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THE EFFECT OF THE COMBINATION OF CONCENTRATION AND SPRAYING TIME BIOLIQUID ORGANIC FERTILIZER FOR GROWTH AND YIELD SWEET CORN PLANT (Zea Mays Var. Saccharata Sturt) BARUNA VARIETIES

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Abstract

This study aims to determine the effect of the combination of concentration and time of spraying bioliquid organic fertilizer on the growth and yield of sweet corn plants (Zea mays Var. saccharata Sturt) Baruna variety. The research was conducted in Tegalsari Village, Plered District, Cirebon Regency from January to May 2023. The experimental method used was using the experimental method with Group Random Design (RAK), consisting of 7 treatment combinations and repeated 4 times. Data analysis was carried out using fingerprints and further tests with the Duncan Multiple Distance Test at the level of 5%. After that, a Correlation Test was carried out with Product Moment t Test analysis between the growth components and the yield of sweet corn plants. The results showed a real influence between the concentration and time of spraying bioliquid organic fertilizer on plant height, number of leaves aged 60 HST, stem diameter, length of husked cob, diameter of husked cob, weight of cob per plant, and weight of husked cob per plot. The concentration of liquid organic fertilizer 5 ml/1 liter of water and spraying time of 14, 28, 42 HST showed the best effect on the weight of cob per plot resulting in production of 15.60 kg/plot or equivalent to 17.33 tons/ha.

Keywords: Sweet corn; concentration and spraying time of bioliquid organic fertilizer; growth, yield

INTRODUCTION

Corn actually comes from Mexico, Central America and has been consumed as a staple food of Native Americans since 8000 years ago (Hopkins, 2008). In line with the growing population growth in the era of globalization, the need for food is increasing. On the other hand, high population growth, the need for land for settlement is getting wider, so that land that was originally for clothing and food turned into residential land. Conditions like this must be made a breakthrough in agricultural cultivation technology that can increase crop production both in terms of quality and in terms of quantity (Syamsurizal & Sutoyo, 2023).

In Indonesia, sweet corn cultivation development is still limited to farmers with strong capital who are able to apply intensive cultivation techniques. This limitation is caused by the relatively expensive price of seeds, intensive irrigation and maintenance needs, low resistance to pests and diseases and high fertilizer needs. The low level of productivity of sweet corn can be caused by several factors, namely the recommended crop cultivation technology has not been applied, climatic conditions that are sometimes unfavorable and low soil fertility so that the nutrients / nutrients received by plants are insufficient. One of the efforts to increase sweet

corn production can be taken by intensification, namely through improving the cultivation system including the use of high-quality varieties and the application of fertilizers (Sumarni et al., 2012).

Because corn plants are plants that require a lot of nutrients or fertilizers, the effort that can be taken to make fertilization more effective and efficient is to spray fertilizer solutions through the leaves and stems of plants. The use of bio-liquid organic fertilizers can save inorganic fertilizers by up to 50% and productivity increases by 40% (Koutsouris, 2018).

According to Lingga, (2013), plant response to fertilization will increase if fertilizer is applied according to the right dose, time, and method. When applying fertilizer in liquid form, what needs to be considered is the concentration given, because each type of plant has a different level of fertilizer solution needs. Before carrying out foliar spraying of fertilizer, the concentration made must strictly follow the instructions in the packaging. If farmers make a lower concentration than recommended, then to compensate foliar fertilizer spraying can be accelerated or shortened the time interval (Busyra, 2010).

One of the liquid organic fertilizers (POC) that has been completely decomposed is Bio-Extreme Liquid Organic Fertilizer, this POC is a Biofertilizer with a population of N-tethering Microbes and P and K solvents in sufficient quantities. According to Fitriningtyas et al., (2019), the use of Bio-Extrim at a dose of 5 ml / liter of water (3.5 bottle caps per 14-liter tank) on sweet corn plants can provide better and maximum results. Spraying Bio-Extrim liquid compound biofertilizer is sprayed at intervals of 2 weeks by spraying it on the soil or on the plant parts (E. Fitriningtyas et al., 2017).

METHOD RESEARCH

The experiment was carried out in Tegalsari Village, Plered District, Cirebon Regency with an altitude of 150 m above sea level (asl), latosol soil type, clay soil texture, and crumb soil structure. The trial will be conducted from January to May 2023.

The materials used for this experiment were Baruna variety sweet corn seeds, manure, Urea fertilizer (46% N), NPK Phonska with (15% N, 15% P 2O5, 15% K2O, and 10% Sulfur), insecticide Decis 2.5 EC, Marshal 25 ST, Furadan 3 G, and Bio-extreme bioliquid organic fertilizer.

