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The Impact of Providing Mycorrhiza and Palm Oil Waste Planting Media on the Growth of Shallot Plants (*Allium ascalonicum*)

Dampak Dari Pemberian Pemberian Mikoriza dan Media Tanam Limbah Kelapa Sawit Terhadap Pertumbuhan Tanaman Bawang Merah (Allium ascalonicum)

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Abstract
Improving shallot cultivation techniques needs to be done by providing mycorrhiza and palm oil waste as a mixture of planting media for shallot growth and production. The aim of this experiment was to determine the effect of mycorrhiza, planting media, the interaction of providing mycorrhiza and shallot production in this research using a Randomized Block Design with a factorial pattern. The first factor is mycorrhizal inoculation consisting of three levels: no mycorrhizal inoculation, 50 and 100 grams of mycorrhizal inoculant/plant. The second factor is the planting media with four levels of planting media: Top soil, Top soil + EFB (1:1), top soil + fiber (1:1), and Top soil + mud (1:1). The research results showed that growing media had a significant effect on the number of shallot leaves. Top soil + mud planting media is the best treatment for growth and. Providing mycorrhiza, the interaction of providing mycorrhiza and planting media did not have a significant effect on plant height and number of shallot seedlings.
Keywords: Shallots, Mycorrhiza Inoculation, Planting Media, Production, Waste, Production

Abstrak
Peningkatan teknik budidaya bawang merah perlu dilakukan dengan memberikan mikoriza dan limbah kelapa sawit sebagai campuran media tanam untuk pertumbuhan dan produksi bawang merah. Tujuan dari percobaan ini adalah untuk menentukan pengaruh mikoriza, media tanam, interaksi pemberian mikoriza dan produksi bawang merah dalam penelitian ini adalah Rancangan Acak Kelompok dengan pola faktorial. Faktor pertama adalah inokulasi mikoriza terdiri dari tiga taraf : tanpa inokulasi mikoriza, inokulan mikoriza 50 dan 100 gram/tanaman. Faktor kedua adalah media tanam dengan empat tingkatan media tanam: Top soil, Top tanah + TKKS (1:1), Tanah pucuk + serat (1:1), dan Tanah pucuk + lumpur (1:1). Hasil penelitian menunjukkan bahwa media berkembang berpengaruh nyata terhadap jumlah daun bawang merah. Media tanam Top soil + lumpur merupakan perlakuan terbaik untuk pertumbuhan dan. Pemberian mikoriza, interaksi pemberian mikoriza dan media tanam tidak berpengaruh nyata terhadap tinggi tanaman dan jumlah anakan bawang merah.
Kata Kunci : Bawang Merah, Inokulasi Mikoriza, Media Tanam, Produksi, Limbah, Produksi

PENDAHULUAN

Palm Empty Bunches a by-product of palm oil production which can be used as compost in large quantities to improve the chemical, biological and physical properties of the ultisol soil layer. The nutritional composition of TKKS compost is as follows: N-Total: 6.79 percent, P2O5: 3.13%, K2O: 8.33 percent, and pH 9.59. (Toiby et al., 2015).

As an organic material that has potential as a planting medium, palm fruit fiber is still used as an energy source in the palm oil industry. The dry weight percentages of nitrogen, phosphorus, potassium, magnesium, and calcium in palm fruit fiber are low: 0.32%, 0.12%, 0.7%, and 0.11%, respectively. Providing fertilizer to Brambang Lanang seeds encourages healthy seedling development

(Apriyanto et al, 2019).

Sludge produced from anaerobic pond II in WWTP contains the following nutrients: C-Organic 5.52%, C/N 30.81, N-total 0.18%, P-total 0.07%, K 0.06%, COD 10082 mg/l, BOD 7333 mg/l, TSS 7928 mg/l and pH value 6.1 (Nursanti, 2013).

Shallots (Allium ascalonicum L.) have various uses and are the main vegetable commodity in Indonesia. Shallots are known to contain carbohydrates, sugar, fatty acids, protein and other nutrients that the human body needs; Shallots also function as a food flavoring and traditional medicine ingredient. (Waluyo and Sinaga, 2015).

The ecological and agronomic role of mycorrhiza, which is a symbiosis of roots with plants, is very important for plant growth. Some of these functions include increasing soil aggregates, encouraging the growth of soil microorganisms which are good for host plant growth, increasing the uptake of soil nutrients such as phosphorus (P) and others, and increasing adaptation to drought. while preventing diseases caused by root knot fungi (Indriani et al, 2011).

