**The Effect of Fertilization of Cow Manure and NPK Fertilizer on Cowpea Growth and Production**

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ABSTRACT

A study aimed to examine the effect of combination of cow manure and NPK fertilizer, and to determine the best combination of fertilizer doses on growth and yield of cowpea. The research was carried out in a plastic house in Sleman from September to December 2014. The design of a 3 x 4 factorial experimental study was arranged in a Completely Randomized Design with three replications. The first factor is dose of cow manure (K), consisting of three levels (K1: 10 tons/ha, K2: 15 tons/ha and K3: 20 tons/ha). The second factor is the dosage of NPK fertilizer (D), consisting of four levels (D1: 0 kg/ha, D2: 75 kg/ha, D3: 100 kg/ha, and D4: 125 kg/ha). The observational data were analyzed variance by the F test at 5% level of trust, and to test the difference in treatment effect, using Duncan's Multiple Range Test (DMRT) at 5% level of trust. The result of experiment showed that the combination of cow manure and NPK fertilizer had significant effect on plant height, branch number, flowering age, pod number, pod weight. The real interaction between treatments is shown in the number of pods. Meanwhile, K3D3 that is combination of dosage treatment of cow dung 20 ton/ha and dosage of NPK 100 kg/ha fertilizer, showed as the best treatment combination effect on crop production of cowpea which is 70 dap.

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**Keywords**: cowpea, cow manure, NPK fertilizer

**INTRODUCTION**

Cowpea plant is also called tholo beans, is a type of beans such as long beans, plant types upright or not twisted (Adrianto and Indarto, 2004). These cowpeas are potential to be developed for various reasons including complete nutrition, with a protein content of about 21-23%, can be consumed freshly as vegetables, and the commercially dried beans can be used as raw materials for flour for livestock feed. In addition, the cultivation area is very broad because the cowpea is a plant that survive in a dry environment, so it can be used as a pioneer plant in critical land or land that has not been used for cultivation during the dry season (Trustinah et al., 2000)

Research on the development of cowpea plants is principled on sustainable agriculture, which increases production by not abandoning the principle of efficiency in the use of production facilities and the principle of non-destructive environment. Cow manure is the main fertilizer of cow dung to improve the physical, chemical and biological properties of the soil (Kariada and Sakadana, 2000). In addition to containing macro nutrients, manure also contains micro nutrients that are needed by plants, one of which is the element molybdenum (Sprent, 1979). Molybdenum element is indispensable for bean crops because it is a component of nitrogena se enzyme that affects nitrate availability (Calla, 2001). NPK fertilizer is a compound fertilizer that contains the main nutrients of more than two types. With 15% Nitrogen content in NH3 form, 15% phosphorus in P2O5 form and 15% potassium in K2O form. The nature of Nitrogen (nitrogen carrier), especially in the form of ammonia, will increase soil acidity which can affect plant growth, therefore if given at high doses can cause decreased soil fertility (Hardjowigeno, 1992).

Problems arise, that the success of the plants to respond to the provision of manure or fertilizer NPK one of them depends on the number of doses. In corn, cow manure 18.18 tons / ha significantly increased yield from 2.96 tons / ha to 6.35 tons / ha (Sunarti, 2000). Adimiharja et al. (2000), the addition of cow manure at a dose of 5 tons / ha can increase the soil C-organic content in Ultisol soil and significantly increase the yield of soybean crops. Adimiharja et al. (2000), in the dry land of sour, the application of cow dung manure dose 5 ton / ha combined with NPK fertilizer (90-45-80) can give corn kernel seed 3,4 ton / ha that is 1,9 ton / ha more high from the use of NPK fertilizer alone. Agus (2000), the combination of cow manure and NPK fertilizer can increase the yield of 0.9 tons / ha in soybean to 2.3 tons / ha. In peanut plants, a dose of 100 kg / ha of NPK fertilizer can increase the yield of 42 to 78% (Safuar, 2002). The use of cow manure is expected to reduce the use of inorganic fertilizers. Therefore, the evaluation of the results was conducted on the use of cow manure (organic fertilizer) and NPK fertilizer (inorganic fertilizer) in a balanced manner.

