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Effect of Tofu Liquid Waste and SP-36 on the Growth and Yield of Sweet Corn Plants *(Zea mays saccharata Sturt).*

Wahyu Qy Rahman, Dwi Fitriani, Suryadi, Jafrizal, Fiana Podesta, Isnin Kurnia Safitri

Study Program Agrotechnologi Faculty of Agriculture and Animal Husbandry Muhammadiyah University of Bengkulu, Bengkulu, 38119, Indonesia

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Corresponding Author:
Isnin Kurnia Safitri, Study Program Agrotechnologi, Faculty of Agriculture and Animal Husbandry, Muhammadiyah University of Bengkulu, Bengkulu, 318119, Indonesia
Email: isninkurniasafitri20@gmail.com

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Abstract

One of the efforts to increase maize production is by using fertilizer. One of the wastes that can be used as fertilizer is fermented tofu waste. This research aims to determine the effect of tofu liquid waste and SP-36 on the growth and yield of sweet corn plants (Zea mays saccharata Sturt.). The research was conducted in the melon garden land of the millennial farmer group. The design used was a Factorial Randomized Complete Block Design (RCBD) with two factors and three replications. The first factor was the application of tofu liquid waste (T): T0 (Control 0%), T1 (20%), T2 (40%), and T3 (60%). Meanwhile, the second factor was SP-36 fertilizer (P): P0 (Control), P1 (2.8 gr/plant), P2 (4.2 gr/plant), and P3 (5.6 gr/plant). Based on the levels tested for both treatment factors, 16 treatment combinations were obtained. Each treatment combination was repeated in three replication, resulting in a total of 48 experimental units, with each experiment consisting of 8 plants. The results of the data analysis used Analysis of Variance's and if they were significantly different, a further test of Duncan's Multiple Range Test (DMRT) was carried out at a level of 5%. Analysis data. The research showed no interaction between the treatment of tofu liquid waste and Sp-36 fertilizer. The 20% tofu liquid waste treatment produced significantly taller plants at 35 DAT and more leaves at 49 DAP than the control. SP-36 fertilizer treatment (2.5g) increased the number of leaves. However, the control showed better wet-weight results on sweet corn than the SP-36 fertilizer application.

Keywords: Sweet Corn (Zea mays saccharata Sturt.), Tofu Liquid Waste, SP-36

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1. Introduction

Sweet corn (*Zea mays saccharata* Sturt.) is a type of plant that originated in America and has long been known and developed in Indonesia. Sweet corn is an agricultural commodity that is very popular with the public, because it tastes good and sweet and contains carbohydrates, little protein, and fat. This is what makes the high demand for sweet corn (Dewi and Kusmiyati 2016).

Sweet corn production data from 2014 to 2018 has always increased; in 2014, it was 19 million tonnes; in 2015, it was 19,61 million tonnes; in 2016, it was 23,57 million tonnes; in 2017, it was 28,92 million tonnes, and in 2018 it was 30,05 million tonnes Kementan RI (2020).

One way to increase maize production is by applying fertilizer. Fertilizer is adding nutrients to the soil and plants Dewanto *et al.* (2017). Fertilization provides additional nutrients to the soil complex, which can directly or indirectly can contribute food to plants Afmerta et al. (2019). The aim is to improve the level of soil fertility so that plants get enough nutrients to improve the quality and quantity of plant growth(Aisyah, et al. 2008).

Tofu wastewater is the residual water of tofu clumping produced during the tofu-making process. At the time of precipitation, not all of it settles. Thus, the remaining protein will not clot, and other water-soluble substances will be contained in the resulting liquid tofu waste. Liquid tofu waste on soil planting media has a significant effect on increasing the growth of vegetative plants. Tofu waste, such as liquid tofu waste, must be utilized to reduce environmental pollution, and it can be used as an organic fertilizer medium (Rosada 2018).

In previous research Fadillah & Akbar (2015), about the effect of SP-36 fertilizer and the right distance on the growth and yield of sweet corn plants (*Zea mays saccharata* sturt) with the results showed that SP-36 fertilizer and plant spacing had a significant effect on the growth and yield of sweet corn plants including plant height, number of leaves, cob length, and cob weight per plot. SP-36 fertilizer 300 kg/ha and plant spacing 70 x 20 cm are the best treatments in increasing the growth and yield of sweet corn plants.

