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The potential of mushroom baglog waste compost by adding FMA on ground water spinach *(Ipomoea reptans* Poir) growth

Adi Rastono[1*], Masrur Muzadi[1], Hamzah Nata Siswara[2]
[1]Budi Daya Tanaman Hortikultura, Politeknik Pertanian Dan Peternakan Mapena, Jalan Imam Bonjol, Singgahan, Tuban Regency, East Java, 62361.
[2]Budidaya Ternak, Politeknik Pertanian Dan Peternakan Mapena, Jalan Imam Bonjol, Singgahan, Tuban Regency, East Java, 62361.
*Email : adirastono3@gmail.com

ABSTRACT

Unrecycled mushroom Baglog waste will be a place for spores to grow so that the spores will spread to the inoculation room, damaging the mushroom Baglog media, which causes crop failure. The right step for utilizing Baglog waste is composting it. A composted Baglog waste will be better if it is added with arbuscular mycorrhizal fungi (FMA), improving and increasing soil nutrient quality. This study aimed to determine the potential of mushroom Baglog waste compost by adding FMA to groundwater spinach growth (*Ipomoea reptans* Poir). This study used RAK to treat compost, compost+AFM 10g, compost+AFMA 20g, and compost+AFMA 30g. The study results indicate that Baglog waste compost and FMA have not been able to interact well on the parameters of tendril length, wet weight, and dry weight, as shown by the results that are not significantly different from compost treatment without FMA. Even so, compost waste has the potential to be used as fertilizer or media because it already has physical quality conforming to SNI. Adding FMA to mushroom Baglog waste compost is recommended because it can potentially increase plants' growth rate. The best interaction between Baglog mushroom waste compost and FMA was the compost + 10 g FMA treatment for all observation parameters.

Keywords: *Baglog Waste, Arbuscular Mycorrhizal Fungi (FMA), Potential Compost.*

1. INTRODUCTION

The increase in oyster mushroom cultivation activities in Indonesia in 2018 amounted to 3,701.956 tons, but in 2019 it became 31,051.57 tons (BPS 2019 in Putri *et al*. 2022. In 2021 UD Oyster Mushroom Agro Wijaya Kusuma produced 2,200 Baglogs of oyster mushrooms (Interview with Mr. Afin, Head of the Venture). Oyster mushroom production is directly proportional to the increase in Baglog waste. (R. B. Putri et al., 2017) Mushroom Baglog waste that is left unattended will have an adverse impact on the environment and also on oyster mushroom cultivation around the waste accumulation site.

(Upadhyay et al., 2021), mentioned that mounds of mushroom Baglog waste that is not recycled will become a place for spores to grow so that the spores will be spread to the inoculation room by the wind or stick to the clothes or limbs of workers. As a result, it will cause damage to the mushroom Baglog media which causes crop failure. One way to use Baglog waste is by composting it to benefit plants and adding other fertilizing ingredients.

Mushroom Baglog waste is very appropriate for compost use as raw material. Hasbiah et al., 2018, stated that Baglog waste contains 0.23% N, 0.30% P, 0.20% K, and 17.93% C. The composition of Baglog waste is mushroom with 80% sawdust and 10% bran Rice is a raw material for super carbon to form a plant body that consists of all organic compounds. (Putri et al., 2022) Her research evaluated the quality of SNI-based oyster mushroom Baglog compost, and the results of oyster mushroom Baglog waste compost met the quality criteria of compost according to SNI No.19-7030-2004. In addition to composting the mushroom-growing media, lime (CaCO3) is added to the mushroom-growing media waste contains high Ca and P (Burhan et al., 2018). Some of the potentials for Baglog waste that has been mentioned can be processed into compost. One of the technologies to accelerate composting is providing microbes that can improve compost quality (Jumar *et al.,* 2020).

The research will be carried out to determine Baglog's potential compost on land kale (Ipomoea reptans Poir) without knowing the elemental quantities through laboratory tests to test the truth of various existing theories with various treatments.

