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The Enhancement Butternut Squash (*Cucurbita moschata*) Growth and Yield through Sugarcane Waste and Banana hump extract Application

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ABSTRACT

Background and Objective: This research was conducted to determine the growth response of Butternut squash (*Cucurbita moschata*) with the application of sugarcane waste (*blotong*) and banana hump extract. **Materials and Methods:** This study caried out in Pitumpidange Village, Libureng District, Bone Regency, South Sulawesi Province, from August to November 2022. A two-factor factorial experiment was adopted with a randomized complete block design as the environmental design. The first factor was the dose of sugarcane waste, consisting of 4 treatment levels, namely without sugarcane waste, 10 tons ha^{-1}, 20 tons ha^{-1}, and 30 tons ha^{-1}. The second factor was the concentration of banana hump extract, comprising 4 levels, namely without banana hump extract, 100 mL L^{-1}, 200 mL L^{-1}, and 300 mL L^{-1}. **Results:** The results showed that there was no interaction between sugarcane waste treatment and banana hump extract in all observations of growth and production of butternut squash. Meanwhile, the

treatment had a sharp linear graph with a maximum point of 30 tons ha^{-1}. The 100 mL L^{-1} banana hump extract treatment indicated a quadratic dominant curve response as the optimal concentration point. **Conclusion:** Therefore, both 100 mL L^{-1} banana hump extract and 30 tons ha^{-1} doses of Sugarcane waste were recommended as part of butternut squash planting package.
Keywords: banana hump extract, Butternut squash , polynomial regression, sugarcane waste, sustainable farming

INTRODUCTION

Butternut squash (*Cucurbita moschata*) is a relatively new horticultural crop commodity [1]. In Indonesia, the term Butternut squash is not widely known because people are more familiar with pumpkin. The physical shape of this commodity resembles a tuber with soft flesh texture and distinctive taste [1,2]. Furthermore, the sugar content increases with the length of storage time (maximum storage of six months). Butternut squash is included in the climacteric category, where ethylene levels and respiration activity increase during the ripening phase [3].

Butternut squash has a soft flesh texture with a distinctive taste and contains fiber, beta-carotene, caratenoids, penolicacid, flavonoids, minerals and vitamins, carotenoids, and polyvenols [4,5]. The plant has high amounts of carbohydrates, antioxidants, fiber, minerals, and vitamins, which can fight free radicals and increase the resistance of the body. Therefore, the development is needed to increase the potential and quality of supporting the economic value of the fruit.

Planting of Butternut squash is relatively minimal and focuses on using chemical fertilization [1]. The relatively large use of chemical inputs is a challenge in determining how to reduce these inputs [1,6]. Continuous input of chemicals can damage soil fertility levels and physical properties [7,8]. In addition, excess fertilizer can be toxic to plant and indirectly affect

fruit quality [9,10]. The use of organic fertilizer is a good alternative to increase the production and quality of Butternut squash.

The use of organic fertilizer has different benefits, specifically in increasing soil fertility levels, aggregates, and microorganism content. Increasing soil physical properties improves the strength, water retention, aeration, and drainage [6,7,8,11]. In addition, optimal application can reduce the input of inorganic fertilizer use to reduce production costs and provide benefits for farmers [6,8]. The application and research of organic fertilizer on butternut squash should be conducted and some components used are sugarcane waste (blotong) and banana hump extract.

Sugarcane waste is an abundant by-product of sugar factories, and its availability can be used as organic fertilizer [12,13]. This is an effort to use industrial waste towards zero [12] and sugarcane waste many nutrients, contains, such as carbon, nitrogen, phosphate, calcium, potassium, iron, manganese, and magnesium [13,14] The use of sugarcane waste on Butternut squash has been reported by Dlamini et al. [15] and banana weevil is also an organic material underused by many people. Farmers leave banana weevil during the harvest process as a source of organic fertilizer to support growth [16]. The weevil extract contains cytokinins and gibberellins, which can be used as growth regulators, and many plant nutrient contents [17. The weevil is a good source of microorganisms for its growth and liquid organic fertilizer [18,19]. Therefore, this research aims to determine the best combination of sugarcane waste fertilizer and banana weevil liquid to support the growth and production of Butternut squash.

MATERIALS AND METHOD

Experimental Design

This research was carried out in Pitumpidange Village, Libureng District, Bone Regency, on former rice fields from August to November 2022. The location was at an altitude of 115 m

above sea level and was carried out in the form of a two-factor factorial experiment with a randomized complete block design (RCBD) as the environmental design. The first factor was the application of sugarcane waste, which consisted of 4 levels, namely without sugarcane cake (S0), a dose of 10 tons ha^{-1} (S1), a dose of 20 tons ha^{-1} (S1), and dose 30 tons ha^{-1} (S3). The second factor was administering banana hump extract, consisting of 4 levels, namely without banana hump extract (B0), concentration 100 mL L^{-1} (B1), concentration 200 mL L^{-1} (B2), and concentration 300 mL L^{-1} (B3). From these two factors, 16 treatment combinations were obtained, and each was repeated three times to yield 48 experimental plots. Furthermore, each plot consisted of 4 plant samples to produce 192 plant samples.

The study was set using a factorial design with Randomized Complete Block Design as environmental design. The first factor was the application of OPEFB compost consisted of three levels, namely: Control (C0), OPEFB compost 10 tons ha^{-1} (C1), and 20 tons ha^{-1} (C2). The second factor was the combination of *Trichoderma harzianum* + *Pleurotus ostreatus* (Tri-Po) consisted of four levels namely; Tri-Po with a dose of 4g + 2g $tree^{-1}$ (P1), 4g + 4g $tree^{-1}$ (P2), 4g + 6g $tree^{-1}$ (P3), and 4g + 8g $tree^{-1}$ (P3), respectively. The treatment was repeated three times so that there were 36 experimental units. Each experimental unit has a plot size of 4m x 3m.

Research procedure

The research preparation started with tilling the land using a hand tractor. The land area used was 17 x 8 m, and each experimental plot had an area of 1 m^2 with a distance of 50 cm. After the plot is formed, the soil is loosened and smoothed to provide good growing space for plants to develop. Subsequently, seed preparation is carried out using the F1 Butternut squash variety, and sowing is conducted in a seedling house measuring 3×1.5 m. The planting medium used is a combination of soil and manure in a ratio of 2:1. Sowing is performed for 21 days until Butternut squash seedlings have institutional leaves and reach a height of 5-7 cm. Meanwhile, planting is carried out with a spacing between plants of 50x50 cm in the afternoon.

Caring for Butternut squash consists of several activities, namely watering, weeding, installing stakes, fertilizing, pruning, pollinating, and controlling pests and diseases. Watering is carried out twice a day in the morning and evening during the vegetative phase. Meanwhile, it is only conducted once in the morning during the generative phase. Weeding is performed manually, scheduled 2 weeks after planting (WAP), and carried out regularly. Installation of stakes is also performed 1 WAP, using bamboo 150 cm high. Fertilization is divided into three types of inorganic chemical fertilizer, namely general, solid sugarcane waste, and liquid fertilizer derived from banana hump extract. The two treatments are explained further in the subsections below, while the inorganic chemical uses Grand-K fertilizer at a rate of 3 g $hole^{-1}$ or 120 kg ha^{-1}. The addition of Grand-K inorganic fertilizer with potassium content is half the recommended dose to provide sufficient nutrient availability for plant. In addition, pruning focuses on water shoots to maintain and optimize the growth of stems and primary branches. Pollination is carried out when fruit ovaries appear and accompanied by female flowers. The male flowers are taken and pollinated to produce good fruit and the process is conducted in the morning from 08:00 – 10:00 WITA. Pest control is also achieved by sanitizing the land and using the insecticide Regen 50 SC to combat mealybugs, whiteflies, oteng-oteng, ants, and ladybugs as the main pests on Butternut squash. Harvesting is performed 60–70 days after planting (DAP) with the characteristics of shiny brown fruit stalks and shiny fruit skin color.

Sugarcane waste fertilizer

Sugarcane waste was taken from the milling process waste disposal site at the Camming Sugar Factory, Libureng District, Bone Regency, South Sulawesi. Sugarcane waste possesses a smooth texture, exhibits a deep black hue, has undergone extended aging, and maintains a dry consistency. The application is carried out a week before planting by sowing in experimental plots according to the treatment.

Banana hump extract fertilizer

Making banana hump extract solution was conducted by chopping 10 kg of banana weevil. Every kilogram of chopped banana weevil was put in a 10-liter bucket with 1 L of air and the process was carried out until the container was full. Subsequently, EM4 decomposer was added for the fermentation process for 14 days and banana hump extract was ready to be filtered before being sprinkled around the plant. Application of the extract was conducted in the afternoon according to the treatment concentration.

Data observation and analysis

Observation parameters included tendril length (cm), age of flowering (days), age of harvest (days), number of fruit per plant (fruit), number of fruit per plot (fruit), fruit weight (kg), and the yield per hectare (ton). The data obtained were explained by variations with an error rate of 5% and the significant characters were tested using a polynomial approach to analysis.

RESULTS

The variance results can be seen in Table 1 and the characteristics of tendril length, fruit weight, and yield are influenced by two treatments, namely sugarcane waste fertilizer and banana hump extract. The characteristics of flowering days and the number of fruit per plot were only influenced by sugarcane waste (SW) treatment. Meanwhile, the character of the day before harvesting was affected by the treatment of banana hump extract (BHE). The interaction between the two treatments showed no significant influence on the observed growth characteristics.

Table 1. Analysis of variance from several butternut squash growth.

Based on Figure 1, tendril length is influenced by treatments (BHE and SW) independently, or the interaction of the two does not have a significant effect. These show curves with high determination values (0.8459 for BHE and 0.9987 for SW), but both have

different curve responses. Banana hump extract treatment reported a quadratic pattern towards tendril length with an optimal concentration of 100 mL L^{-1}. Meanwhile, sugarcane waste processing indicated a linear pattern regarding tendril length with a maximum dose of 30 tons ha^{-1}.

