. 2, pp. 115–127, 2010.

[16] A. F. Handayanto, Eko., Nurul Muddarisna, *Pengelolaan Kesuburan Tanah*. Malang: Universitas Brawijaya Press, 2017.

[17] Normahani, “Mengenal Pupuk Fosfat dan Fungsinya bagi Tanaman,” *Balai Penelit. Pertan. Lahan Rawa*, no. May 2015, pp. 2015–2017, 2015.

[18] Suharyanto, “Sektor Pertanian Serap Banyak Tenaga Kerja,” *Tempo, bisnis*, p. 2017, 2017.

[19] Junaedi, “Efisiensi Produksi, Perilaku Petani dan Daya Saing Usahatani Kapas Rakyat di Sulawesi Selatan,” Universitas Gadjah Mada, 2013.

[20] S. H. S. dan A. P. Kusnadi, Nunung, Netti Tinaprilla, “Analisis Efisiensi Usahatani Padi di Beberapa Sentra Produksi Padi di Indonesia,” *J. Agro Ekon.*, vol. 29, no. 1, pp. 25–48, 2011.

[21] S. H. dan S. Kurniawan, A.Y., “Analisis Daya Saing Usahatani Jagung pada Lahan Kering di Kabupaten Tanah Laut,” *J. Forum Pascasarj.*, vol. 31, no. 2, pp. 93–103, 2015.

[22] Sudarmo, *Pestisida*, vol. 43, no. 8. 1991.

[23] R. C. Loehr, “Pollution Control for Agriculture,” in *ebook elsevier*, Second Edi., Elsevier, 1984, p. 467.

[24] Tim, “Pedoman Budidaya Kacang Tanah (Arachis hypogaea L),” *Agrokomplekskita*, 2017.

[25] K. Y. Chan, L. Van Zwieten, I. Meszaros, A. Downie, and S. Joseph, “Agronomic values of greenwaste biochar as a soil amendment,” *Aust. J. Soil Res.*, vol. 45, no. 8, pp. 629–634, 2007.
[26] M. Yamato, M., Okimori, Y., Wibowo, I.F., Anshori, S. And Ogawa, “Effects of The Application of Charred Bark of Acacia Mangium on The Yield of Maize, Cowpie and Peanut and Soil Chemical Properties in South Sumatera Indonesia,” *J. Soil Sci. Plant Nutr.*, vol. 52, pp. 489–495, 2006.

[27] K. Y. Chan, L. Van Zwieten, I. Meszaros, A. Downie, and S. Joseph, “Using poultry litter biochars as soil amendments,” *Aust. J. Soil Res.*, vol. 46, no. 5, pp. 437–444, 2008.

[28] B. Glaser, J. Lehmann, and W. Zech, “Ameliorating physical and chemical properties of highly weathered soils in the tropics with charcoal - A review,” *Biol. Fertil. Soils*, vol. 35, no. 4, pp. 219–230, 2002.

[29] M. A. Rondon, J. Lehmann, J. Ramírez, and M. Hurtado, “Biological nitrogen fixation by common beans (Phaseolus vulgaris L.) increases with bio-char additions,” *Biol. Fertil. Soils*, vol. 43, no. 6, pp. 699–708, 2007.

[30] Haryono, “Tema : ' Intensifikasi Pengelolaan Lahan Suboptimal dalam Rangka Mendukung Kemandirian Pangan Nasional ' Palembang , 20-21 September 2013,” in *Intensifikasi Pengelolaan Lahan Suboptimal dalam Rangka Mendukung Kemandirian Pangan Nasional*, 2013, no. September, pp. 20–21.

[31] R. Efendi, “Mempertahankan dan meningkatkan produktivitas lahan kering dan produksi jagung dengan sistem penyiapan lahan konservasi,” pp. 978–979, 2009.

[32] Anonymous, “Kabupaten Blitar Dalam Angka,” Kabupaten Blitar, 2013.

