The Influence of Guano Organic Fertilizer in Sustainable Agricultural Systems on Growth and Results of Sweet Corn Plants (Zea mays saccharata L)

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Abstract

The availability of renewable natural resources needs to be maintained as biological and sustainable survival, the use of guano or bat droppings is one of them, bat droppings can be used as an ingredient for making organic fertilizers for plant growth and yields, so this study aims to determine the effect of guano organic fertilizer dosage on growth and yield of sweet corn (Zea mays saccharata L). This research was conducted on agricultural land using beds measuring 300 cm x 200 cm x 20 cm, using 4 (four) treatments and 4 (four) replications. Fertilizer dosage treatments were: g0 = without Guano organic fertilizer, g1 = 3 tons of guano organic fertilizer. ha-1 or 1.8 kg. plot-1, g2 = 5 tons of guano organic fertilizer. ha-1 or 3 kg. plot-1, g3 = 7 tons of guano organic fertilizer. ha-1 or equivalent to 4.2 kg. Plot-1. Observation parameters consisted of plant height (cm), number of leaves (strands), stem diameter (cm), fruit diameter (cm), fruit length (cm), fruit weight per plot (kg). The results showed that the use of various doses of organic fertilizer guano g3 = 7 tonnes of organic fertilizer guano ha-1 or equivalent to 4.2 kg/plot had a significant (P < 0.05) effect on plant height, number of leaves of sweet corn plants, and a very significant effect significantly (P < 0.01) on cob diameter, stem diameter, and fruit weight per plot. The use of guano or bat droppings as organic fertilizer at increasing doses up to 7 tons.ha-1 gave the best results for all research parameters. Bat populations as producers of guano or organic fertilizers need to be maintained and preserved in a sustainable agricultural system.

Keywords: Organic Fertilizer, Guano, Growth, Yield, Zea mays saccharata L.

A. INTRODUCTION

A sustainable agricultural system is a method that is widely practiced by rural farming communities in farming, where farmers grow various types of crops and raise livestock in the same area with the aim of being able to use land optimally, but mostly carried out conventionally. The agricultural intensification system has not been implemented properly, for example the use of fertilizers to increase crop yields, this is due to limited funds. The use of local resources is one alternative to meet these
limitations, namely by utilizing guano or better known as bat manure as organic fertilizer. Guano contains nutrients needed by the main plants for growth and yield improvement.

Guano is used as a multipurpose fertilizer for soil maintenance or as an agent to help plant growth in both horticultural, agricultural and fishery plants (to fertilize pond crops such as algae and plankton, which are eaten by fish) (Guanomad S. A 2014). According to K. D. Subedi and B. L. Ma (2009) that nutrient management, which is integrated with soil, plants and the environment will support sustainable maize production, a deficiency of one element in the soil will cause disrupted plant growth. So it is stated that every essential element cannot be replaced or compensated by other elements, and these elements are directly involved in plant growth and reproduction. Likewise, according to Musadia Afa, (2016) Fertilization using natural organic guano significantly affects: plant height, number of leaves, number of tillers, stem diameter and plant fresh weight. Guano is composed of several main elements, including 10% nitrogen, 3% phosphorus, and 1% potassium. The high nitrogen content functions to make plants green and provide fast growth after application, Phosphorus promotes root growth and flowering, and potassium encourages strong stems (Keleher 2020). The use of organic guano fertilizer is one way to increase plant growth and yield because it can provide essential nutrients for cassava plants. Tropical corn varieties are reported to contain 0.33% P, and 0.39% K in grains (Feil et al., 2005).

In Central Sulawesi Province, there are still many bats found in caves and around mangrove forests, but bat manure (guano) has not been used as fertilizer due to limited knowledge to manage it as a source of organic fertilizer. In connection with this, the use of bat manure was conducted. With the aim to determine the effect of using guano organic fertilizer on the growth and yield of sweet corn. The purpose of this study was to determine the effect of using guano organic fertilizer on the growth and yield of sweet corn (Zea mays saccharata L).

