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Response of Organic (Material) Compost on the Production of Corn and the System Sustainable Agriculture

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

A sustainable agricultural system is an effort to maintain a healthy, dynamic, and sustainable agricultural environment. One of the environmentally friendly concepts is the use of organic matter as fertilizer. The purpose of this study was to obtain the best dose of using organic compost fertilizer.' This research was a quantitative experimental study using a one-factor Randomized Block Design (RBD), namely organic fertilizer with 5 levels of treatment, namely: P0 = No organic fertilizer (control)), P1 = Dose of 20 g.plant-1, P2 = Dose of 40 g.plant-1, P3 = Dose of 60 g.plant-1, P4 = Dose of 80 g.plant-1. The results of the study on the vegetative component at each additional dose increased in size, the yield component had a significant to a very significant effect on cob length, cob diameter, and weight of 1000 seeds. The use of compost can provide maximum results for the production of feed corn, The best use of fertilizer is at a dose of 80 g.plant^{-1}.

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Keywords: Organic matter; compost; sustainable; agriculture; fertilizer; corn.

1. INTRODUCTION

Sustainable agriculture is a farming activity that relies entirely on naturally available natural resources and maintains them continuously for the balance of nature and has social values for nature by maintaining ecological systems. Plant-associated microbiota is receiving increasing attention as part of this strategy as it contributes greatly to plant health, nutrition, and resistance to environmental disturbances [1].

In the current conditions, there has been a scarcity of fertilizers, especially fertilizers containing macro and micronutrients, including Nitrogen, Phosphorus, and Potassium (NPK). Besides that, there has also been a significant price increase, thus becoming the main inhibiting factor in agricultural cultivation. P fertilizer is a fertilizer that is needed in large quantities. However, P can quickly become unavailable in the soil due to its absorption or fast fixation on the surface of soil particles [2].

The use of compost is one solution. The use of compost in agriculture can be considered as an important activity for a sustainable society. Seque, [3], composting is the most sustainable solution from an economic and environmental perspective [4]. and has become the preferred choice for treating organic waste [5]

Organic matter compost made from chicken manure, rice husk biochar, cocoa pod husks, and weevils is the material for this study with a nutrient content of 0.27% N, 3.20% P, 1.63% K, and 17.40% C - Organic [6]. The addition of organic fertilizers to plants will increase soil organic N, P, K, and C, as well as decrease soil pH [7]. Based on this, a study was carried out on the use of organic matter compost on the growth and yield of forage corn plants in sustainable farming systems to obtain the best dosage use.

2. METHODS

2.1 Place and Time of Research

The research was conducted in Pangi Village, Baolan District, Tolitoli District, Central Sulawesi, Indonesia. In August – December 2022, with an altitude of 35º meters above sea level.

2.2 Manufacture of Fertilizers for Research

The tools used are Hoes, machetes, shovels, knives, tape measure, digital cameras, and stationery. The materials used in this research are: Pioneer brand feed corn seed organic fertilizer. raffia rope, insecticides, gramoxone herbicides, treatment labels, and boards.

Fertilizer material

a) Chicken manure 100 kg
b) 30 kg banana weevil
c) Biochar rice husk 20 kg'
d) Cocoa pod skin 20 kg
e) EM4 200 ml

How it works: first weevil cut into small pieces with a size of 5-10 cm. then mixed with chicken manure, biochar and EM4, then covered for 10 days, then finely ground and then closed again for 7 days, air dried until the water content is low, to get a fine texture, then sifted with a size of 4.8 ml.

In this study, 180 plants were used, which were in 4 replicates with 5 treatments so that there were 20 treatment plots, each plot contained 12 plants, but 3 plants were used as samples from each plot so that the total sample size was 60 plants. Observational variables consist of:

a) Plant height was measured from the soil surface to the point of growth or the tip of the highest leaf. Measurements were made at the age of 14 Days After Planting (DAP), 28 DAP and 35 DAP.
b) The number of leaves, counted all the leaves contained in corn plants starting at the age of 14 DAP, 28 DAP and, 35 DAP.
c) Leaf length, calculated as a whole leaf found in corn plants starting at the age of 14 DAP, 28 DAP and, 35 DAP
d) The average cob length (cm) was measured at 110 DAP harvest using a ruler.
e) Fruit diameter (cm) was measured at 110 DAP using a ruler
f) Average Weight The weight of 1000 seeds (g) was weighed using a digital scale

This research is a quantitative experimental study using a one-factor Randomized Block

Design (RBD), namely on organic fertilizers with 5 treatment levels, namely:

P0 = without organic fertilizer (control)
P1 = Dose of 20 g.plant-1
P2 = 40 g dose.plant-1
P3 = 60 g dose.plant-1
p4 = 80 g dose.plant-1

The observed data were then analyzed using a one-factor Randomized Block Design (RBD). If the results of the analysis of variance had a significant or very significant effect, a Duncan 5% multiple follow-up tests were performed.

