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# THE EFFECT OF HUMIC ACID DOSAGE ON THE GROWTH AND YIELD OF BITTER MELON PLANTS (*Momordica charantia L.)*

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**Abstract**

Bitter melon plant (*Momordica charantia* L.) is a plant originating from Asia and cultivated as a vegetable taken for fruit. Bitter melon plants can be cultivated both in lowlands and plains with sufficient light intensity. Knowing the optimal dose of humic acid for the growth and yield of bitter melon plants (*Momordica charantia* L.). The research design used was a single-factor RAK (Group Random Design). The hypothesis about the effect of treatment is tested through the F test, if the F test is real (significant) then the calculation is continued with the 5% BNJ test. The treatment of humic acids in accordance with the treatment used is $A_0$ (without humic acids), A1 humic acid 1 kg / Ha (0.04 g / plant), A2 humic acid 3 kg / Ha (0.12 g / plant), A3 humic acid 5 kg / Ha (0.20 g / plant), A4 humic acid 7 kg / Ha (0.28 g / plant). The results of the study found that the use of humic acids that have a high effect on bitter melon plants is the use of humic acid doses with 5 kg / Ha and 7 kg / Ha found in the treatment (A3) and (A4). The use of humic acid in the vegetative period of plants is best to use humic acid 7kg / Ha, while in the generative period bitter melon plants use a very influential dose of humic acid by using a dose of 7 kg / Ha.

**Keywords**: Bitter Melon Plant, Humic Acid, Dose

## INTRODUCTION

Bitter melon plant (*Momordica charantia* L.) is a plant originating from Asia and cultivated as a vegetable taken for fruit. Bitter melon plants can be cultivated both in lowlands and plains with sufficient light intensity. Bitter melon has quite a lot of benefits and is increasingly aware of public health, so that market demand is increasing. Improve soil structure by carrying out good tillage using organic matter. Improvement of soil nutrients by using organic compounds that have gone through a humification process and dissolve in water commonly called humic acids. The use of humic acids as a complementary ingredient for both organic and non-organic fertilizers can reduce the amount of fertilizer use and can increase the productivity of bitter melon plants because of its role that can activate biological and physiological processes in living organisms in the soil.

The dosage composition of humic acids is expected to increase the growth and yield of bitter melon plants. According to Rustiati (2015) Humic acids have a role as a complement to fertilizers, namely optimizing the use of fertilizers, because humic acids have a coating power that is able to make fertilizer not easily washed or lost by water, besides that humic acids have a high CEC value (Cation Exchange Capacity) that can be used to bind nutrients, and can play a role in spurring flowering. It is necessary to conduct continuous research to get maximum results by using the

composition of humic acid fertilizer doses on the growth and yield of bitter melon plants (*Momordica charantia* L.).

Planting media is a medium where plants can be sown, seeded until cultivated until the harvest arrives. Growing media greatly affects the yield of plant growth. Good growing media used has several criteria including being able to bind and store nutrients well, having good aeration and drainage, not being a source of disease, can store oxygen for the respiration process, is durable and easy to obtain (Bastari, Sipayung, and Ginting, 2017). The selection of planting media can be adjusted to the needs, namely as a seedling, propagation or production media. Bitter melon plants can grow well with temperatures between 18 ° C - 24 ° C, high enough air humidity between 50% - 70% and with relatively low rainfall. A good soil is fertile, loose sandy loam, abundant in organic matter, good aeration and drainage (Pranata, 2020). Although bitter melon has high adaptability, the results will be more satisfying if planted in an open, dry, good draenase, loose soil and contains organic matter. Other requirements that must be considered for bitter melon plants are soil pH and altitude, with a soil pH of 5.5 – 6.5 and an altitude of 1 – 1500 meters above sea level (Kuncoro and Ikrimah Ekowahyu, 2018).

