

RESEARCH ARTICLE

THE BALANCE OF N, P, AND MANURE FERTILIZER DOSAGE ON GROWTH AND YIELD OF PEANUTS IN ALFISOLS DRYLAND

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ABSTRACT

Peanuts cultivation in Alfisols dryland limited by low levels of soil fertility. An agricultural intensification that could be done is application of organic and inorganic fertilizer. This research aimed to study the balance of N, P, and manure fertilizer dosage on growth and yield of peanuts in alfisols dryland. The research was done in April 2014 - September 2014 in Sukosari, Jumantono, Karanganyar. This research was compiled using a Randomized Completely Block Design (RCBD) factorial with three factors, there are dose of urea, SP-36 and cow manure fertilizer. The results showed that the dose combinations of urea, SP-36, and cow manure fertilizer have no interaction affected all of variable plant. The application of 300 kg ha⁻¹ SP-36 fertilizer increased the number of pods and weight of pods, while the weight of 1000 seeds was improved by application of 150 kg ha⁻¹ urea fertilizer.

Keywords: Peanut, Dryland, Alfisols

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INTRODUCTION

Peanuts (*Arachis hypogaea* L.) are annual plant whose strategic role in national food as a source of protein and vegetable oils (Silahooy 2008). In 2015 total consumption of peanuts are predicted to increase 0.297 kg/capita up 9.53% (PUSDATIN 2014). This increasing demand has not been fulfilled yet caused by the low productivity. Increased productivity of peanut need to be developed in dryland.

The Central Department of Statistics (2013) reported decline in peanuts production during the last five years in Indonesia, which is 777.888 ton in 2009 to 701.585 ton in 2013. The increase in productivity of peanuts need to be developed in paddy fields and dryland.

Arinong et al. (2006) stated that approximately 60% of peanut farming in Indonesia is in the dryland and the remaining 40% in paddy fields. Dryland is a potential opportunity that could be developed to increase peanuts production because most of dryland has not been cultivated optimally.

Low levels of soil fertility such as acid soil pH, high content of Al and Fe are faced in peanuts cultivation on alfisols dryland. These could be solved by fertilization using organic and inorganic fertilizers. Selection of the type and dose of fertilizer can increase crop productivity significantly. Therefore, This research aimed to study the balance of N, P, and manure fertilizer dosage on growth and yield of peanuts in alfisols dryland.

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MATERIAL AND METHODS

This research was done in April 2014 - September 2014 in Sukosari, Jumantono, Karanganyar. Soil analysis has done in the Laboratory of Chemistry and Soil Fertility and plant analysis has done in the Laboratory of Ecology and Management of Plant Production (EMPT), Faculty of Agriculture, University of Sebelas Maret Surakarta.

Materials used in this research are the peanut seeds (Kancil Varieties), urea, SP-36, cow manure, and chemicals for soil analysis. Tools used in this research are the hoe, drill, tape measure, raffia, analytical balance, oven, and tools for laboratory analysis.

The research was compiled using a Randomized Completely Block Design (RCBD) factorial with three factors. The first factor was the dose of N fertilizer (urea), three levels are N1 (50 kg ha⁻¹), N2 (100 kg ha⁻¹), and N3 (150 kg ha⁻¹), the second factor was the dose of P fertilizer (SP-36), three levels are P1 (100 kg ha⁻¹), P2 (200 kg ha⁻¹), and P3 (300 kg ha⁻¹), and the third factor was the dose of cow manure fertilizer, three levels are D1 (10 ton ha⁻¹), D2 (20 ton ha⁻¹), and (30 ton ha⁻¹). Each treatment was repeated two times, so there are 54 plots treatment.

The observed variables of plants are plant height, dry straw, number of pods, weight of pods, and weight of 1000 seeds. The data were analyzed using analysis of variance (Anova) level of 5%, then continued by using DMRT (Duncan Multiple Range Test) level of 95%.

RESULT AND DISCUSSIONS

Characteristics of Soil Analysis

Results of soil analysis dryland in Sukosari, Jumantono, Karanganyar presented in Table 1.

Based on the results of soil analysis (Table 1) can be explained that the soil has low nutrient content is the acid soil pH 5.0; Low 15.70 KPK cmol(+)/kg; low organic matter 1.01%; N Total Low 0.12%; available P is very low 2.33 ppm; and available K is low 0.21 me/100 g. Than and Egashira (2008) states that acid soil Alfisols, P sequestered by Al, Fe, and clays. The results are consistent with the statement Minardi (2002) that in general soil total N Alfisol have low, available P is very low and available K is currently, it is necessary the addition of these elements in large quantities to maintain optimal plant growth.

