ISSN: 2597-8713 (Online)
ISSN: 2598-5167 (Print)
Agricultural Science

AGRICULTURAL SCIENCE
Journal Of Agricultural Science And Agriculture Engineering
ISSN : 2597-8713 (Online) - 2598-5167 (Print)
Available on :
http://agriscience.scientific-work.org/index.php/agriscience

Increasing Early Growth of Jatropha Cuttings *(Jatropha Curca L.)* With The Provision of Organic Growth Regulatory Substance

Bambang Gunawan[1*], Nurul Huda[1], Yeni Ika Pratiwi[1]

[1]Lecturer at Agrotechnology Faculty of Agriculture, Merdeka University Surabaya, Indonesia

*Corresponding author E-mail: Gunawanb1011@gmail.com

Article History: Received: July 15, 2021; Accepted: September 04, 2021

ABSTRACT

Jatropha is a pioneer plant that can easily grow even on marginal lands and has high potential as an oil-producing plant for renewable fuels. This plant is an annual plant that can grow until the age of 50 years, in the form of a bush and begins to produce at 6 months after planting with a productivity varying from 0.5 to 12 tons/ha/year with an oil yield of 25-30% and maximum production will be achieved after planting. Plants 4-6 years old. Jatropha has the potential to become an alternative energy source and become a biofuel with *renewable energy sources*or renewable green energy; in addition to other benefits in traditional medicine for various types of diseases. The purpose of this study was to determine the increase in the initial growth of Jatropha cuttings by giving organic growth regulators. Based on the results of the study, it can be concluded as follows: There was no significant interaction in the treatment combination between the concentration of organic growth regulators and the factor of internode location on all dependent variables observed in the early growth of Jatropha stem cuttings. The internode location factor showed a significant effect on the variable number of leaves, shoot length, root length, number of roots, root wet weight, root dry weight, and the location of the 12th internode (R2) gave better results than the 10th internode location. (R1). The concentration factor of organic growth regulators also showed a significant effect on the variables of leaf number, shoot length, root length, root number, root wet weight, root dry weight and K2 treatment (5 ml per liter of water) gave better and more efficient results. compared to other treatments.

Keywords: Jatropha Cuttings, Growth Regulating Substances, Location of Segments

1. INTRODUCTION

The availability of petroleum fuel sources as *non-renewable energy is* dwindling and expensive and world oil tends to soar, so many countries are trying hard to find energy sources As an alternative to the fossil energy that produces diesel, kerosene and other fuel oils, there is a Jatropha plant (*Jatropha curcas L*) which can be an alternative energy source and become a biofuel with energy that is *renewable energy sources* or green renewable energy (Winanti, 2016).

Jatropha curcas as a vegetable energy-producing plant that can grow in various area conditions has great potential to be used as an energy-producing plant. All these potentials are worthless without the support and *political will* from the government and the wider community. The formation of a national team for the development of biofuels by issuing a *blue print* and *road map* in the energy sector to realize the development of biofuels is a strategic step so that energy independence can be achieved through the development of jatropha. Community participation will be very helpful in implementing the development of these bioenergy-producing plants, so that in the end this nation is able to get out of the energy crisis with a sustainable supply of biofuel energy (Prastowo, 2007).

Jatropha is a shrub with a height of up to 3 meters, has the potential as a traditional medicine, substitute for fuel, fertilizer, candles and soap. Parts of plants that can be used as traditional medicine from the roots to the leaves (Hariyadi et al., 2019). Jatropha is used in traditional medicine for various types of diseases such as external rheumatism therapy, anti-inflammatory, *pneumonia,* abortion, deworming, and paralysis. Jatropha sap in Mexico is used to treat canker sores, swelling caused by bee stings and digestive disorders.sap Jatrophacontains *curcacycline A* and *curcacyclim B.* and is indicated to inhibit mosaic virus in watermelon plants and is used to accelerate wound healing that is difficult to heal, gum infection and anti-bleeding in cut or scratched wounds (Gome, 2016).

Jatropha curcas plant produces jatropha seeds consisting of 60% by weight of the kernel (flesh) and 40% by weight of the skin. Jatropha seed core contains about 40-45% oil so that it can be extracted into castor oil by mechanical means or extraction using solvents such as hexane. The seed contains the seed core and seed coat. The core of this seed is the basic material for making biodiesel, an energy source to replace diesel. After going through the milking process from the core of the seeds, milk cake will be produced, which is then extracted. The result is jatropha oil and extraction cake (Al-Ayubi, 2019).

