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# Utilization of peanut shell waste and bio-slurry as organic fertilizer for sweet corn (*Zea mays* L. *Saccharata*)

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**Abstract.** The increasing demand for sweet corn (*Zea mays*, L.) in order to meet community nutrition has encouraged farmers to make improvements to the cultivation system. One of the important factors in the process of increasing sweet corn production is soil nutrients. Peanut shell (*Arachis hypogea*, L.) and bio-slurry are organic waste, when they have undergone a decomposition process they can be used as organic fertilizers. The aim of the study was to test the correct dosage of peanut shells and the concentration of bio-slurry so that it could be used as organic fertilizer for sweet corn plants. The research was conducted in the experimental garden of the Faculty of Agriculture and Animal Husbandry, University of Muhammadiyah Malang from March to May 2020. It is a factorial experiment arranged in randomized groups, the first factor is peanut shell dose: P<sub>1</sub> = 10 tons / ha; P<sub>2</sub> = 15 tons / ha; P<sub>3</sub> = 20 tons / ha. The second factor is the bio-slurry concentration: B<sub>1</sub> = 100 ml/ L; B<sub>2</sub> = 125 ml/ L; B<sub>3</sub> = 150 ml/ L. The results showed that there was an interaction between the peanut shell dosage treatment and the bio-slurry concentration on the growth and yield of sweet corn. Dose treatment of peanut shells on growth and yield variables of sweet corn is influenced by the concentration of bio-slurry. A combination of suitable treatment for growth and yield to sweet corn is peanut shell dose 15 tons/ ha and bio-slurry concentration 125 ml/ L.

## 1. Introduction

Sweet corn (*Zea mays* L. *saccharata*) is a horticultural commodity favored by the community because of its taste [1, 2]. Currently, the demand for sweet corn is increasing, this encourages farmers to make improvements to the cultivation system to increase production. The production of sweet corn in East Java has increased annually, namely in 2015 amounting to 6,131,163 tonnes/ha, in 2016 amounted to 6,278,264 tonnes/ha and in 2017 amounted to 6,335,252 tonnes/ha [3, 4]. National sweet corn production has not been able to meet market demand, one of the obstacles is low productivity [5, 6]. One of the important factors for increasing sweet corn production is fertilizing and/or adding organic matter to the soil [7]. Soil organic matter is important in creating soil fertility because it can improve soil physical, chemical, and biological properties. The imbalance of the nutrient cycle in the soil is a continuing threat to the maize production system, so it is necessary to add organic sources to the soil [8]. So far, peanut shells (*Arachis hypogaea* L.) have not been fully utilized, even though peanut shells contain organic N, P, K, and C macronutrients [9]. Bio-Slurry from cow dung which is processed in a biogas reactor is a high-quality organic fertilizer which is rich in macro-nutrient content that plants need in large quantities and are essential for their growth [10, 11, 12]. The purpose of this study was to tested whether there was an interaction between the treatment of peanut skin waste dosage and bio slurry dosage treatment on the growth and yield of sweet corn, and to determine the optimal dosage of peanut and bio-slurry waste for sweet corn yield.



## 2. Material and Methods

### 2.1. Material

The research was conducted in the experimental garden of the Faculty of Agriculture and Animal Husbandry, University of Muhammadiyah Malang from March to May 2020. It is a factorial experiment arranged in randomized groups, the first factor is peanut shell dose: P1 = 10 tons/ ha; P2 = 15 tons/ ha; P3 = 20 tons/ ha; Control = NPK fertilizer at a dose of 300 kg/ ha. The second factor is the bio-slurry concentration: B1 = 100 L/ m<sup>2</sup>; B2 = 125 L/ m<sup>2</sup>; B3 = 150 L/ m<sup>2</sup>.

Slurry is taken from a cow dung disposal site in Pujon village, Pujon sub-district, Malang district. Liquid slurry is first fermented for 3 weeks or until it has no smell, then poured it onto the surface of the ground where the peanut shell has been sprinkled. Liquid slurry is fermented for 3 weeks or until it has no smell then poured onto the surface of the ground where the peanut shell has been sprinkled. The slurry dose is 400 liters / ha, while the concentration is according to treatment. Peanut shell is ground until crushed and sprinkled on the surface of the soil with a dose according to treatment.