The results of research by Novita, Hermawan, & Wahyuningsih (2019), showed that the research of watering tofu wastewater with a concentration of 25% produced the best value on all mustard growth parameters with watering once a week. According to Kadarisman & Wachjar (2007), the application of inorganic fertilizer alone is not a guarantee to obtain maximum results without being balanced by the application of organic fertilizer, stating that the balance of the use of organic and inorganic fertilizers is the key to proper fertilization. One of the efforts that can be made is the application of tofu liquid waste and urea. Applying tofu liquid waste is expected to minimize the use of inorganic fertilizers. The combination of organic liquid fertilizer and inorganic liquid fertilizer can provide the most optimal results on the growth of test plants (Ann 2012).

Based on the explanation and description above, the authors are to determine the effect of tofu liquid waste and SP-36 on the growth and yield of sweet corn plants (*Zea mays saccharata* Sturt.).

2. Materials and Methods

Plant material and site location

This research has been conducted in field, District Pondok Kubang, with an altitude of ± 20 masl (meter above sea level). The research was conducted from December to March 2023.

The tools used in this research are hoes, buckets, machetes, digital scales, scissors, paddles, tape measure, thrusters, cellphone cameras, bamboo, label paper, and stationery. While the materials used are Tofu Liquid Waste, fertilizer (SP-36, Urea, and KCL), manure, and sweet corn seeds.

Research Methods

The research method used is a factorial Randomized Complete Block Design (RCBD) consisting of 2 factors. The first factor is the provision of tofu liquid waste consisting of 4 levels, namely:

T0 = 0% (Control)
T1 = 20%
T2 = 40%
T3 = 60%

The second factor is SP-36 fertilizer which consists of 4 levels, namely:

P0 = Without SP-36 (Control)
P1 = 2,8 g/plant
P2 = 4,2 g/plant
P3 = 5,6 g/plant

The distance used is 0.25 m x 0.70 m with a treatment area of 2.15 m2. Each treatment combination was repeated in three replications.

The data results were statistically analysed using analysis of variance. If the treatment effect was significant, it was followed by Duncan's Multiple Range Test (DMRT) at the 5% level by Costat Application.

The observed parameters are Plant Height (cm);Number of Leaves (leaves); Stem Diameter (cm);Plant Wet Weight (g);Plant Dry Weight (g);Weight of Torn Cobs (g);Weight of Unhusked Cobs (g)

3. Results and Discussion

Table 1. Analysis of variance of the effect of tofu liquid waste and SP-36 on the growth and yield of sweet corn plants

Parameter	F.COUNT		
	Tofu liquid waste	SP-36	Interaction
Plant Height 21 DAP	1,89 ns	0,06 ns	0,73 ns
Plant Height 35 DAP	3,15*	1,04 ns	2,06 ns
Plant Height 49 DAP	1,16 ns	0,81 ns	1,82 ns
Number of Leaves 21 DAP	1,14 ns	0,39 ns	0,80 ns
Number of Leaves 35 DAP	0,67 ns	0,93 ns	0,75 ns
Number of Leaves 49 DAP	39,10**	3,51*	1,38 ns
Stem Diameter 21 DAP	0,87 ns	1,11 ns	1,04 ns
Stem Diameter 35 DAP	2,29 ns	0,54 ns	0,84 ns
Stem Diameter 49 DAP	1,83 ns	0,01 ns	1,67 ns
Plant Wet Weight	1,06 ns	3,23*	1,17 ns
Plant Dry Weight	1,80 ns	1,29 ns	1,70 ns
Weight of Corn Husked Cobs	1,01 ns	1,16 ns	1,52 ns
Weight of Unhusked Cobs	1,26 ns	0,61 ns	1,60 ns

Description:
ns: Not Significant
**: Significant at0.05 level*
***: Significant at a 0.01 level*

The results of the analysis of variance for each factor and interaction on all parameters observed can be seen in Table 1. Based on the analysis of variance, the interaction between the treatment of tofu liquid waste and SP-36 had no significant effect on all parameters. Tofu liquid waste had a very significant effect on the parameter of the number of leaves at 49 DAP, a significant effect on plant height at 35 HST, and no significant effect on other parameters. The SP-36 fertilizer treatment significantly affected the parameter of the number of leaves at 49 DAP and the wet weight of the plant. The SP-36 treatment had no significant effect on the parameters of plant height (21, 35, and 49 DAP), number of leaves (21 and 35 HST), stem diameter (21, 35, and 49 HST), plant dry weight, cob weight of husked, and weight of unhusked cobs.