Jatropha is able to adapt widely to its growing environment, requiring an optimal growing environment for its growth around 50°LU-40°LS, altitude 0-2000 meters above sea level and temperature between 18 ° -30°C. In areas with low temperatures (<18 ° C) Jatropha growth will be hampered, whereas at high temperatures (> 35 ° C) cause the fall of leaves and flowers, dried fruit so that the production decline. Rainfall for Jatropha growth is between 300 - 1200 mm per year. Furthermore, although this Jatropha plant is easy to grow in various places, but in order for this plant to grow optimally and produce a lot of fruit, Jatropha requires a supportive environment such as: The desired land is dry land, dry lowland climate, Temperature 20-30°C, Precipitation 300 - 1000 mm / year, soil pH 5.5 - 6.5; If the environmental conditions are not suitable, it can interfere with plant growth and less than optimal fruit production. The use of Jatropha seeds can use dried fruit seeds produced by the plant itself or by cuttings (Gome, 2016).

Jatropha can be propagated generatively or vegetatively. The generative propagation of jatropha (seeds) is not easy because it requires relatively large amounts of seeds, while jatropha curcas cannot produce fruit (seeds) at the same time. Vegetative propagation can be done using stem cuttings, shoot cuttings or tissue culture. The use of stem cuttings seeds has the advantage that it can provide more number of seeds and later will be obtained new plants that have properties like the parent.

Growth regulators are complex organic compounds that affect plant growth and development. There are five groups of hormones, including: auxins, gibberellins, cytokinins, ethylene, and abscisic acid, where the discovery of these hormones is the most interesting and promising part of the influence of plant physiology. Organic growth regulators with the trademark "RB", have benefits and uses, including: restoring soil fertility, assisting and growing plants, making effective use of chemical fertilizers, environmentally friendly. Based on laboratory tests, this organic growth regulators contained 152.56 ppm of IAA auxin hormone, cytokinin consisting of 120.18 ppm of kinetin, and 101.95 ppm of zeatin, in addition to 474 ppm of gibberellin acid (GA3, GA5, GA7). .1 ppm (Anonymous, 2009).

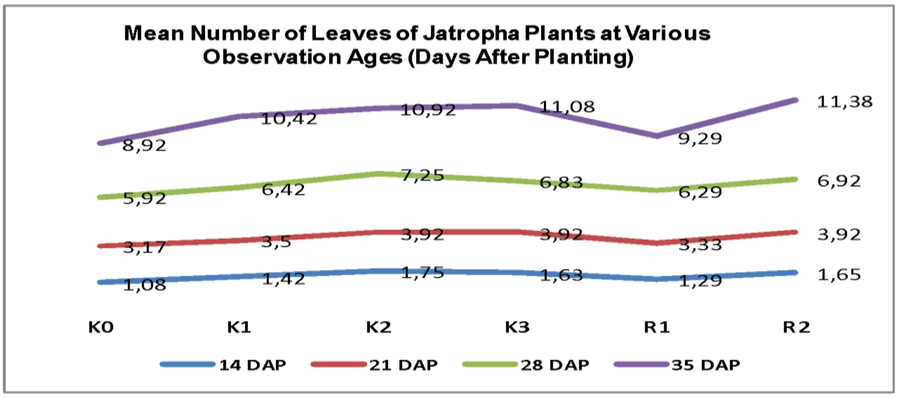
2. RESEARCH METHODS

This study used a Randomized Block Design (RBD) which was arranged according to a factorial pattern with two (2) factors, namely Factor I = Organic Growth Regulator Concentration consisting of 4 levels, including: Ko = 0 ml/liter, K_1= 2 ,5 ml/liter; K_2 = 5.0 ml / liter; K_3 = 7.5 ml/liter; while factor II = the location of the segment consisting of 2 levels, among others: R_1= the location of the 10th segment; R_2= Location of the 12th Section. From these two factors, 8 treatment combinations were obtained which were then repeated 3 times, so that 24 combination treatments were obtained. Observational data were analyzed by the F test to determine the influence of the two factors and their interactions on the parameters studied; then used the smallest significant difference test 5% to determine the difference between treatments (Yitnosumarto, 1991).

