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Peanut Plant (*Arachis hypogaea*) Productivities In Exs Merapi Pyroclastic Land With Different Fertilizers

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ABSTRACT
This study aimed to determine peanut crop/plant (*Arachis hypogaea*) productivities in exs Merapi pyroclastic land with different fertilizers. Peanut seeds planted on land of exs Merapi eruption Kepuharjo village, Cangkringan, Sleman, Yogyakarta with an area of 13 x 10 m^2 divided in three blocks with 3 beds (replication) of manure (P1), compost (P2) and urea (46% N) as a control (P3). Research was designed in Completely Randomized Design (CRD) and the data were analyzed with one way anova with the help of a computer statistical analysis program (SPSS version 16). The results showed that the average number of leaves, branches, and root nodules showed significant differences among treatments ($P<0.05$). The mean numbers of leaves, branches, root nodules, pods containing the beans on manure fertilizer were greater than the nut with compost, respectively at 173.3 vs. 121.3 sheets, 4.5 vs 3.9 branches, 33.1 nodule vs. 14.0 and 13.9% vs. 7.5% pods. The opposite conditions found on the results of the mean percentage of pod beans on compost fertilizer was significantly greater (97.18%) compared to the average number of bean seeds in manure application (92.15%). Based on the result of research, it could be concluded that the different sources of organic fertilizer (mixed manure and compost) affect the number of leaves, number of branches, roots and nodules.

Keywords: *Fertilizer, forage, Merapi volcano, peanut, production*

1. INTRODUCTION

Eruptive activity of Merapi Volcano during October 12 to November 5, 2010 was classified large eruption compared to the 1870 eruption pyroclastic material [1]. After eruption, the land became barren plants can not be planted for several months. This because it was covered by a spill of hot lava and volcanic ash from the eruption of Merapi (pyroclastic). Volcanic ash is a result of the volcanic eruption of the magma discharge events of the earth because of the encouragement of high-pressure gas in the bowels of the earth or the movement of tectonic plates, pile the pressure and heat of liquid magma [2].

The texture of the soil of volcanic ash is generally a sandy soil texture and gray-colored as well as state land is still a lot of rocks. The discharge structure is not able to hold moisture in the soil so that water easily escapes into the soil, since water is one important factor in plant growth. Volcanic material decreases the amount and type of soil fauna, and even deadly, so the population of earthworms 0 / m^2, and organic decomposer larva also 0/ m^2. Post Merapi eruption farmland soils may need treatment to restore fertility to the soil productive plant species. One effort to overcome the soil characteristics of the eruption of Mount Merapi is the application of organic manures. Organic materials are all the rest of living things in the soil, either fresh or has been decomposed, simple or complex compounds [3]. These include root crops, crop residues and animal in all levels of decomposition, humus, microbial and some organic compounds. This organic material will be available fertilizer for plants and some are into soil organic matter, it all depends on the composition of the organic matter.

The increase in soil organic matter is very important for the improvement of soil properties since organic

matter is a source of energy and nutrients for the implementation of the activity of soil biota [4]. Organic matter and the activity of soil microorganisms also determine the processes and physico-chemical behavior in soil. Between the role of soil organic matter on soil biological properties are mobilize anthropogenic compounds and heavy metals into the soil, supplying energy for soil organisms, increasing the saprophyte organisms and suppress parasitic organisms to plants [5]. To maximize the use of cow manure, composting is important to meet ratio of C to N below 20. The composition of the nutrients contained in the organic fertilizer from composted cattle are: N (0.7% to 1.3%), P_2O_5 (1.5% to 2.0%), K_2O (0.5% to 0.8%), organic C (10.0% to 11.0%), MgO (0.5% to 0.7%) , and C to N ratio (14.0% to 18.0%) [6].

Farmers were using organic fertilizers with compost has been processed/composted from cow feces. There were also farmers who take an instant way to use organic fertilizers have not been composted, which was directly extracted from a mixture of cow dung feces and the rest of feed (leaves/stems). One of the common plant that usually are planted by farmer in the sandy soil is peanut. Based on the explanation above, it was necessary to investigate the effect of using immature manure and composted manure on seed growth, number of branches, number of leaves, number of root nodules and the production of bean pods.

2. MATERIALS AND METHOD

This research was conducted in the farmland exs Merapi eruption (pyroclastic) that buried material along Gendol river, Pagerjurang, Kepuharjo, Cangkringan, Sleman, Yogyakarta Province. Data collection was carried out from May 2012 to December 2012 (two years after Merapi erupted). Former land Merapi eruption was used with 13 m x 10 m wide. In each plot of land was divided into three plots, I for peanuts with manure fertilizer, plot II for peanuts with compost fertilizer, and III plots for peanuts as a control without fertilization.

Peanut seed was planted with put in the hole as deep as 5 cm at a spacing of 50 cm x 25 cm. Fertilizer was classified into two type, mixed manure from a mixture of cow dung and feed the remaining ingredients, while the composted manure was came from a mixture of cow dung with fermentation process for 30 days. Fertilizing was done a week before planting, mixed manure and compost equivalent ± 340 g, equivalent to 6.18 tons / ha of dry matter are given in the planting hole. Subsequent fertilization on bean plant at three and six weeks using urea fertilizer dose of 100 kg / ha.