Plant Height

The treatment of tofu liquid waste significantly affect plant height on 35 DAP (Table 1).

Table 2. Effect of tofu liquid waste on average plant height of sweet corn at 49 DAP

Tofu Liquid Waste Treatment (%)	Average (cm)
T0 = Control	143,12 b
T1 = 20 %	155,43 a
T2 = 40 %	151,62 a
T3 = 60 %	150,33 ab

Description: The numbers followed by the same letter are not significantly different by the DMRT test at the 5% level.

Based on the results of further tests (Table 2), the treatment of tofu liquid waste T0 is significantly different for plant height of sweet corn from T1 (155,43 cm) and T2 (151,62 cm) but not significantly different from T3 (150,33 cm).Meanwhile, T2 (151,62 cm) is not significantly different from T3 (150,33 cm). The best treatment is at T1 with a concentration of 20%.

Number of Leaves

Tofu liquid waste treatment had a very significant effect, and SP-36 fertilizer treatment significantly affected the number of leaves parameter at the age of 49 DAP (Table 3).

Table 3. Effect of tofu liquid waste on average number of leaves of sweet corn at 49 DAP

Tofu Liquid Waste Treatment (%)	Average (leaves)
T0 = Control	9,79 c
T1 = 20 %	10,50 b
T2 = 40 %	10,68 ab
T3 = 60 %	10,81 a

Description: The numbers followed by the same letter are not significantly different by DMRT test at the 5% level.

Based on the results of further tests, the treatment of tofu waste T0 (9,79 leaves) is significantly different from T1 (10,50 leaves), T2 (10,68 leaves), and T3 (10,81 leaves), while T1 (10,50 leaves) is not significantly different from T2 (10,68 leaves) but significantly different from T3 (10,81 leaves)

Table 4. Effect of SP-36 on average number of leaves of sweet corn at 49 DAP

SP-36 Fertilizer Treatment (gr)	Average (leaves)
P0 = Control	10,47 a
P1 = 2,8 g/plant	10,56 a
P2 = 4,2 g/plant	10,25 b
P3 = 5,6 g/plant	10,50 a

Description: The numbers followed by the same letter are not significantly different by DMRT test at the 5% level.

Based on the results of further tests, SP-36 fertilizer treatment P0 (10,47 leaves) is not significantly different from P1 (10,56) and P3 (10,50 leaves) but not significantly different from P2 (10,25 leaves), while P2 (10,25 leaves) is significantly different from P3 (10,50 leaves). The best treatment is at P1 with a dosage of 2.8g/plant.

Plant Wet Weight

The treatment of SP-36 fertilizer has no significant effect on plant wet weight parameters (Table 5).

Table 5. Effect of SP-36 on average plant wet weight of sweet corn

SP-36 Treatment	Average (g)
P0 = Control	399,14 a
P1 = 2,8 g/plant	392,41 b
P2 = 4,2 g/plant	397,56 ab
P3 = 5,6 g/plant	391,04 b

Dascription: The numbers followed by the same letter are not significantly different by DMRT test at the 5% level.

Based on the results of further tests, SP-36 treatment P0 (399,14 g) is significantly different from P1 (392,41 g), P3 (391,04 g) but not significantly different from P2 (397,56 g), while P2 (397.56 g) is not significantly different from P3 (391,04 g). The best treatment is P0 that without SP-36

Discussion

Based on the data from the analysis of variance, the interaction effect of the application of tofu liquid waste and SP-36 on the growth and yield of sweet corn (*Zea mays Saccharata* Sturt.) had no significant effect on all parameters. This can be seen in the vegetative phase;the plant response is not different to the treatment of the fertilizers given. Acording to Novizan (2002), this is due to the content of N elements that are not different.

