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Effect of Liquid Organic Bio-Fertilizer on Morphological Growth and Productivity of Five Black Ginger Accessions (*Curcuma aeruginosa* Roxb.)

I F Azizah[1] , Ngatinem Ngatinem[2] , Rusmanto[3] , Agus Himawan S.[4]
[1,2,3,4]National Agency for Research and Innovation BRIN,
Indonesia

Abstract:- Curcuma aeruginosa Roxb. or black ginger is widely distributed in Southeast Asia has a local name ginger erang ginger black is used as a traditional medicine because it contains bioactive compounds such as saponins, flavonoids, polyphenols, triterpenoids, and glucans (Sweetymol and Thomas, 2014; Kitamura et al., 2007). Black ginger rhizome is used for digging herbs and anti-rheumatic or inflammatory (Reanmongkol et al., 2006), skin diseases (Djauharia and Sufiani, 2007), cough and asthma (Nasrullah et al., 2010), anti-microbial (Angel et al., 2012), anti-fungal (Srivastava et al., 2006), and anti- oxidant (Nurcholis et al., 2015). The production and productivity of black ginger in Indonesia are still relatively low when compared to other leading biopharmaca commodities such as ginger. The purpose of this research activity is the use of liquid organic fertilizer on five accessions of black ginger will affect morphology and production as medicinal raw materials (BBOT). The research was conducted with a randomized group design (RAK) experiment with 2 factors. The first factor is liquid organic fertilizer and non-liquid organic fertilizer. The second factor of black ginger accession consists of 5 accessions, namely Yukum Jaya accession (TI.13), Bondowoso accession (TI.14), Ciamis accession (TI.15), Pangandaran accession (TI.16) and Pasuruan accession (TI.17) with 3 repetitions. The parameters observed were plant height, stem diameter and number of leaves. Morphological parameters observed include rhizome harvest weight is the weight of the rhizome measured at harvest, rhizome wet weight, fleshy root weight, number of rhizome propagules. All data were analyzed by analysis of variance and further test using Duncan test (P < 0.05). This study found that the use of LOB can increase production since the vegetative period for the formation of leaves and stems as well as for the development and growth of plants that can be seen in plant morphology in the results of accessions Yukum Jaya, Ciamis and Bondowoso. In addition, rhizome weight using LOB can reach 2,162.11 for Ciamisaccession.

Keywords:- *Biofertilizer, LOB, Accession, Black Ginger, Morphology, Productivity.*

I. INTRODUCTION

Curcuma aeruginosa Roxb. or black ginger is widely distributed in Southeast Asia has a local name ginger erang ginger black is used as a traditional medicine because it contains bioactive compounds such as *saponins, flavonoids, polyphenols, triterpenoids,* and glucans (Sweetymol and Thomas, 2014; Kitamura *et al*., 2007). Black ginger rhizome is used for digging herbs and anti-rheumatic or inflammatory (Reanmongkol *et al.*, 2006), skin diseases (Djauharia and Sufiani, 2007), cough and asthma (Nasrullah et *al.*, 2010), anti-microbial (Angel *et al.*, 2012), anti-fungal (Srivastava *et al.*, 2006), and anti-oxidant (Nurcholis *et al.*, 2015). The production and productivity of black ginger in Indonesia are still relatively low when compared to other leading biopharmaceutical commodities such asginger.

Black ginger (*Curcuma aeruginosa* Roxb.) is a perennial and rhizome terna plant, growing in the open or under stands of trees in tropical forests. This plant is included in the *Zingiberaceae* tribe (Heyne, 1950). Traditionally black ginger rhizome is used as a medicine for stomach pain, cough, asthma, rheumatism, against obesity and helminthiasis. Preclinical evaluation shows that black ginger rhizome extract has *hepatoprotective*, *anthelmintic*, *analgesic* (Reanmongkol, 2006) and *antibacterial* activities. The chemical content of black ginger rhizomes is characterized by a group of essential oil compounds, phenolic compounds, including *is of lavonoids*, and glucans. The identity compound of black ginger rhizome simplisia is the essential oil component of the *sesquiterpene* group, *kurzerenon*.

