

The Effectiveness of Soil Enhancer (Bioamelioran) and Organic Material in Cocoa Seed Germination (*Theobroma cacao* L.)

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Abstract: This study aims to compare the effectiveness of the effect of giving soil amelior (bioamelioran) and organic matter at various concentrations to cocoa seed germination. This research was conducted in the experimental plantations of the Department of Plantation Plantations conducted in April - August 2019. The method used in this study was a Randomized Block Design (RBD), which consisted of four treatments of bioameliorant concentrations namely K0 = No Bioameliorant, K1 = 3 ml / L water, K2 = 4 ml / L water, K3 = 5 ml / L water. The treatment of giving organic material is done evenly with the same dose of 30 tons / ha equivalent to 53 grams / polybag. The treatment was repeated three times so that the total treatment unit was 24. The results showed that the K3 treatment with ml / L concentration of water showed the highest plant height (23.83 cm) and the highest number of leaves was 12 leaves.

Keywords: Bioameliorants, organic matter, cocoa seed

1. Introduction

Cocoa is one of the prospective prime commodity commodities and has a great opportunity to improve the welfare of the community because most of it is cultivated through community plantations (\pm 94.01%). Until 2010, the area of cacao had reached 1,650,621 ha with production of 837,918 tons and spread in 32 provinces. Cocoa is one of the leading commodities of the plantation as a source of foreign exchange, a source of income for farmers, creating farmer jobs, encouraging the development of agribusiness and agro-industry, regional development and environmental preservation (Directorate General of Plantations, 2012).

Cocoa (*Theobroma cacao* L.) is one of the leading national commodities after oil palm and rubber. Cocoa is one of Indonesia's leading export commodities which has contributed foreign exchange to the country of US \$ 1.6 billion at the end of 2010. The existence of Indonesia as the main cocoa producer in the world shows that Indonesian cocoa is sufficiently calculated and has the opportunity to dominate the global market. As market demand for cocoa continues to increase, efforts should be made to increase national productivity and production in order to increase national cocoa exports (Badan Pusat Statistik, 2011).

Cocoa productivity varies greatly between regions and provinces. Each region generally has a productivity level of under 1 ton of dry beans except North Sumatra Province reaching 1.165 tons. This productivity is still below the potential for cocoa production which can reach 2 tons of dry beans / ha / year (Van der Vossen, 1997).

Cultivation technique is one of the factors that will bring great benefits in achieving high production and good quality, while breeding is the beginning of efforts to achieve these goals. Proper and good nursery techniques will provide great opportunities for plant success. Cocoa growing media requires chemical and physical fertility, so that good and healthy seeds can be obtained for further growth. One of the factors that determine the quality of seedlings is the growth

medium. Fertility of growth media can be improved or enhanced by organic fertilization, or the use of biostimulant microorganisms (Quddusy, 1999).

Bioamelioran is a soil enhancer that is made from active bacteria that can improve and increase soil fertility through improvement in physical and chemical conditions of the soil. The bacteria used in this bioamelioran are *Stenotrophomonas maltophilia* Strain MN50 and *Stenotrophomonas nitridicens* Strain MN63 in which the bacteria that function as ZPT (growth aphrodisiac) because it contains auxin IAA (indole acetic acid). In general, plants cannot produce IAA (indole acetic acid) in sufficient quantities for plant growth and development so that bioamelioran products are found that function as growth stimulants because they contain IAA (Indole Acetic Acid). Where IAA is found in auxin ZPT which functions as a hormone for cell division and development so that the plant to be given zpt can accelerate plant growth, this Zpt can also accelerate the formation and extension of stems and accelerate leaf growth. This bioamelioran can also aggregate the soil so that it can improve soil structure, as well as act as a biofertilizer because it can fix nitrogen and as a phosphate solvent (Mu'minah, *et al* 2015).

The growth of cocoa seedlings in the field is largely determined by the growth of plants during the nursery. Growing media is one of the factors that influence the growth of cocoa plants in nurseries. The use of growing media that contains a lot of organic material is very beneficial for the growth of cocoa plants (Sudirja *et al*, 2005). Therefore, to improve the condition of the land and plantations, the use of bioamelioran (soil enhancers) is done to improve the physical, chemical and biological properties of the soil (Mu'minah, *et al*, 2015). The purpose of this study is to compare the effectiveness of the effect of giving soil amelior (bioamelioran) and organic matter at various concentrations to cocoa seed germination.