Mycorrhizal plants usually grow better than those without mycorrhizae. Arbuscular Mycorrhizal Fungi (FMA) play a role in improving and increasing the quality of nutrient absorption from the soil, biological barriers against root pathogen infections, increasing host resistance to drought, increasing growth-promoting hormones (Agustin et al., 2010). Ramadhan et al., 2015, in their research combine organic fertilizers in the form of Gamal leaf compost 10 t ha-1 + FMA 10 g per plant, which can increase the height growth of chili plants. The research that will be carried out is expected that mycorrhiza will be able to interact with mushroom Baglog waste compost in the growth of land kale (Ipomoea reptans Poir).

Based on the description above, this study aims to determine how groundwater spinach's growth response (Ipomoea reptans Poir) when planted using fermented Baglog mushroom compost media but has not gone through laboratory tests and then added with arbuscular mycorrhizal fungi (FMA).

2. MATERIALS AND METHODS

The research was conducted in May-July 2022 in Kedungharjo Village, Bangilan District, Tuban Regency, East Java. With the coordinates of the location Lat -6.973823º and Long 111.717072º, postal code 62364, altitude 43 MDPL, 65 Km from the north coast. The land used is 4m^2 in the yard of the house. The ambient temperature fluctuates by 28ºC-32 ºC. The planting medium used was only Baglog compost without mixing soil media in polybags.

The materials used in this study were as follows: Baglog waste compost, polybags, arbuscular mycorrhizal fungi (FMA), groundwater spinach (Ipomoea reptans Poir), scales, and spoons. Making compost follows Hunaepi et al., 2018, 30 kg of oyster mushroom bag waste, 42 ml of EM4, 6 kg of husk charcoal, and 30 g of molasses.

These materials are presented in the figure below:

Figure 1. Weighting Baglog Waste

Figure 2. EM4

Figure 3. Chaff Charcoal

Figure 4 Molasses

Figure 5. Fermentation Final Result

The study used a randomized block design (RBD) with 4 treatments and 3 repetitions to obtain 12 experimental units. The applied Baglog waste compost has not gone through laboratory tests. This is because the research aims to determine the potential of Baglog waste compost. Dosage of compost using the formula:

= Vol Polibag x BV

= $\pi.r^2.t$ x BV

=3.14.(15x15).20Cm^3 x 1g/Cm^3

= 14,130 g

This study uses the following treatment:

- Compost (Control),
- Compost + FMA (10 g),
- Compost + FMA (20 g),
- Compost + FMA (30 g).

Parameters observed included vine length, wet weight and dry weight. Observation time is 1MST, 2MST, and 3MST. Observational data will be analyzed using analysis of variance and continued with the DMRT test at the 5% level.

The stages of research implementation can be seen in the flowchart as follows:

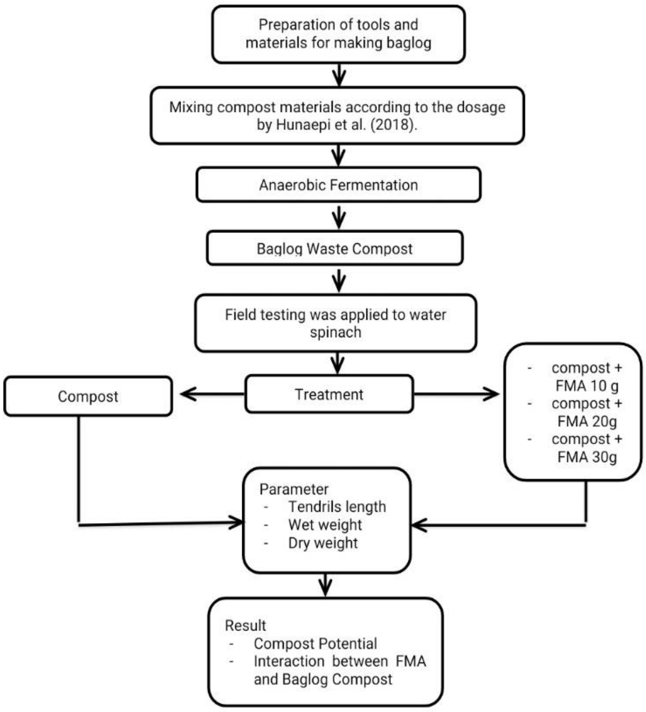

Figure 6. Research Flowchart

3. RESULT AND DISCUSSION

Baglog oyster mushroom waste that has been composted has better physical characteristics. The physical characteristics investigated are the crumbly compost's texture, the compost's smell resembling the soil or the smell of humus, and the color brownish black. These observations tested Baglog mushroom compost by adding arbuscular mycorrhizal fungi on groundwater spinach (Ipomoea reptans Poir) growth. From these tests produce the following data;