**RESEARCH METHODS**

The research was conducted in a plastic house (greenhouse) in Denokan, Maguwoharjo, Depok, Sleman in September to December 2014. The materials used include seedlings of KT 7 variety cowpeas, a collection of BALITKABI (Balai Penelitian Kacangan dan Umbian) Malang, cow manure that has been decomposed perfectly, NPK 15:15:15 fertilizer, soil regosol and Dithane M-45. Equipment used is polybag size 25 cm x 35 cm, soil processing equipment and other measuring equipment as needed.

This research is patterned 3 x 4 factorial arranged in Complete Random Design with three replications. The first factor, dose of cow dung fertilizer (K), consists of three levels namely K1: 10 tons / ha, K2: 15 tons / ha and K3: 20 tons / ha. The second factor, the dose of NPK fertilizer (D), consists of four levels: D1: 0 kg / ha (without fertilizer), D2: 75 kg / ha, D3: 100 kg / ha, and D4: 125 kg / ha. Fertilizer cow dung all the dose is given during processing of planting media by mixed into the soil. The NPK fertilizer, were 2/3 dose given at planting and 1/3 dose given at plant age 4 weeks after planting. Harvesting pods done at age 70 days after planting. Observations included agronomic aspects were plant height, number of leaves, leaf area, number of branches at plant age 4 and 6 weeks after planting, flowering age, number and weight of pods per plant at plant age 70 days after planting. The data were analyzed by F-test and Duncan's Multiple Range Test (DMRT) at 5%.

**DISCUSSION**

The development of plant height, leaf number and leaf area as the growth response by cowpea plant on dosage of cow dung fertilizer and the dosage of NPK fertilizer observed in plants aged 4 and 6 weeks after planting are presented in Table 1. Dosage of cow dung and also dosage of NPK fertilizer have a real impact. It was shown that dosage of 15 tons / ha and 20 tons / ha of cow dung manure resulted in higher crops, more leaf number but not on the number of plant leaves aged 6 mst, and wider than the effect of dose of 10 ton / ha. The dosage of NPK 100 kg / ha and 125 kg / ha of fertilizer resulted in the plant at 6 weeks after planting higher, the more leaves on the plant 4 weeks after planting, the wider leaf area in the plant age 4 and 6 weeks after planting, compared with the treatment of other NPK fertilizer doses. Table 1 also shows that treatment of dosage of cow manure and NPK fertilizer has no interaction.

Table 1. The Average of Plant Height, Number of leaves, Leaf Area at Age 4 and 6 wap.

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | Plant height (cm) | Number of leaves (strands) | Leaf area(cm2) |
| 4 wap | 6 wap | 4 wap | 6 wap | 4 wap | 6 wap |
| **Dose of cow manure** 10 t/ha (K1)15 t/ha (K2)20 t/ha (K3) | 38,23 b41,37 a41,48 a | 47,68 b51,27 a50,73 a | 11,61 b16,62 a16,09 a | 26,08 b**28,47 a**26,37 b | 1287,45 b1291,24 a1289,89 a | 3384,90 b3585,46 a3584,93 a |
| **NPK Dose** 0 kg/ha (D1)75 kg/ha (D2)100 kg/ha (D3)125 kg/ha (D4) | 31,14 q38,92 p43,37 p42,19 p | 46,63 r49,20 q51,97 p51,70 p | 11,75 r13,18 q17,25 p16,91 p | 20,57 r25,46 q**29,28 p**26,18 q | 1286,49 q1287,59 q1292,06 p1291,94 p | 3384,79 q3464,89 q3585,67 p3585,03 p |
| Interactions | (-) | (-) | (-) | (-) | (-) | (-) |

Description: The mean followed by the same letter in the column shows no real difference in the DMRT test

 at the maximum deviation of 5%. (-): No interaction

The addition of dosage of cow dung manure and NPK fertilizer, increase the supply of macro nutrients such as nitrogen. High nitrogen content utilized by plants to be the source of amino acid formation, which eventually will form proteins as protoplasm, enzymes, cell nuclei and so on. In the process of assimilation occurs cell division, followed by cell enlargement, this causes the plant to grow high (primary growth) as in Table 1 (Darmawan and Baharsjah, 1983). The highest number of leaves and leaf area, obtained in crops fed with cow dung at doses of 15 or 20 tons / ha or given 100 or 125 kg / ha of NPK fertilizer. This is due to the high content of macro and micro nutrients from both types of fertilizer, so the effect will be more quickly seen to affect plant growth. Gardner et al. (1991), micro nutrients in fertilizers can stimulate the formation of ATP that plays an important role in absorbing sunlight energy. In line with research Rizqiani et al. (2006), that the provision of organic fertilizer can increase the number of leaves and leaf area in green beans. Increased fertilizer dosage from 15 ton / ha and 100 kg / ha to 20 ton / ha and 125 kg / ha did not affect plant height, leaf area and number of plant leaves aged 4 mst (Table 1). This is considered because the ability of plants to absorb nutrients is very limited. According to Sarief (1996), the plants whose needs can be met optimally, then the plant will grow and develop well or maximally, especially related to the vegetative growth of plants. Conversely, by giving excessive doses of fertilizer, the plant is not able to absorb the nutrients optimally and many nutrients are lost due to not absorbed by the plant.

