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EFFECTIVENESS OF BOKASHI CHICKEN STOOL ON HYBRID CORN PRODUCTIVITY (*Zea mays L*)

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ABSTRACT
This study aims to determine the effectiveness of bokashi on the productivity of hybrid maize (Zea mays L). Bokashi is expected to maintain soil fertility and replace chemical fertilizers, which are very expensive and hurt the soil. High corn productivity helps meet the food needs of the community. The research was carried out in the rice fields of Kepanjen Village Gumukmas. This type of research is a true experiment using a completely randomized design (CRD) and a factorial pattern, which consists of 3 factors, namely: 1) positive control (NPK); 2) negative control; 3) bokashi 50%. Each treatment was repeated three times, with ten plant samples per replication. The research data were tested using Analysis of Variant (ANOVA) v20 and continued with Duncan's test for data that had a significant effect. The results of the ANOVA analysis showed that bokashi had a substantial impact on the productivity of corn plants. In contrast, the follow-up test results stated that the favorable control treatment had the best value, and bokashi was second. Corn grown using bokashi has the advantage that it is more resistant to pests and insects.

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1. INTRODUCTION

Corn is one of the essential plant commodities because Corn has many benefits for humans and animals. The benefits of Corn include being a second food ingredient after rice because it contains carbohydrates and is sometimes eaten with rice (Selatan, 2004; Ningrum, 2017); especially the Madurese have the habit of eating Corn as a daily staple food (Sugiarti & Hayati, 2009). Based on this, it is necessary to increase the productivity of Corn to meet the needs of food self-sufficiency.

The increase in productivity aims to achieve increased self-sufficiency and food security of maize because increasing independence also impacts decreasing maize imports from abroad and can increase domestic food self-sufficiency (Biba, 2016). Productivity manifests all the factors (soil or non-soil) that affect crop yields (Khomsatun, 2017). Nutrients, microelements and macronutrients also influence corn productivity. Therefore, one of the essential factors in increasing the productivity of corn plants that must be considered include climate, soil fertility, use of appropriate fertilizers and use of pesticides (Haryati et al., 2016).

Many farmers use chemical fertilizers in cultivating Corn because they are efficient and easy to obtain. Still, the continuous use of chemical fertilizers only adds nutrients to the soil without improving the physical and biological properties of the ground. Eventually, it will hurt the environment. So that the chemical fertilizers used are less effective in providing nutrients for plants (Nursalam, 2016 & Fallis, 2013; South, 2004). In addition, excessive use of chemical fertilizers is not suitable for corn consumers; consumption of safer food results from productivity from organic plants, such as bokashi (Roidah, 2013). Bokashi is a fermented fertilizer from organic materials consisting of husks, straw, sawdust, manure, animal manure, and other organic materials. As an ingredient to accelerate the fermentation process, the help of a used microorganism activator is (Tabun et al., 2017). Bokashi chicken feces is an organic fertilizer that uses chicken manure, husks, market organic waste mixed with organic plant supplement (OPS) solution. The bokashi effectively fertilizes the soil and increases crop productivity (Hikamah et al., 2019).

The use of bokashi fertilizer is expected to reduce market waste and reduce air pollution in the form of odors caused by chicken feces so that residents do not feel disturbed (Hikamah et al., 2018). Bokashi is also a type of fertilizer that can replace artificial chemical fertilizers. Bokashi can slow down water loss in the soil to prevent land degradation, increase soil fertility, and repair damage to soil properties caused by chemical fertilizers because bokashi contains nutrients, which are high in the form of nitrogen, potassium, phosphorus by the needs of the soil. Bokashi also contains growth-promoting elements that affect vegetation, such as plant height (Munayar, 2011; Tufaila et al., 2014; Permayani et al., 2020).

The gap that has occurred so far is that many farmers have not used bokashi, especially from chicken feces, as a planting medium, so Corn on the market is generally cultivated using chemical fertilizers. The solution presented in this paper is about chicken feces bokashi on the productivity of hybrid maize (Zea mays L).

2. RESEARCH METHOD

Type of research is a true experiment using a completely randomized design (CRD) with a factorial pattern consisting of 3 factors (positive control, negative control, and 50% bokashi). A positive control using soil with NPK fertilizer; negative control using soil without fertilizer; bokashi using soil with 50% bokashi fertilizer. Repeated Each treatment three times with ten corn plants in each repetition.