Chemical-physical/pharmaceutical and pharmacological quality medicinal raw materials that are consistent, obtained from certainty of plant identity, uniformity of plant material sources, controlled cultivation and post-harvest processes. Relatively uniform medicinal plant materials can be obtained from medicinal plant industries/research institutions that have carried out controlled cultivation. However, such industries do not produce all types of medicinal plants. Therefore, it is also necessary to make efforts to produce controlled plant raw materials. Plant growth and production are strongly influenced by soil properties and the availability of plant nutrients. Soil that is planted continuously without paying attention to soil conditions can cause the availability of nutrients to decrease, if this situation is allowed to continue

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to cause plants to lack nutrients so that growth is disrupted (Kriswantoro, et al,2016).

II. ACTIVITY OBJECTIVE

The purpose of this research activity is the use of liquid organic fertilizer on five accessions black ginger will affect morphology and production as medicinal raw materials(BBOT).

III. MATERIALS AND METHODS

Cultivation optimization was carried out in BRIN's experimental garden in Sulusuban, Central Lampung and was part of the black ginger plant multilocation test. The research was conducted from September 2020 to August 2021. The materials used were seeds from the regions: Yukum Jaya- Lampung, Bondowoso, Ciamis, Pangandaran and Pasuruan as many as 5 accessions, *liquid* organic fertilizer (*Liquid organic Biofertilizer*), natural fungicides (ginger, turmeric, laos), organic insecticides (tobacco, soursop leaves) and water.

The tools used in this research are *hand tractor*, *Cultivator*, hoe, meter, water hose, *sprayer*, measuring cup, gloves, scissors, bucket, raffia, knife, digital scale, calculator, chopper, label paper and stationery. This research went through several stages, namely land preparation, seed preparation, planting, maintenance and harvesting.

The research was conducted with experimental randomized group design (RAK) with 2 factors. The first factor is liquid organic fertilizer and non-liquid organic fertilizer. The second factor of black ginger accession consists of 5 accessions namely Yukum Jaya accession (TI.13), Bondowoso accession (TI.14), Ciamis accession (TI.15), Pangandaran accession (TI.16) and Pasuruan accession (TI.17) with 3 repetitions. The parameters observed were plant height, stem diameter and number of leaves. Morphological parameters observed included weight Rhizome harvest is the weight of the rhizome measured at harvest r h i z o m e wet weight, weight of fleshy root, number of rhizome propagules. All data were analyzed by analysis of variance and further test using Duncan test ($P < 0.05$).

IV. RESULTS AND DISCUSSION

Observation of Pests and Diseases and Their Management The implementation of field observations on the Pangandaran accession black ginger plants when they were 6 months old began to be attacked by leaf rust as many as 30 trees out of 120 plants, while in the Pasuruan accession 7 plants were attacked by leaf rust. The characteristics on the surface of the upper leaves are like a thin brownish layer that sticks, then the leaves will turn yellow and dry out, thus disrupting photosynthetic activities, as a result the plant will dry out and die. To overcome this, spraying a natural fungicide made from ginger, turmeric and laos in a ratio of 1:1:1. The solution is then checked for PH, then sprayed on the plants at a dose of 10-20 ml per liter of water checked for PH and added a little detergent as an adhesive. Spraying is carried out in the morning, so as not to be disturbed by the wind and the leaves are still wet so that the fungicide canstick...

Other black ginger accession plants are attacked by walang sangit, henceforth we overcome it by spraying natural insecticides with boiled and fermented jengkol water for 1-2 weeks. The dose sprayed is 20ml /liter of water. From experience in the field, it is quite effective (75%) walang sangit leaves after smelling jengkol water but does not die. It is better to spray more than once so that the mantis is completely gone. Vegetative plant observation was conducted at 3, 5 and 7 months ofage.

A. Physiological Parameters

- *Plant Height*

At the age of 3 months, the growth of plant height was significantly different, the highest was found in Yukum Jaya accession with LOB treatment 97.254 cm and the lowest was Pasuruan LOB accession 78.667 cm. While in other accessions both Non LOB and LOB treatments were not significantly different. When the plants were 5 months after planting, the growth of plant height was significantly different, the highest was in the accession Yukum Jaya LOB treatment 125.033 cm and the lowest was in the Pasuruan LOB accession 78.667 cm. While in other accessions both NonLOB and LOB treatments were not significantly different. When the plants were 7 months old after planting, the highest plant height growth was in the LOBtreatment.on accession Yukum Jaya LOB treatment 142.600 cm.

Table 1: Average results of Plant Height measurements at 3, 5, and 7 months after planting.

