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RESPONSE OF THE GROWTH AND PRODUCTION OF MELON (*CUCUMIS MELO* L.) ON PLANT HORMONE AND COW MANURE APPLICATION

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ABSTRACT

Melons are one of the main priority crops that receive attention among other horticultural crops, as the price of melons is relatively higher. This study aimed to produce higher quality melon fruit with larger diameter and fruit weight, accompanied by increased production. The study was carried out at the Department of Agriculture Jl. Keramat Indah No.4 Selambo, Medan, North Sumatra from June 2016 to August 2016 using a Factorial Random Block Design with three replications. The first factor was the superior plant hormone dose (H) consisting of four levels: 0 mL /L water (H0), 1 mL /L water (H1), 2 mL /L water (H2), and 3 mL/L water (H3). The second factor was the dose of cow manure (P) consisting of four levels, namely: 0 t/Ha (P0), 20 t/Ha (P1), 40 t/Ha (P2), and 60 t/ha (P3). Plant hormone application as much as 3 mL/L of water and cow manure as much as 60 t/ha could increase the number of flowers, fruit diameter, and fruit weight of melon. The quality of melon produced is still not close to the desired quality of the world market, which is around 1.5-3.0 kg, because the optimum concentration of growth hormone and optimum dosage of cow manure has not been obtained yet.

KEYWORDS: Melons are one of the main priority crops that receive attention among other horticultural crops.

INTRODUCTION

Melon (*Cucumis melo* L.) is a plant originating from the Mediterranean region on the border between West Asia to Europe and Africa, but has been developed in Indonesia because melon is a fruit-bearing crops market share among the upper middle class society. Melon is also one of the main priorities plant is gaining attention among other horticultural crops, because the price of melon fruit is relatively high compared with other horticultural commodities, so it would be more profitable to farmers melon.[1]

In addition, melon market share is increasingly widespread since 2010, especially since the entry into force of imported fruits restrictions by the Government. Even today, melon have started to be exported to several countries, such as Singapore and the United Arab Emirates,[2] and in the future world demand for melons is expected to continue to increase the potential market target Singapore and Japan.[3] Melon exports will continue to take place if the fruit can be provided continuously and fruit quality is maintained. The quality of melon fruit to meet export demand is to have thick, solid textured flesh, relatively large fruit size (1.5-3 kg), and has a sweet taste (sugar content of about 14 °Brix).[4]

Generally, melon fruit is organically grown with a relatively small diameter, so it has a fruit weight ranges between 1.25-1.49 kg,[5] whereas the weight of melons cultivated inorganic reach 2 kg more.[6] In accordance with,[7] the weight of organic cucumber cultivation is also lower than the weight of cucumber with inorganic fertilizer application. This is due to the cultivation of organic with the provision of cow manure (organic fertilizer), nutrient availability was lower than that of inorganic fertilizers,[2] so it takes setting the availability of nutrients for plant growth and development melon optimal use of fertilizer and giving hormones to grow.

Fertilization is one way to improve yields. Fertilization can be used as fertilizer in the planting of melons is cow manure. The composition of the nutrient content of cow manure is highly dependent on producing animals (species, age, and condition), type of feed, mixed fabrics, and how to prepare or storage prior to use.[8]

Cow manure is a fertilizer derived from dairy cattle form that is produced by cattle. Cow manure is better than any other natural fertilizer or artificial fertilizer, because it is a humus that contains organic compounds. In addition it is a source of macro nutrients that are important for the growth and development of plants and many contain microorganisms that can help decompose organic

materials in the soil into humus.[9] Cow manure contains 2.2% N, 4.34% P_2O_5, and 2.09% K_2O. This element is a key element needed by plants in growth.[10] The results of the study[9] showed that the application of cow manure as much as 10 t/ha was able to increase vegetative growth and yield of cucumber. In accordance with[11] showed that administration of cow manure is able to increase the yield of tomatoes. Similarly, the results of the study[12] showed that administration of cow manure 30 t/ha in coastal lands were able to increase the yield of onion bulbs.