This research was carried out in rice fields in Jenni Hamlet, Kepanjen Village, District Gumukmas, Jember, from 12 March 2021 - to 12 May 2021. The type of Corn used was hybrid corn type p27. The ingredients of bokashi are chicken feces, husks, husk ash, market organic waste, lime/calcium. At the same time, the supplement ingredients include OPS (organic plant supplements), granulated sugar, molasses, water.

The process of making bokashi begins with activating supplemental bacteria, in this study using OPS. The supplement is mixed with molasses, sugar and water fermented anaerobically for 24 hours. Fermented this mixture was anaerobically for 15 days. This fermented bokashi is used as a growing medium after being aerated until the temperature is by the ambient temperature.

The implementation of the following research is planting, maintenance, harvesting. The research variables included the length of the Cob, the size of the Corn, the weight on the Cob, the weight on the Corn (The term cob refers to corn stalks with the skin on while the term corn refers to corn stalks that have been peeled off) and the number of seeds. Data collection was carried out after harvesting, namely when the Corn was 60 days old. The data obtained were analyzed using the test Analysis of variance (ANOVA) with the help of SPSS v20. The data that had a significant effect was continued with Duncan's test to determine the differences in each treatment.

3. RESULTS AND DISCUSSION

The results of the normality test on maize productivity are presented in Table 1 below:

Table 1. Normality Test Results for the length of the Cob, the Weight of the Cob, and Number of Seeds.

One-Sample Kolmogorov-Smirnov Test

		treatment	The Length of The Cob	The length of the Corn	The Weight of the Cob	The Weight of the Corn	Number of seeds
N		30	30	30	30	30	30
Normal Parameters[a,b]	Mean	2.00	26.127	15.247	238.190	152.080	349.433
	Std. Deviation	.830	5.0758	2.5295	106.7097	54.3700	133.3784
Most Extreme Differences	Absolute	,219	,178	,128	,171	,135	,088
	Positive	,219	,178	,113	,171	,135	,080
	Negative	-,219	-,160	-,128	-,114	-,083	-,088
Kolmogorov-Smirnov Z		1,200	,974	,704	,936	,740	,481
Asymp. Sig. (2-tailed)		,112	,299	,705	,345	,644	,975

a. Test distribution is Normal.

b. Calculated from data.

Table 1 above informs that all observed variables show values asymp sig> 0.05. This means that all data are distributed normally with a sig value > 0.05. Therefore, it is continued with the homogeneity test. The test results are presented in Table 2 below:

Table 2. Results of Homogeneity Test for the length of the Cob, the Weight of the Cob, and Number of Seeds.

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
The Length of The Cob	1,362	2	27	,273 the
The Length of The Corn	,130	2	27	,879 the
The Weight of The Cob	1,849	2	27	,177 the
The Weight of The Corn	,262	2	27	,772
Number of seeds	1,242	2	27	,305

Table 2 above informs that all observed variables show sig values > 0.05. The research data is homogeneous with a sig value > 0.05. Therefore, we continued with the ANOVA test. The results of the ANOVA test are presented in Table 3 below.

Table 3. The results of the One Way ANOVA Test

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
The Length of the Cob	Between Groups	651.309	2	325.654	91.734 ,	000
	Within Groups	95.850	27	3,550		
	Total	747.159	29			
The Length of the Corn	Between Groups	111.173,	2	55.586	20.177	000
	Within Groups	74.382	27	2.755		
	Total	185.555	29			
Weight of cobs	Between Groups	292,177.682	2	146 088,841,	103.680	000
	Within Groups	38044.085	27	1409.040		
	Total	330,221.767	29			
Weight of Corn	between groups	70253.462	2	35126.731	61.293 ,	000
	Within Groups	15473.466	27	573.091		
	Total	85726.928	29			
Total seed	Between Groups	348,808.521	2	174,404.260	28.181 ,	000
	Within Groups	167,095.966	27	6188.739		
	Total	515,904.487	29			

Based on Table 3 above, it is informed that the length of the Cob, the weight of the Cob, and the number of seeds shows all sig 0.00 values. Furthermore, all the data that has been obtained has an effect significant with a value of sig < 0.05. Therefore, Duncan's test was to determine the difference in each treatment. The results of Duncan's test are presented in Table 4 below:

Table 4. The test results Duncan's on the length of the Cob.

