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GROWTH RESPONSE AND YIELD OF PEANUT (*ARACHIS HYPOGAEA*) TO APPLICATION OF NPK COMPOUND FERTILIZER AND PRUNING OF MAIN BRANCHES

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ABSTRACT

Peanut is one of the important food crops in Indonesia and has a strategic role in the national economy, given its multipurpose function, as a source of food, feed, and industrial raw materials. However, its productivity is still very low due to the low input of cultivation technology on peanuts. The input of cultivation technology that can be applied as an effort to increase peanut productivity is the application of NPK compound fertilizer and pruning of main branches. This study aims to determine the effect of NPK compound fertilizer and main branch pruning on the growth and yield of peanuts. The study used a factorial randomized block design with three replications with two treatment factors, namely the dose of NPK compound fertilizer (P) and pruning of main branches (C). The results showed that the dose of compound fertilizer 300 kg/ha (P3) and pruning the main branch by leaving 3 branches (C3) independently resulted in the best growth and yield of peanuts.

KEYWORDS: Peanut, NPK fertilizer, pruning.

INTRODUCTION

Peanut (*Arachis hypogaea*) is one of the important food crops in Indonesia and has a strategic role in the national economy, given its multipurpose function, as a source of food, feed, and industrial raw materials. Domestic demand for peanuts for feed reached 3.48 million tons in 2012; 4.07 million tons in 2014 and is predicted to increase to 6.6 million tons in 2015.[1]

The average yield per hectare at the national level is around 1.29 t/ha,[2] although yields from research plots can reach 2.5-3 t/ha. This is reflected in the small increase in productivity in the last decade, from 1.11 t/ha seeds in 2002 to 1.25 t/ha seeds in 2012.[1] The low productivity of peanuts is due to the diversity of crop management methods, including differences in planting time, planting methods, weeding, fertilization, pest and disease control. In addition, at this time the cultivation of standard peanuts is not yet available for every production center.[3]

Cultivation technology is a combination of several technology components so that high yields can be obtained when each technology component is applied properly. If one of the components is not implemented properly, then optimal productivity cannot be achieved.[3]

Based on the above problems, the solution to increase peanut production is the provision of fertilizers needed by peanut plants for vegetative and generative growth. Giving fertilizer is an act of returning soil nutrients so that it can increase plant production. In addition, to increase the number of gynophores that reach the soil surface, it is necessary to trim the main branches and fertilize.

Plants can grow well and perfectly if the elements needed by these plants are met.[4] The results of Adisarwanto's research.[5] stated that the use of NPK Mutiara 250 kg/ha could increase soybean dry weight by 1.8 t/ha compared to without using NPK Mutiara. This is in accordance with the opinion of Sumarno et al.[6] that peanut plants require sufficient elements, N, P, K, and Ca to help the formation of pods. These elements can be obtained through fertilization and liming. As explained by Adisarwanto,[5] that the total nutrient requirements of peanut plants to produce 1 t/ha pods require 7.9 kg N/ha, 6 kg P/ha, and 43 kg K/ha.

Plant management can also increase production by pruning main branches so that more gynophores can reach the soil surface. Gynophores that are located more than 15 cm from the soil surface usually cannot penetrate the soil and end up dead. At this stage, soil moisture is very necessary, especially to help gynophores enter the soil, which is on the 32nd to 36th day after planting. These gynophores are active in sucking potassium and calcium from the media around the pods, so the availability of these elements at this stage is very necessary. Elongation of gynophores depends on turgor pressure, and is delayed due to drought stress. Gynophores failed to penetrate dry soil, especially in hard soil layers, so gynophores were retained for four days for pod penetration. Once the gynophore is in the soil, it needs adequate moisture and darkness for pod development.[7]

Based on the description above, this study aims to determine the effect of NPK fertilizer application and main branch pruning on the growth and yield of peanuts.