Humic acids can bind water in the soil, high ion exchange ability (CEC), improve soil fertility and plant growth (Suwahyono, 2016). Humic acids include active ingredients from the extraction of organic matter and can function as growth-stimulating agents. Humic acid is a dark-colored compound (blackish-brown) with a loose texture which is the result of the overhaul of soil microorganisms from the remains of living things in the form of animals and plants, where humic acids have the ability to reduce the solubility of Fe2 + in the soil. Humic acids can be used as fertilizers, ameliorant ingredients and plant growth-stimulating hormones. One of the most distinctive characteristics of humic compounds is their ability to interact with metal, oxide, hydroxide, mineral, and organic ions, including other toxic contaminants. A number of organic compounds in the soil are able to bind excess metal ions, so that the amount becomes less in the soil solution as needed by plants (Faizal Anam Al Ubaidah Lubis et al., 2022). The content contained in humic acids includes element C by 40-80%, element N by 2-4%, element S by 1-2%, and element P by 0-0.3%. According to Pratomo, Suwardi, and Darmawan, (2009) Humic acids are complex compounds of aromatic macromolecules containing amino acids, amino sugars, peptides, aliphatic compounds that are bound to each other. Humates also contain many chemical groups such as carboxylic (-COOH), phenolic (-OH) negatively charged and can increase soil CEC.

## METHOD

The research was conducted in rice fields located in Sidomulyo Hamlet, Keniten Village, Geneng District, Ngawi Regency, East Java. Geneng sub-district has an altitude of 50-100 meters above sea level, and a slope of 0% - 2%. It has an average rainfall of 1,800 mm per year. The average air humidity in the area is 240 C. The study was carried out from March to June 2023. The tools used

in this study include hoes, tugal, roll meters, drills, calipers, analytical scales, measuring cups, research boards, labels, buckets, bed sheets, polybags, scissors, stationery, rulers, black cloth, and cameras. The materials used in this study were seeds of Lipa F1 varieties of bitter melon plants, bamboo/wood, rope, cocopeat, black silver plastic mulch, Humic Acid, NPK Pearls, compost, insecticides (Furadan, De-besttan, and Dangke), and water.

The experimental design in this study is a factorial study with a single factor prepared using Group Randomized Design (RAK). The treatment factor used is the dose of humic acid. The treatment factor used in this study used a dose of humic acid using 5 levels, namely:

$A_0$ : No Humic Acid

$A_1$ : Humic Acid Dose 1 Kg/Ha ( 0.04 g/plant)

$A_2$ : Humic Acid Dose 3 Kg/Ha ( 0.12 g/plant)

$A_3$ : Humic Acid Dose 5 Kg/Ha ( 0.20 g/plant)

$A_4$ : Humic Acid Dose 7 Kg/Ha ( 0.28 g/plant)

Based on the number of treatments tried, there are 5 treatments. Each treatment is repeated 5 times so that there are 25 experimental units in the form of beds. Each bed consists of 4 bitter melon plants. So that there are 100 bitter melon plants of the Lipa F1 variety. The factors used are A0, A1, A2, A3, and A4.

Data analysis is carried out based on experimental data using variety analysis in accordance with the design used, namely single-factor Group Random Design (RAK). The effect of the treatment is tested with the F test. The treatment is said to differ markedly if the F-count is greater than the F-table at the level of 5%. The treatment is expressed significantly differently if the F-count is greater than the F-table at the level of 1%. The hypothesis about the effect of treatment is tested through the F test, if the F test is real (significant) then the calculation is continued with the 5% BNJ test. It is useful to know the difference in influence in the treatment (treatment 1%) which gives the best effect of the treatment

## RESULTS AND DISCUSSION

### Plant Height

The results of variety analysis show that the treatment of humic acid dosing can affect the growth of bitter melon plants *(momordica charantia L)*. Observation of bitter melon plant height can be known by looking at the average height of bitter melon plants in (Table 1).