Accessions & Treatments	Age					
	3 Months After Planting (BST)		5 Months After Planting (BST)		7 Months After Planting (BST)	
TI.13.Yukum Jaya + Non LOB	92,067	**bcd**	96,733	cd	99,366	bc
TI.13.Yukum Jaya + LOB	97,254	**d**	125,033	a	142,600	a
TI.14. Bondowoso + Non LOB	88,500	**bc**	106,033	b	130,200	d
TI.14. Bondowoso + LOB	94,200	**bcd**	97,400	b	107,243	b
TI.15. Ciamis + Non LOB	93,200	**bcd**	106,233	b	128,133	b
TI.15. Ciamis + LOB	90,556	**bcd**	128,133	cd	140,333	cd
TI.16.Pangandaran + Non LOB	82,400	**ab**	109,800	cd	119,833	cd
TI.16.Pangandaran + LOB	91,266	**bcd**	132,067	cd	139,600	cd
TI.17 Pasuruan + Non LOB	85,144	**ab**	108,633	cd	136,300	c
TI.17 Pasuruan + LOB	78,667	**a**	78,667	b	112,366	cd

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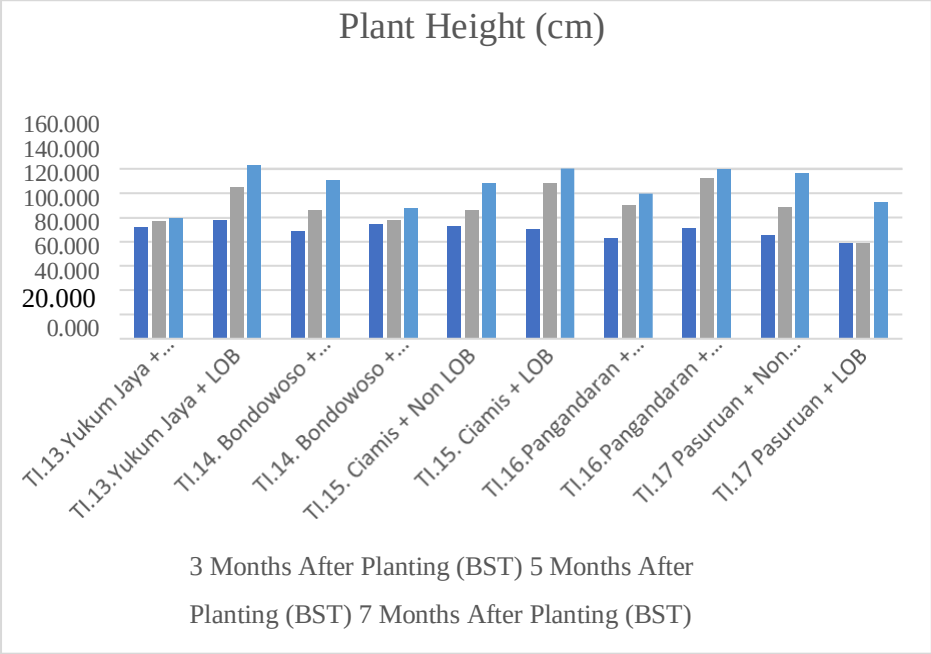

Fig. 1: Plant height of Black Ginger at 3, 5 and 7 months after planting

Based on the calculation results, Yukum Jaya with LOB treatment shows the optimal effect. This is supported by cultivation conditions that support growth in addition to the availability of water and nutrients for plants. In the physiological phase, plants really need nutrients to grow and develop.

➢ *Trunk diameter*

Black ginger stem diameter at the age of 3, 5 and 7 months for Yukum accessions with LOB treatment shows development and growth. The decomposition of nutrients absorbed by plants is used to enlarge the plant stem so that the diameter of the plant stem shows optimal results. This shows that LOB can increase plant growth and development in the vegetative phase.

Table 2: Average results of stem diameter measurements at 3, 5, and 7 months after planting.