In addition to the application of cow manure, increased growth and production of melons can also be done with the addition of growth hormone, including with the growth of plant growth hormone which contains 6.3% N, 6% P, 14% K, 0.22% Na, 0.05% Cu, 0.68 % Fe, 0.02% Mn, 0.01% Zn, <0.01% Cd, 0.21 ppm Pb, 98.37 ppm GA_3, 107.08 ppm GA_5, 131.46 ppm GA_7, 56.35 ppm IAA, 128.04 ppm Kinetin, and 106.45 ppm Zeatin.[13] The results of the study[14] showed that the application of superior plant growth hormone as many as 2000 ppm were able to increase the growth and yield of tomatoes. In accordance with[15] showed that administration of growth hormone GA 300 mg/L can improve the yield and quality of watermelon. Gibberellic acid (GA), especially GA_3, also plays a role in the flowering process and can affect the thickness of skin watermelon skin.[16] Similarly, the results of research[2] shows that growth hormone application gibberellin able to improve the yield and quality of melon. The application of gibberellin with a concentration of 120 ppm increased the height of the melon plant, and the cherry sprayed with gibberellin at 4-6 weeks before the harvest increased the fruit size.[17]

Growth hormone is widely used in agricultural fields for a variety of purposes. Growth hormone application has been done in many plants, especially in the family Solanaceae and Cucurbitaceae, with increased yields and quality are satisfactory. Based on this case it is necessary to do a research on the growth response and yield of melon fruit through application of cow manure and growth hormone. It is expected that with the application of cow manure and growth hormone can produce more quality melon fruit that has thicker fruit flesh and fruit diameter larger, accompanied by increased production.

MATERIALS AND METHODS

The study was carried out at the Department of Agriculture Jl. Kramat Indah No.4 Selambo, Medan, North Sumatera from June 2016 to August 2016.

The study used a Factorial Random Block Design with three replications. The first factor was the superior plant hormone dose (H) consisting of four levels: 0 mL/L water (H_0), 1 mL/L water (H_1), 2 mL/L water (H_2), and 3 mL/L water (H_3). The second factor was the dose of cow manure (P) consisting of four levels: 0 t/Ha (P_0), 20 t/Ha (P_1), 40 t/Ha (P_2), and 60 t/Ha (P_3). Variables observed for plant height, flowering plant age, number of flowers per sample plant, number of fruit per sample plant, number of fruit per plot, fruit weight per sample plant, fruit weight per plot, fruit diameter, and pest and disease inventory of melon plants.

RESULTS

To determine the quality of melon in accordance with the export demand variables were observed among them is the amount of interest, the amount of fruit, fruit diameter and fruit weight. Based on statistic analysis, growth hormone and cow manure have significant effect on flower, fruit, fruit diameter and fruit weight (Table 1).

Table 1: Number of flowers, number of fruit, fruit diameter and fruit weight with growth hormone and cow manure.

Perlakuan	Jumlah bunga per tanaman	Jumlah buah per tanaman (buah)	Diameter buah (cm)	Bobot buah per tanaman (kg)
Hormon tumbuh (H)				
0 mL/L air (H_0)	2.67d	1.23	24.73c	0.75d
1 mL/L air (H_1)	2.92c	1.27	25.20c	0.86c
2 mL/L air (H_2)	3.46b	1.25	33.50a	0.96b
3 mL/L air (H_3)	3.77a	1.35	31.92b	1.02a
Pupuk kandang sapi (P)				
0 kg/Ha (P_0)	2.52c	1.15	22.62d	0.78d
20 t/Ha (P_1)	2.63c	1.33	25.11c	0.83c
40 t/Ha (P_2)	3.38b	1.23	32.08b	0.94b
60 t/Ha (P_3)	4.29a	1.40	35.55a	1.04a
Interaksi perlakuan				
H_0P_0	2.42g	1.00	19.85e	0.68j
H_0P_1	2.50g	1.08	22.94cde	0.73ij
H_0P_2	2.42g	1.33	25.18c	0.77hi
H_0P_3	3.33de	1.50	30.95b	0.82fgh
H_1P_0	2.42g	1.08	21.49de	0.81fgh

H_1P_1	2.58g	1.42	22.16cde	0.84defg
H_1P_2	3.08ef	1.33	23.52cd	0.87def
H_1P_3	3.58d	1.25	33.64b	0.91d
H_2P_0	2.58g	1.17	24.32cd	0.83efgh
H_2P_1	2.80fg	1.42	31.94b	0.89de
H_2P_2	3.50d	1.17	39.75a	0.98c
H_2P_3	4.92b	1.25	37.99a	1.15b
H_3P_0	2.67g	1.33	24.83cd	0.79ghi
H_3P_1	2.58g	1.42	23.35cd	0.86defg
H_3P_2	4.50c	1.08	39.86a	1.14b
H_3P_3	5.33a	1.58	39.64a	1.29a