The data taken in this study included quality mixed manure and compost manure carried out (analysis C, BO, total N, total P, total K and C to N ratio), percentage of seed growing, number of leaves and branches, total root nodules, and the number of active nodules (red). Observations were taken at random from each treatment block as much as 20% of the amount of peanuts plants (*Arachishypogaea*) that grow up to 12 weeks. Known quantity production of pods produced, number of pods containing seeds and fresh production of peanut straw (roots were excluded). The data were analyzed with one way ANOVA were arranged in Completely Randomized Design (CRD). Further test can use the Least Significant Different test (LSD) at P <0.05 to see the connection parameters measured for each plot studies using the SPSS software version 16.

3. RESULTS AND DISCUSSION

3.1. Quality Organic Fertilizer

Table 1. Quality of organic fertilizers*)

Treatments	C (%)	OM (%)	N Total (%)	P Total (%)	K Total (%)	C:N
Mixed manure	12.77	25.53	0.66	0.06	0.34	19.35
Compost	25.14	50.27	1.05	0.12	0.58	23.94

Description: *) analysis at Soil Science Laboratory, Faculty of Agriculture, Universitas Gadjah Mada

From the research of organic fertilizer quality of data used for the application of fertilizer on bean crop land area after the eruption of Merapi. The data analysis of two type fertilizer can be seen in Table 1.

Levels of C-organic compost and mixed manure in was 25.14% and 12.77%. This value has not fulfilled the parameters of National Standard of Indonesia (Standard Nasional Indonesia; SNI) for organic-C is equal to 27% - 58%. Levels of C in the compost will demonstrate its ability to improve soil properties [7]. Soil productivity is influenced by organic C content[8]. In addition, composting has a good effect in improving several physical and chemical properties of the soil such as moisture content, soil volume weight, and soil porosity and C-Organic soil [9].

In other research [10], C-organic content in the manure Imogiri was 13.66%, this value was not much different from the content of C-organic mixed manure in the Merapi area. Total nitrogen content of compost and mixed manure was 1.05% and 0.66%, this value has to meet the minimum of 0.40% of SNI. The C to N ratio of compost and mixed manure showed values of 19.35 and 23.94. According to ISO grade of C to N ratio of mature manure ranged from 10-20, where the value of C to N ratio should approach a value of C to N ratio of the soil which amounted 10-12 [7].

According to the criteria of Balittanah ratio of C to N at 5-10 is classified low category while the ratio of C to N 11-15, including the medium category. So that the ratio of C to N in this research sites included in the medium

category. This indicates that the soil contains organic material which decomposes yet ripe or perfect.

3.2. Fertilizer Quality on Germination

The results of the analysis of the percentage of growth of bean seeds are fertilized with mixed manure and compost are presented in Table 2.

Table 2. Average of peanuts seeds germination (%)

Beds	Treatments		
	Controls	Mixed manure	Compost
Bed 1	87.50	96.00	100.00
Bed 2	85.71	88.50	95.23
Bed 3	93.54	92.00	96.30
Average	88.91[a]	92.15[b]	97.18[b]

Description: [a], [b], [c] superscripts indicate significant differences among treatments (P <0.05).

From the data above, it can be seen that the percentage of beans grown in soil fertilized with compost had a higher (P<0.05) value at 97.18% compared to the control treatment at 88.91%. It was significantly higher because the soil fertilized with compost provide an element of a more adequate than on treatment of mixed manure and without fertilization. Compost had a greater N content than the manure of 1.05%. Total N availability in the soil will allow greater germination of bean because N is needed for formation of seeds. In addition, the content of macro elements, such as P and K, will also affect germination, where the content of these two elements are widely available in the fertilizer on the soil with compost [11]. Nutrient content in compost K was higher at 0.58%, which was useful in the formation of starch and carbohydrates as a result of photosynthesis. Thus, transport of grown seeds was more than without the provision of additional fertilizer.

3.3. The Number of Leaves, Branches, and Roots Nodules

The result of utilization of different type of organic fertilizers on the number of leaves, and branches of peanut is presented in Table 3.

Table 3 shows that the utilization of different organic fertilizers affected to different number of leaves and branches of peanut plant. In Table 3, the number of peanut leaves fertilized with mixed manure had the highest (P<0.01) number of leaves (173.3) compared to peanut cultivated with compost (121.3) and control (98.4). High number of leaves might be caused by organic fertilizer which trigger the stem cells to hold a magnification of cell division and especially in the area meristematis. Organic fertilizer contain nitrogen that make up all proteins, nucleic acids and chlorophyll also usually contain micro-nutrients such as elements of Mn, Zn, Fe, S, B, Ca, and Mg [11]. The micro-nutrients have a role as a catalyst in the process of protein synthesis and the formation of chlorophyll and leaf.