Effect of Treatment on Plants Variable

Plant Height

Plant height is indicator of the most easily recognized in measuring plant growth. Plant height measurements carried out every two weeks from 2 to 8 MST. Based on the analysis of variance for plant height, the dose combination of urea, SP-36, and cow manure fertilizer not significantly affect plant height of peanuts. The dose of urea and SP-36 fertilizer significant effect on plant height peanut 8 MST, independently (Figure 1).

Dose combination of urea 100 kg ha⁻¹

Table 1. Preliminary Results of Soil Analysis

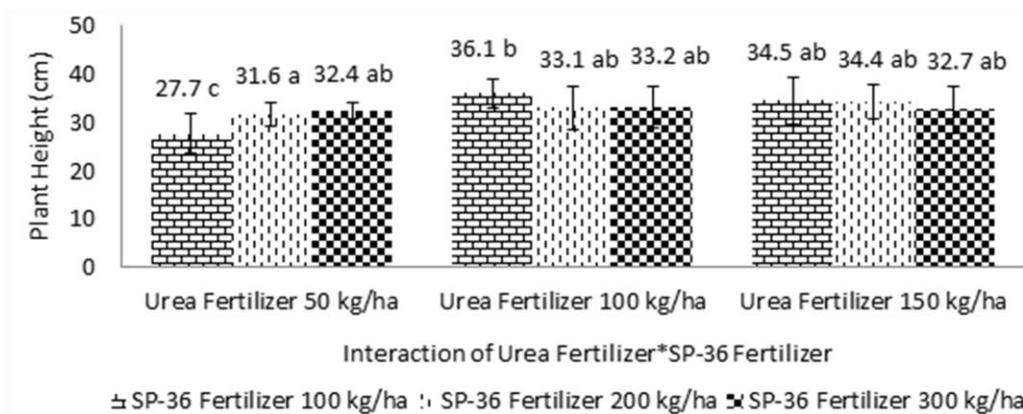
No	Chemical Soil Properties	Result	Unit	Rate
1	Soil pH	5.0	-	Acid*
2	KPK	15.70	cmol(+)/kg	Low*
3	Organic Matter	1.01	%	Low*
4	Total N	0.12	%	Low*
5	Available P	2.33	ppm	Very Low*
6	Available K	0.21	me/100 g	Low*

Remarks: * Rate according Soil Research Institute Bogor (2005)

and SP-36 100 kg ha⁻¹ showed the highest plant height (36.1 cm) and combination of urea 50 kg ha⁻¹ and SP-36 100 kg ha⁻¹ showed high Lowest crop (27.7 cm). Dose combination of urea 50 kg ha⁻¹ and SP-36 100 kg ha⁻¹ (27.7 cm) showed significantly different responses with dose combination of urea 50 kg ha⁻¹ and SP-36 200 kg ha⁻¹ (31.6 cm) and combination of urea 50 kg ha⁻¹ and SP-36 300 kg ha⁻¹ (32.4 cm).

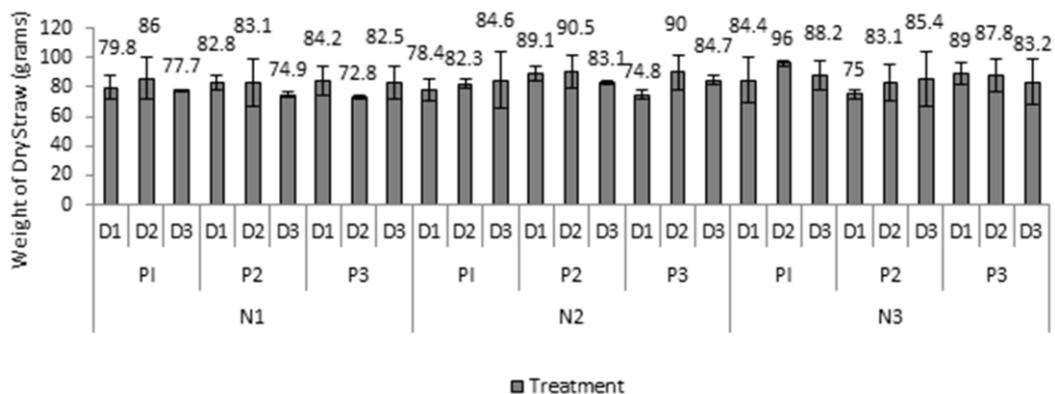
Peanuts able to fulfill the needs of N that is needed to stem growth through fixation by nodule. Fertilizer N on peanuts intended to support early growth. Nitrogen

