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# MAIZE GROWTH AND PRODUCTION RESPONSE WITH A COMBINATION OF MICROBIAL CONSORTIUM, NPK, AND ORTHO SALISIC ACID

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## ABSTRACT
Corn is one of the most important food crops in the world. Corn has a high nutritional content, such as carbohydrates, proteins, and fats. Corn can also be processed into various food and beverage products. Corn production in Indonesia currently still does not meet national needs, one of the factors that causes this is the low productivity of corn. Various efforts have been made to increase corn productivity, one of which is by using fertilizers. The purpose of this study was to examine the response of corn growth and production with a combination of microbial consortium, NPK, and ortho salicylic acid. This study used experimental research methods. Data collection techniques in this study were carried out by literature study and observation. The data that has been collected is analyzed descriptively. The results showed that the consortium combination of 1 dose of 5 ml + NPK 15 gr + leaf fertilizer 3 ml was significantly different to increase the best growth in leaf area, total plant weight, corn weight, fruit diameter (base and middle). Based on the results of the study, it can be concluded that the consortium combination of 1 dose of 5 ml + NPK 15 gr + Foliar fertilizer 3 ml can increase corn growth and production.
**Keywords:** Growth Response, Maize Production, Microbial Consortium Combination, NPK, Ortho Salicic Acid

## INTRODUCTION
Corn is a crucial food crop throughout the world with its various benefits. This plant is not only known for its abundant availability, but also for its high nutritional content, including carbohydrates, proteins, and fats (Farda et al., 2020). The variety of food and beverage products that can be produced from corn makes it a very versatile base material (Crini et al., 2020). Although corn has great potential to meet food needs, its production in Indonesia still has not reached an adequate level to meet national needs, one of the main obstacles that cause this is the low productivity of corn.

Sweet corn productivity in Indonesia reaches an average of 8.31 tons per hectare, while the potential yield of sweet corn can reach a range of 14 to 18 tons per hectare. The growth and yield quality of sweet corn is believed to be influenced by environmental factors, especially soil fertility. Therefore, the application of fertilization is one of the methods used to increase soil fertility and optimize the growth and quality of corn yield (Meriati, 2019). In addition to inorganic fertilization, the existence of biological fertilizers that accompany the performance of inorganic fertilizers is a strategy that aims to increase the availability of nutrients for plants in agriculture. NPK nutrients (Nitrogen, Phosphorus, Potassium) play a key role in supporting plant development. NPK is an

inorganic fertilizer consisting of three essential nutrients that are needed by plants to perform various important functions (Sasongko, 2010).

Biofertilizers, such as microbial consortia, have an important role to play in this process. Microbial consortium, working synergistically with inorganic fertilizers (Kalay et al., 2020). Microorganisms in biofertilizers can help increase the efficiency of nutrient absorption and use by plants. Some microbes can form symbiosis with plant roots and increase the availability of nutrients, such as nitrogen, through the process of nitrogen fixation (Antralina et al., 2015). In addition, ortho saliic acid is an inorganic compound with the formula $Si(OH)_4$. Although rarely observed, orthosilicic acid is the main compound of silica and silicates as well as other precursors of silicic acid. Silicic acid plays an important role in biomineralization and technology (Lagaly, 2000).

Silica has an important role in increasing the physiological activity of plants as well as accelerating the rate of cellular metabolism in response to drought stress (Mathur et al., 2020). In drought stress situations, plants are prone to stress that can hinder their physiological processes (Bhargava et al., 2013). The use of silica as a supplement can help overcome such challenges. Silica works by increasing the efficiency of water use by plants, allowing them to still maintain hydration balance during drought conditions. In addition, silica also plays a role in increasing plant growth and biomass. By modulating the rate of cellular metabolism, silica can stimulate the production of phytohormones that support plant vegetative growth. This process helps plants to keep growing and developing even under the stress of drought, increasing their resistance to unfavorable environmental conditions (Advinda, 2018).

Previous research by (Agustiar et al., 2016) showed that treatment with rice husks up to a dose of 6 kg / plot can increase plant height, stem diameter, cob length, cob weight per plant, but does not affect the number of leaves of sweet corn plants. Treatment with Bayprint liquid fertilizer up to a concentration of 3 cc/l of water can increase plant height, stem diameter, cob length, cob weight per plant, but has no effect on the number of leaves of sweet corn plants. There was no interaction between rice husks and Bayprint liquid fertilizer against all observed parameters.