Other factors that influence the results are the plant itself and the growing environment un favourable for the growth of sweet corn plants. This is reinforced by Siswoyo (2000), that the growth of a plant will be influenced by internal factors, namely the plant itself, such as the anatomical and physiological conditions of the plant. External factors are environmental factors such as soil, temperature, humidity, and sunlight..

The treatment of tofu liquid waste had a significant effect on the parameter of plant height on 35 DAP,very significant on the number of leaves 49 DAP and had no significant effect on other parameters. Tofu liquid waste is the remaining water of tofu clotting produced during making tofu. At the time of precipitation, not all settle; thus, the remaining protein that is not clotted, and other substances that dissolve in water in the resulting tofu liquid waste. Tofu liquid waste is the residue of the washing, soaking, clumping, and moulding during tofu making. Tofu liquid waste contains more organic matter than inorganic matter. The protein content of tofu liquid waste reaches 40-60%, carbohydrates 25-50%, and fat 10%. Organic matter affects water's high phosphorus, nitrogen, and sulfur (Hikmah 2016).

This is thought to be because the tofu liquid waste contains many compounds needed by plants. According to Rosalina (2008), tofu liquid waste contains nitrogen nutrients that plants need for plant height growth. Phosphorus plays a role in energy metabolism in plants, and potassium acts as an activator in severalenzymes needed to form starch and protein.

According to Asmoro (2008), tofu waste contains N 1,24%, P2O5 5,54%, K2O 1,34%, and C-Organic 5,803%,essential nutrients plants need. Tofu waste has a high organic content; when decomposed by soil microbes, the protein in tofu liquid waste will release N compounds, which can eventually be absorbed by plant roots so that tofu liquid waste can be used as organic fertilizer(Rosada 2018).

Tofu liquid waste can be used as an organic fertilizer in plants because of the content of NPK nutrients contained in the tofu liquid waste. Murbandono (2005) states that tofu waste has N content: 1,12 mg/l, P: 51,51 mg/l and K: 163,35 mg/l. Hindersah (2011) recommended using tofu waste in composting to increase compost efficiency and the economic value of tofu waste.

The SP-36 treatment had a significant effect on the number of leaves parameter. According to Matora (2020), the content of P nutrients in SP-36 can increase the growth of sweet corn plants. This is because the content of phosphorus nutrients in SP-36 can stimulate growth associated with cell division and elongation.

Based on the results of the analysis of variance, SP-36 fertilizer treatment has a very significant effect on plant wet weight. Plant wet weight is influenced by length, stem diameter, and number of leaves. In this study showed that the longer the plant, the diameter of the stem and the number of leaves will also affect the wet weight of the plant. The availability of sufficient P elements supports plant growth Plants need phosphorus to stimulate the development of fine roots, so that it affects the capacity of the roots to absorb nutrients in the soil (Mansyur, Pudjiwati & Murtilaksono, 2021).

At various doses of SP-36 fertilizer, the increase in the number of leaves was found at a dose of 200 kg/ha SP-36 fertilizer (2.8 g), presumably because the dose of SP-36 fertilizer given to corn plants is sufficiently available nutrients to stimulate plant growth towards better. This is by Buckman et al. (1982), who state that plants will grow well and be fertile if the nutrients they needd are sufficient.

SP-36 fertilizer treatment is not significant on almost all parameters. It is suspected that SP-36 fertilization is not optimal in supporting the formation of the vegetative phase. Phospor is often called the key to life because it is involved in almost all life processes. This element is a component of every living cell and tends to be concentrated in seeds and plant growing points. Phosphorus-deficient plants will have their growth and development disrupted. As stated by Isrun (2006), plant growth will be disturbed initially in soils that are poor in the phospor (P) element. Plants can grow fast with dense leaves, but the leaves then fall off and the plant decays.

4. Conclution

Based on the results of research with the title "The Influence of Tofu Liquid Waste and SP-36 on Growth and Yield of Sweet Corn (*Zea mays saccharata* Sturt)" can be concluded:

The research showed no interaction between the treatment of tofu liquid waste and Sp-36 fertilizer. The 20% tofu liquid waste treatment produced significantly taller plants at 35 DAT and more leaves at 49 DAP than the control. SP-36 fertilizer treatment (2.5g) increased the number of leaves. However, the control showed better wet-weight results on sweet corn than the SP-36 fertilizer application.

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