Needs then expected to fix N from the air with the help of the simbiose rhizobium bacteria in root nodules (Ispandi Anwar 2002). Furthermore Gardner et al. (1991) cit. Andi et al. 2013 adding that in general the use of nitrogen in plants capable of generating more rapid vegetative growth, increase the length of the rod, increases the size of the leaves and provide greener leaf color. In addition, element P can activate cell division in plants growing point and the development of network of vessels that will affect the growth of plant height.



Remarks: Figures on the same column followed by the same letter are not significantly different shows at the level of 95%

Figure 1. Effect of Dose Combination of Urea and SP-36 Fertilizer on Plant Height Peanut



Remarks: N1 (50 kg ha⁻¹), N2 (100 kg ha⁻¹), N3 (150 kg ha⁻¹), P1 (100 kg ha⁻¹), P2 (200 kg ha⁻¹), P3 (300 kg ha⁻¹), D1 (10 ton ha⁻¹), D2 (20 ton ha⁻¹), D3 (30 ton ha⁻¹).

Figure 2. Dose Combination of Urea, SP-36, and Cow Manure Fertilizer Weight of Peanut's Dry Straw

Weight of Dry Straw

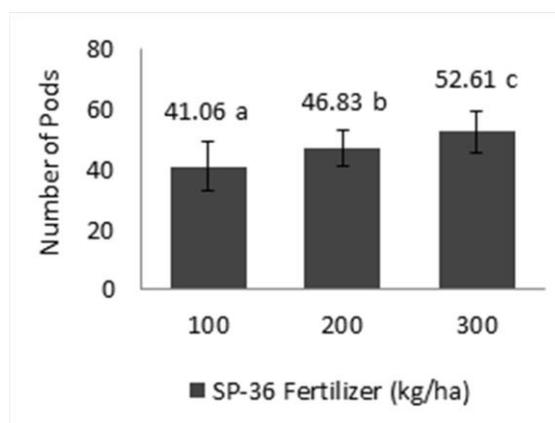
Weight of dry straw reflects how the process of photosynthesis takes place. Based on the analysis of variance weight of dry straw, the dose combination of urea, SP-36, and cow manure fertilizer not significantly affect weight of dry straw. Dose of urea 150 kg ha⁻¹, SP-36 100 kg ha⁻¹, and cow manure fertilizer 20 ton ha⁻¹ (N3P1D2) has the highest weight of dry straw (96 grams) and dose of urea 50 kg ha⁻¹, SP-36 300 kg ha⁻¹, and cow manure fertilizer 20 ton ha⁻¹ (N1P3D2) has weight of dry straw low (72.8 grams) (Figure 2).

Differences in response to the results weight of dry straw in each treatment due to the function of each different fertilizers. fertilizer N (urea) can be supplied themselves through nodules are capable of binding elements of N. P fertilizer (SP-36) for seed formation and cow manure to provide macro and micro nutrients. Darman and Fathurrahman (1997) states that nutrients in relatively high doses do not respond weight of dry straw the plant. Plants will continue to enhance the absorption of nutrients but do not give real response to the growth.

Number of Pods

Pods that produce seed pods which are the subject of the component results. Dose of SP-36 very significant effect on the amount of peanut pods, independently (Figure 3). The treatment of SP-36 100 kg ha⁻¹ showed significantly different results both with SP-36 200 kg ha⁻¹ and 300 kg ha⁻¹. The highest number of pods has reached (52.61 pods/ plant or percentage of 37.44%) on the SP-36 dose of 300 kg ha⁻¹.

Number of pods on SP-36 100 kg ha⁻¹ and 200 kg ha⁻¹ respectively (41.06 pods/plant or an increase 29.22%) and (46.83 pods/plant or an increase of 33.33%). This suggests that the crop needs nutrients, especially



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Figure 3. Effect of Dose Combination of SP-36 Fertilizer Number of Pods Peanut

phosphorus will have been met. SP-36 300 kg ha⁻¹ can increase the number of pods peanuts. Supply of phosphorus in the body of plant will increase the number of pods peanuts.