Accessions & Treatments	**Trunk diameter**					
	3 Months After Planting (BST)		**5 Months After Planting (BST)**		**7 Months After Planting (BST)**	
TI.13.Yukum Jaya + Non LOB	1.682	a	1.913	b	1.46	a
TI.15. Ciamis + Non LOB	2.208	bc	2.137	b	1.77	b
TI.17 Pasuruan + Non LOB	1.977	ab	2.323	b	1.928	bc
TI.14. Bondowoso + Non LOB	1.920	ab	2.367	b	1.93	bc
TI.16.Pangandaran + Non LOB	2.208	bc	2.573	ce	2.003	c
TI.17 Pasuruan + LOB	1.500	a	1.430	a	2.023	c
TI.14. Bondowoso + LOB	1.685	a	2.120	b	2.03	c
TI.15. Ciamis + LOB	2.593	c	2.673	de	2.173	d
TI.13.Yukum Jaya + LOB	3.207	d	3.567	f	2.33	de
TI.16.Pangandaran + LOB	2.507	**c**	2.773	e	2.337	d

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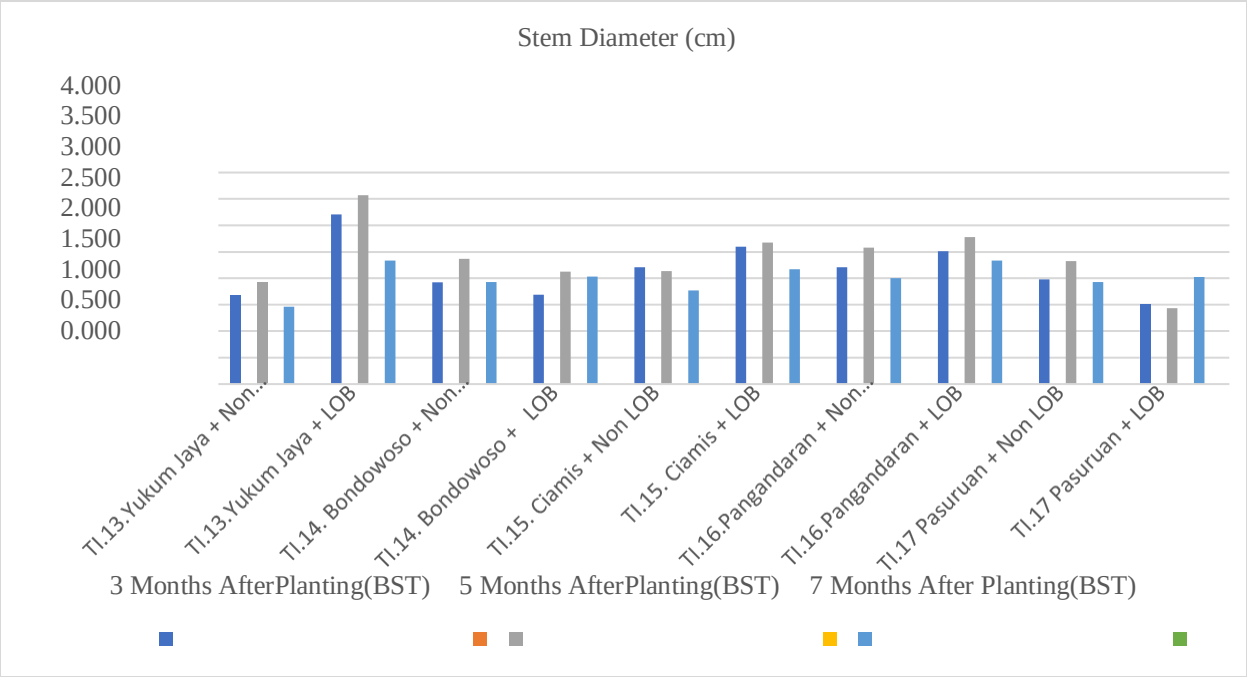

Fig. 2: Diameter of 3, 5 and 7 month oldBlack ginger stems

The results of stem diameter in Figure 2 show that Yukum Jaya with LOB treatment has the optimal stem diameter value compared to other accessions. While the accession that has a small stem diameter is Yukum Jaya without LOB at the age of 7 months. Growth is even inhibited toincrease.

➢ *Number of leaves*

Plants can develop if there are more leaves so that plants can survive. The number of leaves can also make plants absorb more water and nutrients in the soil. Based on the results of the analysis conducted that plants that are 7 months with optimal number of leaves was shown in the growth of Bondowoso accession with LOB treatment. Although at the age of 3 and 5 months this accession did not show significant differences compared to the others.

