

Conference Paper

Land Optimization Through Melon (*Cucumis melo* L.) Cultivation in A Screen House with the Application of Natural Plant Growth Regulators and KNO₃ Fertilizer in Plintahan Village

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ABSTRACT

Plintahan Village is one of the villages in Pandaan District, Pasuruan Regency, East Java that has the potential for developing melon (*Cucumis melo* L.) cultivation. However, melon production in Plintahan Village is still relatively low due to the lack of farmer knowledge about melon cultivation and the high level of pest and disease attacks due to uncontrolled environmental factors. Efforts that can be made to optimize land through melon cultivation are by developing melon cultivation in screenhouses, applying natural Plant Growth Regulators (PGRs) with shallot extract, bamboo shoots, and coconut water, and providing KNO₃ fertilizer. The growth parameters observed were plant height and number of leaves. Based on these parameter data, a plant growth model was then made. The results of the study showed that the use of natural PGRs from a mixture of bamboo shoots, coconut water, shallots, and KNO₃ fertilizer affected the height and number of leaves on melon plants. Cultivation carried out on melon plants in screenhouses provides benefits for the yield and growth of melon plants, namely preventing pest and disease attacks, and reducing the effects of environmental stress. Melon cultivation in screenhouses with the application of natural PGRs and KNO₃ fertilizer can be one effort in optimizing land.

Keywords: Plant growth regulator, shallots, bamboo shoots, coconut water, KNO₃ fertilizer, screenhouse, melon

Introduction

Melon is one of the horticultural commodities that has a fairly high economic value and is profitable to be cultivated as a source of income for farmers. In Indonesia, the demand for melons continues to increase from year to year. Melons are quite popular and are favored by people from all walks of life because they taste sweet and have a fragrant aroma and also have a source of vitamins in the Indonesian people's diet and raw materials for the processed industry.

Plintahan Village is one of the villages in Pandaan District, Pasuruan Regency, East Java. This village has the potential for developing melon cultivation because it has a climate that is suitable for the growth of melon plants. However, melon production in Plintahan Village is still relatively low. This is due to several factors, including the limited knowledge of farmers about good melon cultivation and very high pest and disease attacks on melon plants. Environmental influences such as the rainy season also cause many diseases to appear in plants which have an impact on decreasing melon plant productivity (Murtiati, 2019). Efforts that can be made to solve the problem of melon cultivation in Plintahan Village are by developing melon cultivation in a screen house. A screenhouse is a building made of nets that can protect plants from pests and diseases. The screen house building also uses UV

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plastic material for the roof that can withstand excessive exposure to sunlight (Ansharullah et al., 2023). In addition, the application of natural PGRS and KNO₃ fertilizer in melon cultivation can increase the productivity and quality of melon fruit. According to research by Kamaratih and Ritawati, (2020), KNO₃ fertilizer is easily absorbed by plants, because it contains nitrogen elements of (1-14)% and potassium of (44-46)% which can be directly absorbed by plants in the form of K⁺ ions and are immediately available to plants, while nitrate (NO₃⁻) is directly absorbed by plant roots. Natural PGRS is a compound that can affect the growth and development of plants from natural ingredients, such as shallot extract, coconut water, and bamboo shoots. Shallot extract contains allixin compounds which can act as auxins to stimulate the growth of plant roots and shoots. Coconut water contains amino acid compounds, vitamins, and minerals that can be beneficial for plant growth and development, as well as increase plant resistance to pests and diseases. Bamboo shoots contain cytokinin hormone compounds that play a role in accelerating cell division so that they can accelerate growth (Siburian & Siregar, 2019). Therefore, innovation is needed in melon cultivation in order to improve the quality and quality of melon fruit production by implementing cultivation in screen houses, applying natural PGRs and KNO₃ fertilizer for plant resistance, and providing proper nutrition.