Figure 1. Graph of the effect of banana hump extract (A) dan sugarcane waste (B) to Tendril length

The characteristics of days to flowering were only influenced by sugarcane waste processing (Figure 2A). This was different from the character of the day before harvest which was only influenced by banana hump extract (Figure 2B). SW treatment showed a decreasing linear curve with a determination value reaching 0.993 and the lowest point in days to flowering was at SW dose of 30 tons ha^{-1}. Meanwhile, the days to harvesting BHE curve reported a cubic curve, reaching an absolute determined value of 1. This curve had one main peak and valley, namely 100 mL L^{-1} and 200 mL L^{-1}, respectively.

Figure 2. Graph of the effect of giving banana weevil extract on the day of flowering (A) and bagasse on the day before harvest (B).

The character of the number of fruits also indicated a single influence from sugarcane waste (Figure 3). This character had an upward linear graph with a determination value reaching 0.781. The maximum dose related to the number of fruits and Butternut squash was 30 tons ha^{-1}.

Based on Figure 4, fruit weight was influenced by the two treatments with interaction effects. The treatments showed curves with quite high determination values (0.6459 for BHE and 0.96 for SW) and a quadratic curve. Banana hump extract treatment indicated a quadratic pattern of reduction in fruit weight with an optimal concentration of 100 mL L^{-1}. Meanwhile, sugarcane waste processing reported an upward quadratic pattern with the dose trough and highest points at 30 tons ha^{-1}. SW dose curve also continued to increase as the compost dose increased.

Figure 3. Graph of the effect of sugarcane waste to the number of fruits per plot

Figure 4. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on fruit weight

Yield characteristics were also influenced by the two treatments, such as fruit weight and tendril length. BHE and SW treatments had curves with high determination values, namely 0.90 and 0.91, respectively. However, the two curves showed different response curves and banana hump extract treatment indicated a quadratic pattern with an optimal concentration of 100 mL L^{-1}. Sugarcane waste processing showed an upward linear pattern in yield with a maximum dose of 30 tons ha^{-1}.

Figure 5. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on results

DISCUSSION

The ANOVA results showed that there was a single effect of BHE and SW treatments on all components of the observed butternut squash yield. For some characters, the two treatments did not have a significant effect at the same time. These two treatments played an important and complementary role in supporting the development and growth of Butternut squash yield components. Therefore, there was no difference in response changes between increasing BHE and SW. Additive changes showed that determining the optimal point for each treatment was easier to predict and be used as a consistent reference in its application [20]. Further analysis should become a reference in planting Butternut squash , specifically with the concept of sustainable agriculture.

Based on polynomial tests, sugarcane waste has a relatively linear graph regarding the characteristics of the components produced. The results show that a good dose of sugarcane waste is 30 tons ha^{-1} and are supported by Budiyanto [21] and Tyasmoro and Saitama [22] on

corn and pak choy. Sugarcane waste has the same potential as other organic fertilizers for improving soil properties. The provisions have a big influence on improving the physical properties of the soil by applying other solid organic fertilizers [13,23]. However, sugarcane waste fertilizer has good nutritional and sucrose potential in breeding colonies of microorganisms [24,25,26]. This further supports plant growth and development, hence, the fertilizer dose has a linear graphic response with a high gradient. The sharp linear graph also shows that the dose can be increased beyond the maximum dose. A similar result was stated by Yassi et al. [27] regarding the sharp graphic patterns of compost treatment on rice growth. The dose still needs to be studied and considered more deeply regarding several other aspects, such as the availability of raw materials and costs in the implementation process. The addition of fertilizer is less effective than giving the doses periodically and consistently. Therefore, the recommended dose of 30 tons ha^{-1} can be an initial reference in optimizing the growth and development of Butternut squash .

Based on the polynomial tests, most of the responses to the influence of BHE had a quadratic curve with an optimal point at 100 mL L^{-1}. The curve with the optimal point shows that giving a concentration exceeding the optimal concentration will be increasingly ineffective [16,28,29]. The provision of liquid organic fertilizer has certain limitations and this is based on the concentration of microorganisms, hormones, and nutrients within the fertilizer formulation. The supply of liquid fertilizer becomes stagnant and even reduces productivity when the optimal limit is exceeded. Therefore, BHE administration must be based on the optimum point, namely 100 mL L^{-1} in this research.

The combination of sugarcane waste dosage of 30 tons ha^{-1} and BHE concentration of 100 mL L^{-1} is the optimal point in supporting the growth and production of Butternut squash . Even though significant positive interactions are not provided, the application optimizes the potential for the growth and production of Butternut squash . The combination of these two

treatments can be used as an additional recommendation and research regarding the quality of Butternut squash such as Brix and others also needs to be carried out in the future. This complements the potential benefits of combining the two treatments [1,30]. Further exploration of the potential inherent in this combination is essential to ensure ongoing development. This leads to continual optimization, enhancing its capacity to support the production of Butternut squash over time.

In conclusion, there was no interaction between sugarcane waste treatment and banana hump extract in the observations of the growth and production of Butternut squash . Furthermore, the treatment had a sharp linear graph on the growth of Butternut squash with a maximum point of 30 tons ha^{-1}. The 100 mL L^{-1} banana hump extract treatment also indicated a dominant quadratic response and the combinations were recommended as part of Butternut squash planting package.

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347 Table 1. Analysis of variance from several butternut squash growth.

Characters	S	B	SxB	Error	Cv (%)
Tendril Length	16.83**	2.04**	1.98	1.23	14
days to flowering	16.83**	2.04	1.98	1.23	17
days to harvesting	3.00	188.70**	13.00	8.7	36
number of fruits per plot	3.30**	0.60	0.30	0.20	22
Fruit Weight	69210.60**	40934.10**	1116030	5532.00	14
Yield	207.60**	175.90**	28.00	17.60	23

348 Notes: S : sugarcane waste, B; Banana hump Extract, CV: coefficient of variance, ** significant effect at 1% level

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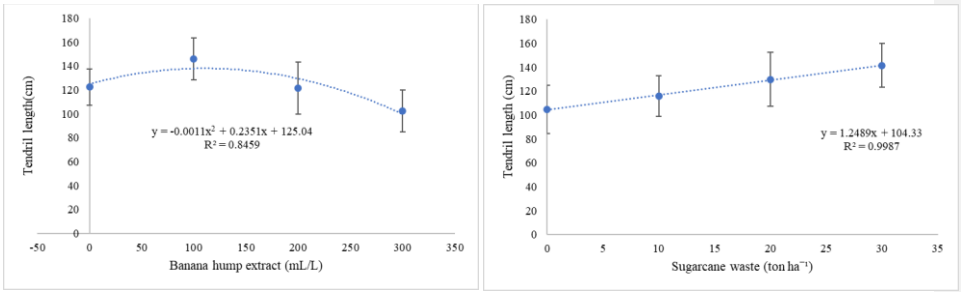

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Figure 1 Graph of the effect of banana hump extract (A) dan sugarcane waste (B) to Tendril length

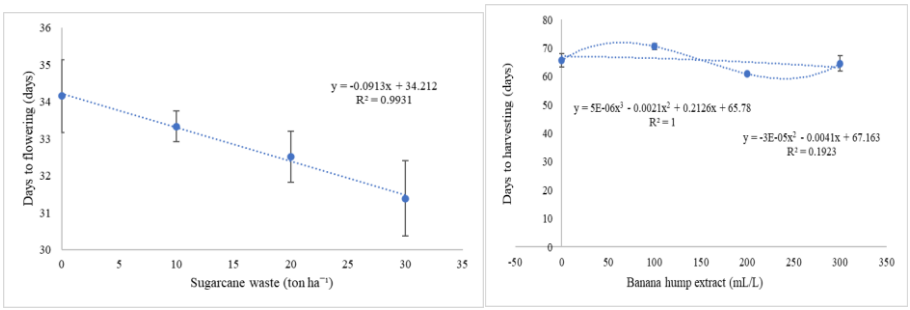

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Figure 2 Graph of the effect of giving banana weevil extract on the day of flowering (A) and bagasse on the day before harvest (B).

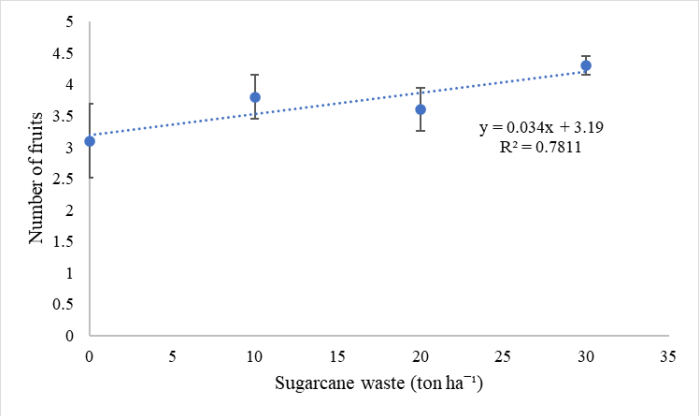
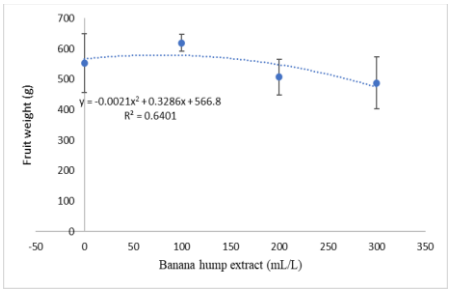
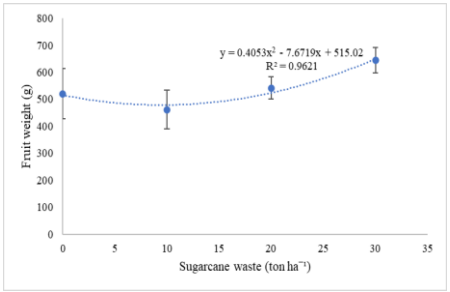


Figure 3. Graph of the effect of sugarcane waste to the number of fruits per plot





A B

Figure 4. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on fruit weight

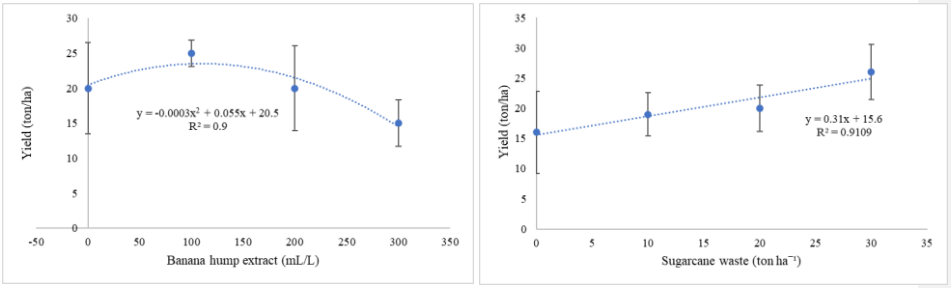


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Figure 5. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on results

COVER LETTER FOR SUBMISSION OF NEW MANUSCRIPTS

September 2023

Dear Chief Editor of Asian Journal of Plant Science

Subject: **SUBMISSION OF NEW MANUSCRIPT FOR EVALUATION**

I am enclosing herewith a manuscript entitled **"[The Enhancement Butternut Squash (Cucurbita moschata) Growth and Yield through Sugarcane Waste and Banana hump extract Application]"** submitted to **"[Asian Journal of Plant Science]"** for possible evaluation.