LOB has a good effect on plants, especially during the vegetative stage. But it does not rule out the possibility that good results will also be obtained in the generative phase of the plant. This has been shown in the variable plant height, stem diameter and number of leaves of the black ginger plant. Bondowoso accession has more leaves than the others. Cultivation environmental conditions affect the growth and development of black ginger.

Table 3: Average results of leaf number measurements at 3, 5, and 7 months after planting.

Accessions & Treatments	**Trunk diameter**					
	3 Months After Planting (BST)		**5 Months After Planting (BST)**		**7 Months After Planting (BST)**	
TI.17 Pasuruan + LOB	5.700	a	5.827	a	6.6	de
TI.15. Ciamis + LOB	6.333	b	7.833	bc	6.067	cd
TI.17 Pasuruan + Non LOB	6.433	b	7.533	b	7.333	e
TI.16.Pangandaran + Non LOB	6.700	bc	7.467	b	5.567	bc
TI.14. Bondowoso + LOB	6.733	bc	7.500	b	7.5	e
TI.15. Ciamis + Non LOB	6.833	bc	8.367	cd	5.067	ab
TI.14. Bondowoso + Non LOB	7.200	c	7.300	b	5.867	c
TI.13.Yukum Jaya + Non LOB	8.267	d	8.400	cd	4.5	a
TI.16.Pangandaran + LOB	8.633	e	8.567	cd	6.567	cde
TI.13.Yukum Jaya + LOB	8.967	e	8.800	d	5.333	bc

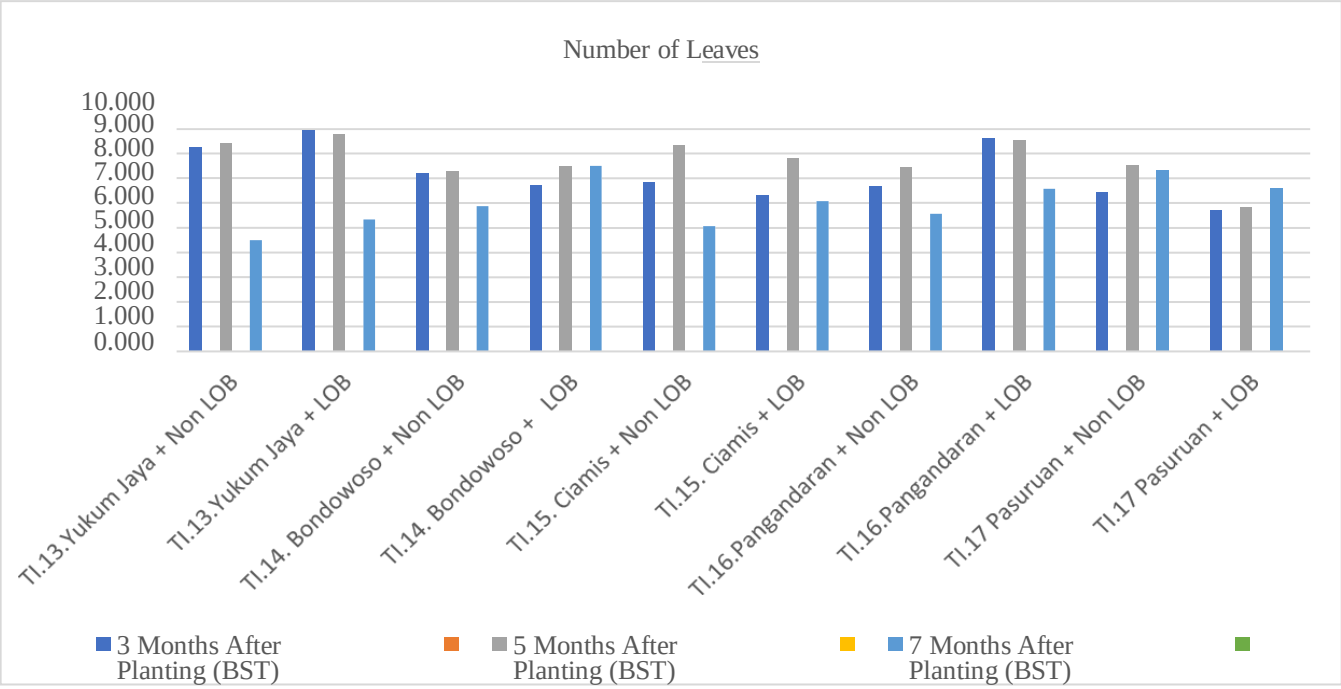

Fig. 3: Graph of the number of Black ginger leaves in months 3, 5 and 7 after planting

B. Morphological Parameters

The results of measuring morphological parameters show that there are significant differences in rhizome harvest weight in Ciamis and Pangandaran accessions by adding LOB. Although root weight showed optimal numbers, it was not followed by root weight, fleshly root weight, rhizome architecture length and number of propagules.