Material and Methods

Making natural PGRs

The manufacture of natural PGRs refers to a journal article from Manurung et al. (2020) which uses basic ingredients from shallot and bamboo shoot extracts. The manufacturing process begins with shallots (500 grams) and bamboo shoots (500 grams) peeled and then washed with clean water. The washed bamboo shoots are cut into small sizes to make it easier to puree. The bamboo shoot pieces (500 grams) can be directly pureed using a blender and 1000 ml of water is added and then filtered to obtain bamboo shoot extract. The bamboo shoot extract that has been obtained is then added to 2 liters of water. Likewise for shallots (500 grams) a similar process is carried out. The final process of making natural PGRS before being applied to melon plants is by mixing shallot extract, bamboo shoot extract, and coconut water in a container.

Melon cultivation

Melon cultivation is carried out in a Screenhouse located in the rice fields of Ngadilegi Hamlet, Plintahan Village, Pandaan District, Pasuruan Regency, East Java Province. The greenhouse measures 8 x 6 x 3 meters, with a frame using hollow material and galvanized C as the main pillar. Equipped with 200-micron UV plastic to cover the top of the screenhouse, and an insect net with a density of 40 mesh for the screenhouse walls. The activity begins with the preparation of tools and materials and seeds to be used, then the seeds are soaked for 2 hours 30 minutes before sowing. After that, the seeds are sown in the seedling tray for 14 days and then transplanted into polybags with a planting medium of a mixture of subsoil soil, rice husk charcoal, and cocopeat. Melon plants begin to produce flowers 21 days after transplanting and produce flowers 28 days after transplanting. Treatment with the provision of natural PGRs from a mixture of bamboo shoots, coconut water, shallots, and KNO₃ fertilizer. The application of natural PGRs on melon plants starts from the age of 15 HST, with an interval of 7-10 days during the vegetative phase. The application of natural PGRS is 150 ml/L per plant. The application of this natural PGRS is poured into the planting medium, in the afternoon. Meanwhile, white KNO₃ fertilizer is applied to the generative phase of the plant after the age of 40 HST, given once a week until harvest with a concentration of 2 gr/L with each plant given a dose of 150 ml per polybag.

Observation of growth parameters

Plant height was measured from the surface of the plant to the longest plant measured with a ruler. Observation the number of leaves (strands) was calculated by observing that the leaves had opened completely. Plant height and number of leaves were measured starting from 14 HST and

repeated every 14 days. Observations of plant height and number of leaves were carried out for all plants in polybags.

Data analysis

Plant growth over time follows a second-order polynomial exponential equation, which is written in Equation 1:

$$A = \exp(a_0 + a_1t + a_2t^2) \quad (1)$$

Equation 1 is then changed by taking the logarithm n on both sides of the equation to obtain Equation 2:

$$\ln A = a_0 + a_1t + a_2t^2 \quad (2)$$

Equation 2 is equivalent to the polynomial equation in Equation 3 (Nugroho et al., 2022):

$$y = ax^2 + bx + c \quad (3)$$

Results and Discussion

Melon cultivation

Growth chambers, greenhouses and screenhouses are some examples of places to grow plants that can adjust the environmental conditions in them to suit the needs of plant growth. Melon plants are sensitive to climate change and are easily attacked by pests and diseases. Therefore, this study tries to solve this problem by carrying out more intensive handling. Cultivating melon plants in screenhouses is carried out as an effort to increase the production of quality melons.

A screenhouse is a building designed for cultivation activities so that plants can avoid pests and diseases and reduce the effects of uncertain environmental stress which of course affects plant production. The material of this screenhouse uses UV plastic which aims to withstand excess ultraviolet light (Ansharullah et al., 2023). The walls of the screen house use 40 mesh insect nets which aim to prevent pests from entering and facilitate air circulation (Harmanto, 2006). In addition, the cultivation method can also affect the growth of melon plants.