With the submission of this manuscript, I would like to undertake that the above-mentioned manuscript has not been published elsewhere, accepted for publication elsewhere, or under editorial review for publication elsewhere; and that my Institute's **[Hasanuddin University]** representative is fully aware of this submission.

Select Type of Submitted manuscript:

- Original Article

For the Editor-in-Chief, I would like to disclose the following information about the project:

The research project was conducted under the supervision of:

[Dr. Novaty Eny Dungga]

and the project was run as my

- BS project

This research project was conducted from **August 2022** to **November 2022**
Starting date Ending date

My Research Project was partially or fully sponsored by {write the name of sponsoring agency} with grant number {write the grant number here}. If you have undergone your research project without any financial assistance, then you must provide information on who was the sponsor of the project? **The project has been funded by my team.**

Detail of the each author with his/her contribution in this paper is as under:

Name of the author and e-mail ID	Types of contribution
Dr. Novaty Eny Dungga	Contributes to the determination of the research idea and initial research plan, responsible for the implementation of the research, responsibility as corespondence author in journal submission, and funding the research, data analysis, writing process and discussion.

Dr. Nurlina Kasim	Contributes to the determination of the research idea and initial research plan, data analysis and discussion.
Dr. Muhammad Fuad Anshori	Contributes to data analysis, writing process, discussion, a
Chalil Gibran Muryadi	Contributes to the determination of the research idea and initial research plan, responsible for the implementation of the research and discussion.

I would also like to share the following information with Editor-in-Chief

I have the following similar manuscripts already published from this project:

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For quick understanding about the importance of the project following are the significant findings of my submitted article?

This project is considered important because butternut squash is a horticultural product that has high economic value. However, the quality and production of fruit needs to be improved, one of which is through organic fertilizer. On the other hand, there are many organic materials that have not been optimized, such as sugar cane waste and banana stems. Both organic materials contain nutrients and provide good microbial habitat for plants. Therefore, the use of both has great potential for butternut squash production. Based on the study results, there was no interaction between sugarcane waste treatment and banana hump extract in all observations of growth and production of butternut squash. Meanwhile, the treatment had a sharp linear graph with a maximum point of 30 tons ha^{-1}. The 100 mL L^{-1} banana hump extract treatment indicated a quadratic dominant curve response as the optimal concentration point. Therefore, both 100 mL L^{-1} banana hump extract and 30 tons ha^{-1} doses of Sugarcane waste were recommended as part of butternut squash planting package.

How findings of this research work are unique in their nature?

This result is unique because research on butternut squash, especially in Indonesia, is still very minimal. Apart from that, it can also be a reference in using organic materials from sugar cane and banana stems. The combination of these two fertilizers has also never been reported together, especially for butternut squash. Therefore, this research has a unique novelty in enhancing the reputation of science and this journal.

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Article No: 112123-AJPS-ANSI

Article Type: Research Article

Status: (Revision)

Plagiarism Ratio: Low (<19%)

Type of Plagiarism: Direct

Novelty: (Acceptable)

Write-up Quality: (Good)

Expert's Opinion: Recommended for publication

Other Comments:

Section II

Significance Level: Moderate

Was the article logically laid out: (Yes)

Literature Citation: (Recent)

Content Reliability:
The article is about Enhancement of Butternut Squash (*Cucurbita moschata*) Growth and Yield and the results and conclusion of the paper support the research problem.

Section III

No. of Available Table(s):1

No. of Cited Table(s): 1

No. of Available Figure(s): 5

No. of Cited Figure(s): 5

No. of Available References: 30

No. of Cited References:30

No. of Outdated References: 0

Scope of the study: The article does fall within the Journal's scope**.**

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Thank you!

The Enhancement of Butternut Squash (*Cucurbita moschata*) Growth and Yield through Sugarcane Waste and Banana hump extract Application

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Running title

Significance statement

Author's contribution

Conflict of interest

ABSTRACT

Background and Objective: This research was conducted to determine the growth response of Butternut squash (*Cucurbita moschata*) with the application of sugarcane waste (*blotong*) and banana hump extract. **Materials and Methods:** This study was carried out in Pitumpidange Village, Libureng District, Bone Regency, South Sulawesi Province, from August to November 2022. A two-factor factorial experiment was adopted with a randomized complete block design as the environmental design. The first factor was the dose of sugarcane waste and the second factor was the concentration of banana hump extract, both comprised of 4 levels. **Results:** The results showed that there was no interaction between sugarcane waste treatment and banana hump

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extract in all observations of growth and production of butternut squash. Meanwhile, the treatment had a sharp linear graph with a maximum point of 30 tons ha^{-1}. The 100 mL L^{-1} banana hump extract treatment indicated a quadratic dominant curve response as the optimal concentration point. **Conclusion:** Therefore, both 100 mL L^{-1} banana hump extract and 30 tons ha^{-1} doses of Sugarcane waste were recommended as part of butternut squash planting package.

KEYWORDS: banana hump extract, Butternut squash , polynomial regression, sugarcane waste, sustainable farming

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INTRODUCTION

Butternut squash (*Cucurbita moschata*) is a relatively new horticultural crop commodity [1]. In Indonesia, the term Butternut squash is not widely known because people are more familiar with pumpkin. The physical shape of this commodity resembles a tuber with a soft flesh texture and distinctive taste [1,2]. Furthermore, the sugar content increases with the length of storage time (maximum storage of six months). Butternut squash is included in the climacteric category, where ethylene levels and respiration activity increase during the ripening phase [3].

Butternut squash has a soft flesh texture with a distinctive taste and contains fiber, beta-carotene, carotenoids, penolic acid, flavonoids, minerals and vitamins, carotenoids, and polyvenols [4,5]. The plant has high amounts of carbohydrates, antioxidants, fiber, minerals, and vitamins, which can fight free radicals and increase the resistance of the body. Therefore, development is needed to increase the potential and quality of supporting the economic value of the fruit.

Planting of Butternut squash is relatively minimal and focuses on using chemical fertilization [1]. The relatively large use of chemical inputs is a challenge in determining how to reduce these inputs [1,6]. Continuous input of chemicals can damage soil fertility levels and

physical properties [7,8]. In addition, excess fertilizer can be toxic to plants and indirectly affect fruit quality [9,10]. The use of organic fertilizer is a good alternative to increase the production and quality of Butternut squash.

The use of organic fertilizer has different benefits, specifically in increasing soil fertility levels, aggregates, and microorganism content. Increasing soil physical properties improves the strength, water retention, aeration, and drainage [6,7,8,11]. In addition, optimal application can reduce the input of inorganic fertilizer use to reduce production costs and provide benefits for farmers [6,8]. The application and research of organic fertilizer on butternut squash should be conducted and some components used are sugarcane waste (blotong) and banana hump extract.

Sugarcane waste is an abundant by-product of sugar factories, and its availability can be used as organic fertilizer [12,13]. This is an effort to use industrial waste towards zero [12] and sugarcane wastes many nutrients, contains, such as carbon, nitrogen, phosphate, calcium, potassium, iron, manganese, and magnesium [13,14] The use of sugarcane waste on Butternut squash has been reported by Dlamini [15] and banana weevil is also an organic material underused by many people. Farmers leave banana weevils during the harvest process as a source of organic fertilizer to support growth [16]. The weevil extract contains cytokinins and gibberellins, which can be used as growth regulators, and many plant nutrient contents [17. The weevil is a good source of microorganisms for its growth and liquid organic fertilizer [18,19]. Therefore, this research aims to determine the best combination of sugarcane waste fertilizer and banana weevil liquid to support the growth and production of Butternut squash.

MATERIALS AND METHOD

Experimental Design

This research was carried out in Pitumpidange Village, Libureng District, Bone Regency, on former rice fields from August to November 2022. The location was at an altitude of 115 m above sea level and was carried out in the form of a two-factor factorial experiment with a randomized complete block design (RCBD) as the environmental design. The first factor was the application of sugarcane waste, which consisted of 4 levels, namely without sugarcane cake (S0), a dose of 10 tons ha^{-1} (S1), a dose of 20 tons ha^{-1} (S1), and a dose of 30 tons ha^{-1} (S3). The second factor was administering banana hump extract, consisting of 4 levels, namely without banana hump extract (B0), concentration 100 mL L^{-1} (B1), concentration 200 mL L^{-1} (B2), and concentration 300 mL L^{-1} (B3). From these two factors, 16 treatment combinations were obtained, and each was repeated three times to yield 48 experimental plots. Furthermore, each plot consisted of 4 plant samples to produce 192 plant samples.

The study was set using a factorial design with a Randomized Complete Block Design as an environmental design. The first factor was the application of OPEFB compost consisting of three levels, namely: Control (C0), OPEFB compost 10 tons ha^{-1} (C1), and 20 tons ha^{-1} (C2). The second factor was the combination of *Trichoderma harzianum* + *Pleurotus ostreatus* (Tri-Po) consisting of four levels namely; Tri-Po with a dose of 4g + 2g $tree^{-1}$ (P1), 4g + 4g $tree^{-1}$ (P2), 4g + 6g $tree^{-1}$ (P3), and 4g + 8g $tree^{-1}$ (P3), respectively. The treatment was repeated three times so that there were 36 experimental units. Each experimental unit has a plot size of 4m x 3m.