3. RESULTS AND DISCUSSION

Number of Leaves

The results of the analysis showed that the combination of organic growth regulator treatment and internode location did not have a significant interaction on the dependent variable number of leaves at all observed ages; however, on each of the factors studied, both the location of the segment and the Organic growth regulator have shown a significant effect.

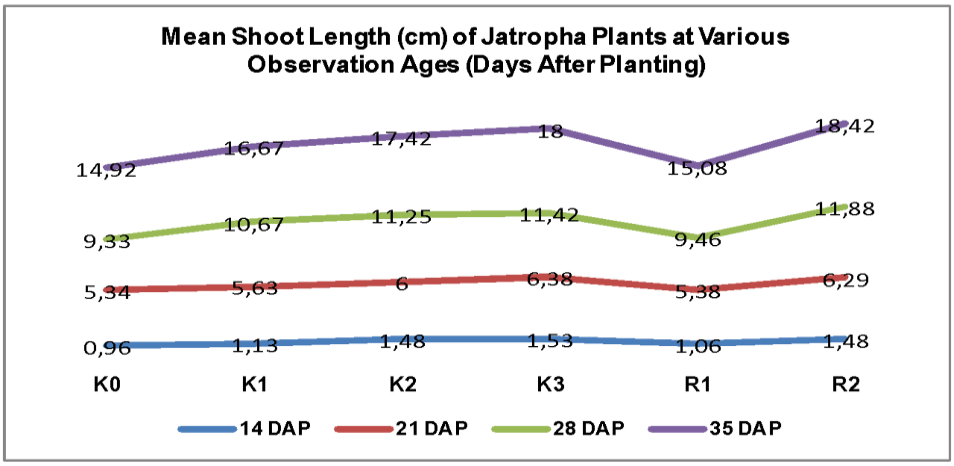


Picture 1. Mean Number of Leaves of Jatropha Plant on Treatment of Concentration of Organic Growth Regulators and Location of Segments at Various Ages of Observation (DAP).

Figure 1 shows that the R2 treatment in all observations gave a higher average value of the number of leaves that was 11.38 compared to the R1 treatment of 9.29 at 35 days after planting. The better response to the R2 treatment can be explained that it is suspected that the stem cuttings used as planting material have been quite good because the skin color of the cuttings is more brown which can identify that the cuttings have an optimum food reserve content. Furthermore, the concentration treatment of Organic growth regulator showed that the K3 treatment gave a better value at the end of the observation (35 days after planting) which was 11.08 although it was not significantly different from the K2 and K1 treatments of 10.92 and 10.42, respectively. According to (Kesumawati & Oktavidiati, 2020), that chemically synthesized plant hormones can react to plants similar to those caused by natural hormones. While plant growth regulators includeplant hormones *natural* and *synthetic* which when applied to plants will affect plant growth and development.

Shoot Length

The results of the analysis showed that the combination of organic growth regulator treatment and internode location did not have a significant interaction on the dependent variable shoot length at all observed ages; However, the results of the analysis on each treatment factor studied, both organic growth regulator and the location of the segment, turned out to have a significant effect.

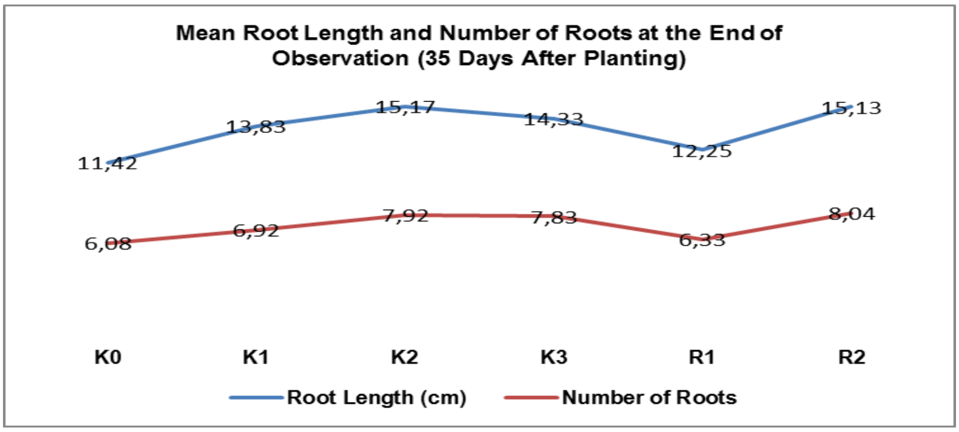


Picture 2. Mean Shoot Length (cm) of Jatropha Plant on Treatment of Concentration of Organic Growth Regulators and Location of Segments at Various Ages of Observation (DAP).