Table 1 Average Height of Bitter Melons Due to Humic Acid Dosing

| Treatment | Plant Height ( cm ) | | | | |
|---|---|---|---|---|---|
| | 14 HST | 21 HST | 28 HST | 35 HST | 42 HST |
| humic acid 0 kg/ha (A0) | 5.3 | 9.3 | 31.35 | 61.56 a | 90.6 A |
| humic acid 1 kg/ha (A1) | 5.35 | 9.45 | 32.4 | 71.45 b | 135.95 b |
| humic acid 3 kg/ha (A2) | 5.4 | 9.5 | 33 | 79.3 c | 145.65 c |
| humic acid 5 kg/ha (A3) | 5.5 | 9.55 | 33.15 | 91.45 s | 158.1 d |

| | | | | | |
|---|---|---|---|---|---|
| humic acid 7 kg/ha (A4) | 5.6 | 9.65 | 33.6 | 95.2 e | 175.6 e |
| BNJ 5% | Mr | Mr | Mr | 3,06 | 4,03 |

Remarks: Numbers followed by the same letter in the same column shows no real difference according to BNJ test 5%, tn : No Influential HST (Day After Planting)

Table 1 shows that the application of humic acids in bitter melon plants has a significant effect on plant height. The average value of the treatment of giving humic acid doses in bitter melon plants has the highest average value of 175.6 cm, namely in the treatment (A4) with a humic acid dose of 7 Kg / Ha, so that the use of humic acid doses is higher, it affects plant height in bitter melon plants. The average value of humic acid dose treatment with the lowest average is 90.6 cm, with control treatment using a humic acid dose of 0 kg / Ha (A0). This is in line with research Setyawan , (2020) plays an active role in spurring growth directly through increasing the rate of photosynthesis, growth, and yield of plants. Humic acids play a role in providing nutrients needed by plants and contain auxins and cytokines that serve to increase physiological activity Sarno and Fitria, (2012)

**Number of leaves**

The results of the variety analysis showed that the treatment of humic acid dosing had a real and intangible effect on the parameters of leaf count in bitter melon plants aged 14 HST, 21 HST, 28 HST, 35 HST, and 42 HST. Then there was a real difference in treatment on plants aged 21 HST, 28 HST, 35 HST, and 42 HST, while the treatment that showed no effect existed when plants aged 14 HST. The average value of the number of leaves caused by the administration of humic acid doses in bitter melon plants can be seen (Table 2).

Table 2.

The average number of bitter melon leaves due to dosing Humic Acids at 14 HST, 21 HST, 28 HST, 35 HST, and 42 HST

| Treatment | Number of Leaves ( strands ) | | | | |
|---|---|---|---|---|---|
| | 14 HST | 21 HST | 28 HST | 35 HST | 42 HST |
| humic acid 0 kg/ha (A0) | 2 | 5.1 A | 10.25 a | 14.3 A | 21.8 a |
| humic acid 1 kg/ha (A1) | 2.2 | 5.35 AB | 10.55 AB | 4.85 pm ab | 26.5 b |
| humic acid 3 kg/ha (A2) | 2.55 | 5.4 AB | 10.85 b | 6.75 b | 29.45 C |
| humic acid 5 kg/ha (A3) | 2.5 | 5.55 AB | 10.8 b | 22.75 b | 34.45 s |
| humic acid 7 kg/ha (A4) | 2.75 | 5.8 b | 11 b | 21.15 b | 37.2 e |
| BNJ 5% | Mr | 0.46 | 0.40 | 0.93 | 1.50 |

Remarks : Numbers followed by the same letter in the same column indicate no real difference according to BNJ test 5%, tn : No effect HST (Day After Planting)

The humic acid dosing factor had the highest value at the time of age data collection of 42 HST with a humic acid dose of 7 Kg/Ha (A4) with an average value of 37.2 hekai, and there is a noticeable influence on bitter melon plants. The lowest value in age data retrieval is 14 HST with the lowest value without using humic acid or control (A0). The average value indicates the absence of the influence of humic acids on plants aged 14 HST. There was an effect of humic acid dose on the average height of bitter melon plants taking age data of 21 HST, 28 HST, 35 HST, and 42 HST.

**The Appearance of Flowers on Bitter Melons**

The results of the analysis of the variety of humic acid administration in bitter melon plants can affect the appearance of flowers. The appearance of flowers on bitter melon plants has a real effect on the number of prospective fruits on bitter melon plants. The dose of humic acid used in this study was different, so the time of appearance of flowers on bitter melon plants was also different. The average value of flower appearance time on bitter melon plants can be seen from (Table 3).