Research procedure

The research preparation started with tilling the land using a hand tractor. The land area used was 17 x 8 m, and each experimental plot had an area of 1 m^2 with a distance of 50 cm. After the plot is formed, the soil is loosened and smoothed to provide good growing space for plants to develop. Subsequently, seed preparation is carried out using the F1 Butternut squash variety, and sowing is conducted in a seedling house measuring 3×1.5 m. The planting medium used is

743 a combination of soil and manure in a ratio of 2:1. Sowing is performed for 21 days until
744 Butternut squash seedlings have institutional leaves and reach a height of 5-7 cm. Meanwhile,
745 planting is carried out with a spacing between plants of 50x50 cm in the afternoon.
746 Caring for Butternut squash consists of several activities, namely watering, weeding,
747 installing stakes, fertilizing, pruning, pollinating, and controlling pests and diseases. Watering
748 is carried out twice a day in the morning and evening during the vegetative phase. Meanwhile,
749 it is only conducted once in the morning during the generative phase. Weeding is performed
750 manually, scheduled 2 weeks after planting (WAP), and carried out regularly. Installation of
751 stakes is also performed 1 WAP, using bamboo 150 cm high. Fertilization is divided into three
752 types of inorganic chemical fertilizer, namely general, solid sugarcane waste, and liquid
753 fertilizer derived from banana hump extract. The two treatments are explained further in the
754 subsections below, while the inorganic chemical uses Grand-K fertilizer at a rate of 3 g $hole^{-1}$
755 or 120 kg ha^{-1}. The addition of Grand-K inorganic fertilizer with potassium content is half the
756 recommended dose to provide sufficient nutrient availability for the plant. In addition, pruning
757 focuses on water shoots to maintain and optimize the growth of stems and primary branches.
758 Pollination is carried out when fruit ovaries appear and are accompanied by female flowers.
759 The male flowers are taken and pollinated to produce good fruit and the process is conducted
760 in the morning from 08:00 – 10:00 WITA. Pest control is also achieved by sanitizing the land
761 and using the insecticide Regen 50 SC to combat mealybugs, whiteflies, oteng-oteng, ants, and
762 ladybugs as the main pests on Butternut squash. Harvesting is performed 60–70 days after
763 planting (DAP) with the characteristics of shiny brown fruit stalks and shiny fruit skin color.
764 **Sugarcane waste fertilizer**
765 Sugarcane waste was taken from the milling process waste disposal site at the Camming
766 Sugar Factory, Libureng District, Bone Regency, South Sulawesi. Sugarcane waste possesses a
767 smooth texture, exhibits a deep black hue, has undergone extended aging, and maintains a dry

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768 consistency. The application is carried out a week before planting by sowing in experimental
769 plots according to the treatment.

770 **Banana hump extract fertilizer**

771 Making banana hump extract solution was conducted by chopping 10 kg of banana
772 weevil. Every kilogram of chopped banana weevil was put in a 10-liter bucket with 1 L of air
773 and the process was carried out until the container was full. Subsequently, EM4 decomposer
774 was added for the fermentation process for 14 days and banana hump extract was ready to be
775 filtered before being sprinkled around the plant. Application of the extract was conducted in the
776 afternoon according to the treatment concentration.

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777 **Data observation and statistical analysis**

778 Observation parameters included tendril length (cm), age of flowering (days), age of
779 harvest (days), number of fruit per plant (fruit), number of fruit per plot (fruit), fruit weight (kg),
780 and the yield per hectare (ton). The data obtained were explained by variations with an error
781 rate of 5% and the significant characters were tested using a polynomial approach to analysis.

782 **RESULTS**

783 The variance results can be seen in Table 1 and the characteristics of tendril length, fruit weight,
784 and yield are influenced by two treatments, namely sugarcane waste fertilizer and banana hump
785 extract. The characteristics of flowering days and the number of fruit per plot were only
786 influenced by sugarcane waste (SW) treatment. Meanwhile, the character of the day before
787 harvesting was affected by the treatment of banana hump extract (BHE). The interaction
788 between the two treatments showed no significant influence on the observed growth
789 characteristics.

790 **Table 1. Analysis of variance from several butternut squash growth.**

791 Based on Fig. 1, tendril length is influenced by treatments (BHE and SW)
792 independently, or the interaction of the two does not have a significant effect. These show

curves with high determination values (0.8459 for BHE and 0.9987 for SW), but both have different curve responses. Banana hump extract treatment reported a quadratic pattern towards tendril length with an optimal concentration of 100 mL L^{-1}. Meanwhile, sugarcane waste processing indicated a linear pattern regarding tendril length with a maximum dose of 30 tons ha^{-1}.

Figure 1. Graph of the effect of banana hump extract (A) dan sugarcane waste (B) to Tendril length

The characteristics of days to flowering were only influenced by sugarcane waste processing (Fig. 2A). This was different from the character of the day before harvest which was only influenced by banana hump extract (Fig. 2B). SW treatment showed a decreasing linear curve with a determination value reaching 0.993 and the lowest point in days to flowering was at SW dose of 30 tons ha^{-1}. Meanwhile, the days to harvesting the BHE curve reported a cubic curve, reaching an absolute determined value of 1. This curve had one main peak and valley, namely 100 mL L^{-1} and 200 mL L^{-1}, respectively.

Figure 2. Graph of the effect of giving banana weevil extract on the day of flowering (A) and bagasse on the day before harvest (B).

The character of the number of fruits also indicated a single influence from sugarcane waste (Fig. 3). This character had an upward linear graph with a determination value reaching 0.781. The maximum dose related to the number of fruits and Butternut squash was 30 tons ha^{-1}.

Based on Fig. 4, fruit weight was influenced by the two treatments with interaction effects. The treatments showed curves with quite high determination values (0.6459 for BHE and 0.96 for SW) and a quadratic curve. Banana hump extract treatment indicated a quadratic pattern of reduction in fruit weight with an optimal concentration of 100 mL L^{-1}. Meanwhile, sugarcane waste processing reported an upward quadratic pattern with the dose trough and

highest points at 30 tons ha^{-1}. SW dose curve also continued to increase as the compost dose increased.

Figure 3. Graph of the effect of sugarcane waste on the number of fruits per plot

Figure 4. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on fruit weight

Yield characteristics were also influenced by the two treatments, such as fruit weight and tendril length. BHE and SW treatments had curves with high determination values, namely 0.90 and 0.91, respectively. However, the two curves showed different response curves and banana hump extract treatment indicated a quadratic pattern with an optimal concentration of 100 mL L^{-1}. Sugarcane waste processing showed an upward linear pattern in yield with a maximum dose of 30 tons ha^{-1}.

Figure 5. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on results

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DISCUSSION

The ANOVA results showed that there was a single effect of BHE and SW treatments on all components of the observed butternut squash yield. For some characters, the two treatments did not have a significant effect at the same time. These two treatments played an important and complementary role in supporting the development and growth of Butternut squash yield components. Therefore, there was no difference in response changes between increasing BHE and SW. Additive changes showed that determining the optimal point for each treatment was easier to predict and be used as a consistent reference in its application [20]. Further analysis should become a reference in planting Butternut squash, specifically with the concept of sustainable agriculture.

Based on polynomial tests, sugarcane waste has a relatively linear graph regarding the characteristics of the components produced. The results show that a good dose of sugarcane

waste is 30 tons ha^{-1} and are supported by Budiyanto [21] and Tyasmoro and Saitama [22] on corn and pak choy. Sugarcane waste has the same potential as other organic fertilizers for improving soil properties. The provisions have a big influence on improving the physical properties of the soil by applying other solid organic fertilizers [13,23]. However, sugarcane waste fertilizer has good nutritional and sucrose potential in breeding colonies of microorganisms [24-26]. This further supports plant growth and development, hence, the fertilizer dose has a linear graphic response with a high gradient. The sharp linear graph also shows that the dose can be increased beyond the maximum dose. A similar result was stated by Yassi et al. [27] regarding the sharp graphic patterns of compost treatment on rice growth. The dose still needs to be studied and considered more deeply regarding several other aspects, such as the availability of raw materials and costs in the implementation process. The addition of fertilizer is less effective than giving the doses periodically and consistently. Therefore, the recommended dose of 30 tons ha^{-1} can be an initial reference in optimizing the growth and development of Butternut squash.

Based on the polynomial tests, most of the responses to the influence of BHE had a quadratic curve with an optimal point at 100 mL L^{-1}. The curve with the optimal point shows that giving a concentration exceeding the optimal concentration will be increasingly ineffective [16,28,29]. The provision of liquid organic fertilizer has certain limitations and this is based on the concentration of microorganisms, hormones, and nutrients within the fertilizer formulation. The supply of liquid fertilizer becomes stagnant and even reduces productivity when the optimal limit is exceeded. Therefore, BHE administration must be based on the optimum point, namely 100 mL L^{-1} in this research.

The combination of sugarcane waste dosage of 30 tons ha^{-1} and BHE concentration of 100 mL L^{-1} is the optimal point in supporting the growth and production of Butternut squash. Even though significant positive interactions are not provided, the application optimizes the

potential for the growth and production of Butternut squash. The combination of these two treatments can be used as an additional recommendation and research regarding the quality of Butternut squash such as Brix and others also needs to be carried out in the future. This complements the potential benefits of combining the two treatments [1,30]. Further exploration of the potential inherent in this combination is essential to ensure ongoing development. This leads to continual optimization, enhancing its capacity to support the production of Butternut squash over time.

Conclusion

In conclusion, there was no interaction between sugarcane waste treatment and banana hump extract in the observations of the growth and production of Butternut squash. Furthermore, the treatment had a sharp linear graph on the growth of Butternut squash with a maximum point of 30 tons ha^{-1}. The 100 mL L^{-1} banana hump extract treatment also indicated a dominant quadratic response and the combinations were recommended as part of the Butternut squash planting package.