Tendrils length

The results of measuring the length of water spinach tendrils (Ipomoea reptans Poir) at 1, 2, and 3 MST, through tests of variance and DMRT, were not significantly different. This can be seen in table 1 below

Table 1: Application of Baglog waste compost by adding FMA on the tendrils length of the groundwater spinach (Ipomoea reptans Poir)

Treatment	The average value of stem diameter (cm) at MST plant age		
	1	**2**	**3**
Compost	14.000[a]	19.667 a	25.667 a
Compost + FMA (10g)	18.333 [a]	23.000 [a]	30.000 [a]
Compost + FMA (20g)	18.333 [a]	24.000 [a]	29.333 [a]
Compost + FMA (20g)	14.333 [a]	25.667 [a]	28.667 [a]

Growth in length of water spinach tendrils (Ipomoea reptans Poir) at 1, 2, and 3 WAP with compost, compost + FMA 10g, compost + FMA 20g, and compost + FMA 30g treatment had results that were not significantly different.

Good compost can be identified through physical properties, such as research by Suwatanti & Widiyaningrum (2017), which produces a brownish to brownish-black color, is odorless, has a fine texture, and decomposes like ground grains according to SNI criteria Number SNI 19-7030-2004. The Baglog waste compost used in this study conforms to the composting outcome that has been carried out (figure 5). The physical quality of Baglog waste compost is influenced by the organic matter contained in the composting material and then the quality of the microbes in degrading the organic matter. It means that Baglog mushroom waste compost has a relatively high availability of the main nutrients N, P, and

K as a planting medium. Anif et al. (2002) mention in their research that the organic matter will cause the soil's color to turn brown to brownish black, affect the soil's physical properties, high cationic ability, and the availability of nutrients is quite high.

The interaction between Baglog waste compost and FMA in this study has not had a significant effect. This is because Baglog waste compost has not been fully able to develop the level of colonialization of FMA, although it still has potential and requires more time. FMA plays a role in helping plants to capture nutrients such as phosphorus, a soil micronutrient, and plays an important role in the initial colonization of soil by plants (*Brundret et al*. 1999). Baglog waste compost and FMA can interact for plant growth but still require soil as the main medium so that FMA can colonize roots quickly. FMA combined with compost waste without soil media requires a relatively long inoculation time. Prayudyaningsih & Sari (2016), in their research, resulted in the high growth of teak seedlings. The combination of FMA and compost had no significant effect. Still, the effect of FMA and compost individually was significantly different. Suwarniati (2014, in her research combining organic fertilizers and FMA on sun plants, produced a significant difference in plant height at 40 HST, and the application of FMA was not significantly different at 20 HST.

The growth of tendril length is closely related to the element Nitrogen (N) content which can stimulate overall plant growth, especially vegetative growth such as stem elongation (Pamuji et al., 2018). It can be assumed that the N element contained in Baglog compost organic matter is available for growth even though it has not been through laboratory tests. It was proven in the growth of vine length that the compost treatment without FMA at the age of 1, 2, and 3 WAP was still able to grow well even without adding FMA.

The best combination treatment of Baglog mushroom compost and the addition of FMA was found in the combination of +10g FMA compost with an average value of 30,000 cm at 3 WAP. These results show that compost organic matter can interact with FMA even though it takes a relatively long time. (Simanungkalit et al., 2006) And Brundrett et al. (1999) state that FMA can decompose organic matter to absorb the nutrients plants needs to grow and develop.

Wet weight

Plant wet weight is the accumulated net yield which is influenced by the absorption of the amount of absorption of nutrients and water in the planting medium. Ahmad et al. (2016)state that the wet weight parameter plays a role in determining the quality of plant products. The results of wet weight measurements on groundwater spinach (Ipomoea reptan Poir) with various treatments are presented in table 2.