Another study by (Khair et al., 2013) the design used was the Factorial Group Random Design (RAK) with two factors studied, namely: Chicken Manure Factor (K) consists of 3 levels and consists of K0 = 0 kg / plot, K1 = 1.5 kg / plot and K2 = 3 kg / plot. The results showed that the supply of chicken manure had a significant effect on plant height, flowering age, cob length, cob weight per sample, cob weight per plot, number of seeds per cob, dry seed weight per plot but did not have a real effect on the number of leaves.

The novelty of this research is from the object of his research, namely the response to the growth and production of corn talents with a combination of microbial consortium, NPK, and ortho salicylic acid. The results of the study can be used as a foundation for the development of an integrated fertilization strategy that includes a consortium of microbes, NPK inorganic fertilizers, and Ortho Salisic Acid. The purpose of this study was to examine the response of corn growth and production with a combination of microbial consortium, NPK, and ortho salicylic acid.

## RESEARCH METHODS

This type of research is quantitative research. According to (Sujarweni, 2014), quantitative research is a type of research that produces findings that can be achieved through the use of statistical procedures or other quantitative measurement methods. This study used experimental research methods. Experimental methods are a type of research that aims to identify the consequences of certain treatments given to an object under investigation (Khaeriyah et al., 2018).

Data collection techniques in this study were carried out by literature studies obtained from Google Schoolar and observation. The research was conducted from May-December 2023, at the Bogor Agricultural Development Polytechnic. The corn used in this study is talent corn. Land agrotechnology recommendations with four factors consisting of biofertilizer type factors, biofertilizer dosage, NPK, and leaf fertilizer with the following levels:

**Table 1. Consortium Composition**

| Consortium 1 | Consortium 2 |
|---|---|
| 1. *Bacillus pumillus* | 1. *Azospirillum lipoferum* |
| 2. *Debaryomyces hansenii* | 2. *Azotobacter vinelandii* |
| 3. *Bacillus thuringiensis* | 3. *Bradyrhizobium japonicum* |
| 4. *Meyerozyma* sp. | 4. *Lactobacillus* sp |
| 5. *Bacillus methylotrophicus* | 5. *Saccharomyces cerevisiae* |
| 6. *Pseudomonas geniculata* | 6. *Microbacterium lactium* |
| | 7. *Phanerochaete* sp. |
| | 8. *Paenibacillus macerans* |
| | 9. *Bacillus thuringiensis* |

1. Biofertilizer type level: 2 levels (consortium 1 and 2)
2. Biofertilizer dosage level: 2 levels (5 ml/liter and 15 ml/liter)
3. NPK 6-27-38-Te grade: 3 levels (5 gr/l, 10 gr/lt, and 15 gr/lt)
4. Leaf fertilizer grade: 2 levels (3 ml/lt and 6 ml/lt)

The foliar fertilizers used in this study were Ortho salicic acid 14% and Potassium 8%.

The planting distance in this study was 1.6m x 2m with 27 random designs, 4 different treatments as follows:

**Table 2. Complete Random Design**

| **Treatment with** | |
|---|---|
| Types of Microbes | 2 levels |
| NPK Fertilizer Dosage | 3 levels |
| Microbial Dosage | 2 levels |
| Foliar fertilizer dosage | 2 levels |
| Negative control (without treatment with) | |
| Positive control (plus microbes) | |
| Total | 24 treatments with |
| Deuteronomy | 3 plants |
| Total experimental units | 72 plants |

Then further tests are carried out with a 5% DMRT if there is a noticeable difference. The data that has been collected is analyzed descriptively.