### 2.2. Methods

After the soil was evenly processed, an experimental plot was made with a size of 1 m<sup>2</sup>, with a distance between the plots of 50 cm. The number of experimental plots was made according to the number of combinations and was repeated three times. In one plot, planting holes were made with a spacing of 70cm x 25cm.

The crushed peanut shell waste was distributed in each plot with the dose according to treatment: P1 = 10 tons / ha; P2 = 15 ton / ha; P3 = 20 ton / ha; Control = NPK fertilizer at a dose of 300 kg / ha or 4.6 grams per plant at 7 days before planting. Likewise, the Bio-Slurry waste was sprayed on the peanut shell waste at a concentration according to the treatment: B1 = 100 ml/ L; B2 = 125 ml/ L; B3 = 150 ml/ L. The maintenance of sweet corn plants includes irrigation, weeding and planting. Watering is carried out every day until the corn plants are four weeks old. Furthermore, watering is carried out only when the plants need it. In the flowering and seed formation phases, irrigation needs to be done intensively, because in that phase the plants need more water. Routine weeding is done when the plants are one to four weeks old. After the planting is more than four weeks old, weed it only if weeds cover 50% of the plot. Heading is carried out when the plants are 3 WAP (week after planting) by filling the roots of the maize with soil. The purpose of heading is to prevent the plants from falling easily.

Observations were made on the variables: diameter of corn stem, weight of corn cob, length of corn cob, and amount dissolved solid. The data obtained were analyzed using analysis of variance, if there is a difference then it is followed by a 5% real difference test.

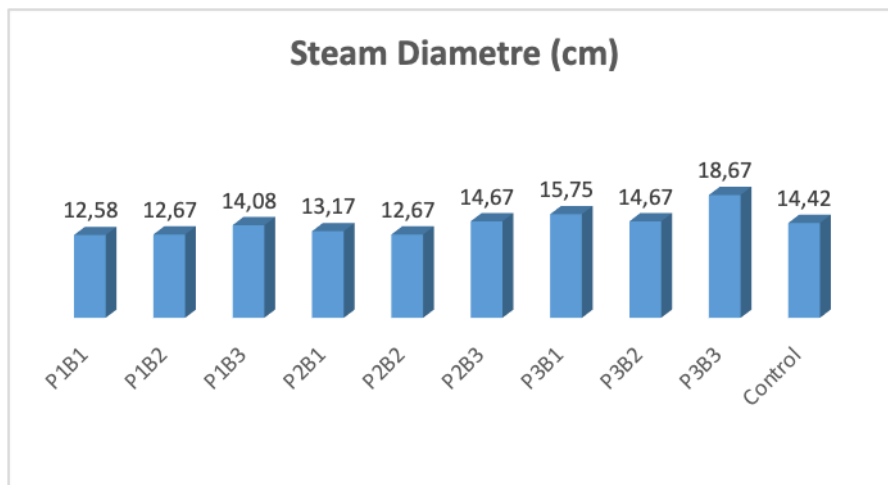
## 3. Results and Discussion

### 3.1. Result

The results showed that there was an interaction between the treatment of peanut shells and the concentration of bio-slurry on the growth and yield of sweet corn. After the 5% Duncan follow-up test, each treatment combination showed a significant difference. Observation variables include: stem diameter, corn cobs length, corn cobs weight, amount to dissolved solids.

#### 3.1.1 Stem Diameter

There is an interaction between the treatment of peanut shell waste dosage and the treatment of bio-slurry waste concentration on the diameter of the corn plant. This means that every change in the dose of peanut shell waste and changes into the concentration of bio-slurry waste will have an effect on changes in the diameter of the corn plant. The 5% real difference tested results showed that there were differences between each treatment combination as presented in Figure 1.