Notes: Values in the same column followed by the same letter are not significantly different at 5% Duncan

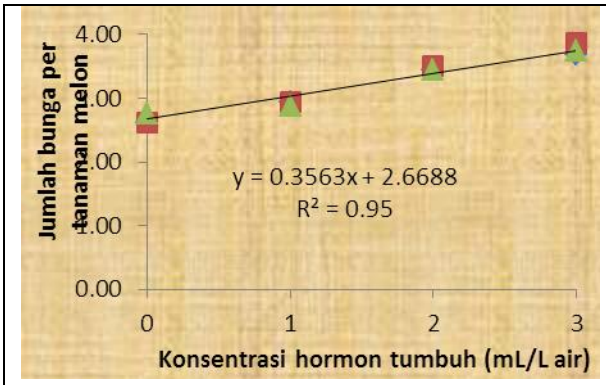
Table 1 shows that the combination of growth hormone treatment and cow manure has a significant effect on the number of flowers, fruit diameter, and melon fruit weight, but no significant effect on the number of melons.

The highest number of flowers per plant was found in a combination of 3 mL/L of water hormone treatment grown with 60 t/Ha of cow manure (H_3P_3), whereas the number of flowers per plant was found least in the combination of treatment without growth hormone without cow manure (H_0P_0). Similarly, fruit diameter and fruit weight, a combination of 3 mL/L treatment of water hormone grown with 60 t/Ha of cow manure (H_3P_3) yielded the highest fruit diameter and fruit weight, whereas the combination of treatment without hormone grown without cow manure (H_0P_0) fruit diameter and lowest fruit weight.

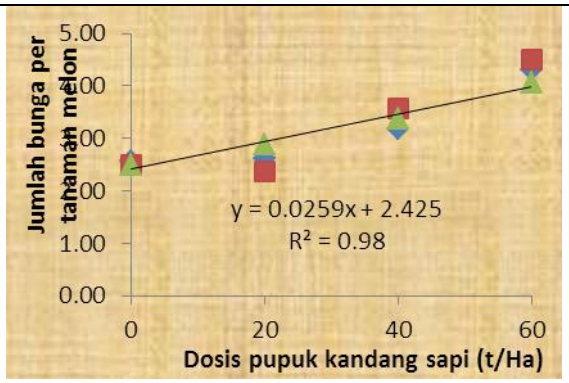
Table 1 also shows that growth hormone and cow manure have significant effect on the number of flower, fruit diameter, and fruit weight, but it has no significant effect on the number of fruits per melon plant. Giving hormones to grow as much as 3 mL/L of water can produce the highest number of flowers, fruit diameter, and fruit weight. Similarly, the application of cow manure as much as 60 t/Ha resulted in the highest number of flowers, fruit diameter, and fruit weight. However, the optimum concentration of growth hormone and optimum dosage of cow manure has not been found, because the higher concentration of growth hormone and dosage of cow manure, the higher the number of flowers, the diameter of fruit, and the weight of melon fruit as seen in Figure 1.

Figure 1A, 1C and 1E show that the number of flowers per plant and weight of fruit per plant melon is influenced by hormones to grow. Judging from the value of the determinant coefficient (R^2) is high, ie respectively 0.95 and 0.96. This means that the number of flowers per 95% melon plant is affected by the growing hormone, and the weight of the fruit per 96% melon plant is affected by the growing hormone. While the diameter of melon only 61% are influenced by growth hormone which is visible from the value of the determinant coefficient (R^2) of 0.61.

Figures 1B, 1D, and 1F show that in addition to being influenced by growth hormone, the number of flowers, fruit diameter, and fruit weight per melon plant are also influenced by cow manure. In contrast to the growth hormone, cow manure affects all variables of fruit quality, ie 98% influenced by cow manure (R^2 = 0.98), 99% melon fruit diameter influenced by cow manure (R^2 = 0.99), and fruit weight per 97% melon plants are affected by cow manure (R^2 = 0.97).