Treatment R2 in figure 2 shows the highest average shoot length of 18.42 cm which is significantly different from R1 of 15.08 cm at 35 days after planting; then the K3 treatment gave the highest average value at the end of the observation of 18.00 cm which was not significantly different from the K1 and K2 treatments, but the three treatments were significantly different from the K0 treatment. The better effect on the treatment factors R2 and K3, it is suspected that the cuttings material for the 12th segment is good enough to be used as a seedling material because the stem is not too young, the stem color is slightly brownish and has an optimum nutrient content for its metabolic process; while the organic growth regulator concentration of 7.5 ml per liter of water gave a better effect even though the K2 treatment was considered more efficient because statistically the value was considered the same. According to (Karjadi & Buchory, 2008), that the growth of shoot length is the result of cell growth and development that depends on the food supply provided by the roots for metabolism and protein synthesis, the more roots there are in the plant, the greater the absorption of nutrients.

Root Length and Number of Roots

The results of the analysis showed that the combination of organic growth regulator treatment and internode location had no significant interaction on the dependent variable of root length and number of roots at the end of the observed observations; but the results of the analysis on each treatment factor both organic growth regulator and the location of the segment showed a significant effect.



Picture 3. Mean Root Length (cm) and Number of Roots of Jatropha Plant on Treatment of Concentration of Organic Growth Regulators and Location of Segments at the End of Observation (35 DAP).

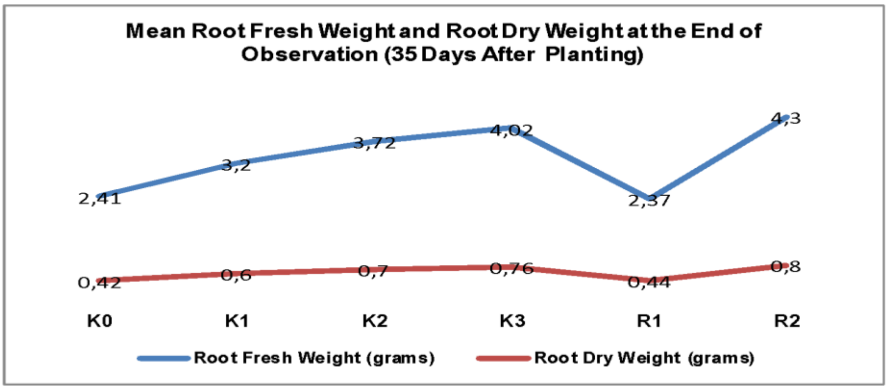
Figure 3 shows that the R2 treatment gave the highest mean value at root length of 15.13 cm which was significantly different from R1 of 12.25 cm, and also R2 gave the highest mean value of the number of roots of 8.04 which was significantly different from R1 of 6 ,33 at the end of the observation 35 days after planting; while the organic growth regulator concentration factor showed that the highest mean value of root length was achieved by K2 treatment of 15.17 cm which was not significant with K3 of 14.33 cm, and the highest mean value of root length was achieved by K2 treatment of 7.92 which was not significant with K3 treatment of 7.83.

The better mean value in the K2 treatment (5.0 ml/liter), it can be assumed that giving ZPT at the right level can trigger the acceleration of cuttings growth and encourage the process of root formation, especially on cuttings with sufficient maturity that have the availability of carbohydrates for metabolic processes in the body. formation of root and shoot cuttings. According to (Lestari, 2011), that the presence of a wound on the cut cuttings will stimulate callus growth, where the callus is a collection of parenchyma cells whose growth is not uniform which is generally found in the cambium tissue, and adventitious roots will form on the meristem, resulting in scarring. cuttings will trigger cell differentiation in the area where adventitious roots grow.