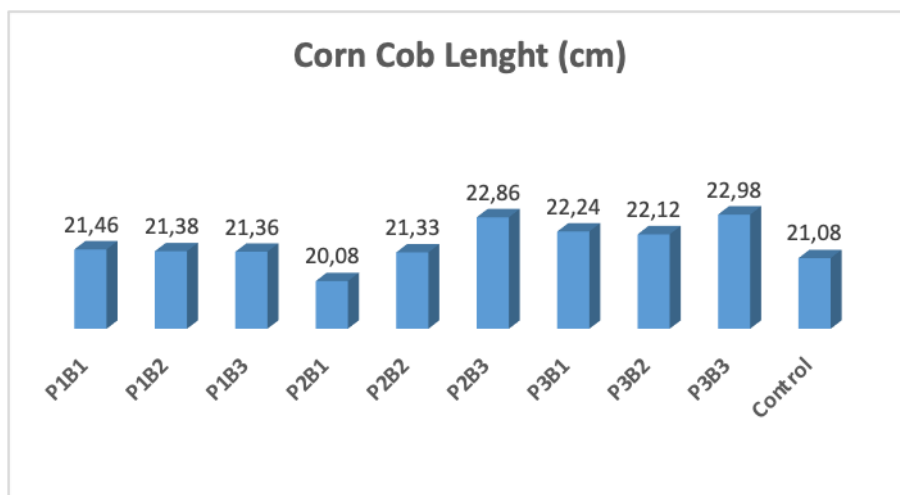


**Figure 1.** Combination of doses of peanut shells and bio-slurry concentration on the diameter of maize stem.

In Figure 1, it can be seen that the P3B3 treatment combination shows the largest stem diameter followed by P3B1. While the treatment combination P1B3, P2B3, P3B2 and control did not show any significant difference. In Figure 1 it appears that the P3B3 treatment combination shows the largest stem diameter followed by P3B1. Meanwhile, the combination treatment P1B3, P2B3, P3B2 and control showed no significant difference.

*3.1.2 Corn Cobs Lenght*

There is an interaction between the treatment of peanut shell waste dosage and the treatment of bio-slurry waste concentration on the length of corn cobs. This means that every change in the dose of peanut shell waste and changes into the concentration of bio-slurry waste will have an effect on changes in the diameter of the corn cob lenght. The 5% significant difference test results showed that there were differences between each treatment combination as presented in Figure 2



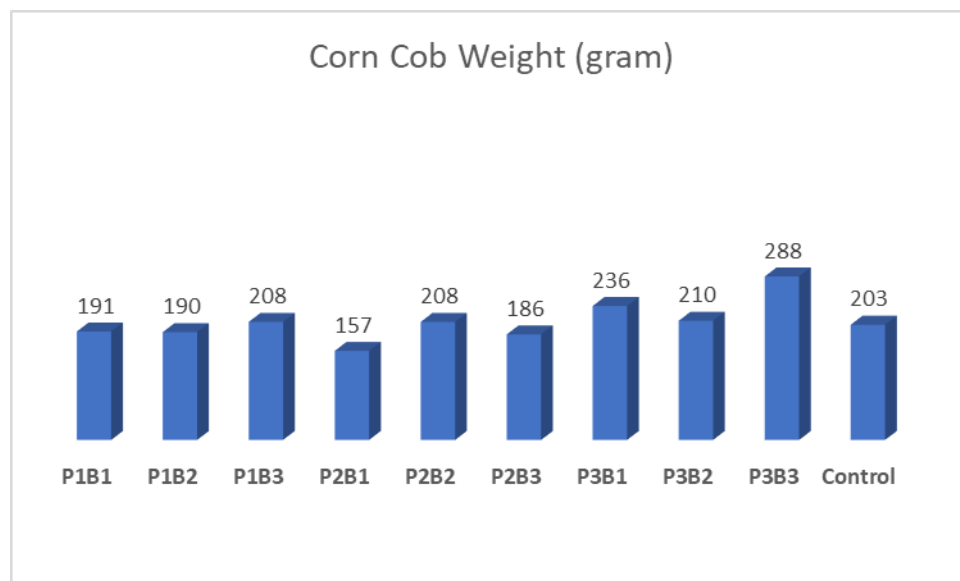
**Figure 2.** Combination of doses of peanut shell and bio-slurry concentration on the length of corn cobs.

In Figure2 it can be seen that the length of corn cobs in the combination treatment of P2B3 and P3B3 does not show a significant difference based on the 5% real object test . Meanwhile , the yield of corn

cobs in the two treatment combinations was significantly different from the lengths of corn cobs in the combination of other treatments.