3. RESULTS

3.1 Growth Component

The results of the analysis of diversity showed that the application of 20 g, 40 g, 60 g, and 80 g of organic fertilizers did not significantly affect the height of plants aged 14 DAP, 28 DAP, and 35 DAP. However, each farm has a height difference, this can be seen in Fig. 1.

The tallest plant of the 5 treatments was 14 DAP (34.8 cm) and 28 DAP (75.45 cm) which was 40 g per tree, while 35 DAP was given 80 g/plant with a height of 165.8 cm.

Likewise the parameters of leaf length and the number of leaves, each treatment had no significant effect on the age of 14 DAP, 28 DAP, and 35 HST. This can be seen in Fig. 2.

Furthermore, for leaf length, at 14 DAP and 28 DAP, there was an increase with the administration of a dose of 40 g/plant, while the longest leaf at 35 DAP was found at a dose of 80 g/plant.

While for the number of leaves parameter, at 14 DAP, 28, DAP, and 35 DAP the highest number of leaves was found at the dose of 80 g/plant (4.3 leaves, 7.9, and 12.2 leaves), and was very significantly different from other treatments, in age 35 DAP.

3.2 Yield Component

The results of the analysis of cob length, cob diameter, and weight of 1000 seeds had a significant effect on all doses given, the average yield components can be seen in Table 2.

Table 2. Shows that fruit length was very significantly different from other treatments, namely the use of organic fertilizer 80 g/plant, followed by 60 g, 40 g, and 20 g treatments. Likewise, the cob diameter and weight of 1000 seeds were significantly different from the other treatments