[33] E. R. Walpole, *Introduction to statistics*. 1968.
Table 1. Difference between Fertilization and Dryland Farming

| Characteristic | Fertile Land | Dry Land |
|----------------|--------------|----------|
| Irrigation     | Technical irrigation, semi-technical, simple | Rainfed |
| Fertility      | Generally fertile, not easily degraded/damaged | Generally, less fertile and easily degraded |
| Productivity   | Moderate to high and generally can be maintained. | In general, low to moderate and easily reduced |
| Production     | In general, moderate to high, can be maintained and improved. | In general, low to moderate, and easy to decline and difficult to increase. |
| Potentials (Large) | Moderate to large but continues to decline | Large and many are not yet optimally managed, and continue to decline |

Source: [30], [31] and [32].
Table 2. Production Function and Risk Function of Farming in the First Season Dry Peanut Farming.

| Production (f) | Coefficient | T-Ratio |
|---------------|-------------|---------|
| C             | 7.6779***   | -141.3030*** |
| Land area     | 1.1055***   | -20.1086*** |
| Seed          | -0.0640*    | 1.9698*** |
| Nitrogen fertilizer | 0.0103 | -0.0869 |
| Phosphor fertilizer | -0.1461*** | 3.6895*** |
| Kalium fertilizer | -0.0031 | 0.0361 |
| Manure        | 0.0004      | 0.0215 |
| Pesticide     | -0.0036     | 0.1895 |
| Family labour | -0.0633***  | 1.2146*** |
| Outside family labour | 0.0484** | -0.9923*** |
| R-squared     | 0.9821      | 0.7287 |
| Adjusted R-squared | 0.9809 | 0.6827 |
| F-statistic   | 854.8655    | 15.8485 |
| Prob(F-statistic) | 0.0000 | 0.0000 |

Source: Primary Data Processed (2016)
Information:

***) Significant at the level $\alpha = 1\%$  
***) t-table $\alpha = 1\% = 2.576$

**) Significant at the level $\alpha = 5\%$  
**) t-table $\alpha = 5\% = 1.645$

*) Significant at the level $\alpha = 10\%$  
*) t-table $\alpha = 10\% = 1.282$ [33].
Table 3. Production Function and Risk Function of Peanut Farming on Dry Land Second Cropping Pattern after Corn

| Variable                 | Coefficient | T-Ratio |
|--------------------------|-------------|----------|
| **Production function (f)** |             |          |
| C                        | 5.8167***   | 8.0469*** |
| Land area                | 0.7861***   | -0.0695  |
| Seed                     | 0.1137      | 0.0247   |
| Nitrogen fertilizer      | 0.0156      | -0.1379  |
| Posphor fertilizer       | 0.0576      | -0.0038  |
| Kalium fertilizer        | -0.0154**   | 0.0009   |
| Manure                   | 0.0050      | -0.0774***|
| Pesticide                | 0.0679**    | -0.1189* |
| Family labour            | 0.0881*     | 0.0327   |
| Outside family labour    | -0.0559*    | 0.0271** |
| **Risk function (h)**    |             |          |
| C                        | 1.1885***   |          |
| Land area                | -0.0695     |          |
| Seed                     | 0.0247      |          |
| Nitrogen fertilizer      | 0.2395      |          |
| Posphor fertilizer       | 0.8298      |          |
| Kalium fertilizer        | -1.8866     |          |
| Manure                   | -0.0774***  |          |
| Pesticide                | 1.9343      |          |
| Family labour            | -1.5065     |          |
| Outside family labour    | 1.0059      |          |

R-squared 0.9465 0.9457
Adjusted R-squared 0.9430 0.9369
F-statistic 275.3257 107.9095
Prob(F-statistic) 0.0000 0.0000

Source: Primary Data Processed (2016)
Information:
***) Significant at the level of \( \alpha = 1\% \) t-table \( \alpha = 1\% = 2.576 \)
**) Significant at the level of \( \alpha = 5\% \) t-table \( \alpha = 5\% = 1.645 \)
*) Significant at the level of \( \alpha = 10\% \) t-table \( \alpha = 10\% = 1.282 [33] \).