The Effectiveness of cow manure and inorganic fertilizer on sweetcorn (Zea mays saccharata sturt) productivity

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Abstract. Sweetcorn has been treated by cow manure and inorganic fertilizer in Inceptisols. Inceptisols possess low soil fertility and a relatively low to moderate level of organic matter content. This study has been conducted from June to December 2018 at the Field Experimental Station of Agriculture Faculty, Universitas Padjadjaran, Jatinangor, West Java. The treatments are as follow: A = Control, B = Standard NPK, C = 0 NPK + 1 cow manure, D = ¼ NPK + 1 cow manure, E = ½ NPK + 1 cow manure, F = ¾ NPK + 1 cow manure, G = 1 NPK + 1 cow manure, H = ¾ NPK + ¼ cow manure, I = ¾ NPK + ½ cow manure and J = ¾ NPK + ¾ cow manure. The combination of cow manure and inorganic performed the best result.

1. Introduction

Nowadays, the Indonesia farmers are engaging with various devising techniques and practices that promotes efficiency in farming, particularly with crop farming. Crop farmers seeks effective ways that promotes both productivity and efficiency. These facts had brought farmers to increase the production of sweet corn (Zea mays saccharata Sturt). Thus, the effort escalates for farming business due to its increasing demand and productivity.

In the development of this crop farming, namely low productivity due to high cost of facilities, one of them is inorganic fertilizer production. In modern agricultural practices where increasing agricultural chemicals, especially fertilizers used for optimum results, it is important to understand the processes involving water and the interaction of nitrogen in the soil and its efficiency in plant growth [1]. Cultivation of superior quality, including sweetcorn, highly dependent on adequate and balanced nutrient fertilization [2].

NPK is part of the essential nutrients necessary for the production of meristematic and physiological activities such as leaves, roots, buds, dry matter production, leading to efficient water translocation and nutrition, sun radiation interception and carbon dioxide, which can enhance the process of photosynthesis [3]. Sweet corn requires more nutrients, especially N elements, which is 150 - 300 kg N ha⁻¹ compared to ordinary corn, which only requires 70 kg N ha⁻¹, thus sweet corn plants can be classified as a nutrient-hungry plant [4].
Implementation of continuous inorganic fertilizer without the addition of organic fertilizer will drains soil, and organic matter degrade of soil biology environment. The use of organic substance as chemical fertilizer substitution and optimization land with intercropping can be an alternative solution to solve the problem. Implementation of organic materials such as cow manure is usefull to repair the damaged soil structure due to the use of chemical fertilizers.

2. Materials and Methods
This research was conducted from June to December 2018 at the Field Experimental Station of Agriculture Faculty, Universitas Padjadjaran in Jatinangor, West Java.

2.1. Materials
Tools used in the study, including hoe, sickle, rulers, scales, light meters, ovens. The material used is corn seed sweet, compost cow manure, Urea, SP-36, and KCl and pesticides.

2.2. Methods
Research used a Randomized Group Design (RGD) with 10 treatments 3 replication, there is a total of 30 polybags. This research uses the treatment are A = Control, B = Standard NPK, C = 0 NPK + 1 cow manure, D = ¼ NPK + 1 cow manure, E = ½ NPK + 1 cow manure, F = ¾ NPK + 1 cow manure, G = 1 NPK + 1 cow manure, H = ¼ NPK + ¼ cow manure, I = ¾ NPK + ½ cow manure and J = ¾ NPK + ¾ cow manure. The sweet corn was harvested at 70 days after planting, and the cornhusk were removed. Supporting views includes observing the light intensity and soil analysis. Data obtained analyzed with variance (F count test) at the 5% level to find out the effect of each treatment. If there is a real difference, then it continued with the BNT test level of 5%.

3. Result & Discussion
The results showed that overall, on various types and composition of organic and organic fertilizers inorganic shows growth and generally different results real inter-treatment. Overall, treatments have a significant effect on sweetcorn yield. However, it does not affect the yield of sweet corn plants. The results of the variance indicate the method of cow manure and inorganic fertilizer affect the sweetcorn yield. The effect of treatment was presented in Tables 1.

Sweetcorn Yield
The components of the observed sweetcorn yield (ear of corn weight). The results of statistical analysis show the differences in the effect of treatment on the components of sweet corn (Table 1).
Table 1. Ear of corn weight of sweet corn

| Treatments | Ear of Corn Weight (g) |
|------------|------------------------|
| A = Control | 142.1 a                |
| B = Standard NPK | 336.0 d                |
| C = 0 NPK + 1 cow manure | 144.3 a               |
| D = ¼ NPK + 1 cow manure | 204.5 b               |
| E = ½ NPK + 1 cow manure | 254.2 c               |
| F = ¾ NPK + 1 cow manure | 263.6 c               |
| G = 1 NPK + 1 cow manure | 317.3 d               |
| H = ¾ NPK + ¼ cow manure | 392.4 e               |
| I = ¾ NPK + ½ cow manure | 383.8 e               |
| J = ¾ NPK + ¾ cow manure | 403.1 e               |

Numbers in each column followed by the common letter are not significantly different based on the Duncan’s Multiple Range Test at 5% of significance.