## RESULTS AND DISCUSSION
### Research Results

### 1. Leaf Area

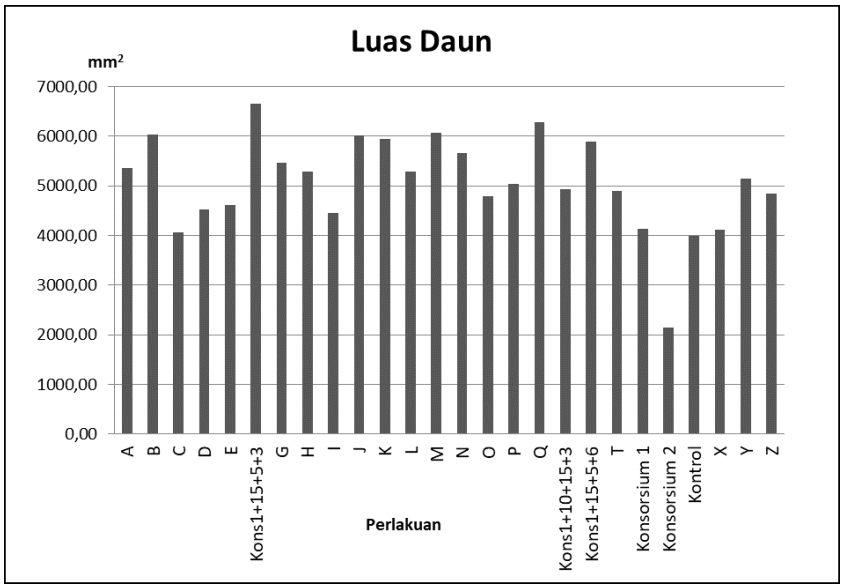


Figure 1. Leaf Area

The leaf area obtained based on treatment with a consortium of 1, 15 NPK, 5 biological fertilizers, and 3 leaf fertilizers obtained a value of 6654.78k. In the treatment with consortium 2, a value of 2149.506a was obtained. While in the treatment with control obtained a value of 3987,361b.

### 2. Number of leaves

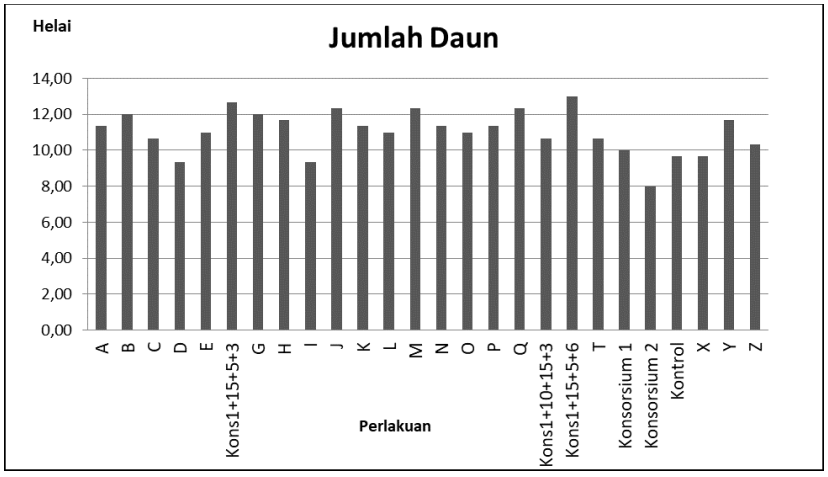


Figure 2. Number of leaves

The number of leaves obtained based on treatment with a consortium of 1, 15 NPK, 5 biological fertilizers, and 6 leaf fertilizers received a value of 13l. In the treatment with consortium 2 get a value of 8a. And in the treatment with control obtained a value of 9.666667abcd.

### 3. Plant Height

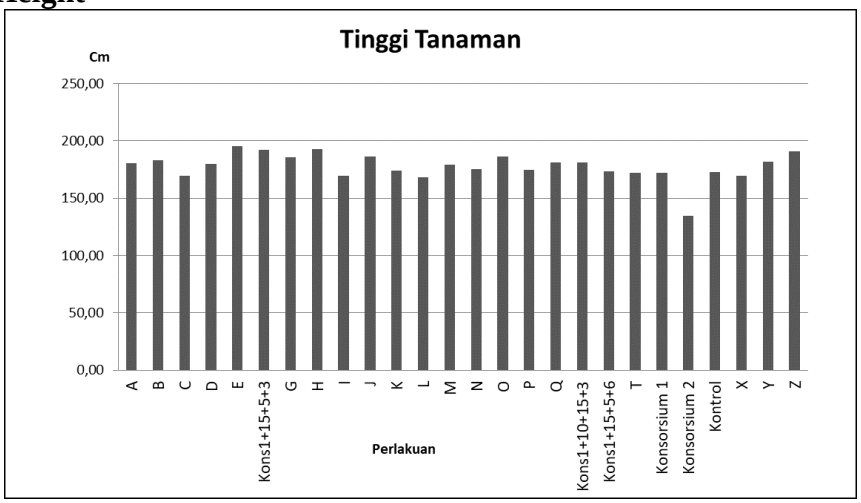


Figure 3. Tanamam Height

Plant height obtained based on treatment with a consortium of 2, 15 NPK, 15 biological fertilizers, and 6 leaf fertilizers obtained a value of 195.6667l. In the treatment with consortium 2 get a value of 134.6667a. And in the treatment with control, a value of 172.6667bcdefgh was obtained.