The Length of The Cob Hybrid

Duncan

Treatment	N	Subset for alpha = 0.05		
		1	2	3
K-	10	21.710		
Bokashi	10		24.100	
NPK	10			32,570
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10,000.

Based on Table 4 above, the length of the Cob on NPK, bokashi and K-fertilizers obtained significantly different mean values. The average values are as follows: NPK is 32.57, bokashi is 24.10, and K- is 21.71. The average value shows that the NPK treatment has the most significant difference. Bokashi has the second-best value after NPK, while K- has the worst difference.

Table 5. The results of the Duncan Test on the Length of the Corn.

The Length of The Corn Hybrid

Duncan

Treatment	N	Subset for alpha = 0:05		
		1	2	3
	K-10	13,100		
Bokashi	10		14,870	
NPK.	10			17 770
Sig		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10,000.

Based on Table 5 above, the Cob length that did not mix with NPK, bokashi and K-fertilizers resulted in significantly different mean values. The average values are as follows: NPK is 17,770, bokashi is 14,870, and K-13,100 is. The average value shows that the NPK treatment has the most significant difference. Bokashi has the second-best value after NPK, while K- has the worst difference.

Table 6. The Results of The Duncan Test Weights Cob

The weight of the Cob Hybrid

Duncan, with the treatment

	N	Subset for alpha = 0.05		
		1	2	3
K-	10	141,300		
Bokashi	10		199,640	
NPK	10			373,630
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 10,000.

Based on Table 6 above, the weight of cobs on NPK, bokashi and K-fertilizers obtained significantly different mean values. The average values are as follows: NPK is 373.630, bokashi is 199.640, and K- is 141,300. The average value shows that the NPK treatment has the most significant difference. Bokashi has the second-best value after NPK, while K- has the worst difference.

Table 7. The Results of The Duncan Test the Weight of the Corn

The weight of the Corn Hybrid

Duncan

Treatment	N	Subset for alpha = 0.05		
		1	2	3
K-	10	103,980		
Bokashi	10		133,970	
NPK	10			218,290
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10,000.

Based on Table 7 above, the cobs' weight that did not mix with NPK, bokashi and K-fertilizers resulted in significantly different mean values. The average values are as follows: NPK is 218,290, bokashi is 133,970, and K- is 103.980. The average value shows that the NPK treatment has the most significant difference. Bokashi has the second-best value after NPK, while K- has the worst difference.

Table 8. Test Results *Duncan* Number of Seeds

Number of hybrid Seeds

Duncan

Treatment	N	Subset for alpha = 0.05		
		1	2	3
K-	10	232.320		
Bokashi	10		323.410	
NPK	10			492.570
Sig.		1,000	1,000	1,000

Means for groups in homogeneous subsets are displayed.

a. Uses Harmonic Mean Sample Size = 10,000.

Based on Table 8 Duncan's test above, the number of seeds in NPK, bokashi and K-fertilizers obtained significantly different average values. The average values are as follows: NPK is 492.570, bokashi is 323.410, and K- is 232.320. The average value shows that the NPK treatment has the most significant difference. Bokashi has the second-best value after NPK, while K- has the worst difference.

4. DISCUSSION

Based on the results of Duncan's test on the parameters of the length of the Cob and the size of the Corn in Tables 4 and 5, it was that the NPK, bokashi and K- treatments had very significant differences in each treatment. The NPK treatment has the most significant difference, and bokashi has the second-best value after NPK while K- has the lowest value. It causes NPK fertilizers to have complex nutrients to meet the needs of plants. This is in line with the opinion (Amir et al., 2018) that NPK fertilizer is a compound fertilizer containing more than two types of nutrients. The fertilizer contains 15% nitrogen in NH3, phosphorus 15%in the form of P2O%, and 15% potassium in K2O, the nature of nitrogen (nitrogen carrier). Ammonia will increase soil acidity, which can support plant growth. Maximum plant growth will produce leading fruit as well.

Bokashi can meet macro and micronutrients to increase productivity in Corn. The nutrient content of phosphorus (p) in bokashi plays an essential role in flower formation, cob size and formation, and the number of seeds.