MATERIALS AND METHODS

Research Location

This research was carried out on the Agricultural Practice Field of the Indonesian Community Development University, Medan, from June to September 2024 with a height of approximately 29 meters above sea level.

Research Tools and Materials

The tools used were 5 kg polybags, hoes, measuring tapes, scales, plastic ropes, sieves, boards, machetes, knives, gembors, plywood, scissors, paranets, bamboo, cameras and stationery. The materials used are red onion bulbs of the Maja Cipanas variety, topsoil, EFB, fiber, sludge and water.

Research methods

The research used a factorial randomized block design (RAK) with 2 treatment factors, each treatment being repeated 3 times. The first factor is that mycorrhiza treatment consists of 3 levels, namely; S0 = 0 grams/plant S1 = 50 grams/plant S2 = 100 grams/plant, Second Factor Oil Palm Waste Mixed Media consists of 4 levels, namely; T0 = Top Soil T1 = Top Soil + Tkks T2 = Top Soil + Fiber T3 = Top Soil + Sludge.

RESULTS AND DISCUSSION

Plant Height

The results of the test for differences in average height of shallot plants at the age of 12 WAP can be seen in Table 1 which includes mycorrhizal treatment and palm oil waste.

Table 1. Test results for average shallot plant height due to mycorrhizal treatment and palm oil waste at 12 weeks after planting (WAP).

Mycorrhiza	Palm Oil Waste				Average
	T0 (Control)	T1(Empty Palm Oil Bunches)	T2 (Fiber)	T3(Sludge)	
S0(Kontrol)	34,43	32,80	33,23	37,70	34,54
S1(50gr)	30,97	34,23	35,23	41,67	35,53
S2(100gr)	33,90	36,17	37,40	38,33	36,45
Average	33,1b	34,4 b	35,29 ab	39,23 a	

Note: Means followed by different letters indicate significant differences in the 5% DMRT test. Having no symbols = not being real."

The results of Table 1 above show that the treatment of palm oil waste T3 is significantly different from T2 (Fiber) and T1 (Tkks) but is not significantly different from T0 (Control). The best treatment T3 (Sludge) is 39.23 cm.

Allegedly because Sawir Valley sludge has sufficient nutrient content and also has the ability to increase soil fertility. Apart from that, sludge is believed to help the growth of shallot plants because of the large number of beneficial macro nutrients. Nitrogen, phosphorus, potassium, magnesium, and calcium are all present in fairly high concentrations in mud, according to Assadiq (2015).

Wet Weight of Tubers Per Plot

The results of the average difference test of the effect of mycorrhizal treatment and palm waste planting material on the wet weight of tubers per shallot plant plot at 12 WAP, as well as their interactions are in Table 2.

Table 2. Test results of the average wet weight of tubers per shallot plot due to the treatment of oil palm waste planting media.

Mycorrhiza	Palm Oil Waste				Average
	T0 (Control)	T1 (Empty Palm Oil Bunches)	T2 (Fiber)	T3 (Sludge)	
S0 (Control)	18.58 d	20.06 cd	18.11 de	30.02 b	21.69 b
S1(50gr)	21.62 cd	29.63 b	24.96 bcd	37.50 a	28.43 a
S2(100gr)	17.24 e	19.03 d	21.25 cd	25.53 bcd	20.76 b
Average	19.15 c	22.91 b	21.44 bc	31.02 a	

Note: Means followed by different letters indicate significant differences in the 5% DMRT test. Having no symbols = not being real."

The results of Table 2. above show that the S1 mycorrhizal treatment was significantly different from all treatments and the S1 treatment (50 gr) showed the highest wet weight of tubers per plot, namely 28.43 gr. The T3 palm waste treatment was significantly different from all T1 (Tkks), T2 (Fiber) and T0 (Control) treatments. The best treatment T3 (Sludge) is 31.02 gr.