MATERIALS AND METHODS

The research was carried out in the experimental field of the Faculty of Agriculture, Islamic University of North Sumatra, Medan, North Sumatra at an altitude of ± 25 meters above sea level with a flat topography from November 2021 to February 2022.

The study used a factorial randomized block design with three replications with two treatment factors. The first factor is the dose of NPK compound fertilizer (P) which consists of four levels, namely 0 kg/ha (P0), 100 kg/ha (P1), 200 kg/ha (P2), and 300 kg/ha (P3). The second factor is pruning the main branch (C) which consists of three levels, namely without pruning (C1), pruning leaving 2 main branches (C2), and pruning leaving 3 main branches (C3).

Experimental plots measuring 1.20 m x 1.20 m with a distance between replicates of 100 cm, a distance between plots of 50 cm and a plot height of 30 cm. The seeds used were the hypoma 1 variety. Before planting, the seeds were first soaked in water for 10 minutes to accelerate germination and determine which seeds were good to use. Planting using a spacing of 40 cm x 2 cm and carried out singly by planting 3 seeds per planting hole.

Pruning was carried out according to the treatment, namely without pruning (C0), pruning leaving 2 main branches from the shoot (C1) and pruning leaving 3 nodes from the main branch (C3) which aims to position the gynophore which is on a branch close to the soil surface. Fertilization is carried out in an array by giving a dose of fertilizer according to the treatment, namely 0 kg/ha (P0), 100 kg/ha (P1), 200 kg/ha (P2), and 300 kg/ha (P3).

The variables observed were the number of branches, the number of pods per plant, the number of filled pods per plant, the weight of the seeds per plant, and the weight of the pods per plant.

RESULTS AND DISCUSSION

Based on analysis of variance showed that the dose of NPK compound fertilizer independently significantly affected the number of branches, number of pods per plant, number of pods filled per plant, seed weight per plant and pod weight per peanut plant plot. Similarly, the treatment of pruning the main branch independently had a significant effect on the number of branches, the number of pods per plant, the number of filled pods per plant, and the weight of the pod per plot of peanuts, but had no significant effect on the weight of seeds per plant of peanuts. Meanwhile, the combination of treatment dose of NPK fertilizer and pruning of main branches only had a significant effect on pod weight per peanut plant plot (Table 1).

Table 1: The effect of the amount of red bean flour on the observed variables.

Treatments	Number of branches	Number of pods per plant	Number of pods contained per plant	Seed weight per plant	Pod weight per plot
NPK Fertilizer Dosage (P)					
P0	7.38 a	23.11 c	21.83 c	29.38 b	850.67 b
P1	7.44 a	24.16 bc	22.26 bc	30.19 b	903.33 b
P2	7.63 b	25.47 b	23.94 b	31.38 b	1043.78 a
P3	7.75 b	27.25 a	25.75 a	38.66 a	1130.11 a
Branch Pruning (C)					
C1	7.27 c	23.85 b	22.41 b	31.46	929.42 a
C2	7.45 b	24.47 b	23.25 b	31.91	955.83 b
C3	7.93 a	26.66 a	24.97 a	33.85	1060.67 a
Combination Treatment					
P0C1	7.17	21.75	20.50	29.25	798.67 e
P0C2	7.17	22.50	21.42	27.92	825.33 e
P0C3	7.83	25.08	23.58	31.00	928.00 bcde
P1C1	7.17	23.58	22.08	29.75	921.67 cde
P1C2	7.42	23.25	22.08	30.00	834.67 de
P1C3	7.75	25.67	23.83	30.83	953.67 bcde

P2C1	7.42	24.08	22.33	30.17	1065.33 bc
P2C2	7.58	25.50	24.25	31.00	1056.67 bc
P2C3	7.92	26.83	25.25	33.00	1009.33 bccd
P3C1	7.33	26.00	24.75	36.67	932.00 bcde
P3C2	7.67	26.67	25.25	38.75	1106.67 b
P3C3	8.25	29.08	27.25	40.58	1351.67 a