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When citing a non-English reference in a scientific journal, it is important to provide a translation of the title of the work into English, enclosed in square brackets, after the original title. Additionally, the language of the publication should be indicated in parentheses after the title. For example

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1023 Table 1. Analysis of variance from several butternut squash growth.

Characters	S	B	SxB	Error	Cv (%)
Tendril Length	16.83**	2.04**	1.98	1.23	14
days to flowering	16.83**	2.04	1.98	1.23	17
days to harvesting	3.00	188.70**	13.00	8.7	36
number of fruits per plot	3.30**	0.60	0.30	0.20	22
Fruit Weight	69210.60**	40934.10**	1116030	5532.00	14
Yield	207.60**	175.90**	28.00	17.60	23

1024 Notes: S : sugarcane waste, B; Banana hump Extract, CV: coefficient of variance, ** significant effect at 1% level

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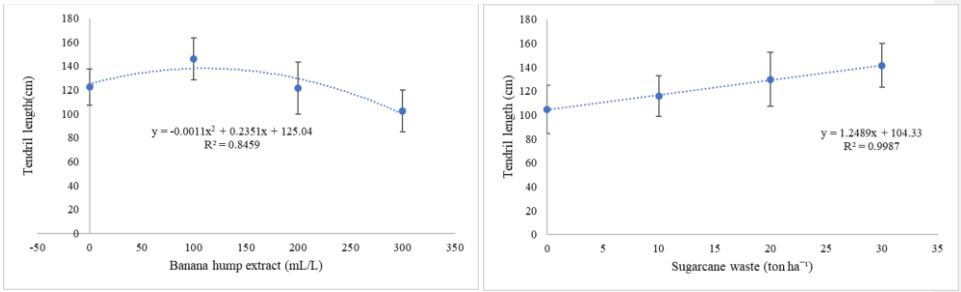

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Figure 1 Graph of the effect of banana hump extract (A) dan sugarcane waste (B) to Tendril length

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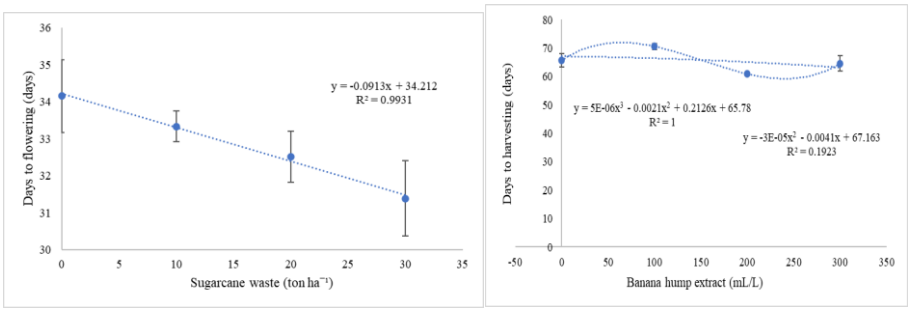

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Figure 2 Graph of the effect of giving banana weevil extract on the day of flowering (A) and bagasse on the day before harvest (B).

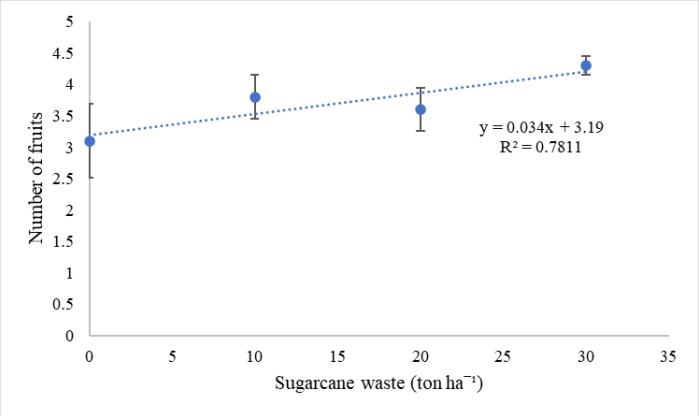
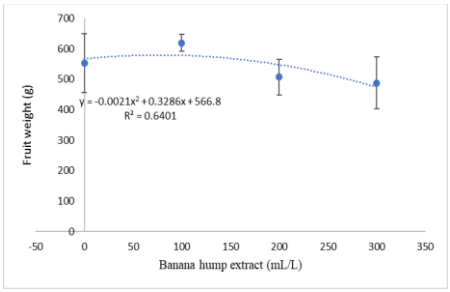


Figure 3. Graph of the effect of sugarcane waste on the number of fruits per plot



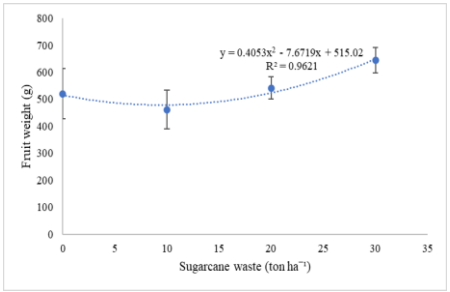


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Figure 4. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on fruit weight

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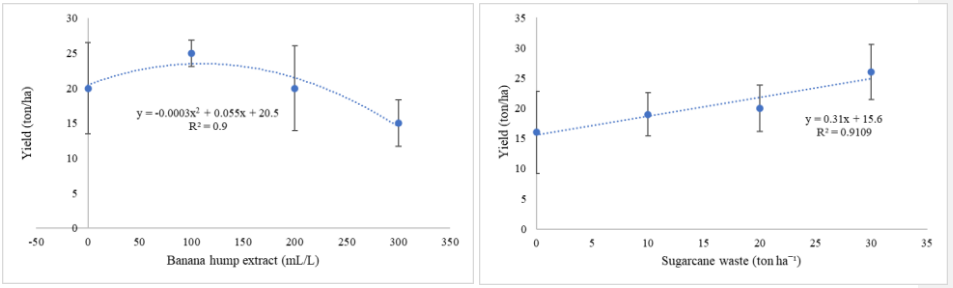

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Figure 5. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on results

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Revised

Internal/External Evaluation Report

Section I

Article No: 112123-AJPS-ANSI

Article Type: Research Article

Status: (Revision)

Plagiarism Ratio: Low (<19%)

Type of Plagiarism: Direct

Novelty: (Acceptable)

Write-up Quality: (Good)

Expert's Opinion: Recommended for publication

Other Comments:

Section II

Significance Level: Moderate

Was the article logically laid out: (Yes)

Literature Citation: (Recent)

Content Reliability:
The article is about Enhancement of Butternut Squash (*Cucurbita moschata*) Growth and Yield and the results and conclusion of the paper support the research problem.

Section III

No. of Available Table(s):1

No. of Cited Table(s): 1

No. of Available Figure(s): 5

No. of Cited Figure(s): 5

No. of Available References: 30

No. of Cited References:30

No. of Outdated References: 0

Scope of the study: The article does fall within the Journal's scope**.**

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Thank you for your article submission. There are a few things you have to address in the submitted article. Always use track changes to revise the article to minimize the revision rounds and remained the highlighted parts as it is (marked citations, tables, figures, and sections). It will help to finalize your paper easily in the next steps.

Thank you!

The Enhancement of Butternut Squash (*Cucurbita moschata*) Growth and Yield through Sugarcane Waste and Banana hump extract Application

Novaty Eny Dungga[1*], Nurlina Kasim[1], Muhammad Fuad Anshori[1], Chalil Gibran Muryadi[2]

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Running title: The Enhancement of Butternut Squash by organic matter fertilizer

Significance statement: Based on the study results, there was no interaction between sugarcane waste treatment and banana hump extract in all observations of growth and production of butternut squash. Meanwhile, the treatment had a sharp linear graph with a maximum point of 30 tons ha^{-1} sugarcane waste. The 100 mL L^{-1} banana hump extract treatment indicated a quadratic dominant curve response as the optimal concentration point. Therefore, both 100 mL L^{-1} banana hump extract and 30 tons ha^{-1} doses of Sugarcane waste were recommended as part of butternut squash planting package.

Author's contribution

Name of the author and e-mail ID	Types of contribution
Dr. Novaty Eny Dungga	Contributes to the determination of the research idea and initial research plan, responsible for the implementation of the research, responsibility as corespondence author in journal submission, and funding the research, data analysis, writing process and discussion.

Commented [A.S16]: A running title/short title is mandatory for each manuscript as per our journal format. A running title helps the reader to understand the scope of the study in relation to how it was designed to address the research problem. Please provide a supportive running title comprising 5-7 words max.

Commented [NED17R16]: Thank you for your suggestions. We have added it according to your suggestions

Commented [A.S18]: The significant statement's objective is to explain why your study was necessary and what unique contribution your research made to expanding academic understanding of your subject. The author is requested to mention the purpose of the work and the main results of the study within a word limit of 120 max.

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Commented [A.S20]: Please describe each author's contribution to the submitted paper, including the study's idea, design, implementation, or interpretation. Transparency in author contributions is strongly encouraged; for reference, you can use the structure of a CRediT author statement.

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Dr. Nurlina Kasim	Contributes to the determination of the research idea and initial research plan, data analysis and discussion.
Dr. Muhammad Fuad Anshori	Contributes to data analysis, writing process, discussion, a
Chalil Gibran Muryadi	Contributes to the determination of the research idea and initial research plan, responsible for the implementation of the research and discussion.

Conflict of interest: there are not conflict of interest in this Manuscript.

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ABSTRACT

Background and Objective: The butternut squash (*Cucurbita moschata*) is is one of the horticultural crops that has high economic potential. To increase its sustainability, organic fertilizers is needed, which is abundantly available and has not been optimized much, such as sugarcane waste and banana hump extract. Therefore, the research aims is to determine the growth response of Butternut squash (*Cucurbita moschata*) with the application of sugarcane waste (*blotong*) and banana hump extract. **Materials and Methods:** This study was carried out in Pitumpidange Village, Libureng District, Bone Regency, South Sulawesi Province, from August to November 2022. A two-factor factorial experiment was adopted with a randomized complete block design as the environmental design. The first factor was the dose of sugarcane waste and the second factor was the concentration of banana hump extract, both comprised of 4 levels. . Observation parameters included tendril length, days to flowering, days to harvest, number of fruit per plot, fruit weight, and yield. The data obtained were analyzed using analysis of variation and polynomial analysis. **Results:** The results showed that there was no interaction between sugarcane waste treatment and banana hump extract in all observations of growth and production of butternut squash. Meanwhile, the treatment had a sharp linear graph with a maximum point of 30 tons ha^{-1}. The 100 mL L^{-1} banana hump extract treatment indicated a quadratic dominant curve response as the optimal concentration point. **Conclusion:** Therefore, both 100 mL L^{-1} banana hump extract and 30 tons ha^{-1} doses of Sugarcane waste were recommended as part of butternut squash planting package.