Melon cultivation is carried out in a screenhouse starting from the initial stage, namely seed preparation. Melon seeds need to be soaked to break the dormancy period. Soaking the seeds in plain water for 2 hours and 30 minutes. Re-soaking is done with a PGPR solution in the form of a mixture of 6 ml of PGPR *Pseudomonas fluorescens*, 6 ml of *Bacillus subtilis*, and 200 ml of plain water. The seeds that have been soaked in PGPR use tweezers on a tray that has been given kitchen tissue that has been moistened by spraying water. Then the tray is wrapped in black plastic. The seed sowing process is carried out in a mixture of cocopeat and soil with a ratio of 1:1 in the seedling tray. Melon seedlings that are more than 14 HSS (days after sowing) are ready to be transferred into the prepared planting medium. The planting medium used is a mixture of rice husk charcoal, cocopeat, and soil with a ratio of 1:1:2. Two days before transplanting, the planting medium is given the biological agent *Trichoderma* sp. Cultivation is carried out in polybags measuring 35x35 cm. The advantages of cultivating melons in polybags are that weeds grow less and are easy to eradicate, and fertilizer and water given to plants are more efficient because there is no competition between plant roots and others in the absorption of nutrients and water from fertilizers. Melon seedlings that are ready to be transplanted are moved slowly and when transplanting the plant roots can be transported and the roots are not cut or damaged.

Melon plant maintenance is done by routine monitoring carried out every day by carrying out maintenance on melon plants such as watering, and weed sanitation in the polybag area. Watering

melon plants is usually done once a day, namely in the morning and evening with a water volume of 400-500 ml per pot. However, the frequency of watering can be adjusted according to weather conditions and the growth phase of the plant. When the weather is very hot, the volume of water can be increased. Watering should be done in the morning and evening when the sun is not too hot. Watering when the sun is hot causes plasmolysis, which is the pulling of plant fluids out so that the plant becomes stressed and can even cause the plant to die (Tiffany, 2016).

The fertilization of melon plants is divided into two phases, namely the vegetative phase and the generative phase. During the vegetative phase, melon plants are given NPK 16:16:16 fertilizer with a dose of 3.5 tablespoons or 53 grams dissolved in 15 liters of water and given to the plants as much as 250 ml/polybag. NPK fertilizer is given twice a week during the vegetative period and each week the fertilizer dose is increased by 1 tablespoon or 15 grams. In addition to NPK fertilization, during the vegetative period, nutrients are also given in the form of natural PGRS from a combination of red onion extract, bamboo shoot extract, and coconut water. In melon plants, PGRS is given at 15 HST, 22 HST, 29 HST, and 36 HST during the vegetative phase. After entering the generative period, the fertilization given is different from that during the vegetative period. The fertilizer given during the generative phase is white KNO₃ fertilizer when the plant is 40 HST old and red KNO₃ when the melon plant is 50 HST old.

Pruning of tendrils and branches is done starting from the first leaf segment to the 11th segment and above the 15th segment by leaving one leaf. Branches on the 9th to 11th segments do not need to be pruned because they will be used as a place for the emergence of potential fruits. Melon plants will start to flower when they are 10 days old after planting. Pollination of flowers is done on the 9th to 15th leaf segments. The purpose of fruit selection is to obtain good quality fruit with larger fruit sizes and a sweeter taste. Fruit that grows on branches on the 9th to 12th segments is selected one at a time when the fruit size is the size of a chicken egg, which is 7 to 10 days after pollination.

Melon plants are plants with stems that grow creeping, so the activity of wrapping the plant stems is an activity that must be carried out in melon cultivation. The wrapping uses a 5 m long spanning thread attached to a galvanized wire located on the ceiling of the screenhouse. Melon plant wrapping is done so that plant growth can creep upright. The winding is done to make it easier to carry out maintenance and fruit selection, the plants do not fall over easily, and the plants grow more regularly because the distance between the plants becomes wider and they get enough sunlight.

Plant growth

In general, plant height and number of leaves are parameters that can be used to indicate the growth of a plant. The following are plant heights and number of leaves based on field observations presented in Figure 1:

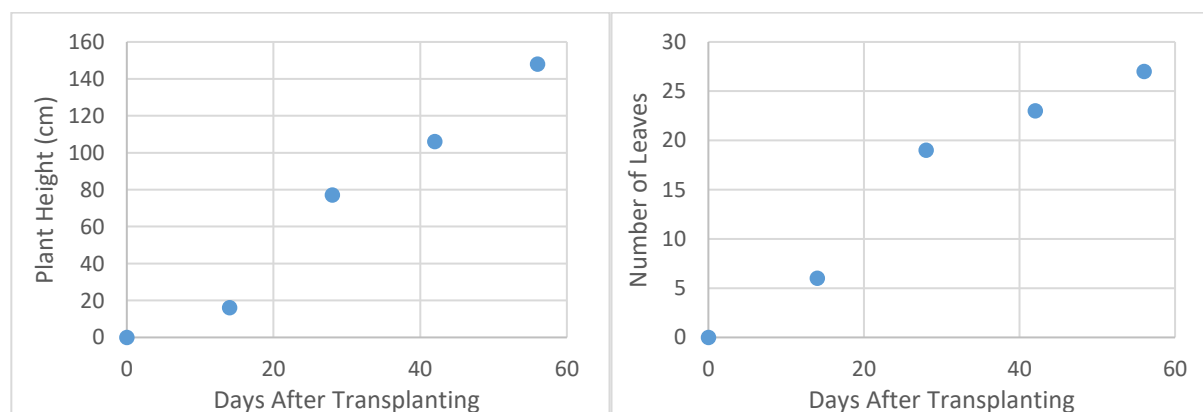


Figure 1. Plant height and number of leaves based on observation

Based on Figure 1 shows that the growth of melon plants from the early growth phase or vegetative to the flowering and fruiting phase or generative with the application of natural PGRS and KNO₃ experienced an increase in plant height and number of leaves. Plant height was seen at 28 HST experiencing rapid growth in melon plants, which was 77 cm. The number of leaves was also seen at 28 HST, the addition of leaves was very rapid, which was 19 strands.

The application of natural PGRS carried out at 14 HST caused melon plants to experience an increase at 28 HST. This shows that bamboo shoots as one of the natural PGRS ingredients can help increase plant growth. Bamboo shoots contain gibberellins which can help increase the growth of plant stems. Gibberellin helps accelerate stem elongation and increase the number of stem segments. According to Febmita and Putri (2023), bamboo shoots have gibberellin phytohormones which affect plant growth from the germination process to old age. The graph in Figure 1. Also shows that the growth phase of melon plants in plant height and number of leaves shows a pattern leading to a sigmoid curve up to 56 HST.

Plant Growth Regulators with shallot extract and coconut water also affect plant height. Shallots contain auxins, gibberellins, and cytokinins which can help increase plant growth. Auxins help lengthen stems, gibberellins help accelerate stem and leaf growth, and cytokinins help divide cells and accelerate tissue growth. According to Ariyanti et al. (2020) also said that natural PGRS with the use of a mixture of coconut water can have a high effect on the chlorophyll content of plant leaves. Chlorophyll is a green pigment found in plant leaves that plays an important role in photosynthesis. Photosynthesis is the process by which plants convert light energy into chemical energy stored in the form of glucose. So that plants with high chlorophyll content can increase the photosynthesis process to accelerate plant development and growth.