B. MATERIALS AND METHODS

1. Materials

The material used in this research is guano organic fertilizer. Before it is applied to guano plants, dry it first, then mash it, diayaak with uk. 60 Mess then weighed according to the needs of each plant sample. The amount of guano organic fertilizer used was 36 kg. The sweet corn seeds used were the Bonanza F1 variety, the seeds were planted as many as 2 per hole, before the seeds were planted, sorting was done first, sorting the seeds by putting them into a medium containing water. The floating seeds are discarded while the seeds used are those that sink into the water.
Before planting, the land to be used is processed using a hand tractor and crushed using a hoe. This tillage is done because it is to eliminate weeds and loosen the soil so that the roots of plants can grow well. Subsequent soil processing is continued with the manufacture of beds arranged using ropes. Bed size 3 m X 2 m with a bed height of 20 cm. The distance between treatments was 100 cm and the distance between replications was 50 cm. This study consisted of 4 treatments and 4 times each, so that there were 16 experimental plots. Planting is done by making a hole in the hole with a depth of ± 5 cm. Each hole is planted with 1 sweet corn seed with a spacing of 70 x 40 cm so that there are 21 plant populations per plot. Guano organic fertilizer was applied to the beds according to the treatment given at intervals of 7 days before planting. Fertilization was carried out on the entire surface of the soil in each research plot.

2. Sampling Method

Corn plant height (cm), measured from the part of the maize plant visible above the ground to the highest leaves measured at the age of 14 days after planting (DAS), 28 DAS and 42 DAS. The number of leaves of corn (strands), the number of leaves of corn is calculated at the age of 14 HST, 28 HST and 42 HST, on leaves that have been fully opened and leaves of institutions are not counted. Corn stem diameter (cm). The diameter of corn stalks was measured at the base of the stem which was carried out at the age of 14 DAS, 28 DAS and 42 DAS. Diameter of corn (cm), diameter of corn with corns measured 3 cm from the base of the fruit using a sigma tool / calipers and carried out at harvest time (cm). Corn length (cm), the length of the corn fruit is measured from the base of the seed to the tip of the last seed (cm). Weight of corn without husks per plot (kg). Fruit weight per sample was carried out by weighing the fruit at harvest (kg).

3. Data Analysis Methods

This study was prepared using a randomized block design (RBD) with 4 doses of guano organic fertilizer, namely:

- \( g_0 \) = Without guano organic fertilizer (control)
- \( g_1 \) = 3 tonnes of organic fertilizer guano ha -1 or equivalent to 1.8 kg / plot
- \( g_2 \) = 5 tonnes of organic fertilizer guano ha -1 or equivalent to 3 kg / plot
- \( g_3 \) = 7 tonnes of organic fertilizer guano ha -1 or equivalent to 4.2 kg / plot

Each experimental plot contained 21 plant populations, bringing the total to 336 plant populations. While each experimental plot contained 5 sample plants, so there were a total of 80 sample plants. Based on this design, according to Heryanto (1996), the statistical analysis model used is: The data obtained were analyzed for diversity
with the F test. If the analysis of variance shows a real or very real effect, then it is continued by using the least significant difference (LSD) at the 5% level (Hanafiah, 2002).

C. RESULT AND DISCUSSION

1. Plant Height (cm)

Observation data of plant height (cm) sweet corn (Zea mays Sacarata. L) at the age of 14, 28, 42 days after planting (DAS). The list of variance shows that the use of various doses of guano organic fertilizer significantly affected the height of the 42-year-old panda sweet corn (HTS). The average plant heights of sweet corn 14, 28 and 42 DAS are presented in Figure 1.

![Figure 1. Average Height of Sweet Corn Plants Age 14, 28, and 42 DAP](image)

The results obtained are as shown in Figure 1, it can be seen that the application of guano organic fertilizer of 7 tons Ha-1 (g3) is the best treatment that can increase the height of sweet corn plants up to 42 DAS compared to other treatments.