Table 2. Wet weight of groundwater spinach (Ipomea reptans Poir)

Treatment	Wet weight (g)
Compost	9.440 [a]
Compost + FMA (10g)	14.147 [a]
Compost + FMA (20g)	13.133 [a]
Compost + FMA (20g)	13.820 [a]

Analysis of variance and DMRT test, the treatment results showed that the treatment was not significantly different. This treatment proves that the mushroom Baglog compost treatment has the potential to stimulate plant growth because it contains the nutrients needed by plants even without the application of FMA. The planting medium used is

Baglog waste compost without using soil because Baglog compost waste is considered to have met the criteria as a planting medium. Anif et al. (2002) stated that the quality of compost could be known through the physical properties of compost, so it can be concluded that compost contains the main nutrients N, P, and K needed by plants.

The highest average wet weight (Kangkung Darat (Ipomea reptans Poir) was obtained from the compost +10 g FMA treatment, 14,147 g. This proves that applying mushroom Baglog compost as a planting medium with the addition of FMA increases the availability and absorption of nutrients. The results This study shows that a combination of Baglog mushroom compost and FMA is more recommended than using only Baglog compost without the combination of FMA (Table 2). The study results align with research by Prayudyaningsih & Sari (2016); teak seedlings inoculated with FMA and planted on media mixed with 5% and 15% compost had better biomass than non-inoculated seedlings or only planted on media mixed with compost.

FMA applied to mushroom Baglog compost media helps absorb nutrients that affect the development of plant organs, such as the formation of cellulose and thickening of cell walls which will affect the total wet weight of plants resulting from the photosynthesis process (Siddiqui et al., 2008). Compost is an organic fertilizer that is slowly released. Besides that, the nutrients in organic fertilizer are lower than inorganic fertilizers, so plants with a short harvest period cannot be utilized as fully as possible, considering groundwater spinach (Ipomoea reptan Poir) has a harvest time of around ± 25 days only. Parallel to Kresnatita et al. (2013) study, they resulted in the use of inorganic fertilizers increased the growth and yield of sweet corn plants, where the yields achieved increased by 114.8% compared to the treatment of organic fertilizers, which produced 5.76 tonnes/ha.

The wet weight of the plant is directly proportional to the dry weight of the plant or biomass. The main effect of mycorrhiza is to increase the uptake of phosphate elements from the soil. Hence, it affects the photosynthesis rate and stimulates new leaf formation resulting in increased biomass (Rewald et al., 2015).

Dry Weight

Stove dry weight is an observation of the weight of all plant parts in the form of roots, stems, and leaves. The analysis of the effect of adding mushroom Baglog compost with the addition of FMA on the dry weight of groundwater spinach (Ipomoea reptans Poir) showed no significant effect. The results of weighing dry weight can be seen in table 3.

Table 3. Dry weight of ground kale *(Ipomoea reptans* Poir)

Treatment	Dry weight (g)
A0	0.7933 [a]
A1	1.1200 [a]
A2	1.0567 [a]
A3	1.0700 [a]

After carrying out the variance test, the results of observations continued with the DMRT test showed that treatments a0, a1, a2, and a3 had an average total weight that was not real. However, as seen from the average number, a0 has the lowest number compared to the average treatment a1, a2, and a3. Treatment a0 only applies compost as a planting medium, but treatments a1, a2, and a3 use a combination of Baglog compost and FMA.

The above data shows that the nutrient content contained in mushroom Baglog can be utilized by land kale plants (Ipomoea reptans Poir) to form cell numbers. Sobari, et al. (2022) stated that Baglog compost contains more macronutrients than compost from sheep manure. The mixed material for making mushroom Baglog is like sawdust which contains N, P, and K so that it can be used as a medium for plant growth

(Purwanto dan Nugroho, 2015). Element K in mushroom Baglog compost plays a role in forming carbohydrates in plants to increase dry weight.

The addition of FMA increased the dry weight of water spinach plants (Ipomoea reptans Poir), although the value was not significantly different in table 3. The interaction between P elements in mushroom Baglog compost and FMA can experience nutrient deficiencies which are proven to increase dry weight. The best interaction is in treatment a1 with a value of 1.1200. Plants with a greater dry weight mean high and fast productivity and development of tissue cells.