Bokashi can also fertilize the soil. The soil mixed with bokashi will be more friable because the rate of decomposition and mineralization can run faster than the others, so that plant roots can easily absorb the nutrients needed. Adequate nutrient absorption also affects the fruit in plants (AS Maulana, 2015).

The NPK treatment is better than bokashi. It is predicted because the bokashi treatment requires additional soil that has been mixed with bokashi in the generative phase so that nutritional needs are maintained. This is in line with the opinion (Laksono et al., 2018; Pasta et al., 2015). The administration of the right and optimal dose of bokashi can increase the required nutrients and improve the stability of the soil's physical, chemical, and biological conditions. Lack of nutrients needed can also affect the length of the corn cobs because the availability of sufficient nutrients affects plant productivity.

Based on the results of Duncan's test, the parameters of the length of the Cob and the size of the Corn are in Tables 6 and 7. The results showed that the NPK, bokashi and K- treatments had very significant differences in each treatment. The NPK treatment had the most significant difference, and bokashi has the second-best value after NPK while K- has the lowest value. This is because NPK can provide N, P, and K nutrients plants need. The more supply of nutrients in plants, the more optimal results will be for each plant because the better the plant's metabolic rate, the better the productivity will be. Suntoro et al, 2014; Kriswantoro et al, 2016).

Bokashi provides a lot of needed nutrients such as N, P, K and cation exchange capacity (CEC) in the soil compared to chemical fertilizers, potassium contained in chicken feces plays a role in promoting carbohydrate translocation, which affects the formation of starch in Corn, so that can also affect the weight of the corn cob (Hartatik et al., 2015; Yuliana et al., 2013; Yedmi et al., 2018).

The NPK treatment is better than bokashi. It is predicted because the bokashi treatment requires additional soil that has been mixed with 50% bokashi fertilizer in the generative phase so that nutritional needs are met and maintained because, in the production phase, Corn requires more nutrients on the Cob (Laksono et al., 2018).

Based on Duncan's test on the number of seeds in table 8, the NPK, bokashi and K- treatments had very significant differences in each treatment. The NPK treatment has the most significant difference, and bokashi has the second-best value after NPK, while K- has the lowest value. This is because NPK has P and K nutrients which will be translocated in the formation of cobs in Corn and filling in seeds in Corn so that the quality of the cobs will be good, and if the quality of the cobs is good, the number of seeds will be large (Nainggolan & Hapsoh 2017). Bokashi chicken feces can provide nutrients N, P, K, and other microelements, elements of phosphorus, which improve corn cobs. These potassium elements function to fill corn cobs which causes the cobs to be full of seeds. The content of these nutrients causes the development of the work of microorganisms in decomposing organic matter in the soil (Amir et al., 2018; Mulyanti et al., 2015).

The NPK treatment is better than bokashi. It is predicted because the bokashi treatment requires additional soil that has been mixed with 50% bokashi fertilizer in the generative phase so that nutritional needs are met because if there is a disturbance at the beginning of the formative stage, it will delay the formation of flowers, this is because in this phase the corn plant will collect sufficient nutrients to form generative organs that will produce fruit (Ayunda, 2014; Syifa' et al. 2019).

5. CONCLUSSION

Using bokashi as a planting medium for hybrid maize (Zea mays L) significantly affects its productivity. These effects include 1) the length of the Cob; 2) the length of the Corn; 3) the weight of the Cob; 4) the weight of the Corn; 4) the number of seeds. NPK contains complex nutrients, so that nutrient absorption can be optimal and can meet the needs of Corn in its generative phase so that the formation of cobs and seeds is also maximized. Bokashi chicken feces contains N, P, K, and other microelements elements. P elements affect the appearance of flowers, the length of the Cob and the weight of the Cob, while K elements affect the shape of seeds. The follow-up test results with Duncan's test stated that the favorable control treatment had the best value among other treatments, and next was bokashi.

This study found that Corn with bokashi treatment was more resistant to insect larvae (not surrounded by maggots) and rat pests, so further research on nutrition and content in bokashi treated corn seeds is needed. The conclusion also needs to be considered in the stages of making bokashi because if there are fewer than optimal stages, it will affect the success factor of making bokashi. It will also affect the results of growth and productivity.

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