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Commented [Cp26]: Add 1-2 lines regarding measured parameters and used statistical method.

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KEYWORDS: banana hump extract, Butternut squash , organic fertilizer, sugarcane blotong. polynomial regression, sugarcane waste, sustainable farming

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INTRODUCTION

Butternut squash (*Cucurbita moschata*) is a relatively new horticultural crop commodity [1]. In Indonesia, the term Butternut squash is not widely known because people are more familiar with pumpkin. The physical shape of this commodity resembles a tuber with a soft flesh texture and distinctive taste [1,2]. Furthermore, the sugar content increases with the length of storage time (maximum storage of six months). Butternut squash is included in the climacteric category, where ethylene levels and respiration activity increase during the ripening phase [3].

Butternut squash has a soft flesh texture with a distinctive taste and contains fiber, beta-carotene, carotenoids, penolic acid, flavonoids, minerals and vitamins, carotenoids, and polyvenols [4,5]. The plant has high amounts of carbohydrates, antioxidants, fiber, minerals, and vitamins, which can fight free radicals and increase the resistance of the body. Therefore, development is needed to increase the potential and quality of supporting the economic value of the fruit.

Planting of Butternut squash is relatively minimal and focuses on using chemical fertilization [1]. The relatively large use of chemical inputs is a challenge in determining how to reduce these inputs [1,6]. Continuous input of chemicals can damage soil fertility levels and physical properties [7,8]. In addition, excess fertilizer can be toxic to plants and indirectly affect fruit quality [9,10]. The use of organic fertilizer is a good alternative to increase the production and quality of Butternut squash.

The use of organic fertilizer has different benefits, specifically in increasing soil fertility levels, aggregates, and microorganism content. Increasing soil physical properties improves the

strength, water retention, aeration, and drainage [6,7,8,11]. In addition, optimal application can reduce the input of inorganic fertilizer use to reduce production costs and provide benefits for farmers [6,8]. The application and research of organic fertilizer on butternut squash should be conducted and some components used are sugarcane waste (blotong) and banana hump extract.

Sugarcane waste is an abundant by-product of sugar factories, and its availability can be used as organic fertilizer [12,13]. This is an effort to use industrial waste towards zero [12] and sugarcane wastes many nutrients, contains, such as carbon, nitrogen, phosphate, calcium, potassium, iron, manganese, and magnesium [13,14] The use of sugarcane waste on Butternut squash has been reported by Dlamini [15] and banana weevil is also an organic material underused by many people. Farmers leave banana weevils during the harvest process as a source of organic fertilizer to support growth [16]. The weevil extract contains cytokinins and gibberellins, which can be used as growth regulators, and many plant nutrient contents [17. The weevil is a good source of microorganisms for its growth and liquid organic fertilizer [18,19]. Therefore, this research aims to determine the best combination of sugarcane waste fertilizer and banana weevil liquid to support the growth and production of Butternut squash.

MATERIALS AND METHOD

Experimental Design

This research was carried out in Pitumpidange Village, Libureng District, Bone Regency, on former rice fields from August to November 2022. The location was at an altitude of 115 m above sea level and was carried out in the form of a two-factor factorial experiment with a randomized complete block design (RCBD) as the environmental design. The first factor was the application of sugarcane waste, which consisted of 4 levels, namely without sugarcane cake

(S0), a dose of 10 tons ha^{-1} (S1), a dose of 20 tons ha^{-1} (S1), and a dose of 30 tons ha^{-1} (S3). The second factor was administering banana hump extract, consisting of 4 levels, namely without banana hump extract (B0), concentration 100 mL L^{-1} (B1), concentration 200 mL L^{-1} (B2), and concentration 300 mL L^{-1} (B3). From these two factors, 16 treatment combinations were obtained, and each was repeated three times to yield 48 experimental plots. Furthermore, each plot consisted of 4 plant samples to produce 192 plant samples.

The study was set using a factorial design with a Randomized Complete Block Design as an environmental design. The first factor was the application of OPEFB compost consisting of three levels, namely: Control (C0), OPEFB compost 10 tons ha^{-1} (C1), and 20 tons ha^{-1} (C2). The second factor was the combination of *Trichoderma harzianum* + *Pleurotus ostreatus* (Tri-Po) consisting of four levels namely; Tri-Po with a dose of 4g + 2g $tree^{-1}$ (P1), 4g + 4g $tree^{-1}$ (P2), 4g + 6g $tree^{-1}$ (P3), and 4g + 8g $tree^{-1}$ (P3), respectively. The treatment was repeated three times so that there were 36 experimental units. Each experimental unit has a plot size of 4m x 3m.

Research procedure

The research preparation started with tilling the land using a hand tractor. The land area used was 17 x 8 m, and each experimental plot had an area of 1 m^2 with a distance of 50 cm. After the plot is formed, the soil is loosened and smoothed to provide good growing space for plants to develop. Subsequently, seed preparation is carried out using the F1 Butternut squash variety, and sowing is conducted in a seedling house measuring 3×1.5 m. The planting medium used is a combination of soil and manure in a ratio of 2:1. Sowing is performed for 21 days until Butternut squash seedlings have institutional leaves and reach a height of 5-7 cm. Meanwhile, planting is carried out with a spacing between plants of 50x50 cm in the afternoon.

Caring for Butternut squash consists of several activities, namely watering, weeding, installing stakes, fertilizing, pruning, pollinating, and controlling pests and diseases. Watering

is carried out twice a day in the morning and evening during the vegetative phase. Meanwhile, it is only conducted once in the morning during the generative phase. Weeding is performed manually, scheduled 2 weeks after planting (WAP), and carried out regularly. Installation of stakes is also performed 1 WAP, using bamboo 150 cm high. Fertilization is divided into three types of inorganic chemical fertilizer, namely general, solid sugarcane waste, and liquid fertilizer derived from banana hump extract. The two treatments are explained further in the subsections below, while the inorganic chemical uses Grand-K fertilizer at a rate of 3 g $hole^{-1}$ or 120 kg ha^{-1}. The addition of Grand-K inorganic fertilizer with potassium content is half the recommended dose to provide sufficient nutrient availability for the plant. In addition, pruning focuses on water shoots to maintain and optimize the growth of stems and primary branches. Pollination is carried out when fruit ovaries appear and are accompanied by female flowers. The male flowers are taken and pollinated to produce good fruit and the process is conducted in the morning from 08:00 – 10:00 WITA. Pest control is also achieved by sanitizing the land and using the insecticide Regen 50 SC to combat mealybugs, whiteflies, oteng-oteng, ants, and ladybugs as the main pests on Butternut squash. Harvesting is performed 60–70 days after planting (DAP) with the characteristics of shiny brown fruit stalks and shiny fruit skin color.

Sugarcane waste fertilizer

Sugarcane waste was taken from the milling process waste disposal site at the Camming Sugar Factory, Libureng District, Bone Regency, South Sulawesi. This waste taken on this area was 72 kg. Sugarcane waste possesses a smooth texture, exhibits a deep black hue, has undergone extended aging, and maintains a dry consistency. The application is carried out a week before planting by sowing in experimental plots according to the treatment.

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Banana hump extract fertilizer

Making banana hump extract solution was conducted by chopping 10 kg of banana weevil. The bananas were taken in Cina Subdistrict, Bone Regency, South Sulawesi as the

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second highest production of banana. Every kilogram of chopped banana weevil was put in a 10-liter bucket with 1 L of air and the process was carried out until the container was full. Subsequently, EM4 decomposer was added for the fermentation process for 14 days and banana hump extract was ready to be filtered before being sprinkled around the plant. Application of the extract was conducted in the afternoon according to the treatment concentration.

Data observation and statistical analysis

Observation parameters included tendril length, days to flowering, days to harvest, number of fruit per plot, fruit weight, and yield. The data obtained were analyzed using analysis of variation with an error rate of 5% and significant characters were tested using a polynomial analysis approach..

RESULTS

The variance results can be seen in Table 1 and the characteristics of tendril length, fruit weight, and yield are influenced by two treatments, namely sugarcane waste fertilizer and banana hump extract. The characteristics of flowering days and the number of fruit per plot were only influenced by sugarcane waste (SW) treatment. Meanwhile, the character of the day before harvesting was affected by the treatment of banana hump extract (BHE). The interaction between the two treatments showed no significant influence on the observed growth characteristics.

Table 1. Analysis of variance from several butternut squash growth.

Based on Fig. 1, tendril length is influenced by treatments (BHE and SW) independently, or the interaction of the two does not have a significant effect. These show curves with high determination values (0.8459 for BHE and 0.9987 for SW), but both have different curve responses. Banana hump extract treatment reported a quadratic pattern towards tendril length with an optimal concentration of 100 mL L^{-1} (Fig 1A). Meanwhile, sugarcane

waste processing indicated a linear pattern regarding tendril length with a maximum dose of 30 tons ha^{-1} (Fig 1B).

Figure 1. Graph of the effect of banana hump extract (A) dan sugarcane waste (B) to Tendril length

The characteristics of days to flowering were only influenced by sugarcane waste processing (Fig. 2A). This was different from the character of the day before harvest which was only influenced by banana hump extract (Fig. 2B). SW treatment showed a decreasing linear curve with a determination value reaching 0.993 and the lowest point in days to flowering was at SW dose of 30 tons ha^{-1}. Meanwhile, the days to harvesting the BHE curve reported a cubic curve, reaching an absolute determined value of 1. This curve had one main peak and valley, namely 100 mL L^{-1} and 200 mL L^{-1}, respectively.