### 4. Wet weight of plants

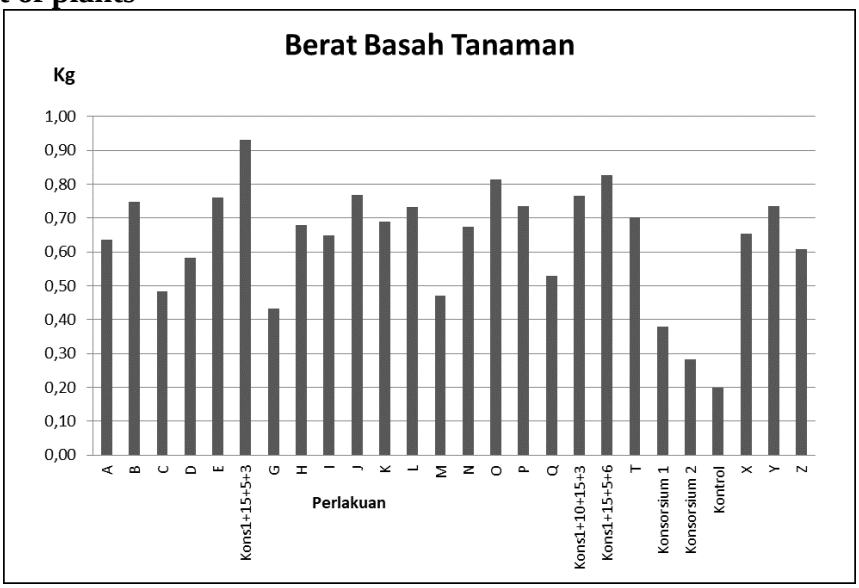


Figure 4. Wet weight of plants

The wet weight of plants obtained based on treatment with a consortium of 1, 15 NPK, 15 biological fertilizers, and 3 leaf fertilizers received a value of 0.93l. And in treatment with control obtained a value of 0.2a.

## 5. Rod Diameter (Top)

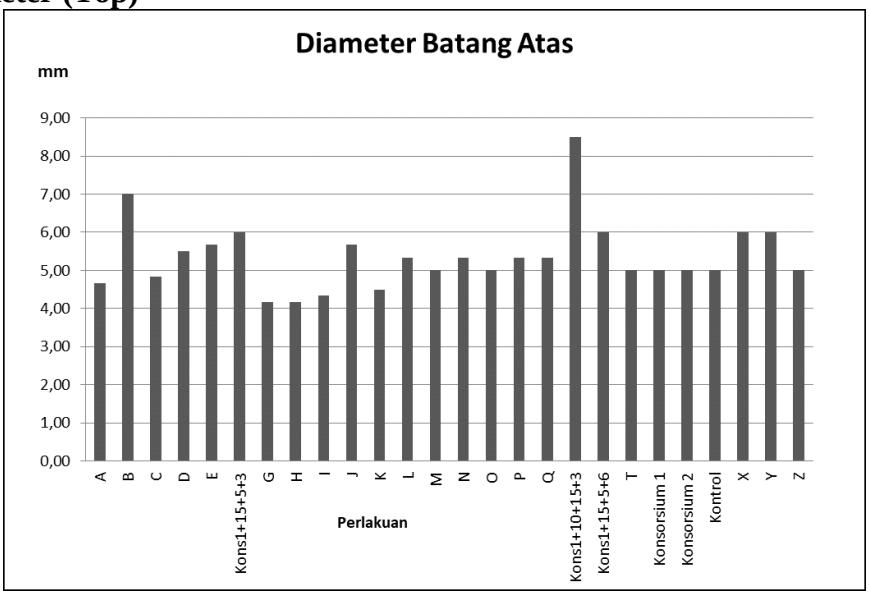


Figure 5. Rod Diameter (Top)

The diameter of the stem (top) obtained based on treatment with a consortium of 2, 15 NPK, 5 biological fertilizers, and 3 leaf fertilizers obtained a value of 7k. In the treatment with a consortium of 1, 10 NPK, 15 biological fertilizers, and 3 leaf fertilizers get a value of 8.5l. And in treatment with control obtained a value of 5abcdefghij.