A



B

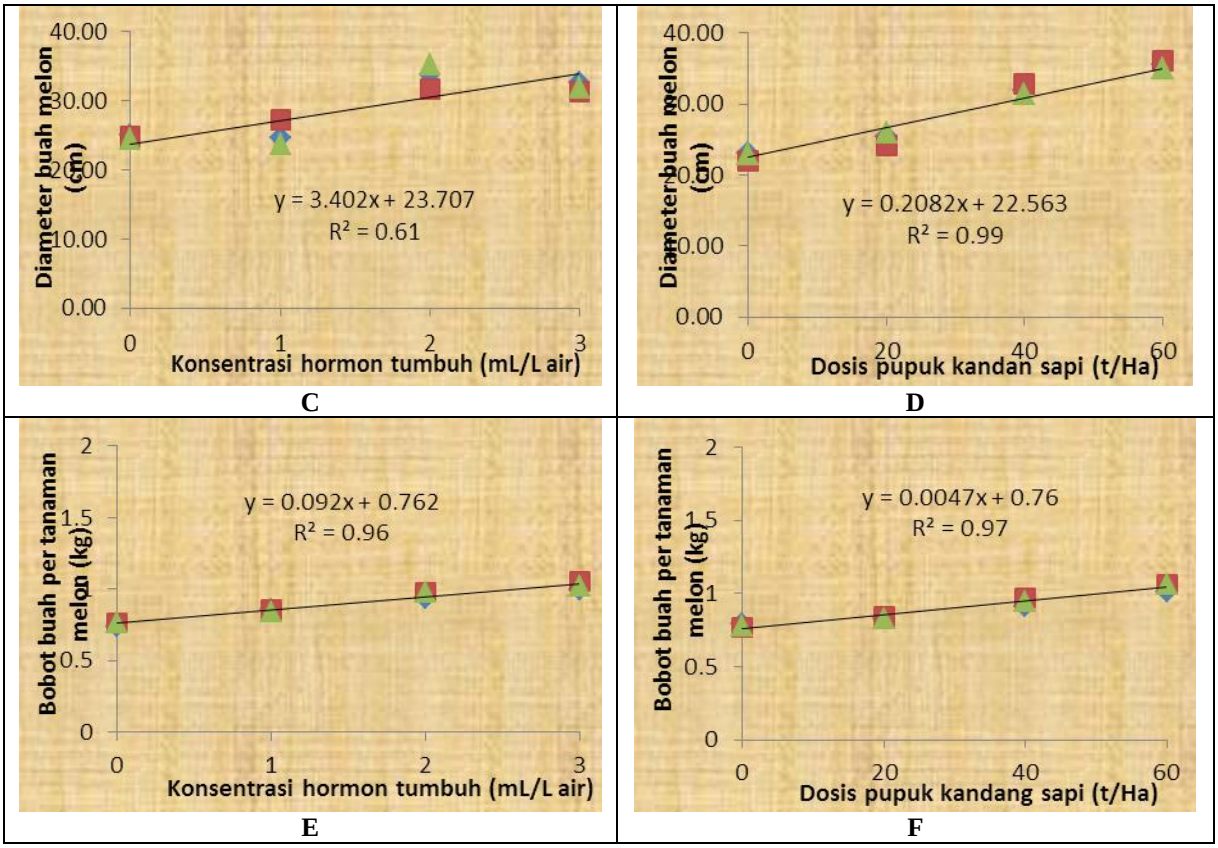
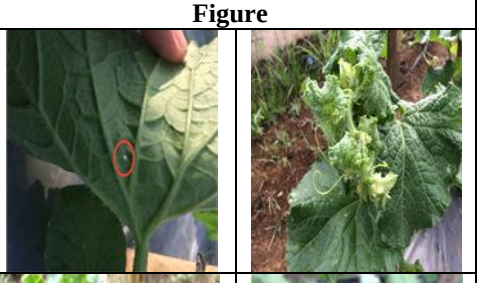
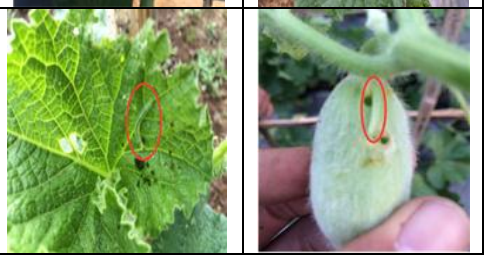
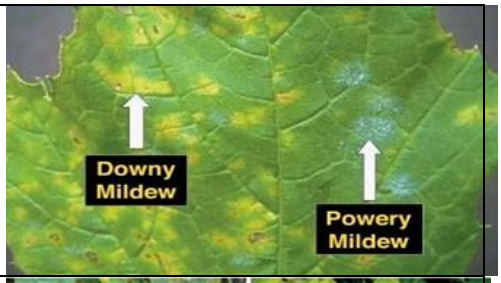
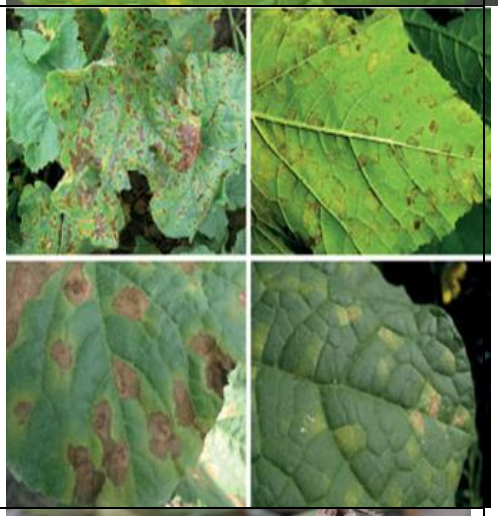
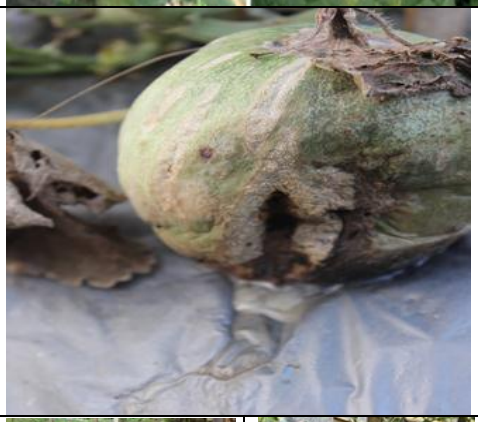
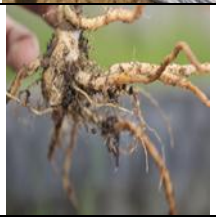