Wet Weight and Dry Weight of Roots per Plant

The results of the analysis showed that the combination of organic growth regulator treatment and internode location had no significant interaction on the dependent variable of root wet weight and root dry weight at the end of the observed observations; but the results of the analysis on each treatment factor both organic growth regulator and the location of the segment showed a significant effect.

The organic growth regulator concentration factor showed that the highest mean value was achieved by K3 treatment at root wet weight (4.02 grams) and root dry weight (0.76 grams) which were not significantly different from K2 treatment at root wet weight of 3.72 grams and root dry weight was 0.70 grams at the end of the observation. While the internode location factor showed that the highest mean values of root wet weight and root dry weight were both achieved by treatment R2 of 4.30 grams and 0.80 grams compared to treatment R1 of 2.37 grams and 0.44 grams respectively.



Picture 4. Mean Root Fresh Weight (grams) and Root Dry Weight (grams) of Jatropha Plant on Treatment of Concentration of Organic Growth Regulators and Location of Segments at the End of Observation (35 DAP).

The use of growth regulators with appropriate levels can stimulate the formation of roots. Roots are plant components that function to absorb water and nutrients so as to encourage plant growth. The dry weight of plant roots is also one of the components of the dry weight of the plant as a whole which can be an indicator of the results of the photosynthesis process that is going well which reflects the growth and development of plants. According to Harjadi (1979) *in* Zuchri, (2009), that plant growth is an irreversible measure where one of them can be known from the increase in plant dry weight.

4. CONCLUSION

Based on the results of the study, it can be concluded There was no significant interaction in the treatment combination between the concentration of organic growth regulators and the factor of internode location on all dependent variables observed in the initial growth of Jatropha stem cuttings. The internode location factor showed a significant effect on the variable number of leaves, shoot length, shoot diameter, root length, number of roots, root wet weight, root dry weight, and the location of the 12th internode (R2) gave better results than the location of the 10th internode. (R1). And The concentration factor of organic growth regulators also showed a significant effect on the variables of leaf number, shoot length, shoot diameter, root length, root number, root wet weight, root dry weight and K2 treatment (5 ml per liter of water) gave better and more efficient results. compared to other treatments.

REFERENCES

Al-Ayubi, S. (2019). *Making biodiesel from castor oil (Castor Oil) through transesterification reaction with temperature variations using KOH/Zeolite catalyst*. Maulana Malik Ibrahim State Islamic University.

Anonymous, (2009). Organic Growth Regulator "Queen of Biogen". Organic / Herbal Indonesia. PT. Trubus Mitra Swadaya. Jakarta.

Gome, JDJ (2016). *Practical Instructions for Cultivation of Jatropha (Jatropha curcas L.) and Oil Processing*. Universitas Brawijaya Press.

Karjadi, AK, & Buchory, A. (2008). Effect of auxin and cytokinin on growth and development of potato meristem tissue of Granola cultivar. *Journal of Horticulture*, *18*(4).

Kesumawati, S., & Oktavidiati, E. (2020). EFFECT OF NATURAL AND SYNTHETIC ZPT CONCENTRATIONS ON THE GROWTH AND PRODUCTION OF SOYBEAN (Glycine max L. Merril). *Agriculture*, *1*(1).

Lestari, EG (2011). The role of growth regulators in plant propagation through tissue culture. *Journal of AgroBiogen*, *7*(1), 63–68.

Prastowo, B. (2007). Vegetable Fuel from Plantation Plants as an Alternative to Kerosene for Households. *Perspective*, *6*(1), 10–18.

Hariyadi, B. W., Huda, N., Ali, M., & Wandik, E. (2019). The Effect of Tambsil Organic Fertilizer on The Growth And Results of Onion (Allium Ascalonicum L.) In Lowland. *Agricultural Science*, *2*(2), 127–138.

Winanti, ET (2016). Potential of Biological Natural Resources as Alternative Energy Providers. *Proceedings of the National Seminar on Applied Science and Technology*, 1–13.

Yitnosumarto. S. 1991. Experiment: Design, Analysis and Interpretation Dep. P and K. UNIBRAW MIPA Program.

Zuchri, A. (2009). SP36 Fertilization on Regosol Soil Reacts Acidly on Growth and Yield of Two Varieties of Peanut (Arachis hypogea L.). *Agrovigor: Journal of Agroecotechnology*, *2*(1), 31–34.