Table 3 Average Age of Flower Appearance on Bitter Melons

| Treatment | Age of Emerging Flowers (HST) |
|---|---|
| humic acid 0 kg/ha (A0) | 35.2 C |
| humic acid 1 kg/ha (A1) | 32.2 BC |
| humic acid 3 kg/ha (A2) | 31.4 b |
| humic acid 5 kg/ha (A3) | 29.6 a |
| humic acid 7 kg/ha (A4) | 30.4 ab |
| BNJ 5% | 1.27 |

Remarks: Numbers followed by the same letter in the same column indicate no real difference according to the 5% BNJ test.

Table 3 of humic acid dosing factors shows the effect of humic acid on the bitter melon plant. More doses of humic acid on bitter melon plants can accelerate the appearance of flowers on bitter melon plants. The fastest flowers appeared in the administration of humic acid doses of 5 kg / Ha (A3) with an average age of 29.6 HST, and the longest appeared flowers were in the control treatment of 0 kg / Ha (A0) with an average age of 35.2 HST flowers.

**Number of Fruits Per Plant**

The results of the analysis on the dosing of humic acid showed that there was an influence on bitter melon plants on several observations. Calculation data analysis is used to see how many fruits per plant. The average value of the number of fruits per plant in bitter melon plants given different doses of humic acid there are some observations that have an effect and some that have no effect. The average harvest of bitter melon plants is carried out per harvest period as seen from (Table 4).

Table 4 Average Number of Fruits Per Plant in Bitter Melons Due to Feeding doses of humic acid.

| Treatment | Number of Fruits Per Plant Per Period (Fruit) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 0 kg/ha (A0) | 0 | 0 | 0.1 a | 1 a | 1.3 A | 1.5 A | 1.5 A | 1.6 A | 3 a | 3.6 a | 4.6 a | 3.8 A |
| 1 kg/ha (A1) | 0 | 0.4 | 0.6 AB | 2 ab | 1.75 AB | 1.8 AB | 2.8 b | 2.4 AB | 3.2 AB | 4.8 AB | 6.6 b | 5.2 AB |
| 3 kg/ha (A2) | 0.5 | 0.4 | 0.8 AB | 2.6 b | 2.4 AB | 3 ab | 3.2 BC | 3.8 b | 4 AB | 6 b | 7.6 BC | 6.8 b |
| 5 kg/ha (A3) | 1 | 0.4 | 1 b | 3.6 b | 6.2 c | 5.4 b | 5.6 c | 6.2 c | 8 c | 7.2 c | 11.8 s | 10.2 c |
| 7 kg/ha (A4) | 1 | 1 | 1.4 AB | 2.7 AB | 3.4 b | 3.6 b | 4.4 c | 5 BC | 5.8 b | 9.2 BC | 9.4 c | 8.8 BC |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BNJ 5% | Mr | Mr | 1.03 | 1.78 | 2.21 | 2.06 | 1.23 | 1.46 | 2.00 | 1.47 | 1.87 | 2.07 |

Remarks: Numbers followed by the same letter in the same column indicate no real difference according to the 5% BNJ test. tn : no effect

Table 4 shows that the application of humic acids to bitter melon plants can have an effect when observing fruit in observations 3 to 12. Humic Acid has the highest effect on the 11th harvest bitter melon plant with an average number of fruits per plant of 11.8 pieces with a dose treatment of humic acid 5 Kg / Ha (A3), the number of fruits per plant at harvest begins to decrease during the 12th harvest period. While the lowest average value is in the control treatment of 0 Kg / Ha (A0). Observations 1 and 2 had no effect on the number of fruits per plant on bitter melon plants using humic acid doses according to the treatment.