Table 3. Number of Leaves and Branches of peanut plant with different organic fertilizer

Measured Variable	Beds	Former land eruption treatments		
		Controls	Mixed manure	Compost
Number of Leaves	Bed 1	116.0	164.8	109.6
	Bed 2	80.8	175.2	114.4
	Bed 3	98.4	180.0	140.0
	Average	98.4[p]	173.3[q]	121.3[r]
Number of Branches	Bed 1	4.6	4.0	4.4
	Bed 2	3.2	4.6	4.0
	Bed 3	3.8	4.8	3.4
	Average	3.9	4.5	3.9

Description: [p], [q], [r]superscripts indicate significant differences among treatments (P <0.01).

The number of peanuts branches had similar trend with number of leaves. Rate of growth and the sintesisis can be affected by type of organic fertilizer [12]. The number of leaves on every branch or branch that accompanied by the appearance of green leaves indicate that chlorophyll can produce photosynthate for growth and development [11].

The numbers of nodules, ative nodules, roots length and weight of roots were affected by different organic fertilizers that present in Table 4.

Table 4 shows that the peanut plant were fertilized with mixed manure resulted the highest total root nodules (33.1) and active nodules (28.3) followed by compost (14.0 and 11.0) and control the smallest (8.2 and 7.3). The average length and weight ($P< 0.05$) of roots were fertilized with mixed manure was the highest (8.7 and 3.1) as compared to groundnut fertilized with compost (8.6 and 2.2) and control (8.0 and 1.1). This could be caused by mixed manure that had the lower C to N ratio, then tended to provide more nutrients available easily absorbed by plants. High content of C in the fertilizer in the land might be inhibit the growth of main plant, caused by defficent of N. The availability of N would be used by decomposer microbia for docompost organic matterial, not for plant [6]. While the peanuts are not given fertilizer at all showed average the lowest. This was caused by the soil after eruption of Merapi that provided a very small elements needed by the plant, so that the results also small number.

Table 4. The number of roots nodules, ative nodules, roots length and weight of roots at different organic Fertilizer.

Measured Variable	Beds	Former land eruption treatments		
		Controls	Mixed manure	Compost
Total Root Nodules	Bed 1	1.2	52.0	11.0
	Bed 2	5.8	29.0	21.0
	Bed 3	18.0	18.0	10.0
	Average	8.2	33.1	14.0
Active Root Nodules	Bed 1	1.2	42.4	8.6
	Bed 2	5.6	26.8	16.0
	Bed 3	15.2	15.6	8.4
	Average	7.3	28.3	11.0
Roots Length (cm)	Bed 1	7.0	7.6	8.7
	Bed 2	8.4	11.0	8.0
	Bed 3	8.7	7.1	9.0
	Average	8.0	8.7	8.6
Weight of Roots (g)	Bed 1	1.1	3.6	1.9
	Bed 2	1.2	2.6	2.8
	Bed 3	1.1	3.2	1.8
	Average	1.1^{b}	3.1^{a}	2.2^{a}

Description: ^{a}, ^{b}, ^{c}superscripts indicate significant differences among treatments ($P <0.05$).

3.4. Total Seed and Pods

The effect of different type of fertilizer on pods production and pods contain seed can be seen in Table 5.

Table 5 shows that the total number of pods of bean and pods containing seed of peanut plant were fertilized with mixed manure was significantly the highest (17.9 and 13.9), followed by compost treatment (13.3 and 7.5) and control (10.7 and 4.1). This might be caused by mixed manure fertilizer was more mature than compost. This can be seen from the C to N ratio value was lower than the compost (19.39 vs 23.94). Immature fertilizers will have a longer decomposition, meanwhile fertilizer with low C to N ratio is categorize as mature fertilizer. It will be decomposed more quickly, then quickly provides a variety of nutrients and play a role in the formation of humus [13], [14]. According to ISO grade of C to N ratio of mature fertilizer ranged from 10-20, where the value of C to N ratio should approach a value of C to N ratio of the soil 10-12. Compost fertilizer decomposed completely yet, so it still took time for the process of decomposition [6]. This made that the effect of compost did not significant compared with control. Control treatment always had significant lowest value compared with fertilizer. This was because the nutrients N, P, and K in the soil more available than without fertilizer (control).

Table 5. The number of pods and productive pods.

Measured Variable	Beds	Former land eruption treatments		
		Controls	Mixed manure	Compost
The Number of Pods Beans	Bed 1	6.20	20.1	12.6
	Bed 2	12.6	21.4	12.0
	Bed 3	13.4	12.2	15.2
	Average	10.7^{q}	17.9^{p}	13.3^{q}
The Number of Productive Pod (Nuts Inside)	Bed 1	2.2	11.8	5.4
	Bed 2	5.2	14.6	7.6
	Bed 3	4.8	15.4	9.4
	Average	4.1^{r}	13.9^{p}	7.5^{q}

Description: ^{p}, ^{q}, ^{r} superscripts indicate significant differences among treatments ($P <0.01$).

4. CONCLUSIONS

Differences type of organic fertilizer (mixed manure and compost) affected to the germination, number of leaves, number of branches, roots and nodules, pods and seed production of peanut plant planted in the exs Merapi eruption land. C to N ratio value was important parameter in the fertilizer that will affect to the growth performace and production of peanut plant planted in Merapi pyroclastic land.

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