Figure 2. Graph of the effect of giving banana weevil extract on the day of flowering (A) and bagasse on the day before harvest (B).

The character of the number of fruits also indicated a single influence from sugarcane waste (Fig. 3). This character had an upward linear graph with a determination value reaching 0.781. The maximum dose related to the number of fruits and Butternut squash was 30 tons ha^{-1}.

Based on Fig. 4, fruit weight was influenced by the two treatments with interaction effects. The treatments showed curves with quite high determination values (0.6459 for BHE and 0.96 for SW) and a quadratic curve. Banana hump extract treatment indicated a quadratic pattern of reduction in fruit weight with an optimal concentration of 100 mL L^{-1} (Fig 4A). Meanwhile, sugarcane waste processing reported an upward quadratic pattern with the dose trough and highest points at 30 tons ha^{-1} (Fig 4B). SW dose curve also continued to increase as the compost dose increased.

Figure 3. Graph of the effect of sugarcane waste on the number of fruits per plot

Figure 4. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on fruit weight

Yield characteristics were also influenced by the two treatments, such as fruit weight and tendril length (Fig 5). BHE and SW treatments had curves with high determination values, namely 0.90 and 0.91, respectively. However, the two curves showed different response curves and banana hump extract treatment indicated a quadratic pattern with an optimal concentration of 100 mL L^{-1} (Fig 5A). Sugarcane waste processing showed an upward linear pattern in yield with a maximum dose of 30 tons ha^{-1} (Fig 5B).

Figure 5. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on results

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DISCUSSION

The ANOVA results showed that there was a single effect of BHE and SW treatments on all components of the observed butternut squash yield. For some characters, the two treatments did not have a significant effect at the same time. These two treatments played an important and complementary role in supporting the development and growth of Butternut squash yield components. Therefore, there was no difference in response changes between increasing BHE and SW. Additive changes showed that determining the optimal point for each treatment was easier to predict and be used as a consistent reference in its application [20]. Further analysis should become a reference in planting Butternut squash, specifically with the concept of sustainable agriculture.

Based on polynomial tests, sugarcane waste has a relatively linear graph regarding the characteristics of the components produced. The results show that a good dose of sugarcane waste is 30 tons ha^{-1} and are supported by Budiyanto [21] and Tyasmoro and Saitama [22] on corn and pak choy. Sugarcane waste has the same potential as other organic fertilizers for improving soil properties. The provisions have a big influence on improving the physical

properties of the soil by applying other solid organic fertilizers [13,23]. However, sugarcane waste fertilizer has good nutritional and sucrose potential in breeding colonies of microorganisms [24-26]. This further supports plant growth and development, hence, the fertilizer dose has a linear graphic response with a high gradient. The sharp linear graph also shows that the dose can be increased beyond the maximum dose. A similar result was stated by Yassi et al. [27] regarding the sharp graphic patterns of compost treatment on rice growth. The dose still needs to be studied and considered more deeply regarding several other aspects, such as the availability of raw materials and costs in the implementation process. The addition of fertilizer is less effective than giving the doses periodically and consistently. Therefore, the recommended dose of 30 tons ha^{-1} can be an initial reference in optimizing the growth and development of Butternut squash.

Based on the polynomial tests, most of the responses to the influence of BHE had a quadratic curve with an optimal point at 100 mL L^{-1}. The curve with the optimal point shows that giving a concentration exceeding the optimal concentration will be increasingly ineffective [16,28,29]. The provision of liquid organic fertilizer has certain limitations and this is based on the concentration of microorganisms, hormones, and nutrients within the fertilizer formulation. The supply of liquid fertilizer becomes stagnant and even reduces productivity when the optimal limit is exceeded. Therefore, BHE administration must be based on the optimum point, namely 100 mL L^{-1} in this research.

The combination of sugarcane waste dosage of 30 tons ha^{-1} and BHE concentration of 100 mL L^{-1} is the optimal point in supporting the growth and production of Butternut squash. Even though significant positive interactions are not provided, the application optimizes the potential for the growth and production of Butternut squash. The combination of these two treatments can be used as an additional recommendation and research regarding the quality of Butternut squash such as Brix and others also needs to be carried out in the future. This

complements the potential benefits of combining the two treatments [1,30]. Further exploration of the potential inherent in this combination is essential to ensure ongoing development. This leads to continual optimization, enhancing its capacity to support the production of Butternut squash over time.

Conclusion

In conclusion, there was no interaction between sugarcane waste treatment and banana hump extract in the observations of the growth and production of Butternut squash. Furthermore, the treatment had a sharp linear graph on the growth of Butternut squash with a maximum point of 30 tons ha^{-1} sugarcane waste. The 100 mL L^{-1} banana hump extract treatment also indicated a dominant quadratic response and the combinations were recommended as part of the Butternut squash planting package.

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62 [Kurniati, F., I. Hodiyah, T. Hartoyo and I Nurfalah. 2018. Respons labu madu (*Cucurbita moschata* Dusrch) terhadap zat pengatur tumbuh alami berbagai dosis [Response of butternut squash (Cucurbita moschata Dusrch) to various doses of natural growth regulators].(Indonesia). Agrotech. Res. J., 2: 16–21.

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Commented [CM36]: Same problem in reference number 3, 11
When citing a non-English reference in a scientific journal, it is important to provide a translation of the title of the work into English, enclosed in square brackets, after the original title. Additionally, the language of the publication should be indicated in parentheses after the title. For example

Last name, Initials. (Year). Title of work in original language [Translated title in English]. (Language of publication). Name of Journal, volume number(issue number), page numbers.

Commented [NED37R36]: Thank you for your suggestion. We have revised about the Indonesian reference to your recommendation reference format

cultivation technology and its use as alternative food in Pasigaran Village, Sumedang, West Java]. (Indonesia). Jurnal Aplikasi Ipteks untuk Masyarakat, 10 (2) :159–162. [Indonesia]

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Commented [CM38]: Despite our best efforts, we were unable to locate the DOI or Direct Link for this reference. Please provide the required DOI or Direct Link, as it is mandatory. If you are also unable to find this information, please replace the reference with a suitable alternative.

Commented [NED39R38]: Thank you for your suggestion. We have added doi of this reference

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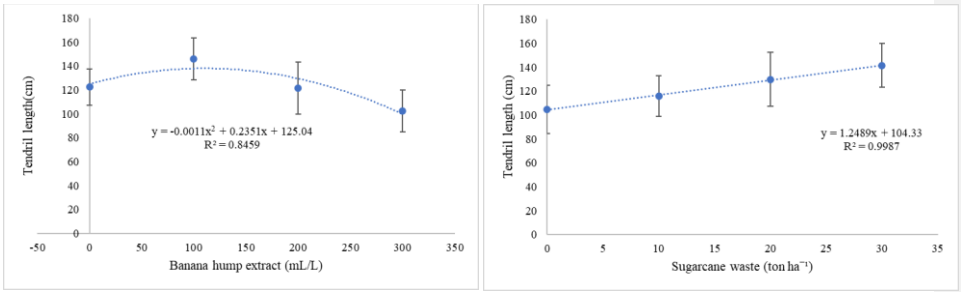
Table 1. Analysis of variance from several butternut squash growth.

Characters	S	B	SxB	Error	Cv (%)
Tendril Length	16.83**	2.04**	1.98	1.23	14
Days to flowering	16.83**	2.04	1.98	1.23	17
Days to harvesting	3.00	188.70**	13.00	8.7	36
Number of fruits per plot	3.30**	0.60	0.30	0.20	22
Fruit Weight	69210.60*	40934.10*	1116030	5532.00	14
Yield	207.60**	175.90**	28.00	17.60	23

Notes: S : sugarcane waste, B; Banana hump Extract, CV: coefficient of variance, ** significant effect at 1% level error.

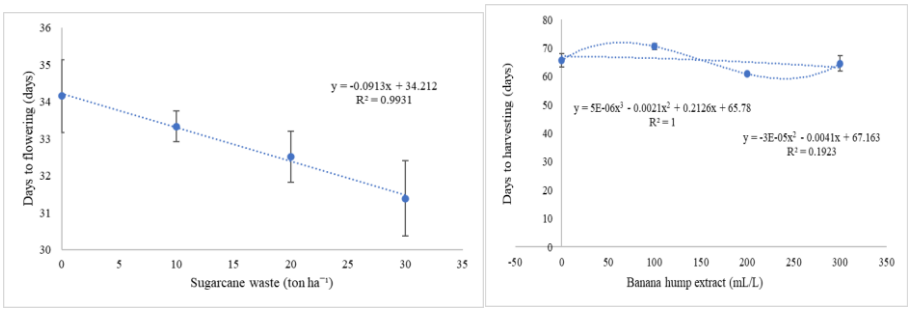


A B

Figure 1 Graph of the effect of banana hump extract (A) dan sugarcane waste (B) to Tendril length

Commented [A.S40]: Cite the figure subparts in the text.

Commented [NED41R40]: Thank you for your suggestions. We have citated the Fig 1A (Line 211), and Fig 1B (Line 213)



A B

Figure 2 Graph of the effect of giving banana weevil extract on the day of flowering (A) and bagasse on the day before harvest (B).