## 6. Rod Diameter (Bottom)

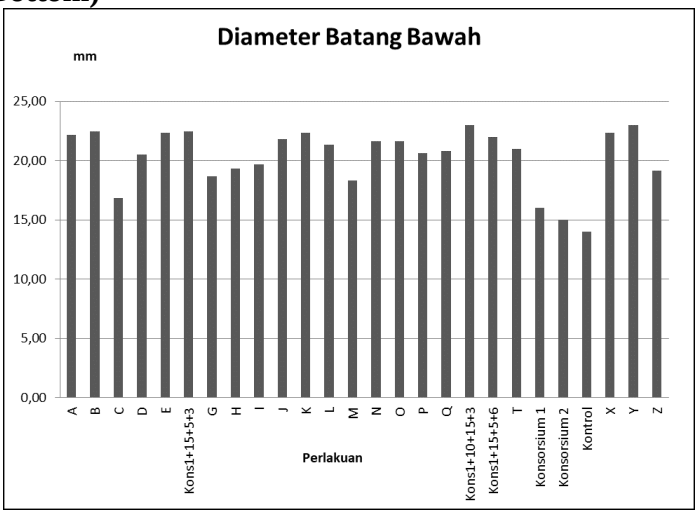


Figure 6. Rootstock Diameter

The diameter of the rootstock obtained based on treatment with a consortium of 1, 15 NPK, 5 biological fertilizers, and 3 leaf fertilizers obtained a value of 22.5jkl. In treatment with a consortium of 1, 15 NPK, 15 biological fertilizers, and 3 leaf fertilizers get a value of 23l. And in treatment with control obtained a value of 14a.

## 7. Trunk Diameter (Middle)

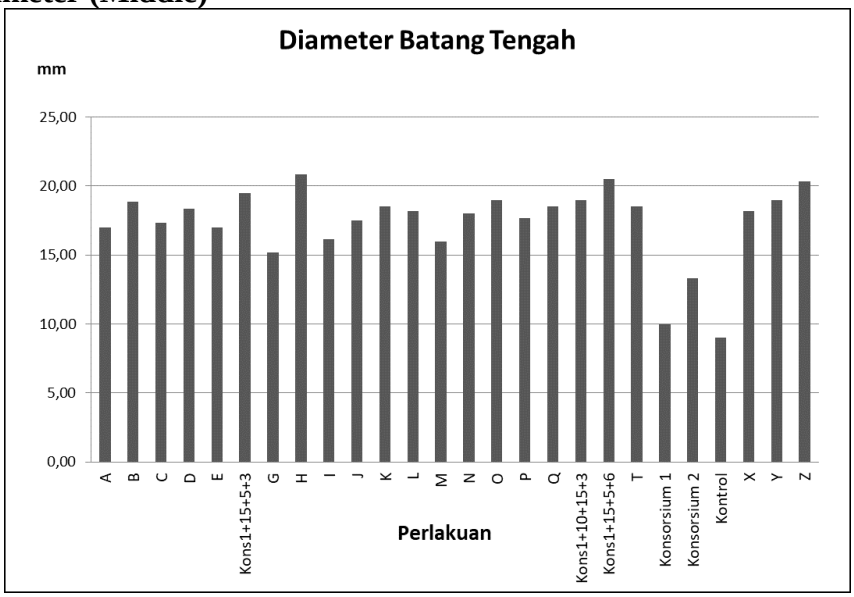


Figure 7. Trunk Diameter (Middle)

The diameter of the stem (middle) obtained based on treatment with a consortium of 1, 15 NPK, 5 biological fertilizers, and 3 leaf fertilizers obtained a value of 19.5ijkl. In treatment with a consortium of 2, 5 NPK, 15 biological fertilizers, and 6 leaf fertilizers get a value of 20.83333l. And in treatment with control, a value of 9a was obtained.