This is believed to be caused by the presence of mycorrhizal fungi which help absorb nutrients and may play a role in the growth and production of shallot plants—especially in the wet weight of bulbs per plot by absorbing macro nutrients such as N, P, and K. Nitrogen fertilizer helps plants make protein , which is important for cell division, growth and development of vegetative tissue as well as larger cells and cell enlargement are also supporting factors in increasing the production of bulb weight per plot from the results of photosynthesis (Fitriana, et al 2012). Anisyah, et al (2014) said that K nutrient influences production, where K nutrient is also a factor that really supports plants in the process of photosynthesis for plant production, especially the wet weight of tubers. In palm oil waste, sludge contains macro nutrients which influence the increase in shallot plant production, apart from that, sludge also influences the texture, structure, porosity, stability, color consistency and temperature of the soil which plays a role in plant root activity based on the role of each available nutrient. can be absorbed by plant roots to absorb nutrients (Hakim et al., 1986). Apart from that, Br Manik (2018), the use of mud as an organic fertilizer helps unite soil particles, prevents compaction, and increases water binding, all of which are beneficial for the development and formation of shallot bulbs.

Root Volume

The results of the average difference test of mycorrhizal treatment and tankos

planting media on the root volume of shallot plants at the age of 12 WAP (Table 3)

Table 3. Average test results for shallot root volume due to treatment with palm waste planting media at 12 weeks after planting (WAP)

Mycorrhiza	Palm Oil Waste				Average
	T0 (Control)	T1 (Empty Palm Oil Bunches)	T2 (Fiber)	T3 (Sludge)	
S0 (Control)	1,3	1,73	1,42	2,57	1,76
S1(50gr)	1,33	1,45	1,2	2	1,50
S2(100gr)	1,12	1,18	1,67	2,17	1,54
Average	1,25 c	1,45 b	1,43 b	2,24 a	

Note: Means followed by different letters indicate significant differences in the 5% DMRT test. Having no symbols = not being real."

The results of Table 3. above show that the T3 (sludge) palm waste treatment is significantly different from the T1 (tkks) and T0 (Control) treatments but is not significantly different from the T2 (fiber) treatment. The best treatment for T3 (Sludge) is 2.25 cm^3.This is thought to be due to the fact that plants are able to absorb macronutrients efficiently, and nitrogen plays an important role in photosynthesis. These cells continually produce new cells and expand existing cells, ensuring that the plant's vegetative organs develop to their full potential. Apart from that, as stated by Lingga and Marsono (2013), nitrogen primarily helps plant growth by encouraging the expansion of various parts, such as stems, branches and leaves. The nutrients phosphorus and potassium which are also found in mud are believed to have a significant influence on the growth of shallot plants, where the element phosphorus (P) functions in root formation, strengthening plant stems, and increasing yields thereby influencing root volume parameters and this is the basis for how The growth and production of onion plants has a significant effect because the nutrient absorption process goes well (Zaimah and Erma, 2012).

Degree of Root Infection

Laboratory data on the degree of root infection of shallot plants is presented in appendix 9. Data on the degree of root infection of shallot plants can be seen in table 7.

Table 4. Average percentage degree of root infection of shallot plants (%)

Mycorrhiza	Palm Oil Waste				Average
	T0 (Control)	T1 (Empty Palm Oil Bunches)	T2 (Fiber)	T3 (Sludge)	
S0(Control)	10	10	20	20	15
S1(50gr)	50	40	40	60	48
S2(100gr)	70	50	40	40	50
Average	43	33	33	40	

Table 4 above shows that the highest mycorrhizal treatment was S2 (100 gr), namely 50%. The highest T0 treatment for palm oil waste is 43%. The best interaction of S2T0

treatment (Mycorrhiza 100 gr + No palm waste) was 70%. This is thought to be due to the lack of symbiosis between the mycorrhiza and the palm oil waste planting medium, so it is supported by Harahap et al., (2014) that the planted mycorrhiza does not form the best relationship with its host, resulting in insufficient nutrient absorption; As a result, plants that grow from this condition also tend to have a relatively uniform height, so it is important to pay attention to the planting medium for mycorrhizal hosts because the right planting medium will maximize the association of mycorrhizae with plant roots such as the Sateria splendida grass plant which has the highest root colonization percentage of (97 %).

CONCLUSION

1. The best treatment with mycorrhiza produced a wet weight of 28.43 grams per S1 plot of shallots.
2. Palm oil waste affects shallot plant height and root volume, with T3 (Mud) as the optimum solution. This affects the production of shallot plants, fresh weight per plot, and T3 (Mud) treatment is the best treatment because the mycorrhiza inoculated with the host has a poor association, so that nutrient absorption is insufficient and plant height is similar.
3. There is a significant interaction between mycorrhizal treatment and palm oil waste on fresh weight per S1T3 plot (50 grams + Sludge), the best treatment interaction.

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