The increase in the level of maize plants is caused by the influence of the N element in the guano fertilizer given. The function of N is to stimulate plant growth, Feil et al., (2005) stated that the N content in guano is 1.46%. increasing plant height according to Jalali et al., (2014) is caused by the availability of Nitrogen content, then it is said that Nitrogen is a very important element in building the protein needed by plants and if N is not available then plant growth will decrease. Nitrogen affects various physiological and biochemical processes in plant cells which ultimately affect plant growth and development (Jiban. Et al, 2018). Akbar et al, (1999) stated that maize plant height increases with increasing N. The increase in N level and the amount of separation prolongs the vegetative growth period of maize which may increase photosynthate formation and partition into stems which has a beneficial impact on plant height (Amanullah et al., 2009). Masdar et al., (2006) asserted that differences in plant height were caused by the application of suitable fertilizers, and
if given at inappropriate dosages would inhibit their growth. Furthermore the increase in N is also influenced by climatic conditions at the time of application (Bustami et al., 2012 and Amanullah et al., 2009b).

2. Number of Leaves (strands)

Observation data on the number of leaves (strands) of sweet corn (Zea mays Sacarata. L) at the age of 14, 28, 42 DAS, can be seen in appendices 4a, 5a, and 6a while the variance can be seen in appendices 4b, 5b, and 6b variance shows that the use of various doses of organic guano fertilizer significantly affected the number of leaves of panda sweet corn plant age 42 HST. The mean number of leaves of sweet corn plants 14, 28 and 42, hts is presented in Figure 2.

![Figure 2. An average number of leaves of Sweet Corn Plants Age 14, 28, and 42 DAP](image)

The results obtained are as shown in Figure 2, it can be seen that the provision of guano organic fertilizer is 7 tons. ha-1 or the equivalent of 4.2 kg. plot-1 was the best treatment that was able to produce the highest number of leaves of sweet corn plants at the age of 42 DAS, compared to other treatments.

The increase in the number of leaves in this phase is due to the mineralization process of the guano in the soil so that the N nutrient is easily absorbed by the roots. Hadas and Rosenberg (1992) stated that the process of guano mineralization in soil is faster than in water. Zafata, (2002) found that guano is a good source of N. This significant growth occurred because the nitrogen, C-organic, and P content in bat dung were included in the very high category. Gideon and Hapsoh, 2017) Adisarwanto and Yustina (2001), state that nitrogen is one of the macro nutrients which is the main limiting factor for maize production on dry land. Corn is a plant that requires a high amount of nutrients due to its very large nutrient utilization...
capacity. A higher volume of nitrogen is required for higher yields. Nitrogen is needed in more significant amounts than other nutrients (Jiban et al., 2018). Thi Sothearen et al. (2014) stated that the application of bat guano can increase plant growth. Compared to the control, all plant species in the guano treatment showed a greater growth rate, it was further stated that when compared to the chemical fertilizer treatment, the three species in the guano treatment also showed better growth.

3. Rod Diameter (cm)

Observation data on stem diameter (cm) of sweet corn plants at the age of 14, 28, 42 DAS, the results of variance showed that the use of various doses of guano organic fertilizer had a significant effect on the stem diameter of the panda sweet corn plants aged 42 DAS. The average number of stem diameters of sweet corn plants 14, 28 and 42, HST are presented in Figure 3.

The results obtained are as shown in Figure 3, it can be seen that the provision of guano organic fertilizer is 7 tons. ha-1 or equivalent to 4.2 kg. plot-1 was the best treatment which produced the largest stem diameter of sweet corn at 42 DAS, compared to other treatments.

Measurement of stem diameter greatly affects the results obtained, stems that have a large diameter will carry large amounts of food as well, thus affecting the size of the cob and the number of seeds. This opinion is in line with the opinion of Kelly et al., (2015) that stem diameter plant height has a positive correlation with maize seed yield. Likewise, according to Musadia Afa, (2016) Fertilization using natural organic guano significantly affects: plant height, number of leaves, number of tillers, stem diameter and plant fresh weight.
4. Fruit Diameter (cm)

Observation data of fruit diameter (cm) of sweet corn without husks. The results of variance showed that the use of various doses of guano organic fertilizer had a very significant effect on the fruit diameter of sweet corn plants. The average fruit diameter of sweet corn without husks is presented in Figure 4.