## 8. Corn Diameter (Base)

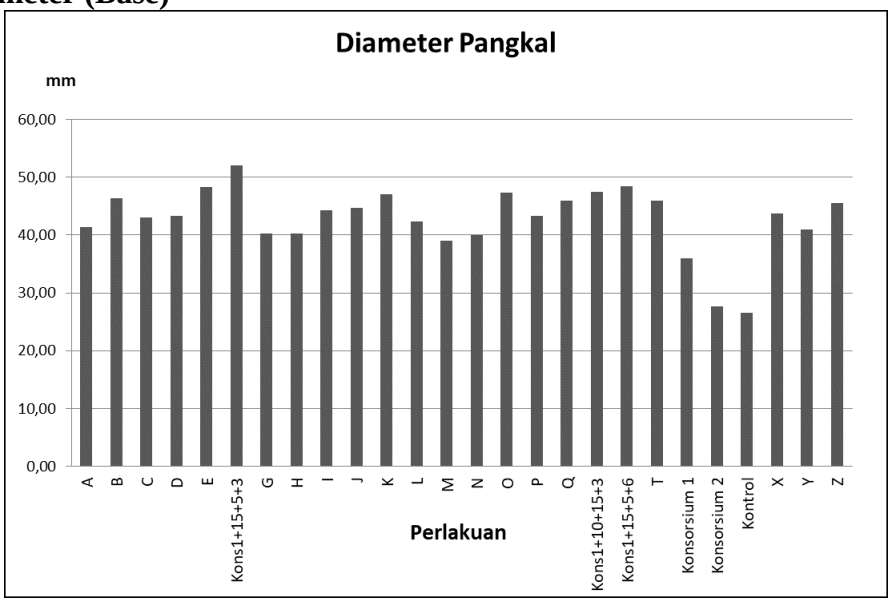


Figure 8. Corn Diameter (Base)

The diameter of the stem (top) obtained based on treatment with a consortium of 1, 15 NPK, 5 biological fertilizers, and 3 leaf fertilizers obtained a value of 52k. And in treatment with control, a value of 26.5a was obtained.

## 9. Corn Diameter (Middle)

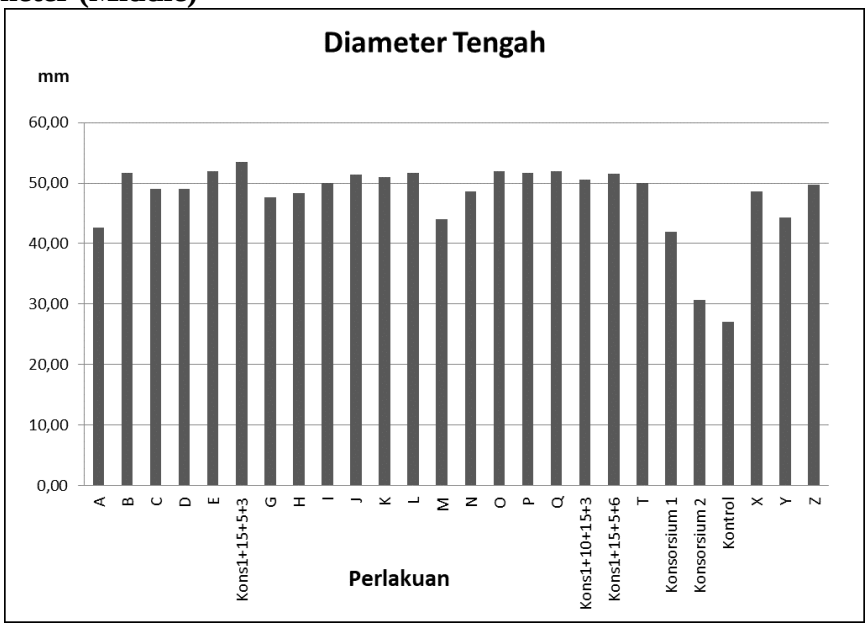


Figure 9. Corn Diameter (Middle)

The diameter of corn (tangah) obtained based on treatment with a consortium of 1, 15 NPK, 5 biological fertilizers, and 3 leaf fertilizers obtained a value of 53.5k. And in treatment with control, a value of 27a was obtained.