Black ginger is harvested in the form of rhizomes because it belongs to the Zingiberaceae family. What is currently being utilized is the rhizome. Apart from rhizomes, when harvesting black ginger produces fleshly roots, propagules and roots that have not been widely utilized.

Black ginger rhizome resembles other gingers but the difference lies in the rhizome if it is split, a black circle will appear. This is what makes Curcuma aeruginosa called black ginger. Apart from rhizomes, fleshly roots are also produced which are food reserves for rhizomes to survive. If the age increases, the less fleshly root is harvested. In addition, there are also rhizome roots which are used to absorb nutrients and water as the plant grows untilharvest.

The use of fertilizers greatly affects the weight of the rhizome. Black ginger using LOB has a higher rhizome weight compared to non-LOB. That result shown in table 4 with a maximum value of 2,162.11 grams for Ciamis accession and 1,743.06 for Pangandaran accession. While those that did not use LOB were the lowest for Ciamis accession. Bondowoso accession showed a low rhizome bobpot despite using LOB, which was 552.22 grams. Meanwhile, the lowest weight of the non-LOB Ciamis accession was 476.57. It may be possible that LOB helps reduce food reserves because nutrients have been fulfilled from LOB feeding. However, some of the non-LOB accessions also gave low numbers.The highest fleshly root weight was produced by the non-LOB Yukum Jaya accession at 1,444.36 grams.

Table 4: Average results of leaf number measurements at 3, 5, and 7 months after planting.

Treatment	Rhizome Weight at 10 Months		Root Weight		Weight without *Fleshly Root*		Number of Propagules		Rhizome Arctic Length	
TI. 14 Bondowoso+ LOB	552.22	a	12.66	cd	488.15	a	97.58	ef	32.06	de
TI. 14 Bondowoso+ Non LOB	712.50	a	11.17	bcd	975.02	b	68.75	cd	34.00	de
TI.13 Yukum Jaya + Non LOB	1,357.78	c	14.43	d	1,444.36	c	63.80	b	32.12	de
TI.13 Yukum Jaya +LOB	1,173.33	b	10.48	bcd	875.85	b	82.17	cde	31.36	d
TI.15 Ciamis+ LOB	2,162.11	d	8.26	ab	948.22	b	85.92	def	28.44	c
TI.15 Ciamis+ Non LOB	557.78	a	22.68	e	476.57	a	101.66	f	34.56	e
TI.16 Pangandaran+ LOB	1,743.06	cd	12.89	cd	1,436.08	bc	64.44	bc	29.70	cd
TI.16 Pangandaran+ Non LOB	1,553.89	c	8.48	ab	1,185.95	bc	49.56	b	23.75	b
TI.17 Pasuruan + LOB	1,578.33	c	6.35	a	940.50	b	18.36	a	24.11	b
TI.17 Pasuruan + Non LOB	1,548.33	c	5.37	a	1,193.69	bc	29.61	a	15.86	a

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C. Liquid Organic Biofertilizer(LOB)

Liquid Organic Biofertilizer (LOB) is an organic fertilizer that can help plant growth and development and also help improve soil fertility. Several crops have been tested using LOB, especially horticultural crops such as corn, vegetables and annuals with a harvest period of 3 months.

LOB has a function to increase productivity, maintain and preserve soil fertility and health and reduce the use of chemical fertilizers. The main factor that encourages the use of organic fertilizers is the soil degradation caused by the continuous and sustainable use of chemical fertilizers. In addition, the support of short time and increased production is very tempting for farmers to continue using chemical fertilizers. However, this is a time bomb that can degrade soil quality so that future crop productivity decreases if notcontrolled.

LOB contains a variety of good bacteria that can improve soil and increase crop production. The content of LOB bacteria includes Pseudomonas sp., Bacillus sp. and Saccharomyces. These microbes function to dissolve phosphorus from the soil so that it is easily absorbed by plants, produce ZPT (Auxin, Gibberellin and Cytokinin) to encourage growth.plants, and to fertilize plants and soil due to the content of micro and macro nutrients (e-lob.carrd.co).