**Fruit length**

The results of the variety analysis table on the treatment of using humic acid doses on bitter melon plants greatly affect the length of the bitter melon plant. Some harvest periods may indicate that humic acids have an effect on the length of the fruit, and no effect on the length of the fruit of the bitter melon plant. Harvesting is carried out as many as 12 harvesting periods with an interval of 5 days. The average length of bitter melon during the harvest period can be seen and analyzed in (Table 5).

Table 5

Average Fruit Length of Bitter Melons Due to Giving Treatment Dosage of humic acids with 12 periods of harvest.

| Treatment | Fruit Length(cm) |
|---|---|
| 0 kg/ha (A0) | 22.76 a |
| 1 kg/ha (A1) | 23.62 b |
| 3 kg/ha (A2) | 23.94 BC |
| 5 kg/ha (A3) | 25.68 c |
| 7 kg/ha (A4) | 26.97 s |
| BNJ 5% | 0.60 |

Remarks: Numbers followed by the same letter in the same column noreal difference according to the 5% BNJ test. tn: no effect

Table 5 shows that the use of humic acid doses in bitter melon plants affects the length of the bitter melon plant, the humic acid dose that most affects fruit length is by using doses of 5kg/Ha, and 7kg/Ha. The average length of the longest bitter melon plant fruit with treatment (A4) using a dose of humic acid 7 kg / Ha with an average length of bitter melon fruit 26.97 cm. Harvest period The length of the smallest bitter melon fruit is the treatment (A0) with 0kg/Ha humic acid, the average value of bitter melon is 22.76 cm.

**Fruit Diameter**

The results of the analysis of the various uses of different doses of humic acids in bitter melon plants that affect the diameter of the bitter melon plant, observations were taken by measuring the diameter of the fruit in each period of harvesting the fruit of bitter melon plants. Each dose treatment given showed a real and no noticeable effect on each harvesting period. The average value of fruit diameter in bitter melon plants with different humic acid dose treatments in bitter melon plants can be seen in (Table 6).

Table 6 Average Fruit Diameter of Bitter Melons Due to Acid Dose Treatment Humic.

| Treatment | Fruit Diameter (cm) |
|---|---|
| 0 kg/ha (A0) | 4.59 a |
| 1 kg/ha (A1) | 4.95 b |
| 3 kg/ha (A2) | 5.03 BC |
| 5 kg/ha (A3) | 5.48 C |
| 7 kg/ha (A4) | 5.71 s |
| BNJ 5% | 1.79 |

Remarks: Numbers followed by the same letter in the same column indicate no real difference according to the 5% BNJ test. tn : no effect

Table 6 shows that different doses of humic acid treatment on bitter melon plants can affect fruit diameter. The average diameter of the longest bitter melon plant fruit with treatment (A4) using a dose of humic acid 7 kg / Ha with an average value of diameter value of 5.71 cm. The smallest bitter melon fruit diameter is treated (A0) with 0kg/Ha humic acid with an average value of 4.59 cm bitter melon diameter.

**Fruit Weight**

The results of the analysis table vary in the treatment of using different doses of humic acid in bitter melon plants. Sampling the weight of the fruit on bitter melon plants was taken during 12 harvest periods, so that the average weight of the fruit of bitter melon plants can be seen on. The average value of fruit weight in bitter melon plants with different humic acid dose treatments can be seen in (Table 7).

Table 7 Average Weight of Bitter Melons Due to Dosage Treatment Humic Acids

| Treatment | Fruit Weight (gr) |
|---|---|
| 0 kg/ha (A0) | 256.57 a |
| 1 kg/ha (A1) | 289.37 b |
| 3 kg/ha (A2) | 294.39 BC |
| 5 kg/ha (A3) | 314.84 c |
| 7 kg/ha (A4) | 320.17 c |
| BNJ 5% | 14.501 |

Remarks: Numbers followed by the same letter in the same column indicate no real difference according to the 5% BNJ test.

Table 7 shows that different doses of humic acid treatment in bitter melon plants have a significant effect on fruit weight. The dosing of humic acid had an effect on bitter melon plants with treatments (A3) and (A4) did not differ markedly. The highest average value occurred in the treatment

(A4) with a dose of humic acid as much as 7 kg / Ha with an average value of fruit weight of 320.17 g/fruit. While the lowest average weight value with treatment (A0) using a dose of humic acid 0 kg / Ha with an average value of fruit weight per fruit 256.57 g / fruit.