## 10. Corn Diameter (Top)

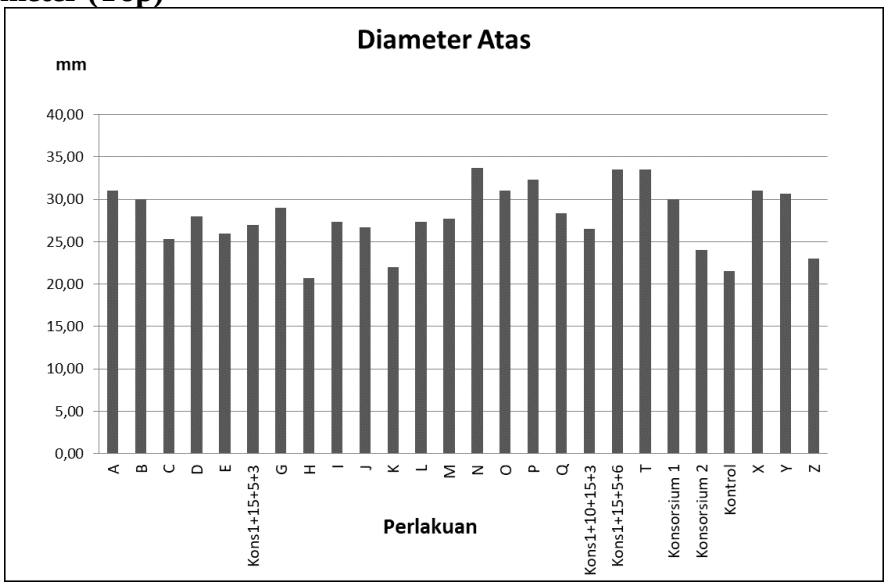


Figure 10. Corn Diameter (Top)

The diameter of corn (top) obtained based on treatment with a consortium of 2, 5 NPK, 15 biological fertilizers, and 6 leaf fertilizers obtained a value of 20.66667ab. In treatment with a consortium of 2, 15 NPK, 15 biofertilizers, and 3 leaf fertilizers get a value of 3.66667l. And in the treatment with control, a value of 21.5a was obtained.

**11. Corn Length**

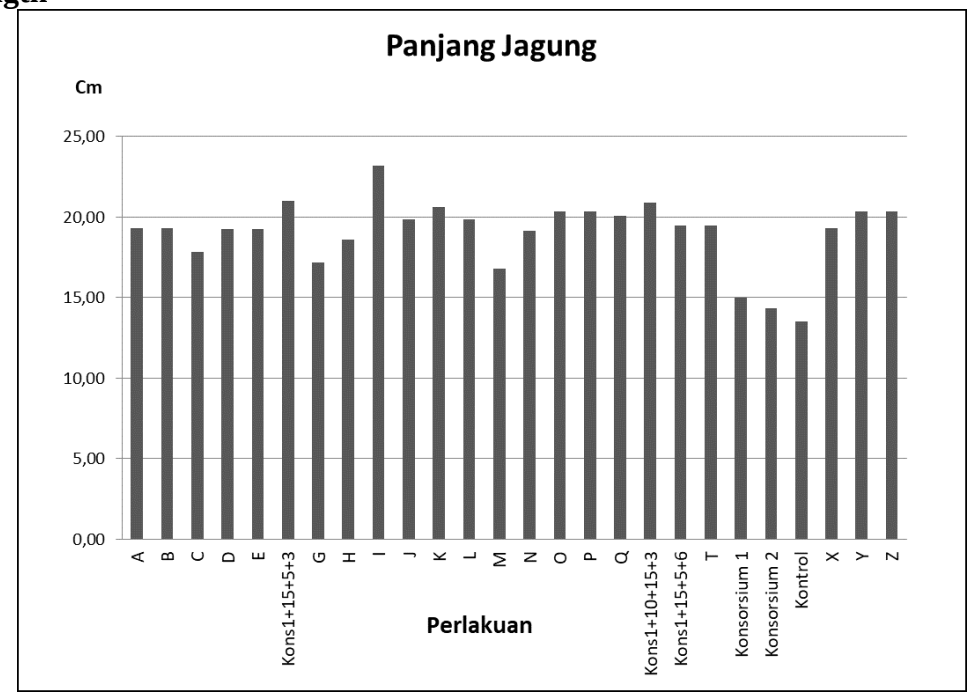


Figure 11. Corn Length

The length of corn obtained based on treatment with a consortium of 1, 15 NPK, 5 biological fertilizers, and 3 leaf fertilizers received a value of 21kl. In treatment with a consortium of 1, 10 NPK, 15 biological fertilizers, and 6 leaf fertilizers get a value of 23.16667l. And in treatment with control obtained a value of 13.5a.