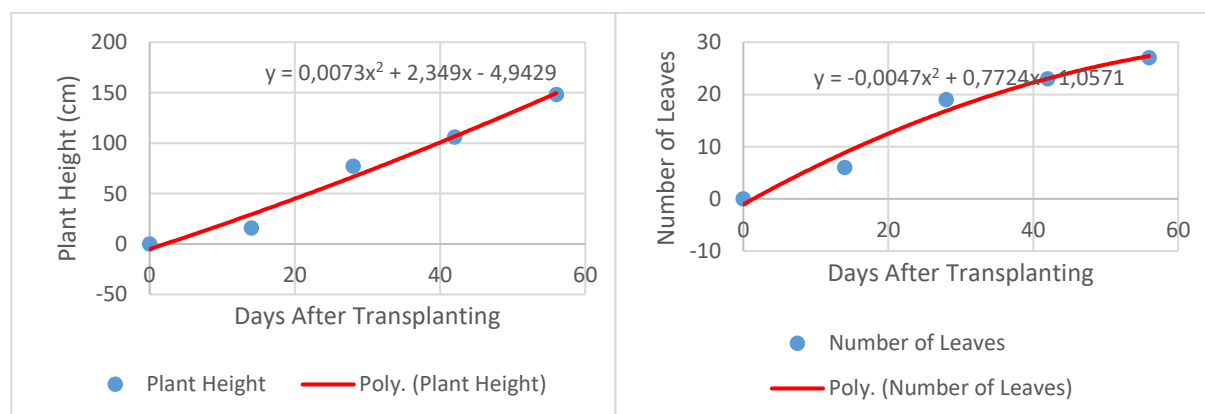


Figure 2. Plant Height and Number of Leaves Observation and Prediction

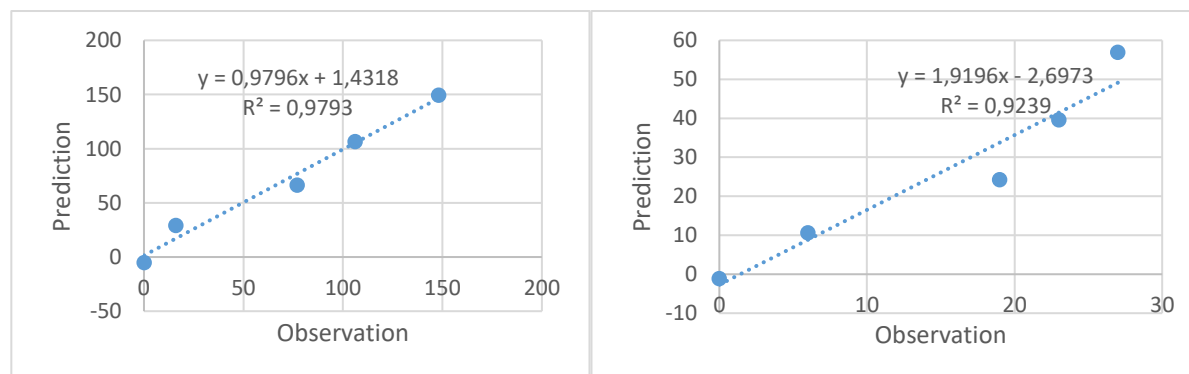


Figure 3. Relationship between prediction and observation of Plant Height and Number of Leaves to determine the R2 value

The provision of PGRS with shallot extract, bamboo shoots, and coconut water affects the increase in the number of melon plant leaves because it contains auxin, gibberellin, and cytokinin. Auxin helps accelerate leaf growth and increases the number of leaf segments. Gibberellin helps accelerate leaf cell division and increases leaf area. Cytokinin helps extend leaf life and increases leaf thickness. In addition, the provision of KNO₃ fertilizer also provides nutrients for plants with an N content of 12%. The nitrogen element plays a role in the formation of plant cells, tissues, and organs so that the results of photosynthesis increase and accumulate into the growth of the number of leaves and plant length (Muhadan et al., 2016).

Treatment with the provision of natural PGRS from a mixture of bamboo shoots, coconut water, shallots, and KNO₃ fertilizer increases the growth of melon plants. According to Isnaini (2010) fertilizers containing nitrogen, phosphorus, and potassium are important fertilizers for plant growth.

When viewed from the results of observations carried out on the growth of melon plants increased in the vegetative and generative phases. A comparison of observation and prediction results is shown in Figure 2. Meanwhile, the evaluation of the model based on observation results using the determination coefficient (R²) is shown in Figure 3.

Based on the coefficient of determination (R²) value in Figure 3 to determine the suitability of the model with the observation results, it is known that the R² value for plant height and number of leaves is 0.97 and 0.92. The coefficient of determination is said to be robust if its value is close to 1 so that both treatments show model results close to observations.

Conclusion

The use of natural PGRS from a mixture of bamboo shoots, coconut water, shallots, and KNO₃ fertilizer affects the height and number of leaves on melon plants. The growth of melon plant height is directly proportional to the addition of the number of melon plant leaves. The use of screen houses can prevent melon plants from pests and diseases, and reduce the effects of environmental stress that can affect plant production. Melon cultivation in screen houses with the application of natural PGRS and KNO₃ fertilizer can be one effort in land optimization.

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