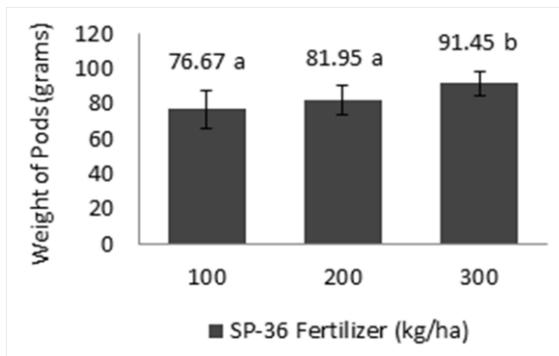
Deficiencies of P resulted in peanut plants grow thin and stunted, small pale green leaves, pods formed a little, and the result is very low. Phosphorus for plants can improve generative growth, especially the formation of flowers, fruits, and seeds. If good vegetative growth, generated fotosintate more. This causes the plant is ability to form generative organ is increasing (Hidayat 2008).

Weight of Pods

Weight of pods plot is taken from the total weight of pods that produce seeds not including the weight of empty pods. Weighing pods predicts total productive pods obtained from the total population of the plant.

Based on the analysis of variance weight of pods, dose combination of urea, SP-36, and cow manure fertilizer not significantly affect weight of peanut pods. Dose SP-36 fertilizer very significant effect on weight peanut pods,

independently (Figure 4). SP-36 100 kg ha⁻¹ was



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Figure 4. Effect of Dose Combination of SP-36 Fertilizer of Weight of Pods Peanut.

not significantly different from SP-36 200 kg ha⁻¹.

SP-36 300 kg ha⁻¹ significant effect on the results of weight of pods. SP-36 fertilizer dose of 300 kg ha⁻¹ increased weight (91.45 grams of pods/plant or an increase by a percentage increase of 36.57%) compared with SP-36 fertilizer dose of 100 kg ha⁻¹ (76.67 gram/plant with a percentage of 30.66%) and SP-36 fertilizer dose of 200 kg ha⁻¹ (81.95 gram/plant with a percentage of 32.77%). SP-36 300 kg ha⁻¹ role in the formation and ripening pods. Phosphorus improve the quality of fruits, vegetables, grains and very important in the formation of seeds. Yulhasmir (2009) adds weight gain fresh pods/plant is highly correlated with the presence of nutrients that exist and absorbed by plants.

Weight of 1000 Seeds

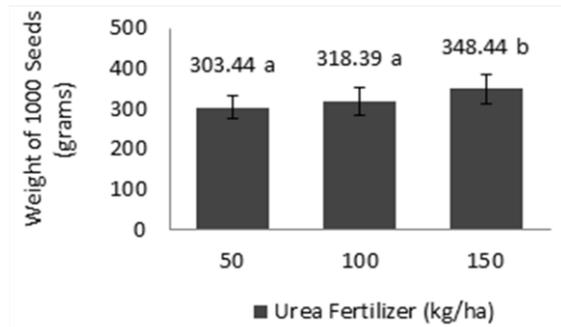
Weight of 1000 seeds are one of parameters relating to the production of crop. Based on the analysis of variance weight of 1000 seeds, dose combination of urea, SP-36, and cow manure fertilizer not significantly affect weight of 1000 seeds. Dose of urea

significantly affect weight of 1000 seeds of peanut, independently (Figure 5).

Dose of urea 150 kg ha⁻¹ significantly increased the weight of 1000 seeds (348.44 grams or by 35.91%) compared to dose of urea 50 kg ha⁻¹ (303.44 grams or by 31.27%) and 100 kg ha⁻¹ (318.39 grams or by 32.81%). According to Sutopo (2002) the difference of the weight of 1000 seeds due to plant genetic. Plant genetic is one of which the seed size, the larger of seed, the greater from the weight of 1000 seeds and the ability of plants to absorb nutrients from the environment.

CONCLUSION

The dose combination of urea, SP-36, and cow manure fertilizer have no interaction



Remarks: The figure shows followed by the same letter are not significantly different at the level of 95%

Figure 5. Effect of Dose Combination of Urea Fertilizer Weight of 1000 Seeds Peanut.

affected all of variable plant. The application of 300 kg ha⁻¹ SP-36 fertilizer increased the number of pods and weight of pods, while the weight of 1000 seeds was improved by application of 150 kg ha⁻¹ urea fertilizer. The dose combination of urea 150 kg ha⁻¹, SP-36 300 kg ha⁻¹, and cow manure 10 ton ha⁻¹ can be recommended to farmers and communities to improve the productivity of peanuts in alfisols dryland.

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