![Figure 4. Average Diameter of Sweet Corn Cobs](image)

The results obtained are as shown in Figure 4, it can be seen that the administration of various doses of guano organic fertilizer is 7 tons. ha-1 or the equivalent of 4.2 kg. plot-1 was the treatment that produced the largest fruit diameter of sweet corn without husk compared to other treatments.

Thus it can be said that the dose is 7 tons. ha-1 is the correct dosage for guano use. Isareethika and Jayasvasti (2018) reported that bat Guano is rich in phosphate. Phosphate functions to activate plant growth, flower growth, accelerate fruit and plant ripening. According to Fahmi. et al., (2010) if phosphorus functions normally, the ability of soil fixation will occur so that the release of nutrients will occur, and if plant growth is getting better, of course, the ability of the roots to absorb nutrients is also greater, ultimately causing the amount of nutrients absorbed by plants to also be the greater it is.

5. Fruit Length (cm)

Observation data on fruit length (cm) of sweet corn plants without husks, the results of variance showed that the use of various doses of guano organic fertilizer had a very significant effect on fruit length of sweet corn plants. The average fruit length of the sweet corn plant without the husk is shown in Figure 5.
The results obtained are as shown in Figure 5, it can be seen that the administration of various doses of guano organic fertilizer is 7 tons/ha or the equivalent of 4.2 kg/plot was the treatment that produced the longest fruit length of sweet corn without husked corn compared to other treatments.

The length of the fruit is caused because the nutrients absorbed by the root are completely fulfilled, so that the sweet corn will give its appearance according to its genetic potential. Guano organic fertilizer contains complete macro nutrients, including nitrogen and phosphorus and potassium. Vance et al., (2003) Phosphate is required for energy production, nucleic acid synthesis, carbohydrate metabolism and nitrogen fixation. Phosphorus promotes growth and flowering, as well as root propagation, while potassium strengthens the stems (Keleher 2020), furthermore, the fruit length of the corn plant is greatly influenced by the amount of nutrients absorbed by the roots. The composition of tissue nutrients varies according to the supply of nutrients available in the soil and those derived from applied nutrients).

### 6. Weight of Corn Fruit Plots (kg)

Observation data of fruit weight (kg) of sweet corn per plot without. The results of the variance indicate that the use of various doses of organic guano fertilizer significantly affected the fruit weight of sweet corn per plot. The average fruit weight of sweet maize per plot without klobot is shown in Figure 6.
The results obtained are as shown in Figure 6, it can be seen that the administration of various doses of guano organic fertilizer is 7 tons. ha-1 or the equivalent of 4.2 kg. plot-1 was the treatment that produced the heaviest fruit weight of sweet corn per plot without husk compared to other treatments.

Fruit weight is more supported by the content of phosphorus and nitrogen found in guano. Phosphorus significantly affects plant height, ear diameter, ear length, grain yield, skinned green ear weight and 1000 g weight (Amir, et al., 2011). Seed yield is affected by the N provided before and after the flowers bloom. For example, soil and leaves applied N around silking can increase seed yield and nitrogen use efficiency by up to 15% (Ma et al., 2004). Phosphorus deficiency usually occurs when corn plants are young, when the concentration of P. solution is inadequate to meet the high P requirements of faster growth. The concentration of granulated N continued to decline rapidly during the first 20 days during the seed filling phase and remained constant thereafter (Ma et al., 2001). Likewise, phosphorus deficiency will occur when the plants are still young (KD Subedi and BLMa (2011). It is further stated that tropical maize varieties are reported to contain 0.33% P and 0.39% K in grains (Feil et al., 2005).

**D. CONCLUSION**

The use of guano of 7 tons ha-1 or equivalent to 4.2 kg of plot-1 is the best dose treatment in this study where it produces, average plant height, number of leaves, diameter of filled ear, length of filled ear, and weight of fruit. corn without husks per plot gave the highest yield. 7.83 kg or equivalent to 32.65 Ton ha-1.
REFERENCES