The research method used is an experimental method using Group Random Design (RAK). The treatment combination consists of 7 combinations and is repeated 4 times: A (without bioliquid organic fertilizer), B (bioliquid organic fertilizer 5 ml/1 liter of water + spraying 7, 21, 35 HST), C (bioliquid organic fertilizer 5 ml/1 liter of water + spraying 14, 28, 42 HST), D (bioliquid organic fertilizer 5 ml/1 liter of water + spraying 21, 35, 49 HST), E (bioliquid organic fertilizer 10 ml/1 liter water + spraying 7, 21, 35 HST), F (bioliquid organic fertilizer 10 ml/1 liter water + spraying 14, 28, 42 HST), G (bioliquid organic fertilizer 10 ml/1 liter water + spraying 21, 35, 49 HST).

Tillage 14 days before planting. After that, a map is made – map according to the predetermined layout. Plots are made of 28 plots, each test consists of 7 plots with a size of 3 m x 2.4 m, a distance between treatment plots of 0.3 m and a distance between repetitions of 0.5 m which serves for waterways and plant control. Planting is done by cutting 3 cm deep with a planting distance of 60 cm x 30 cm, each planting hole is filled with 1 seed. The fertilizers given are Urea (N 46%) with a dose of 150 kg / ha and NPK Phonska fertilizer (N 15 %, P 2O5 15 %, K2O 15 %, and Sulfur 10 %) with a dose of 250 kg / ha.

The parameters observed were plant height, number of leaves, stem diameter, length of cob, diameter of cob, and weight of cob per plant and per plot. Data analysis was carried out using fingerprints and follow-up tests with the Duncan Multiple Distance Test at the level of

5%. After that, a Correlation Test was carried out with Product Moment t Test analysis between the growth components and the yield of sweet corn plants.

RESULT AND DISCUSSION

Plant Height

The results of variance analysis showed that the tested treatment had a significant effect on plant height at the age of 50, 60 and 70 HST. Furthermore, the results of further tests using the Duncan Test are presented in Table 1

Table 1.
Effect of Combination of Concentration and Spraying Time of Bioliquid Organic Fertilizer on Plant Height Age 50, 60, 70 HST (cm)

Treatment	Plant Height (cm) Age:		
	50 HST	60 HST	70 HST
A (without bioliquid organic fertilizer)	176.95 a	193.30 A	197.55 a
B (concentration 5 ml/1 liter of water + 7, 21, 35 HST)	191.05 a	201.70 b	207.90 b
C (concentration 5 ml/1 liter water + 14, 28, 42 HST)	200.55 b	209.85 c	213.95 C
D (concentration 5 ml/1 liter water + 21, 35, 49 HST)	178.80 A	197.15 a	199.55 A
E (concentration 10 ml/1 liter of water + 7, 21, 35 HST)	174.40 A	190.90 a	192.70 A
F (concentration 10 ml/1 liter water 14, 28, 42 HST)	172.70 A	189.95 A	190.90 a
G (concentration 10 ml/1 liter of water + 21, 35, 49 HST)	177.70 A	194.00 a	196.15 A

Remarks: The average number accompanied by the same letters in the same column, shows no real difference based on the Duncan Multiple Distance Test at a real level of 5%.

Table 1 shows that the combination of concentration treatment and spraying time of bioliquid organic fertilizer has a significant effect on plant height. The application of Bio-Extrim bioliquid organic fertilizer with a concentration of 5 ml / 1 liter of water and spraying aged 14, 28, 42 HST according to plant needs, so that it can increase nutrient absorption by plants and then can improve plant growth, especially plant height. When applying organic fertilizer in liquid form, what needs to be considered is the concentration given, because each type of plant has a different level of solution needs. In addition, each type of fertilizer solution has a different elemental content, so its effect on plant growth and development will be different. The accuracy of the concentration and amount of nutrients needed from each type of solution is important to know (Mansyur et al., 2021).