### 3.1.3 Corn Cob Weight

There is an interaction between the treatment of peanut shell waste dosage and the treatment of bio-slurry waste concentration on the weight of corn cobs. This means that every change in the dose of peanut shell waste and changes into the concentration of bio-slurry waste will have an effect on changes in the diameter of the corn cob weight. The 5% significant difference test results showed that there were differences between each treatment combination as presented in Figure 3.

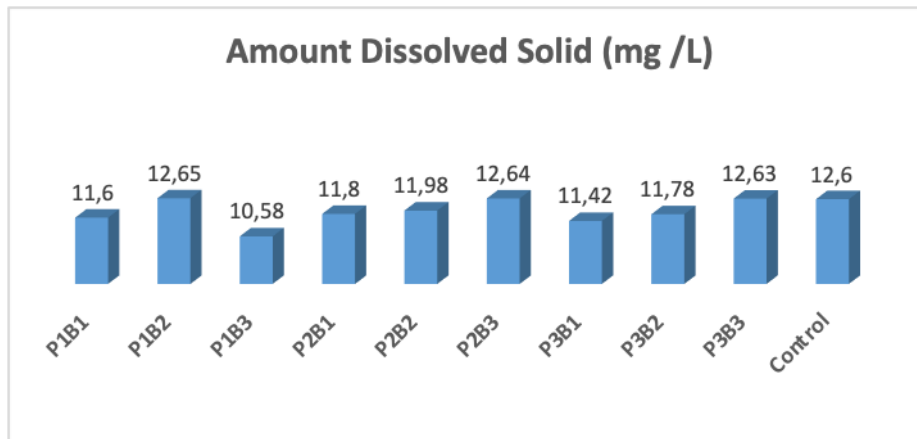


**Figure 3.** Combination treatment of peanut shells waste dosage and bio-slurry concentration on corn cobs weight.

In Figure 3 it can be seen that the highest yield of corn cobs weight is the P3B3 combination treatment followed by the P3B1 combination treatment. Meanwhile, the combination treatment of P1B3, P2B2, and P3B2 did not show a significant difference in the yield of corn cobs weight. Likewise for the combination treatment of P1B1, P1B2, and P2B3, did not show a significant difference in the yield of corn cobs weigh.

### 3.1.4 Amount of Dissolved Solid

There is an interaction between the treatment of peanut shell waste dosage and the treatment of bio-slurry waste concentration on the amount of dissolved solid. This means that every change in the dose of peanut shell waste and changes into the concentration of bio-slurry waste will have an effect on changes in the diameter of the amount dissolved solid. The 5% significant difference test results showed that there were differences between each treatment combination as presented in Figure 4.



**Figure 4.** Combination of doses of peanut shells and bio-slurry concentration on the amount of dissolved solid.

In Figure 4, it can be seen that the dissolved solids of maize in the combination treatment of P1B2, P2B3, P3B3, and control showed no significant difference based on the results of the 5% significant difference test. This shows that the treatment of the waste user is able to produce the same amount of dissolved solids in corn as the use of inorganic NPK. However, it should be not that the use of inorganic fertilizers can damage the physical structure of the soil. On the other hand, organic waste that is returned to the soil can be used as fertilizer because it can improve the physical, chemical and biological properties of the soil so that it is beneficial to plants.

### 3.2. Discussion

The overall results showed that the utilization of peanut shell and bio-slurry waste was better for the growth and yield of sweet corn compared to the use of inorganic NPK fertilizers. Because organic waste is a medium for growth and reproduction for decomposing organisms such as bacteria, fungi and actinomycetes. Organic matter also improves soil chemical properties, which can increase cation exchange capacity and nutrient availability. Organic matter also improves soil biological properties, which provides a growing medium for decomposing microorganisms [13, 14, 15].

Peanut skins are waste that has not been fully utilized, even though peanut shells contain macronutrient compounds of cellulose, hemicellulose, chitin and lignin [16];[17]. Bio-slurry contains 68.59% organic matter, 17.87% C-org, 1.47% N, 0.52% P, 0.38% K, and 9.09% C / N [11]. In addition, bio-slurry contains probiotic microbes which are beneficial to the health of agricultural land and fertilize the soil [12].