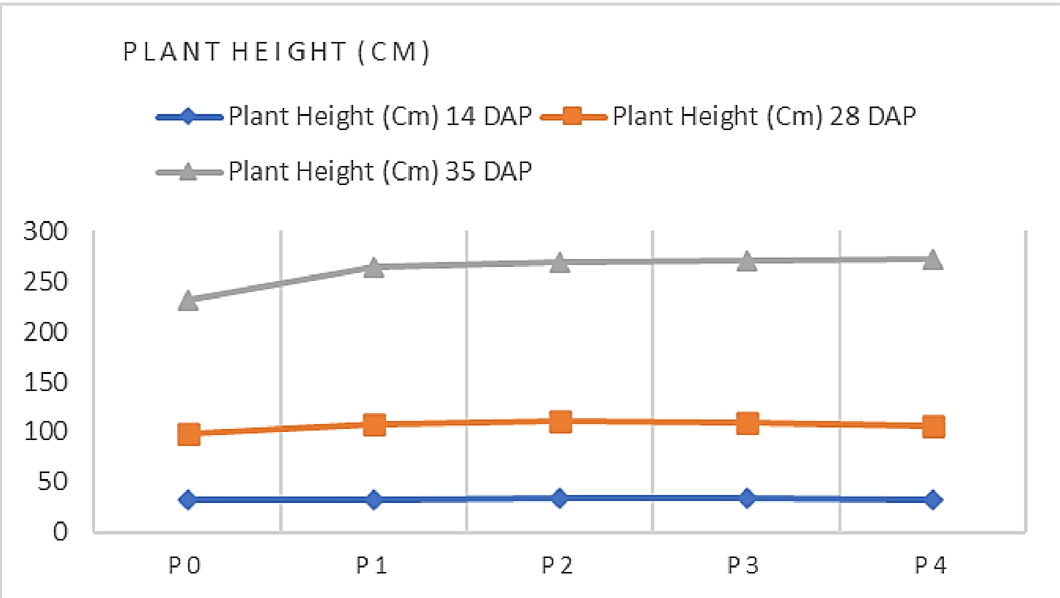

Fig. 1. The average height of corn plants aged 14 DAP, 28 DAP, and 35 DAP

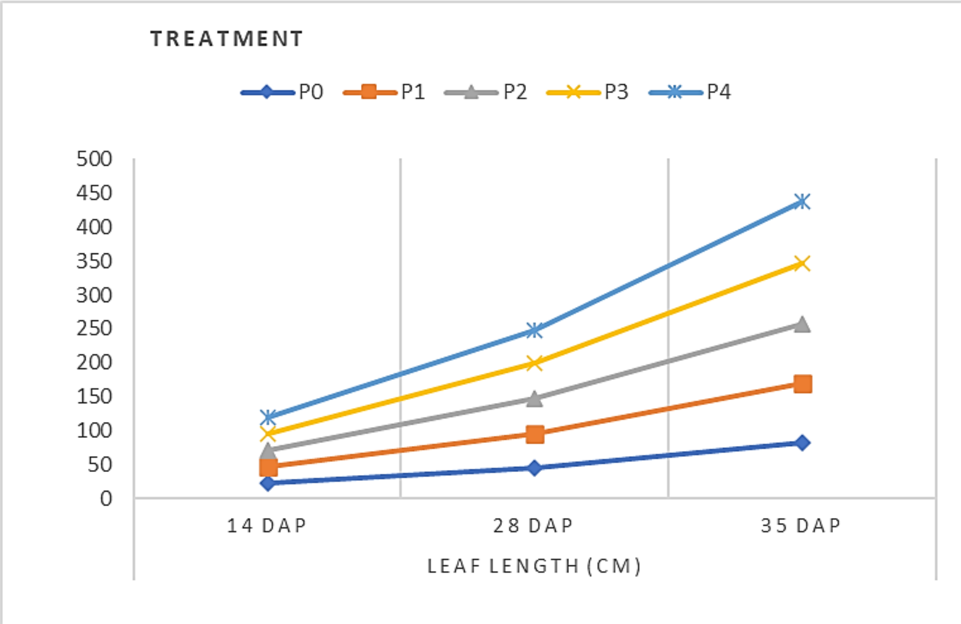

Fig. 2. Average leaf length of corn plants at 14 DAP, 28 DAP, and 35 DAP

Table 1. The average number of leaves of corn plants aged 14 DAP, 28 DAP, and 35 DAP

Treatment	Number of Leaves (Streams)		
	14 DAP	28 DAP	35 DAP
P0	4,1	6,85	10,05a
P1	4,25	7,95	11,4b
P2	4,2	8	11,7bc
P3	4,35	7,95	11,7bc
P4	4,3	7,95	12,2c

Note: Numbers marked with the same letter in the same column and row are not significantly different at the 5% HSD test level.

Table 2. Average cob length (cm), cob diameter (cm), and weight of 1000 seeds at 110 DAP

Treatment	Yield Component (110 DAP)		
	Cob length (Cm)	Cob diameter (Cm)	Weight 1000 seeds
P0	15,13a	4,05a	98,95a
P1	16,6ab	4,21ab	108,98ab
P2	17,93b	4,30b	110,30b
P3	17,85c	4,30c	113,25c
P4	18,65d	4,35d	114,01d

Note: Numbers marked with the same letter in the same column and row are not significantly different at the 5% HSD test level.

4. DISCUSSION

4.1 Growth Components

The growth parameters of corn plants, both for plant height, leaf length, and leaf area at doses of 20 g/plant up to 80 g/plant have no significant effect, this is because the nutrient content in the fertilizer used is still relatively small or the dose used is still insufficient. The organic fertilizer used contains 0.27% N [6] and high organic C [8]. However, the growth of corn plants aged 35 HST is still considered ideal, namely, the average plant height reaches 160 cm [9] plants that use organic fertilizers have an average height of 165.8 cm. Furthermore, 5-10 tons of organic fertilizer for chicken manure have an average size of 179 cm [10]. Thus, the use of organic fertilizer can replace the function of organic fertilizer (Joseph et al., 2020), especially when applied through the soil [11]. Leaf length and leaf width can be used to measure plant growth [12]. Leaf length and leaf width are also more influenced by N content and environmental factors [13]. Leaf length using a dose of 80 g/plant reached 91.16 cm with an average number of leaves of 12.2 strands. Applying organic fertilizers can be a low-cost alternative to improve soil quality and promote soil C uptake in continuous corn cropping systems [14].

4.2 Yield Component

Applying organic fertilizer in the form of compost can affect the length of the cob, and the weight of 100 corn plants [10,13]. Furthermore, the research conducted [15] states that applying 30-40 tons/ha of compost gives the most significant average cob length (14.3 to 18.7 cm), cob circumference (15.3 to 20.26 cm), a thousand-grain weight (250.8 to 310.5 g). Research using organic fertilizers with the essential ingredients of chicken manure, banana weevil, cocoa peel, and rice husk biochar 3.5 tons/ha gave results with a cob length of 18.65cm, a weight of 1000 grains of 114.01 g. Compared with the previous experiment, the use of organic fertilizer was much less, up to 10 times. P functions in the formation and filling of seeds helping cell division and P is needed in large quantities in young cells, such as shoots and root tips, and helps in photosynthesis [16]. Apart from P, the K content contained in the K+ experimental fertilizer is the main osmoticum to encourage cellular expansion and organ movement, such as stomata opening. In addition, K+ transport is essential for controlling cytoplasmic and luminal pH in endosomes, regulating of membrane potential, and enzyme activity [17]. Thus, applying organic fertilizers can increase the yield of corn plants [18,19].

5. CONCLUSION

Using organic compost fertilizer derived from organic waste is the best solution to scarcity and rising prices which have been a problem for farmers. At the proper dosage, it can improve the growth and yield of forage corn plants because it contains complete and sufficient nutrients while maintaining sustainability and the surrounding environment.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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