Figure. 7 Research Result

Element P is very important for plant growth to increase plant dry weight. However, element P is difficult for plants to absorb. FMA can increase nutrient uptake by forming external hyphae to reach P nutrients further from the roots and change the biochemical and physiological conditions of the rhizosphere to increase the accessibility of P into the roots to absorb nutrients. This result aligns with Rosita et al. (2017) research, and they reveal FMA was able to interact well with element P in increasing the dry weight of pepper plants (*Eucalyptus deglupta* Blume).

4. CONCLUSION

The study's results with the parameters measuring the length of the vines, fresh weight, and dry weight of the plants in all treatments showed no significant difference. Still, the compost treatment had a lower value when viewed from the average value of all treatments. Treatment of Baglog waste compost without adding FMA can be used as a planting medium or as organic fertilizer. Additionally, adding FMA on mushroom Baglog waste compost is recommended because it can potentially increase plants' growth rate even though it takes longer to inoculate FMA on the host. The best interaction between Baglog mushroom waste compost and FMA was the treatment of compost + 10 g of FMA on the parameters of vine length, wet weight, and dry weight, and ground kale plants (*Ipomoea reptans* Poir).

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REFERENCE

Agustin, W., Ilyas, S., Budi, S. W., Anas, I., & Suwarno, F. C. (2010). Inokulasi fungi mikoriza arbuskula (FMA) dan pemupukan P untuk meningkatkan hasil dan mutu benih cabai (Capsicum annuum L.). *J. Agron. Indonesia*, *38*(2), 218–224. https://doi.org/https://doi.org/10.24831/jai.v38i3.14967

Ahmad, F., Fathurrahman, & Bahrudin. (2016). Pengaruh media dan interval pemupukan terhadap pertumbuhan vigor cengkeh (Syzygum aromaticum L.). *E-Jurnal Mitra Sains*, *4*(4), 36–47.

Anif, S., Rahayu, T., & Faatih, M. (2002). Pemanfaatan limbah tomat sebagai pengganti EM-4 pada proses pengomposan sampah organik. *Jurnal Penelitian Sains Dan Teknologi*, *8*(2), 119–143.

Burhan, B., Riski, D., Sekolah, P., Perkebunan, T., Pagar, J. Z., Rajabasa, A., & Lampung, K. B. (2018). Pengaruh komposisi kompos Baglog terhadap pertumbuhan dan Hasil tanaman bawang merah (Allium ascalonicum L.). *Jurnal Penelitian Pertanian Terapan*, *18*(2), 25. https://doi.org/10.25181/jppt.v18i2.824

Brundrett MC., Abbott L.K., Jassper D.A.1999. Comparison of the effectiveness and specificity of different isolation procedures Research. 8 :305–314

Hasbiah, A. W., Yustiani, Y. M., & Desiriani, N. S. (2018). Pengomposan limbah Baglog jamur tiram secara anaerobik dengan variasi aktivator, kotoran kambing dan urea di Desa Cisarua, Lembang Kabupaten Bandung Barat. *Proceeding of Community Development*, *1*, 205. https://doi.org/10.30874/comdev.2017.27

Hunaepi, H., Dharawibawa, I. D., Asy'ari, M., Samsuri, T., & Mirawati, B. (2018). Pengolahan limbah Baglog jamur tiram menjadi pupuk organik komersil. *Jurnal SOLMA*, *7*(2), 277–288. https://doi.org/10.29405/solma.v7i2.1392

Jumar J, Saputra RA, Wafiuddin MS. 2020. Teknologi Pengomposan Limbah Kulit Durian Menggunakan EM4. EnviroScienteae. 16(2):241–251.

Kresnatita, S., Koesriharti, & Santoso, M. (2013). Pengaruh rabuk organik terhadap pertumbuhan dan hasil tanaman jagung manis. *Indonesian Green Technology Journal*, *2*(1), 8–17.

Pamuji, A., Pratomo, B., & Manurung, S. (2018). Pengaruh kompos limbah Baglog jamur tiram dan urin sapi yang difermentasi terhadap pertumbuhan bibit kelapa sawit (Elaeis guineensis Jacq.) di Pre Nursery. *Agroprimatech*, *1*(2), 44–56.