2. Material and Method

This research was carried out from April to August 2019 which was located in the Experimental Garden of the Department of Plant Cultivation in the Village of Mandalle, Mandalle District, Pangkep Regency.

The method used in this study is a randomized block design (RCBD) with 4 treatments of bioamelioran concentration, viz

K0 = control

K1 = 3 ml / liter of water

K2 = 4 ml / liter of water

K3 = 5 ml / liter of water

Where treatments K1, K2, and K3 use bioameliorants, each dissolved in one liter of water which is then applied to cocoa seedlings, while the use of organic material with the same dose for all treatments is 30 tons / ha equivalent to 53 grams / polybag . Each treatment consisted of 2 units with 3 replications so that the total treatment unit was 24 units.

The research consists of

a) Seed preparation

Cocoa seeds that will be treated are separated from the mucus (pulp), then soaked in a bioamelioran solution for 6 hours before planting.

b) Treatment Application

Bioamelioeran is dissolved in one liter of water according to the treatment dose, which is given to plants once a week during the study.

c) Maintenance

Maintenance done is watering in the morning and evening, and weeding is done when there are weeds growing on polybags.

Observation of plant parameters is done by measuring:

a) Plant height measured at 3 weeks after planting (after the cotyledons are removed). Then proceed every 1 week using the bar.

b) The number of leaves is counted since the plants are 3 weeks old and continued once a week.

3. Result and Discussion

The smallest significant difference (LSD) test results showed that the highest seedling height in table 1 was shown by the K3 treatment with a concentration of 5ml (23.38 cm) and significantly different from the K1 treatment with a concentration of 3ml (21.67cm). Whereas the K0 treatment (control) gave the shortest seedling height (20.36 cm) and was not significantly different from the K1 treatment with a concentration of 3ml (21.67 cm).

Table 1: Average plant height (cm)

Treatment	Plant Height (cm)	NP LSD 0,05
K0 : (Control)	20,33 ^a	1,97
K1 : (3 ml/liter of water)	21,67 ^a	
K2 : (4 ml/liter of water)	22,67 ^{ab}	
K3 : (5 ml/liter of water)	23,83 ^b	

Note: the numbers followed by the same letters in columns (a, b) differ from the 0.05 test level

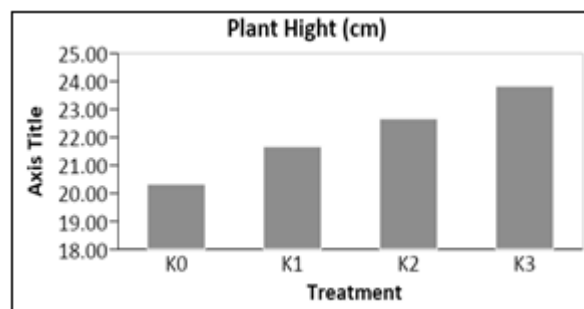


Figure 1: Graphic height increase of plants on giving bioameliorant

LSD test results showed that the highest number of leaves in cocoa seedlings in table 2 was shown by the K3 treatment with a concentration of 5 ml (12 leaf blade) and significantly different from the K2 treatment with a concentration of 4 ml (10 strands). Whereas K0 (control) gave the smallest number of leaves (9 leaf blade) and was not significantly different from the K1 treatment (10 leaf blade).

Table 2: Average number of leaves (Leaf blade)

Treatment	Number of leaves (Leaf blade)	NP LSD 0,01
K0 : (Kontrol)	9 ^a	1,04
K1 : (3 ml/liter of water)	10 ^a	
K2 : (4 ml/liter of water)	10 ^a	
K3 : (5 ml/liter of water)	12 ^b	

Note: the numbers followed by the same letters in columns (a, b) are significantly different at the 0.01 test level

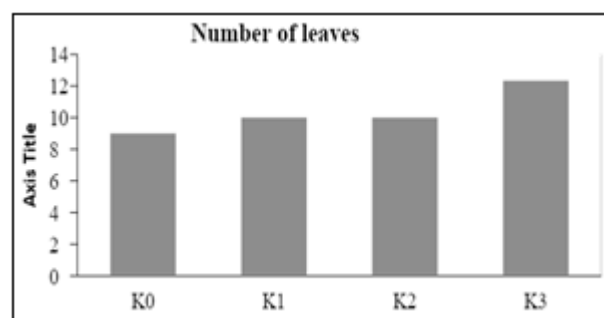


Figure 2: Graph of increasing the number of leaves in the administration of bioamelioran

The results showed that bioameliorants (soil enhancers) and organic matter supplied to cocoa plants were positively correlated to the growth of cocoa plants. Planting media which are rich in organic material are very good for plant growth supported by the provision of bioamelioran as a plant growth promoter that contains IAA auksin will greatly assist in the process of cell division which will affect plant growth activities both increase plant height and number of leaves.