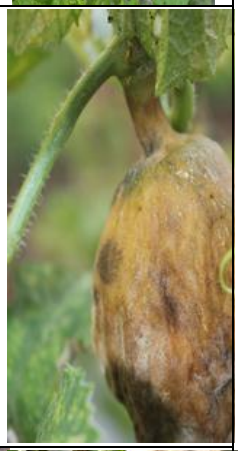
Fig. 1: Effect of growth hormone on the number of flowers (A), fruit diameter (C), fruit weight (E), and the effect of cow manure on the number of flowers (B), fruit diameter (D), melon fruit weight (F).

During the study, melon plants attacked by several pests and diseases that commonly occur in melon plants, including pest *Thrips parvispinus*, *Palpita sp*., *Spodoptera litura*, disease powdery mildew caused by the fungus *Oidium sp*. Diseases downy mildew caused by the fungus *Pseudoperonospora cubensis*, anthracnose disease caused by fungus *Colletotrichum sp*., fusarium wilt disease caused by fungus *Fusarium oxysporum*, root disease caused by nematodes *Meloidogyne incognita*, stem rot disease caused by fungus *Mycosphaerella melonis*, fruit rot disease caused by fungi *Phytophthora nicotianae*, and disease caused by CMV virus (*Cucumber mosaic virus*) (Table 2).

Table 2: Pests and diseases that attack melon plants during the study.

Name of pest and disease	Characteristics and symptoms	Figure
Pest *Thrips parvispinus*	Young leaves and shoots become critical The affected old leaves become dry Flowers fall and abnormal fruit Plants become dwarfed.	
Leaf caterpillars (*Palpita sp*) / armyworm (*Spodoptera litura*)	Leaves rolled and punched In the remaining severe attacks only leaf bone There are bites on the skin of the fruit.	

Powdery mildew. Pathogen: *Oidium sp* fungus or *Erysiphe cichoracearm*	The leaves and stems are easily coated in a kind of white powder The affected fruit is small and the taste is not sweet.	
Downy mildew. Pathogen: fungus *Pseudoperonospora cubensis*.	Visible fine gray feathers at the bottom of the spots (on the underside of the leaf). The appearance of yellow spots on the leaves, then turned into a reddish brown. Abnormally formed fruit, small, tasteless, and its fragrance does not exist.	
Antraknosa Patogen: fungus *Colletotrichum sp.*	Arise in the form of grayish brown spots until blackish which then fused into the plant such as leaves, easy stems, flowers and fruit. The fungus can form a pink spore period on the brown spots that are formed.	
Fusarium wilt. Patogen: fungus *Fusarium oxysporum*	Tendrils in affected plants becomes yellow and withered, then all plants wither and over time the plants will die. In the stem there is a scratch and has a pale spore fungus, brownish stem.	 
Root-knot Patogen: nematode *Meloidogyne incognita*	Yellowing leaves, stunted growth, and withered plants. Lump and swollen plant roots (puru).	 