Number of leaves

The test results using F-Test through variety analysis showed that the tested treatment had a significant effect on the number of leaves per plant at the age of 50, 60 and 70 HST. Furthermore, the results of further tests using the Duncan Test are presented in Table 2

Table 2.
Effect of Combination of Concentration and Spraying Time of Bioliquid Organic Fertilizer on the Number of Leaves Age 50, 60, 70 HST (helai)

Treatment	Number of Leaves (helai) Age:		
	50 HST	60 HST	70 HST
A (without bioliquid organic fertilizer)	10.00 A	11.10 a	11.35 a
B (concentration 5 ml/1 liter of water + 7, 21, 35 HST)	11.05 a	11.75 A	11.80 A
C (concentration 5 ml/1 liter water + 14, 28, 42 HST)	11.40 a	12.20 b	12.15 a
D (concentration 5 ml/1 liter water + 21, 35, 49 HST)	10.50 a	11.30 a	11.45 a
E (concentration 10 ml/1 liter of water + 7, 21, 35 HST)	10.60 a	11.50 A	11.70 A
F (concentration 10 ml/1 liter water 14, 28, 42 HST)	11.00 A	11.35 a	11.55 a
G (concentration 10 ml/1 liter of water + 21, 35, 49 HST)	11.00 A	11.30 a	11.65 a

Remarks: The average number accompanied by the same letters in the same column, shows no real difference based on the Duncan Multiple Distance Test at a real level of 5%.

The combination of concentration treatment and spraying time of bioliquid organic fertilizer had a significant effect on leaf count at the age of 60 HST (Table 2). The concentration of bioliquid organic fertilizer 5 ml / 1 liter of water hasmet the needs of macro and micro nutrients needed by sweet corn plants which can increase the number of leaves in sweet corn plants. With the addition of bio-liquid organic fertilizer more than 5 ml / 1 liter of water does nothave a noticeable effecton the number of leaves, it can evenreduce the number of leaves. inaccordance with the p of Abdul Rahmi and Jumiati (2017) that the application of bio-liquid organic fertilizerUp to a certain concentration can increase plant yields, but if the bioliquid organic fertilizer is applied with improper concentrations (excessive) it can inhibit growth and reduce plant yields.

Rod Diameter

The results of the F-Test through variance analysis showed that the tested treatment had a significant effect on plant stem diameter at the age of 50, 60 and 70 HST. Furthermore, the results of further tests using the Duncan Test showed that the largest rod diameter was obtained in a combination of 5 ml / l water concentration treatment given at 14, 28 and 42 HST. The test results of the Duncan Test are presented in Table 3

Table 3.
Effect of Combination of Concentration and Spraying Time of Bioliquid Organic Fertilizer on Stem Diameter Age 50, 60, 70 HST (cm)

Treatment	Rod Diameter (cm) Age :		
	50 HST	50 HST	50 HST
A (without bioliquid organic fertilizer)	1.76 a	1.76 a	1.76 a
B (concentration 5 ml/1 liter of water + 7, 21, 35 HST)	1.93 b	1.93 b	1.93 b
C (concentration 5 ml/1 liter water + 14, 28, 42 HST)	2.07 c	2.07 c	2.07 c
D (concentration 5 ml/1 liter water + 21, 35, 49 HST)	1.90 b	1.90 b	1.90 b
E (concentration 10 ml/1 liter of water + 7, 21, 35 HST)	1.84 a	1.84 a	1.84 a
F (concentration 10 ml/1 liter water 14, 28, 42 HST)	1.80 A	1.80 A	1.80 A
G (concentration 10 ml/1 liter of water + 21, 35, 49 HST)	1.78 a	1.78 a	1.78 a

Remarks: The average number accompanied by the same letters in the same column, shows no real difference based on the Duncan Multiple Distance Test at a real level of 5%.

Table 3 shows that the combination of concentration treatment and spraying time of bioliquid organic fertilizer has a significant effect on stem diameters aged 50, 60, and 70 HST. The application of bioliquid organic fertilizer to sweet corn plants is expected to accelerate the synthesis of amino acids and proteins so as to accelerate plant growth. This is in accordance with the opinion of Sudjana, (2014) and Miftakhurrohmat, (2019) who said that bioliquid organic fertilizer contains potassium elements which play an important role in every plant metabolic process, namely in the synthesis of amino acids and proteins from ammonium ions and play a role in maintaining turgor pressure properly so as to allow smooth metabolic processes and ensure the continuity of cell elongation.

Cob Length

The length of the cob shows differences due to different concentration treatments and administration times. Duncan's test showed that the length of the cob was best obtained in a combination of 5 ml/l water concentration treatment given at 14, 28 and 42 HST. The results of the cob length test using the Duncan Test are presented in Table 4

Table 4.
The Effect of the Combination of Concentration and Spraying Time of Bioliquid Organic Fertilizer on the Length of the Cob (cm)

Treatment	Husked Cob Length (cm)
A (without bioliquid organic fertilizer)	24.40 A
B (concentration 5 ml/1 liter of water + 7, 21, 35 HST)	25.40 a
C (concentration 5 ml/1 liter water + 14, 28, 42 HST)	27.70 C
D (concentration 5 ml/1 liter water + 21, 35, 49 HST)	25.75 a
E (concentration 10 ml/1 liter of water + 7, 21, 35 HST)	25.90 a
F (concentration 10 ml/1 liter water 14, 28, 42 HST)	26.25 b
G (concentration 10 ml/1 liter of water + 21, 35, 49 HST)	25.45 a

Remarks: The average number accompanied by the same letters in the same column, shows no real difference based on the Duncan Multiple Distance Test at a real level of 5%.