Therefore, LOB is quiteimportant during the vegetative period of the crop. In addition, LOB can improve soil quality along with a sustainable agricultural system and improve soil quality. Lob which is used for the growth and development of black ginger shows optimal results in Yukum Jaya and Bondowoso accessions for the vegetative period. However, the black ginger plant in the generative period by giving LOB theoptimal results were shown by the Ciamis and Pangandaran accessions with LOB. These two accessions have stable growth during the vegetative to generative period.

V. CONCLUSION

This study found that the use of LOB can increase production since the vegetative period forthe formation of leaves and stems as well as for the development and growth of plants that can be seen in the morphology of plants in Yukum Jaya, Ciamis and Bondowoso accessions. In addition, rhizome weight using LOB can reach 2,162.11 for Ciamis accession. The results of other accessions are quite good.

REFERENCES

[1]. Sweetymol, J., T.D. Thomas. 2014. Compharative phytochemical and antibacterial studies of two indigenous medicinal plant. Int. J. Green Pharm. 8:65-71.

[2]. Reanmongkol, W., S. Subhadhirasakul, N. Khaisombat, P. Fuengnawakit, S. Jantasila, A. Khamjun. 2006. Investigation the antinociceptive, antipyretic and anti-inflammatory activities of Curcuma aeruginosa Roxb. extract in experimental animals. J. Sci. Technol. 28:999-1008.

[3]. Djauharia, E., S. Sufiani. 2007. Observasi keragaan tanaman temu hitam (*Curcuma aeruginosa* Roxb.) pada berbagai jarak tanam. Warta Tumbuhan Obat Indonesia 7:21-23.

[4]. Nasrullah, I., S. Murhandini, W.P. Rahayu. 2010. Phitochemical study from Curcuma aeruginosa Roxb. rhizome for standardizing traditional medicinal extract. J. Int. Env. Appl. Sci. 5:748-750.

[5]. Angel, G.R., B. Vimala, B. Nambisan. 2012. Phenolic content and antioxidant activity in five underutilized starchy Curcuma species. Int. J. Pharmacog. Phytochem.Res. 4:69-73.

[6]. Srivastava, S., N. Chitranshi, S. Srivastava, M. Dan, A.K.S. Rawat, P. Pushpangadan. 2006. Pharmacognostic evaluation of Curcuma aeruginosa Roxb. Nat. Prod. Sci. 12:162-165.

[7]. Nurcholis, W., N. Khumaida, M. Syukur, M. Bintang, I.D.A.A.C. Ardyani. 2015. Phytochemical screening, antioxidant and cytotoxic activities in extracts of different rhizome parts from Curcuma aeruginosa Roxb. Int. Res. Ayurveda Pharm. 6:634-637.

[8]. Heyne, K., 1950. Tumbuhan Berguna Indonesia. Jilid I. Terjemahan oleh Badan Litbang Kehutanan, Jakarta. 615 p.

[9]. Setiadi.A, Nurul Khumaida, Sintho Wahyuning A. 2017. Keberagaman Beberapa Aksesi Temu Hitam (Curcuma aeruginosa Roxb.) Berdasarkan Karakter Morfologi. J.Agron. April 2017, 45(1):71-78. DOI: https://dx.doi.org/10.24831/jai.v45i1.13773 Indonesia.

[10]. Dalimartha, Setiawan. 2008. 1001 Resep Herbal. Jakarta : Penebar Swadaya

[11]. Bombardelli, E. Technologies for the Processing of Medicinal Plants. Florida. CRC Press. 1991.

[12]. Rochmat, Agus. 2019. Isolasi dan Bioinhibitor Aktivitas enzim Tirosinase Dari Ekstrak etil Asetat padi Hitam (Oryza Sativa L Indica). Borneo Journal of Phamascientech, Vol. 03, No. 02, Oktober Tahun 2019. ISSN-Online. 2548 – 3897

[13]. Umasjaya. 2018. https://e-lob.carrd.co/Kriswantoro, Haris, Safriyani, Etty & Syamsul B. (2016). Pemberian pupuk organik dan pupuk NPK pada tanaman jagung manis (Zea mays saccharata Sturt). Jurnal Klorofil. 11-1.