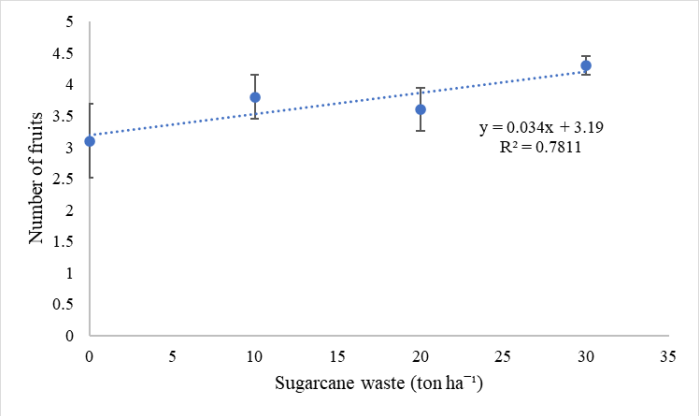
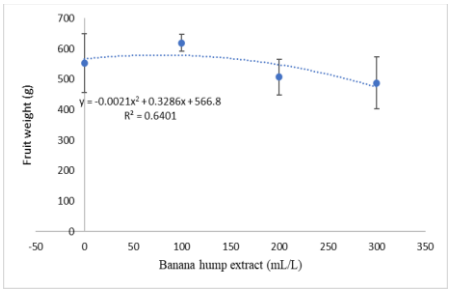
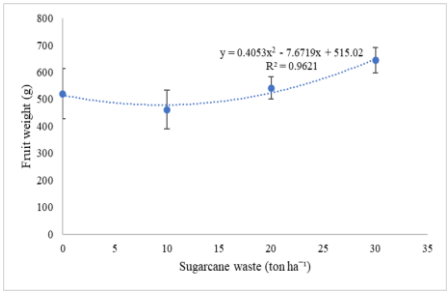


Figure 3. Graph of the effect of sugarcane waste on the number of fruits per plot



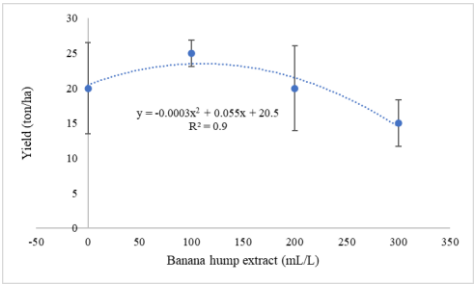


A B

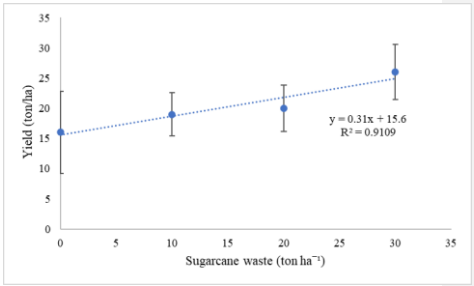
Figure 4. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on fruit weight

Commented [A.S42]: Cite the figure subparts in the text.

Commented [NED43R42]: Thank you for your suggestions. We have citated the Fig 4A (Line 233), and Fig 4B (Line 234)



A



B

Figure 5. Graph of the effect of banana weevil extract (A) and sugarcane bagasse (B) on results

Commented [A.S44]: Cite the figure subparts in the text.

Commented [NED45R44]: Thank you for your suggestions. We have citated the Fig 5 (line 240), Fig 5A (Line 243), and Fig 5B (Line 244)

Reviewer A.S

Response: Thank you for your constructive comments and suggestions. Please find below our responses to your comments.

Q1	A running title/short title is mandatory for each manuscript as per our journal format. A running title helps the reader to understand the scope of the study in relation to how it was designed to address the research problem. Please provide a supportive running title comprising 5-7 words max.
A1	Thank you for your suggestions. We have added it according to your suggestions
Revision	The Enhancement of Butternut Squash by organic matter fertilizer (46 Line)

Q2	The significant statement's objective is to explain why your study was necessary and what unique contribution your research made to expanding academic understanding of your subject. The author is requested to mention the purpose of the work and the main results of the study within a word limit of 120 max.
A2	Thank you for your suggestions. We have added it according to your suggestions
Revision	Based on the study results, there was no interaction between sugarcane waste treatment and banana hump extract in all observations of growth and production of butternut squash. Meanwhile, the treatment had a sharp linear graph with a maximum point of 30 tons ha-1 sugarcane waste. The 100 mL L-1 banana hump extract treatment indicated a quadratic dominant curve response as the optimal concentration point. Therefore, both 100 mL L-1 banana hump extract and 30 tons ha-1 doses of Sugarcane waste were recommended as part of butternut squash planting package. (47-53 Lines)

Q3	Please describe each author's contribution to the submitted paper, including the study's idea, design, implementation, or interpretation. Transparency in author contributions is strongly encouraged; for reference, you can use the structure of a CRediT author statement.
A3	Thank you for your suggestions. We have added it according to your suggestions

Revision

Name of the author and e-mail ID	Types of contribution
Dr. Novaty Eny Dungga	Contributes to the determination of the research idea and initial research plan, responsible for the implementation of the research, responsibility as corespondence author in journal submission, and funding the research, data analysis, writing process and discussion.
Dr. Nurlina Kasim	Contributes to the determination of the research idea and initial research plan, data analysis and discussion.
Dr. Muhammad Fuad Anshori	Contributes to data analysis, writing process, discussion, a
Chalil Gibran Muryadi	Contributes to the determination of the research idea and initial research plan, responsible for the implementation of the research and discussion.

	(line 54-55)

Q4	Please provide a statement on the conflict of interest.
A4	Thank you for your suggestions. We have added it according to your suggestions
Revision	there are not conflict of interest in this Manuscript. (line 56)

Q5	Your background should begin with defining a topic for the reader. You must identify which topic you need to review and what your reader already knows about the topic. Please provide a background of the study (max 1-2 lines).
A5	Thank you for your suggestions. We have added it according to your suggestions
Revision	The butternut squash (Cucurbita moschata) is is one of the horticultural crops that has high economic potential. To increase its sustainability, organic fertilizers is needed, which is abundantly available and has not been optimized much, such as sugarcane waste and banana hump extract. Therefore,This the research aimswas conducted is to determine the growth response of Butternut squash (Cucurbita moschata) with the application of sugarcane waste (blotong) and banana hump extract (59-64 Lines)

Q6	The keywords are not effective. Please provide 3-4 more unique keywords.
A6	Thank you for your suggestions. We have added some keywords. I hope it is suitable with your suggestions
Revision	organic fertilizer, sugarcane blotong. (80 line)

Q7	Mention the waste quantity.
A7	Thank you for your question. We taken the sugarcane wastes as 72 kg.
Revision	This waste taken on this area was 72 kg. (177-178 lines)

Q8	Cite the figure subparts in the text.
A8	Thank you for your suggestions. We have citated the Fig 1A (Line 211), and Fig 1B (Line 213)
Revision	

Q9	Cite the figure subparts in the text.
A9	Thank you for your suggestions. We have citated the Fig 4A (Line 233), and Fig 4B (Line 234)
Revision	

Q10	Cite the figure subparts in the text.
A10	Thank you for your suggestions. We have citated the Fig 5 (line 240), Fig 5A (Line 243), and Fig 5B (Line 244)
Revision	

Reviewer S.A

Response: Thank you for your constructive comments and suggestions. Please find below our responses to your comments.

Q1	Add 1-2 lines regarding measured parameters and used statistical method.
A1	Thank you for your suggestions. We have added it according to your suggestions in **Materials and Methods** of this abstract (71-73 lines)
Revision	Observation parameters included tendril length, days to flowering, days to harvest, number of fruit per plot, fruit weight, and yield. The data obtained were analyzed using analysis of variation and polynomial analysis

Q2	From where the bananas were taken?
A2	Thank you for your question. We taken the the bananan hump from Cina Subdistrict, Bone Regency, South Sulawesi as the second highest of banana production We have added in line 183
Revision	. The bananas were taken in Cina Subdistrict, Bone Regency, South Sulawesi as the second highest production of banana

Q3	Provide citation of figure 5 in the text.
A3	Thank you for your suggestions. We have citated the Fig 5 (line 240), Fig 5A (Line 243), and Fig 5B (Line 244)
Revision	

Computer Mart

Q1	Same problem in reference number 3, 11 When citing a non-English reference in a scientific journal, it is important to provide a translation of the title of the work into English, enclosed in square brackets, after the original title. Additionally, the language of the publication should be indicated in parentheses after the title. For example Last name, Initials. (Year). Title of work in original language [Translated title in English]. (Language of publication). Name of Journal, volume number(issue number), page numbers.
A1	Thank you for your suggestion. We have revised about the Indonesian reference to your recommendation reference format
Revision	2. Kurniati, F., I. Hodiyah, T. Hartoyo and I Nurfalah. 2018. Respons labu madu (*Cucurbita moschata* Dusrch) terhadap zat pengatur tumbuh alami berbagai dosis [Response of butternut squash (Cucurbita moschata Dusrch) to various doses of natural growth regulators].(Indonesia). Agrotech. Res. J., 2: 16–21. 3. Ariyanti, M. and S. Erni. 2021. Teknologi budidaya labu madu dan pemanfaatannya sebagai pangan alternatif di Desa Pasigaran, Sumedang, Jawa Barat [Butternut squash cultivation technology and its use as alternative food in Pasigaran Village, Sumedang, West Java]. (Indonesia). Jurnal Aplikasi Ipteks untuk Masyarakat, 10 (2) :159–162. [Indonesia] 11. Walida, H., E. H. Darmadi and M. Zuhirsyan. 2020. Pemberian pupuk kotoran ayam dalam upaya rehabilitasi tanah ultisol desa janji yang terdegradasi [Providing chicken manure fertilizer in an effort to rehabilitate

	the degraded Ultisol soil of Janji Village]. (Indonesia). Jurnal Agrica Ekstensia, 14: 75–80

Q2	Despite our best efforts, we were unable to locate the DOI or Direct Link for this reference. Please provide the required DOI or Direct Link, as it is mandatory. If you are also unable to find this information, please replace the reference with a suitable alternative.
A2	Thank you for your suggestion. We have added doi of this reference
Revision	21. Budiyanto G. 2021. The effect of combination of sugarcane pressmud compost and potassium. Food Res., 5: 289–296. https://doi.org/10.26656/fr.2017.5(3).630

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Oct 13, 2023

Novaty Eny Dungga1,

Subject: Acceptance Letter for Article No. 112123-AJPS-ANSI

It's a great pleasure for us to inform you that below mentioned manuscript has been accepted for publication in Asian Journal of Plant Sciences as Research Article on the recommendation of the reviewers.

Title: The Enhancement Butternut Squash (Cucurbita moschata) Growth and Yield through Sugarcane Waste and Banana hump extract Application

Author's Name: Novaty Eny Dungga, Nurlina Kasim, Muhammad Fuad Anshori and Chalil Gibran Muryadi

Receiving Date: September 20, 2023

Regards

M. Imran Pasha
Publication Manager