Notes: Numbers in the same column and row followed by different letters show a significant difference at the 5% level based on Duncan's test 0 kg/ha (P0), 100 kg/ha (P1), 200 kg/ha (P2), and 300 kg/ha (P3). No pruning (C1), pruned leaving 2 main branches (C2), and pruning leaving 3 main branches (C3)

Table 1 can be seen that the application of NPK compound fertilizer (16:6:16) significantly affected all observed variables. This was due to the fact that vegetative and generative growth really needed optimal nutrients including branch growth, pod formation and pod filling that really needed macro nutrients such as N, P, and K. The soil at the research site is classified as a soil with a low fertility level. According to Fauziah,[8] the application of NPK fertilizer can affect the number of leaves and number of branches at the age of 60 days after planting (DAP), and the more N fertilizer is applied, the fresh weight of the stover will increase. This is because N is an element that functions as a constituent of the vegetative part of plants. Sumampow.[9] said that N is an important constituent of amide acids, nucleotides, nucleoproteins and is important for cell division and enlargement so that N plays a very important role in plant growth.

Fertilization of N with a dose of 100 kg/ha can be absorbed by plants for photosynthesis and produce fully filled pods, element P is the material for the formation of ATP which functions in the photosynthesis process. This is in accordance with the opinion of Fitter and Hay.[10] that sufficient ATP will cause nutrient uptake by plants to increase so that pod yields increase. The K fertilizer applied also plays a role in producing high seed weight. Buckman and Brady.[11] added that in general the element K provides a balance effect on both N and P, therefore K is important in the composition of mixed fertilizers. According to Novizan,[12] in general the role of K is related to metabolic processes such as photosynthesis and respiration.

The availability of P and K nutrients will cause the photosynthesis process to run smoothly. Purbayanti et al.[13] states that N together with P will form proteins, carbohydrates, nucleic acids and are translocated by K elements so that dry weight increases. This is in line with the results of Hanum's research.[14] which showed that the combination of doses of N, P and K fertilizers had a significant effect on the dry weight of the peanut plant. The combination of doses of N and P fertilizers had a significant effect on the number and weight of peanut pods. The combination of P and K fertilizer doses had a significant effect on the dry seed weight of peanuts. The dose of N had a significant effect on the fresh weight of plant pods.

Furthermore, Hanum.[14] stated that micro and macro nutrients are important for plant growth and yield because micro nutrients such as borium are needed in accelerating cell growth, especially cells at the growing point as well as for the process of forming pollen, roots and flowers. While macro nutrients such as C, H, and O become raw materials for the formation of tissue in the plant body. With the presence of these three ingredients, during the formation of carbohydrates, respiration, photosynthesis, chemical work, mechanical work and also osmotic work in plants can run smoothly. The next function of macro and micro nutrients is to increase plant growth, increase leaf greenness, accelerate plant growth such as increase in height and number of leaves. In addition, protein levels in plants will increase in the presence of macro nutrients such as N, P, K, Mg, Ca, and S, as well as micro nutrients such as B, Cu, Zn, Fe, and Na.

Table 1 also shows that pruning of main branches can affect the number of branches, number of pods per plant, number of filled pods per plant, and pod weight per plot, but has no significant effect on seed weight per plant. This is because the pruning of nodes on the main branch can increase the number of branches, because pruning breaks the dominant activity of the apical meristem or shoot growth and stimulates the growth of lateral meristems or branch growth.

Furthermore, increasing the number of filled pods per plant, number of pods per plant, and pod weight per plot due to pruning can shorten the branches so that the length of the gynophore is close to the ground, so that many pods are formed. Meanwhile, the effect of pruning the main branch on seed weight per plant is not significant because seed weight is strongly influenced by fertilization and nutrient content in the soil.