Prayudyaningsih, R., & Sari, R. (2016). Aplikasi fungi mikoriza arbuskula (FMA) dan kompos untuk meningkatkan aplikasi fungi mikoriza arbuskula (FMA) dan kompos untuk meningkatkan pertumbuhan semai jati (Tectona grandis linn.f.) pada media tanah bekas tambang kapur. *Jurnal Penelitian Kehutanan Wallacea*, *5*(1), 37–46. www.jurnal.balithutmakassar.org

Putri, K. A., Jumar, J., & Saputra, R. A. (2022). Evaluasi kualitas kompos limbah Baglog jamur tiram berbasis Standar nasional Indonesia dan uji perkecambahan benih pada tanah sulfat masam. *Agrotechnology Research Journal*, *6*(1), 8–15. https://doi.org/10.20961/agrotechresj.v6i1.51272

Putri, R. B., Sulistyo, T. D., & Anwar, C. (2017). Penggunaan limbah Baglog tiram dan jenis nutrisi terhadap pakcoy pada hidroponik substrat. *Agrosains*, *19*(1), 28–33.

Ramadhan, M. F., Hidayat, C., & Hasani, S. (2015). Pengaruh Aplikasi Ragam Bahan Organik dan FMA terhadap Pertumbuhan dan Hasil Tanaman Cabai (Capsicum annum L.) Varietas Landung pada Tanah Pasca Galian C. *Jurnal Agro*, *2*(2), 50–57. https://doi.org/10.15575/438

Purwanto A.M., dan Nugroho B. 2015. Efektifitas Limbah Media Tanam Jamur Tiram Sebagai Pupuk Organic Pada Budidaya Bawang Merah Ditanah Ultisol. *Agritech*. 17(2): 97-105.

Rewald, B., Holzer, L., & Göransson, H. (2015). Arbuscular mycorrhiza inoculum reduces root respiration and improves biomass accumulation of salt-stressed Ulmus glabra seedlings. *Urban Forestry and Urban Greening*, *14*(2), 432–437. https://doi.org/10.1016/j.ufug.2015.04.011

Rosita, I., Wilarso B, S., & Wulandari, A. S. (2017). Efektivitas fungi mikoriza arbuskula dan pupuk P terhadap pertumbuhan bibit leda (Eucalyptus deglupta Blume) di media tanah pasca tambang. *Jurnal Silvikultur Tropika*, *08*(2), 96–102.

Siddiqui, Z. A., Akhtar, Mohd. S., & Futai, K. (2008). Mycorrhizae: Sustainable Agriculture and Forestry. In *Mycorrhizae: Sustainable Agriculture and Forestry* (Vol. 1, pp. 1–359). Springer Netherlands. https://doi.org/10.1007/978-1-4020-8770-7_3

Simanungkalit, R. D. M., Suriadikarta, D. A., Saraswati, R., Setyorini, D., & Hartatik, W. (2006). *Pupuk Organik dan Pupuk Hayati* (Vol. 1). Balai Besar Litbang Sumberdaya Lahan Pertanian, Badan Penelitian dan Pengembangan Pertanian.

Sobari, E., M.A. Hadi, dan F.Fathurohman. 2022. Respon Pemberian Kompos Limbah Baglog Jamur dan Pupuk Kandang Domba Terhadap Pertumbuhan dan Hasil Kacang Tanah (Arachis hypogaea L.). Industrial Research Workshop

And National Seminar. Polban. IRONS diakses tanggal 13/12/2022

Suwarniati. (2014). Pengaruh FMA dan pupuk organik terhadap sifat kimia tanah dan pertumbuhan bunga matahari. *Jurnal Biotik*, *2*(1), 1–76.

Suwatanti, E. P. S., & Widiyaningrum, P. (2017). Pemanfaatan MOL limbah sayur pada proses pembuatan kompos. *Jurnal MIPA*, *40*(1), 1–6. http://journal.unnes.ac.id/nju/index.php/JM

Upadhyay, S. K., Sahani, R. K., & Srivastava, N. K. (2021). Microbial contamination on oyster mushroom after harvest and their management using some essential oils in Azamgarh (UP) India. *FLORA AND FAUNA*, *27*(1), 68–72. https://doi.org/10.33451/florafauna.v27i1pp68-72