Bioameliorant is a soil-enhancing agent that is made from active bacteria which has the function to function as a growth stimulant because it contains IAA (Indole Acetic Acid), which functions as a biofertilizer because it can fix nitrogen and as a phosphate solvent). Isolation of exopolysaccharide-producing bacteria obtained from the rhizosphere of potato plants is widely available in the soil matrix, in the soil matrix, root development produces root exudates from plant metabolism which contain a lot of

carbon compounds that are highly demanded by microbes and also for nutrient needs. Bioamelioran can also play a role in improving and increasing soil fertility through improving physical and chemical soil conditions, and improving soil structure (Mu'minah, *et al* 2015).

Organic material is material on the surface or soil that comes from the rest of plants, animals and humans, both those that have undergone decomposition and those undergoing decomposition. The types of organic material used in the study are compost, compost is one of man-made organic fertilizers made from the decomposition of the remains of organic material such as plants and animals. (Balasubramian, V. 2005)

Organic matter has an important function for the soil, which is to loosen the surface layer of the soil (top soil), increase the population of soil microorganisms, enhance absorption and water retention capacity which will overall increase soil fertility. According to (Simanungkalit RDM, *et. Al.* 2006).

4. Conclusion

Provision of bioameliorants and organic matter in cocoa seedlings showed a significant effect on plant height, with a concentration of 5 ml / L water showing the highest plant height (23.83 cm). As for the highest number of leaves, it was shown in the bioamelioran treatment with a concentration of 5 ml / L of water with the number of strands or 12 strands to the growth of cocoa seedlings.

References

- [1] Balasubramian, V. 2005. Bahan Organik Tanah. www.lemnit.unud.ac.id. Diakses pada tanggal 1 mei 2011
- [2] Badan Pusat Statistik.2011. Statistik Indonesia. Badan Pusat Statistik. Jakarta
- [3] Direktorat Jenderal Perkebunan .2012. Pedoman Teknis Daerah Gerakan Nasional Peningkatan Produksi dan Mutu Kakao.Kementerian pertanian. Jakarta
- [4] Ditjenbun. 2010. Rencana Strategis Pembangunan Perkebunan 2010-2014, Kementerian Pertanian RI.
- [5] Mu'minah, *et al.* 2005. Isolation and Screening Bacterial Exopolysaccharide (EPS) from Potato Rhizosphere in Highland and The Potential as a Producer *Indole Acetic Acid* (IAA)
- [6] Quddusy, N. 1999. Respon Pemupukan Bibit Kakao (theobroma cacao L.) Pada Media Tumbuh yang di Beri Kompos Alang-Alang dengan Trichoderma
- [7] Sudrija, R., M, A, Solihin, dan santi, R 2005. Pengaruh Kompos Kulit Buah Kakao dan Kascing Terhadap Perbaikan Beberapa Sifat Kimia Fluventic eutrudepts. Skripsi. Universitas Padjajaran, Bandung.
- [8] Simanungkalit RDM, *et.al.* 2006. Pupuk Organik dan Pupuk hayati. Jawa barat. Balai Besar Litbang Sumber daya Lahan Pertanian Badan Penelitian dan Pengembangan Pertanian.
- [9] Vander Vosen, H.A.M. 1997. Strategies of Variety Improvement on Cocoa with Emphasis on Durable Disease Resistance. INGENIC. Reading, UK. 32p.

- [10]Wahyudi, T., T.R Panggabean, and Pujiyanto . 2008 *Panduan Kakao Lengkap, Manajemen Agribisnis dari Hulu hingga Hilir*. Penebar Swadaya, jakarta
- [11]Waluyo, Lud. 2012. *Mikrobiologi umum*. UMM Press: Malang.