Table 2. Average Number of Branches aged 4 and 6 wap; The Age of Flowering;

 The Weight Pod at the age of 70 dap.

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment | Number of branches | Age of flowering (days) | Weights pods(g) |
| 4 wap | 6 wap |
| **Dose of cow manure**10 t/ha (K1)15 t/ha (K2)20 t/ha (K3) | 2,10 a2,74 a2,74 a | 3,42 a3,73 a3,89 a | 46.32 a43.24 b42.44 b | 362.93 p332.86 p360.80 p |
| **NPK dose**0 kg/ha (D1)75 kg/ha (D2)100 kg/ha (D3)125 kg/ha (D4) | 2,50 p2,73 p2,61 p2,74 p | 3,52 p3,74 p4,42 p4,25 p | 48,42 p46.43 q41.40 r**37.18 s** | 212, 34 b258.71 a443.29 a354.60 a |
| Interactions | (-) | (-) | (-) | (-) |

Description: The mean followed by the same letter in the column shows no real difference in the DMRT test

 at the maximum deviation of 5%. (-): No interaction

Table 2. shows no significant effect of treatment on the number of branches, nor the interaction between the two treatments is not real. This may be due to the number of branches of plants, less strongly influenced by environmental factors but rather influenced by genetic factors. Provision of cow dung fertilizer doses of 15 and or 20 tons / ha and a dose of 125 kg / ha NPK significantly accelerate the flowering age. This is due to the addition of elements N, P and K contained in cow dung manure, and NPK fertilizer. According to Darmawan and Baharsjah (1983), phosphates are important in the process of respiration and are part of DNA and ATP. ATP changes produce very useful energy for the formation of generative organs (flowers, fruits, and seeds). Acceleration of flowering plants results in increased number of pods (Table 3) as well as an increase in the weight of pods per plant (Table 2). Increased absorption of macro elements by these plants is stimulated or driven by the presence of micro nutrients contained in cow dung manure, where the role of micro elements such as Mg, Fe, Zn, and Mn are as enzyme cofactors that promote increased metabolic activity in the plant body (Pranata. 2004).

Table 3. The Average Number of Pods per Plant age 6 wap

|  |  |  |
| --- | --- | --- |
| Dosage of NPK Fertilizer. | Dose of Cow Manure. | Average |
| 10 t/ha (K1) | 15 t/ha (K2) | 20 t/ha (K3) |
|  0 kg/ha (D1) | 75, 81 d |  99,39 b |  93,13 b | 89,44 |
|  75 kg/ha (D2) | 83,71 c | 107,03 a | 108,02 a | 99,59 |
|  100 kg/ha (D3) | 93,38 b | 109,91 a | 110,01 a | 104,43 |
|  125 kg/ha (D4) | 81,13 c |  81,32 c |  83,67 c | 82,04 |
| Average | 83,51 | 99,41 | 98,71 | (+) |

Description: The mean followed by the same letter in the column shows no real difference in the DMRT test

 at the maximum deviation of 5%. (-): No interaction

Manure is useful to provide macro and micro nutrients and has a high ion binding power that will streamline inorganic materials in the soil, including inorganic fertilizers. In addition, manure can improve soil structure, so that plant growth can be optimal.

**CONCLUSION**
Limited to this research can be concluded that:
1. The combination of doses of cow manure fertilizer and NPK fertilizer had a significant effect on plant height, number of branches, flowering age, number of pods and weight of pods
2. There is a real interaction between the dosage of cow dung fertilizer and the dosage of NPK fertilizer on the number of pods
3. K3D3; dose of cow dung fertilizer 20 ton / ha and dosage of NPK 100 kg / ha; is the best combination of dosage on crop production of cowpea age 70 days after planting.

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# CONCLUSION

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