Stem rot base, Patogen: *Mycosphaerella melonis.*	Initially the base of the stem such as oil-dipped, then out the red-brown mucus. Plants wither and die, and the stricken area dries up.		
Rotten fruit Patogen: fungus *Phytophthora nicotianae.*	Long brown patches of wetness, leaf-like splashes and then widespread. Spots of wetness on the fruit into dark and soft brown, the longer the spots are wrinkled and settled, the rotten pieces of fruit are covered with white fungus.		
Diseases caused by viruses Patogen: CMV (*Cucumber mosaic virus*).	Dwarf plant growth. Curly and wavy leaves with irregular yellow spots. Plants generally fail to form fruit or fruit dwarfs and abnormalities.		

DISCUSSION

Plant growth and production are influenced by genetic and environmental factors. The use of growth hormone and cow manure is one of the supporting factors for the plant to produce good fruit growth and production[15]. The results of the study (Table 1) showed that the interaction of growth hormone and cow manure had significant effect on the number of flowers, fruit diameter, and fruit weight per melon plant, but not significant on the number of fruits per melon plant. This shows that the growth of hormone and cow manure is able to stimulate the growth of melon plants so that fruit production also increases.

Giving crop hormone and cow manure affected fruit development as shown in Table 1, where 3 mL/L of water hormone treatment grew and 60 t/Ha of cow manure gave highest yield compared with other treatments. Fruit enlargement is indicated by variable diameter and fruit weight due to superior plant growth hormone as a growth compound to the development of fruit that contains not only the growth hormone auxin, gibberellin and cytokines, but also contains macro and micro nutrients needed for the growth and development of melon plants, ie N, P, K, Na, Cu, Fe, Mn, Zn, Cd, and Pb elements. According to,[18] growth hormone can stimulate seed germination and assist in fruit development process at the time of flower development. While cow manure used contained 2.2% N, 4.34% P_2O_5, and 2.09% K_2O. The nutrient elements contained in cow manure is a macro nutrient that is needed by plants for the growth and development of plants.[10]

The fruit weight increases with increasing concentrations of growth hormone suggests that the fruit-adding phase is associated with increased concentrations of the GA_3 hormone in the fruit, the addition of growth hormone to the plant increases the cell size resulting in the addition of fruit weight by photosynthesis. This is also supported by the content of other hormones that are in the fruit. In line with the results of the study[15] in watermelon plants which showed that the increased concentration of growth hormone given, the watermelon fruit weight is also increasing. The rapid increase of photosynthetic production will increase the C/N ratio to be relatively

larger. This condition encourages the plant to switch phase from the vegetative phase to the genetic phase. The genetic phase of plants stimulates the formation of storage networks, so that storage network cells will form more and larger.[19]

The relationship between increased concentrations of growth hormone and dose of cow manure with the development of melon fruit can be seen in the development of fruit diameter. Where the increased concentrations of growth hormone and dose of cow manure, the diameter of melon fruit is also increasing (Table 1, Figure 1C and 1D). In line with the results of the study[2] which showed that increased concentrations of growth hormone and dose of cow manure spurred increased weight and diameter of melon fruit.

Increased fruit diameter growth hormone as a result of the provision allegedly due to the interaction of hormone grow gibberellin and auxin in plants.[15] For plants, seeds are the auxin reserves. Auxin works by affecting cell division in the plant body. With increasing cell division, it will affect the size or diameter of the fruit. While[20] states that in the body of phosphorus plants play an important role in terms of some activities, such as the formation of flowers, fruits, and seeds, so with a combination of growth hormone that contains other than growth hormone but also contains some macro nutrients such as phosphorus, and the application of cow manure that also contains phosphorus can increase the number of flowers, fruit diameter, and the weight of melon fruit.

CONCLUSION

Giving hormone grows as much as 3 mL / L of water and cow manure as much as 60 t / ha can increase the number of flowers, fruit diameter, and fruit weight of melon plants.

The quality of melon produced is not yet close to the desired quality of the world market, which is around 1.5-3.0 kg, because the optimum concentration of growth hormone and optimum dosage of cow manure has not been obtained yet.

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