The effect of treatment on ear of corn weight component affect overall result. The results of sweet corn will increase in line with the nature of the sweetcorn. Based on ear of corn weight, the treatment by using organic fertilizer combined with NPK showed good results when compared to the treatment of single effect of organic fertilizer (without combination with NPK). Plants that are not fertilized have a wide area leaf lower, this is a reference to the fact that changes in leaf number are related to the overall performance of plants, such as leaf function as an organ of plant photosynthesis [5]. NPK is part of the essential nutrients needed for meristematic and physiological activities such as leaf formation, roots, as, dry matter production, and others, leading to efficient water translocation and nutrition, interception of solar radiation and carbon dioxide. This can improve the process of larger photosynthesis from adequate assimilation to subsequent translocation to various channels [6].

Based on the statistical analysis ear of corn weight, the highest yield is shown by H treatment (¾ NPK + ¼ cow manure), I treatment (¾ NPK + ½ cow manure), and J treatment (¾ NPK + ¾ cow manure) but the efficient treatment was on H treatment with dosage ¾ NPK + ¼ of cow manure because not significantly different. These results is in line with the findings of [7] and [8]. They found that the result the combination is the highest compared with control treatments and the combination between poultry manure and inorganic fertilizer. The research results show that the use of ¾ NPK + ¼ cow manure recommended dosage can increase the sweetcorn yield. The availability of sufficient growth nutrients from inorganic fertilizers leads to increased cell activity, increased propagation and cell enlargement, as well as growth fertility [9]. This shows that to get a good harvest, soil needs additional fertilizer, especially in the corn plant. The lowest tropical soil fertility status inhibits corn production because maize has a very strong grueling effect on the soil. It is generally observed that maize fails to produce good grain in plantings without adequate nutrients [10].

4. Conclusions
There is a significant increase in sweet corn yield with the integrated application of cow dung with inorganic fertilizer compared to control treatment or inorganic fertilizer treatment alone. This experiment shows that the productivity of sweet corn is much higher when the application of a combination of doses ¾ NPK + ¼ cow manure.

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References

[1] A K Quaye, B L Kofi and A M Stephen 2009 Oil Water and Nitrogen Interaction Effects on Maize (Zea mays L.) Grown on a Vertisol. *Journal of Forestry, Horticulture And Soil Science* 3(1):15-21.

[2] K L Sahrawat, T J Rego, S P Wani, G Pardhasaradhi 2008 Sulfur, Boron, and Zinc Fertilization Effects on Grain and Straw Quality of Maize and Sorghum Grown in SemiArid Tropical Region of India. *Journal Of Plant Nutrition* 31: 1578-1584.

[3] A M Jaliya, A M Falaki, M Mahmud and Y A Sani 2008 Effects of sowing date and NPK fertilizer rate on yield and yield components of quality maize protein (Zea mays L.) *ARPN J. Agric. Biological Sci.* 2: 23-29.

[4] B W Simanihuruk, A. D Nusantara dan Faradill 2002 The Role of EM5 and NPK Fertilizers in Increasing Growth and Yield of Sweet Corn Plants on Reeds. *Jurnal Ilmu – ilmu Pertanan Indonesia* 4 (1) : 56 – 61.

[5] K E Law-Ogbomo and J E Law-Ogbomo 2009 The Performance of Zea mays as Influenced by NPK Fertilizer Application *Not Sci. Biol.* 1(1) 59-62.

[6] A M Jaliya, A M Falaki, M Mahmud and Y A Sani 2008 Effects of sowing date and NPK fertilizer rate on yield and yield components of quality maize protein (Zea mays L.) *ARPN J. Agric. Biological Sci.* 2: 23-29.

[7] C C Mitchell, S T 2005 Long-term evaluation of poultry litter as a source of nitrogen for cotton and corn. *Agronomy Journal*. 2005;97(2):399–407.

[8] M Sharif, M Ahmad, MS Sarir, R A Khattak 2004 Effect of organic and inorganic fertilizers on the yield and yield components of maize. *Pakistan Journal of Agriculture, Agricultural Engineering Veterinary Sciences*. 2004;20(1):11–16.

[9] U S Fashina, K A Olatunji and K O Alasiri 2002 Effects of different plant population and poultry manure on yield of Ugu (Telfairia occidentalis) in Lagos State *Nigeria in Proceedings of the annual Conference of Horticultural Society of Nigeria (HORTON)* 123-127.

[10] J A Adediran and V A Banjoko 2003 Comparative effectiveness of some compost fertilizer formulations for maize in Nigeria *Nig. J. Soil Sci.* 13: 42-48.