The combination of concentration treatment and spraying time of bioliquid organic fertilizer had a significant effect on the length of the cob (Table 4). Application of bio-liquid organic fertilizer with the right dose and spraying time can increase the length of the cob. As stated by Nugroho, (2012), that in spraying bioliquid organic fertilizer there are several things that need to be considered, namely in addition to the type of bioliquid organic fertilizer used, the nutrient content of bioliquid organic fertilizer and the concentration of the solution given, as well as the time of spraying. Explained by Mansyur et al., (2021) that plant needs for various nutrients during growth and development are not the same, require different time and not the same.

Cob Diameter

Furthermore, the effect of the combination of concentration treatment and spraying time of bioliquid organic fertilizer on the diameter of the cob is presented in Table 5. Where the combination of concentration treatment and spraying time of bioliquid organic fertilizer has a significant effect on the diameter of the cob. Bio-Extrim bioliquid organic fertilizer with a concentration of 5 ml / 1 liter of water and spraying aged 14, 28, 42 HST inaccordance with brochures canincrease the diameter of the cob in sweet corn plants.

Table 5.
Effect of Combination of Concentration and Spraying Time of Bioliquid Organic Fertilizer on the Diameter of the Cob (cm)

Treatment	Husked Cob Diameter (cm)
A (without bioliquid organic fertilizer)	5.18 a
B (concentration 5 ml/1 liter of water + 7, 21, 35 HST)	5.32 a
C (concentration 5 ml/1 liter water + 14, 28, 42 HST)	5.94 C
D (concentration 5 ml/1 liter water + 21, 35, 49 HST)	5.45 a
E (concentration 10 ml/1 liter of water + 7, 21, 35 HST)	5.54 b
F (concentration 10 ml/1 liter water 14, 28, 42 HST)	5.43 a
G (concentration 10 ml/1 liter of water + 21, 35, 49 HST)	5.47 a

Remarks: The average number accompanied by the same letters in the same column, shows no real difference based on the Duncan Multiple Distance Test at a real level of 5%.

According to Lingga, (2013), before spraying bioliquid organic fertilizer, the concentration made must strictly follow the instructions in the packaging. One type of foliar fertilizer that contains macro nutrients and micronutrients is Bio-Extreme bioliquid organic fertilizer. The application of liquid organic fertilizer can improve growth, accelerate harvest, extend the production period or life, and can increase plant yields (Wayan Supadno, 2012). Weight of husked cob per plant

Table 6.
The Effect of the Combination of Concentration and Spraying Time of Bioliquid Organic Fertilizer on the Weight of Cobs Per Plant (g)

Treatment	Husked Cob Weight per Plant (kg)
A (without bioliquid organic fertilizer)	0.36 a
B (concentration 5 ml/1 liter of water + 7, 21, 35 HST)	0.39 a
C (concentration 5 ml/1 liter water + 14, 28, 42 HST)	0.46 b
D (concentration 5 ml/1 liter water + 21, 35, 49 HST)	0.43 b
E (concentration 10 ml/1 liter of water + 7, 21, 35 HST)	0.44 b
F (concentration 10 ml/1 liter water 14, 28, 42 HST)	0.41 a
G (concentration 10 ml/1 liter of water + 21, 35, 49 HST)	0.38 a

Remarks: The average number accompanied by the same letters in the same column, shows no real difference based on the Duncan Multiple Distance Test at a real level of 5%.
Weight of husked cob per plot

Table 7.
Effect of Combined Concentration and Spraying Time of Bioliquid Organic Fertilizer on Cob Weight Per Plot (kg)

Treatment	Husked Cob Weight per Plot (kg)
A (without bioliquid organic fertilizer)	12.63 a
B (concentration 5 ml/1 liter of water + 7, 21, 35 HST)	12.80 A
C (concentration 5 ml/1 liter water + 14, 28, 42 HST)	15.60 C
D (concentration 5 ml/1 liter water + 21, 35, 49 HST)	14.10 b
E (concentration 10 ml/1 liter of water + 7, 21, 35 HST)	11.93 a
F (concentration 10 ml/1 liter water 14, 28, 42 HST)	11.13 a
G (concentration 10 ml/1 liter of water + 21, 35, 49 HST)	12.88 a

Remarks: The average number accompanied by the same letters in the same column, shows no real difference based on the Duncan Multiple Distance Test at a real level of 5%.