The treatment of pruning the main branch can stimulate branch growth because of the inhibition of the work of the hormone auxin so that it stimulates the work of cytokinins which results in the growth rate of the apical meristem (shoots) being directed to the lateral meristem (branches). In line with the research results of Saidi et al.[15] which shows an increase in the number of branches in pruned plants due to a break in apical dominance in shoots so that plants shift growth to side shoots. As a result, side shoots grow higher than side shoots in plants without shoot pruning. Similarly, the results of research by Sutrisno and Wijarnako.[16] found a significant increase in the number of branches at 2 weeks of age pruning after planting (WAP) due to the plant being in the phase of maximum vegetative growth rate, as a result all shoots that have the potential to grow are maximally stimulated to produce more new branches. On the other hand, at the age of 3 and 4 WAP pruning plants must divide the direction of growth into vegetative and generative so that the formation of new shoots does not occur optimally.

In addition, it is also closely related to the increase in the number of leaves. Where the more leaves that photosynthesize, the greater the photosynthate produced to increase seed weight per plant and indirectly related to increased seed weight per plot. Salisbury and Ross.[17] stated that the more the number of branches, the higher the number of leaves. In line with the results of Zulkarnain's research.[18] the higher the number of branches, the higher the number of leaves, the total leaf area and the leaf area index. This is because the photosynthesis process runs smoothly so that when the plant enters the generative phase in the formation and filling of pods, the photosynthate flow almost completely goes to the formation of flowers and gynophores.[19] In peanut plants, pods are one of the places for storing photosynthetic products other than seeds. Pod weight is strongly influenced by the accumulation of photosynthetic products. The accumulation of photosynthetic results in pods can be maximized if the availability of water and nutrients is optimal during the photosynthesis process.[20]

Table 1 shows that the combination of fertilization and pruning of main branches had a significant effect on pod weight per plot but had no significant effect on number of branches, number of pods per plant, number of filled pods per plant, and seed weight per plant. The combination of P3C2 treatment showed the highest growth and yield compared to other treatments. This is because by pruning the main branch as much as 3 nodes shortens the distance of the gynophores to enter the soil so that the number of pods formed increases and for pod formation and seed filling, optimal macro nutrients are needed.

Pruning with the aim of suppressing the vegetative growth of peanut plants so that photosynthesis results can be stopped for leaf formation and can focus on the formation of flowers and pods and through pruning efforts will produce new branches to the side so that it can further lower the position or place of emergence of flowers (distanced from each other). less than 15 cm from the soil surface), so that if the flower grows and develops into a gynophore, the gynophore will be able to reach the ground and will be able to grow and develop into a pod.

Pruning can increase pod yield if pruning time is carefully considered. Pruning the top of the peanut plant after a few days of flowering results in the photosynthate which is usually mostly used for vegetative growth to be transferred and utilized for pod filling.[21] The results of Zulkarnain's research.[18] proved that pruning of peanuts can accelerate the filling of pods. Peanut pods produced are more pithy than those of peanut plants that are left lush after their generative phase.

CONCLUSION

1. Fertilization treatment with NPK compound fertilizer (16:16:16) significantly affected the number of branches, number of pods per plant, number of pods filled per plant, seed weight per plant, and pod weight per plant. The application of NPK compound fertilizer dose of 300 kg/ha (P3) showed the highest growth and yield of peanuts compared to the control treatment (P0), 100 kg/ha (P1), and 200 kg/ha (P2).
2. Treatment of book pruning on the main branch had a significant effect on the number of branches, the number of pods per plant, the number of filled pods per plant, and the weight of the pod per plant, but had no significant effect on the weight of seeds per plant. The best pruning of the main branch was pruning leaving 3 main branches (C3).
3. The combination of fertilization and pruning of main branches only had a significant effect on pod weight per plot with the best combination treatment P3C2, combination treatment of 300 kg/ha NPK compound fertilizer dose and pruning leaving 2 main branches.

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