**Fruit Weight Per Plant**

The results of the analysis of various treatments using different doses of humic acid on bitter melon plants can be seen on. Sampling the weight of the fruit per plant on bitter melon plants was taken during 12 harvest periods, so as to get the average weight of the fruit per bitter melon plant. The average value of fruit weight per plant in bitter melon plants with different humic acid dose treatments can be seen in (Table 8).

Table 8 Average Weight of Fruit Per Plant in Bitter Melons Due to Humic Acid Dosing Treatment

| Treatment | Fruit Weight Per Plant (g) |
|---|---|
| humic acid 0 kg/ha (A0) | 613.93 A |
| humic acid 1 kg/ha (A1) | 859.13 b |
| humic acid 3 kg/ha (A2) | 915.25 BC |
| humic acid 5 kg/ha (A3) | 1259.65 C |
| humic acid 7 kg/ha (A4) | 1145.55 C |
| BNJ 5% | 1.76 |

Remarks: Numbers followed by the same letter in the same column indicate no real difference according to the 5% BNJ test.

Table 8 shows that the treatment of different doses of humic acids in bitter melon plants has a significant effect on the weight of the fruit per plant. The highest average value occurred in the treatment (A3) with a dose of humic acid as much as 5 kg/Ha with an average value of fruit weight per plant of 1259.65 g/plant. While the average weight value for the lowest plant with treatment (A0) using a dose of humic acid 0 kg / Ha with an average value of fruit weight of 613.93 g / plant.

**Total Fruit Weight Crop Harvest**

The results of the variety analysis with the treatment of using different doses of humic acids on bitter melon plants affect the total fruit weight of the harvest. The average value of fruit weight per plant in bitter melon plants with different humic acid dose treatments can be seen in (Table 9).

Table 9

Average Fruit Weight of Total Crop Harvest in Bitter Melons Asa result of humic acid dosage treatment

| Treatment | Fruit weight per plant (kg) |
|---|---|
| humic acid 0 kg/ha (A0) | 5.52 A |
| humic acid 1 kg/ha (A1) | 7.73 b |
| humic acid 3 kg/ha (A2) | 8.24 BC |
| humic acid 5 kg/ha (A3) | 11.34 c |
| humic acid 7 kg/ha (A4) | 10.31 C |
| BNJ 5% | 1.76 |

Remarks: Numbers followed by the same letter in the same column indicate no real difference according to the 5% BNJ test.

Table 9 shows that the treatment dose of humic acid can affect the total fruit weight of bitter melon crop harvest during 12 harvests. The highest average value of total harvest fruit weight occurred in the treatment (A3) using a humic acid dose of 5 Kg/Ha with an average total fruit weight of 11.34 Kg. The average value of total fruit weight harvested in the treatment (A4) with a humic acid dose of 7 kg/Ha obtained an average value of 10.31 Kg. Meanwhile, the total fruit weight of the harvest received the least weight in the control treatment (A0) using a dose of humic acid 0kg / Ha, with an average total fruit weight of 5.52 kg.

## CONCLUSION

The results of research on the effect of humic acid doses on the growth and yield of bitter melon plants can be concluded that the use of humic acids has an effect on bitter melon plants. There is a significant effect on the use of humic acids 5 kg/Ha (A3) and 7 kg/Ha (A4). Affects the vegetative and generative period of bitter melon plants. The highest dose of humic acid treatment using 7 kg / Ha (A4) obtained the highest average value at plant height 175.6 cm, number of leaves 37.2 strands, flowers appeared at the age of 29.6 HST, number of fruits 11.8, fruit length 26.97 cm, fruit diameter 5.71 cm, fruit weight 320.17 gr, fruit weight per plant 1145.55 gr, and total fruit weight of crop harvest 10.31 kg. So that the most optimal use for the growth and yield of bitter melon plants is a dose of humic acid 7 kg / Ha (A4).

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