The effect of the combined treatment concentration and spraying time of bioliquid organic fertilizer on the weight of cobs per plot is presented in Table 7. The combination of concentration treatment and spraying time of bioliquid organic fertilizer has a significant effect on the weight of cobs per plot. At the recommended dose can provide sufficient nutrients according to the needs and development. Dwidjoseputro, (2020)stated that plants will grow well if the nutrients provided are in a balanced amount and in accordance with plant needs. In addition, at this dose it can meet better nutrients for the growth of corn plants. In line with this, (Maruli, 2014) stated that with the increase in P absorption in plants, plant growth becomes good, so that it can provide maximum results.

Analysis of the Correlation Between Growth and Yield Components

A clear correlation between plant height and cob weight per plot was found in plants aged 50, 60, and 70 HST (Table 8). The use of bio-liquid organic fertilizers can help the vegetative phase, namely plant height growth, and the generative phase, namely the formation of cobs. This is in accordance with the results of research by the Agricultural Research and Development Agency that bioliquid organic fertilizer has the benefit of increasing the availability of macronutrients (N, P, K, Ca, Mg, and S) and micronutrients (Mn, Mo, Fe, Cu, Co, and B) for plants that are useful for the growth and development of sweet corn plants (Momsen, 2019).

Table 8.
Results of the Correlation Analysis Between Plant Height and Weight of Cobs per Plot

Description	Plant Height		
	50 HST	60 HST	70 HST
R value	0,536	0,817	0,712
Category r	Medium Correlation	High Correlation	High Correlation
R^2 value	0,287	0,668	0,506
Value of t	3,238	7,229	5,164
Value $t_{0,025(26)}$	2,056	2,056	2,056
Conclusion	Real	Real	Real

An intangible correlation between the number of leaves and the weight of cobs per plot was found at the age of 50 HST plants (Table 9).

Table 9.
Results of the Correlation Analysis Between the Number of Leaves and the Weight of Cobs per Plot

Description	Number of leaves		
	50 HST	60 HST	70 HST
R value	0,354	0,558	0,616
Category r	Low correlation	Medium Correlation	Medium Correlation
R^2 value	0,126	0,311	0,379
Value of t	1,932	3,430	3,983
Value $t_{0,025(26)}$	2,056	2,056	2,056
Conclusion	Unreal	Real	Real

A noticeable correlation between the number of leaves and the weight of cobs per plot was found in plants aged 60 and 70 HST. This is because the more leaves there are on the plant will make more and more photosynthesis processes occur. Marschner (1986 *) in* (Maulana et al., 2017) suggests that nutrient absorption is carried out through leaves, namely in stomata.

Table 10.
Results of Correlation Analysis Between Rod Diameter and Weight of Husked Cob per Plot

Description	Rod Diameter		
	50 HST	60 HST	70 HST
R value	0,535	0,533	0,574
Category r	Medium Correlation	Medium Correlation	Medium Correlation
R^2 value	0,287	0,306	0,330
Value of t	3,233	3,386	3,575
Value $t_{0,025(26)}$	2,056	2,056	2,056
Conclusion	Real	Real	Real

Table 10 shows that there is a significant correlation between stem diameter and cob weight per plot at plant ages 50, 60, and 70 HST, this shows that the larger the diameter of sweet corn stalks will increase the weight of cob per plot.

Thus, it can be concluded that plant height, number of leaves 60 and 70 HST, and stem diameter are indications of an increase in the yield of cobs per plot. Thus, the higher the number of leaves of 60 and 70 HST, plant height, and stem diameter will further increase the production of sweet corn cobs.

CONCLUSION

The combination of concentration and spraying time of Bio-Extrim bioliquid organic fertilizer has a significant effect on the parameters of average plant height, number of leaves aged 60 HST, stem diameter, length of husked cob, diameter of husked cob, weight of cob per plant, and weight of husked cob per plot. Concentration Bio-Extrim bioliquid organic fertilizer 5 ml/1 liter of water and spraying time of 14, 28, 42 HST showed the best effect on cob weight per plot which produces production of 15.60 kg / plot or equivalent to 17.33 tons / ha. There was a marked correlation between plant height (ages 50, 60, and 70 HST), number of leaves

(ages 60 and 70 HST), and stem diameter (ages 50, 60, and 70 HST) with weight of husked cobs per plot.

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