The addition of organic matter in the soil at the same time can improve the physical, chemical and biological properties of the soil, so that it can be useful as an organic fertilizer [17, 18]. As the results of the study indicate that there is a synergy interaction between arbuscular mycorrhizal fungi and phosphate solubilizing bacteria, so that it can increase phosphorus uptake and plant growth [19]. Another opinion states that the presence of Zn solubilizing rhizobacteria isolated from the rhizosphere of maize plants can increase the bioavailability of Zn in the soil [20, 21]. The natural fermentation process (decomposition) of organic matter in anaerobic (without oxygen) by methane bacteria (methanogenic bacteria) so that methane gas is produced as an essential nutrient for plant growth [11].

Utilization of organic waste is a solution to the application of safe and environmentally friendly technology. Bacterial and fungal inoculums have the potential to restore fertility to degraded land through several processes. Microorganisms increase the availability of biological nutrients through nitrogen fixation and mobilization of key nutrients such as phosphorus, potassium and iron. Microbial inoculation of fungi and bacteria can help reduce the negative impact of artificial fertilizers on the environment and help restore sustainable fertility.

#### 4. Conclusion

Base on the research results, it can be concluded as follows: there was a significant interaction between peanut shell dose treatment and bio slurry concentration on the growth and production of sweet corn. So that every change in the dosage of peanut shell waste and changes from the concentration of bi-slurry waste will affect the growth and yield of sweet corn. The combination treatment of peanut shell dose 10 ton / ha and bio slurry concentration 125 ml / L is good for variable cob corn length, the amount of dissolved solids. while the combination treatment of peanut shell dosage of 20 tons / ha and concentration of bio slurry 125 ml/ L is good for variable cob corn weight and stem diameter. Recommended combined treatments for sweet corn growth and yield are: peanut shell dose 15 tons/ ha and bio-slurry concentration 125 ml/ L.

#### 5. References

- [1] Awalita M, Sri Darmanti, S Parman 2006 *Buletin Anatoni dan Fisiologi* **16** 20-6
- [2] Aris Satriyo W, Barunawati N, Maghfoer MD 2017 *J Produksi Tanaman* **8** 1381-1388
- [3] Badan Pusat Statistik 2018 *Ekonomi dan perdagangan. Indonesia impor jagung merdeka com* <https://www.merdeka.com>.
- [4] Umi Maryamah, SH Sutjahyo, A Hindita 2017 *Buletin Agrohorti* **5** 88-97
- [5] Meriati 2019 *J Embrio* **2** 24-35
- [6] Laksono RA, WS Nurcahyo, M Syafii 2008 *J Kultivasi* **17** 608-615
- [7] Irshad M, Ashraf M, Eneji AE, Hussain Z 2013 *J Soil Sci and Plant Nutr* **13** 115-21.
- [8] Flores D-Sanches, Pastor A, Rossing WAH, Kroppt MJ, Lantinga EA. 2016 *J Soil Sci Plant Nut.* **16** 801-17
- [9] Dahlan, Darmansyah 2011. *J Agrisistem* **7** 69-78
- [10] Masi R, Cri WBY, Novaty ED 2015 *J Agrotan* **1** 45-56
- [11] Saufani I, Wawan 2017 *Jurnal Online Mahasiswa* **4** 1-11
- [12] Hilmi A, Saimul L, Tintrim R 2018 *Known Nature* **1** (1) 65–73.
- [13] Darwin HP, Ginting YC, Saputra LP, Fitri H 2017 *JHI* **8** 59-67
- [14] Precillia GP, Yunus A, Harjoko D 2018 *Agrosains* **20** 28-33
- [15] Jumini, Nurhayati, Murzani 2011 *J Floratek* **6** 165-170.
- [16] Pratiwi NE, Bistok HS, Dina B 2017 *JIP* **29** 11-20
- [17] Christina NE, Achmad A 2007 *J Sains MIPA Unila* **5** 177-82
- [18] Ramiro Gonzales M, Rinker DL 2006 *Bioresour Tech* **97** 1697-86
- [19] Shubhangi S, Company S, Ballhausen MB, Rappel S, Franken P 2020 *Microbiol Res* **240** 1-10.
- [20] Mumtaz MZ, Ahmad M, Jamil M, Hussain T 2017 *Microbiol Res* **202** 51-60
- [21] Marco A, Lampis S, Saprolli, Angelini E, Vallini G 2016 *Microbiol Res* **183** 42-52

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