**12. Corn Wet Weight**

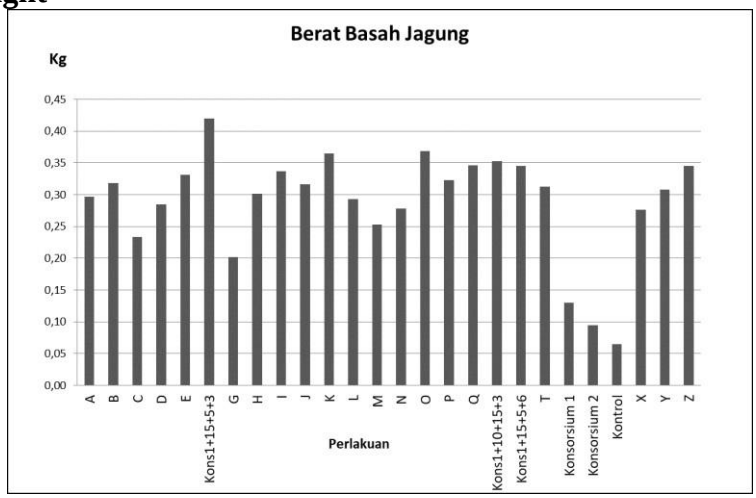


Figure 12. Corn Wet Weight

The wet weight of corn obtained based on treatment with a consortium of 1, 15 NPK, 5 biological fertilizers, and 3 leaf fertilizers received a value of 0.42a. And in the treatment with control, a value of 0.065 was obtained.

Based on the results of the analysis, it was found that the combination of consortium 1 with a dose of 5 ml, NPK 15 gr, and leaf fertilizer 3 ml was significantly different in increasing the best growth in corn plant growth. Observed parameters such as leaf area, stem diameter, total weight, corn weight, corn diameter, plant height, number of leaves, and corn length showed marked improvement. Previous research by (Sitorus, 2015) examined the response of maize plant growth and production to the frequency of liquid organic fertilizer application and NPK fertilizer application, this study showed that the frequency of POC fertilization had no real effect on plant height, stem diameter and production per plot. NPK fertilizer application treatment has a significant effect on stem diameter age 15-60 HST and production per plot. The interaction between POC fertilization frequency and NPK fertilizer application had no significant effect on plant height, stem diameter and production per plot.

Another study by (Hawalid et al., 2019) examined the response of growth and production of sweet corn (zea mays saccharata sturt) with the application of organic and inorganic fertilizers in wetland, this study used Group Randomized Design (RAK) with 8 treatments repeated 4 times. The treatment factors are as follows: Inorganic Fertilization Treatment (A) NPK Complete, Without N (PK + Manure), Without P (NK + Manure), Without K (NP + Manure), Without NP (K + Manure), Without NK (P + Manure), Without PK (N + Manure), Without NPK (Manure). The observed variables were plant height (cm), number of leaves (strands), cob diameter (cm), cob length (cm), cob weight (g), cob weight per hectare (ton), wet pruning weight (g). The results of diversity analysis showed that treatment without N (PK + manure) gave production close to NPK fertilizer treatment (manure).

A similar study by (Asbur et al., 2019) examined the response of maize plant growth and production (Zea mays L.) to the cow planting and manure system, using a Factorial Group Randomized Design with three repeats. The first treatment is a planting system consisting of 3 levels, namely: ordinary planting system (75 cm x 20 cm), 4:1 jar planting system (20 cm x 40 cm), and 2:1 jar planting system (20 cm x 50 cm). The second treatment is a dose of cow manure consisting of 4 levels, namely: 0, 5, 10, and 15 t / ha. The results showed that the 2:1 field planting system and the application of cow manure as much as 15 t / ha were able to increase the growth and production of corn plants, while the treatment interaction between the planting system and the dose of cow manure had not been able to affect the growth and production of corn plants.

## CONCLUSION

The combination of microbial consortium administration with a dose of 5 ml, NPK fertilizer as much as 15 grams, and leaf fertilizer as much as 3 ml significantly affects the growth of corn plants. Observed parameters such as leaf area, stem diameter, total weight, corn weight, corn diameter, plant height, number of leaves, and corn length showed marked improvement. This indicates that the combination of microbial consortium with NPK inorganic fertilizer and foliar fertilizer is able to have an overall positive impact on the development and production of corn plants. Based on the findings of this study, it can be concluded that giving a consortium of microbes with a dose of 5 ml, NPK as much as 15 grams, and leaf fertilizer as much as 3 ml is an effective strategy to increase corn growth and production. The integration between organic fertilizers (microbial consortium), inorganic fertilizers (NPK), and foliar fertilizers provides a beneficial

synergistic effect for corn plants. These conclusions provide important insights for agricultural practitioners and researchers to design holistic and sustainable agroecosystem approaches to increase agricultural yields.

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