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Guidance and Training for Banana Farmers in Padang Tiji District to Make Trichoderma Sp from Various Sources

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Abstract:

The income of Padang Tiji farming community has been sufficient to support their families so that some of them send their children to college. But recently, because of the failure of their banana farming business due to Fusarium wilt disease, their lives have become difficult. Therefore, we, the teaching staff of the Faculty of Agriculture, took the initiative to carry out community service to help banana farmers in Meukee Village, Padang Tiji District. The community service is in the form of guidance and training in making Trichoderma Sp from several sources including: Bamboo roots and leaves and from fertile soil that is still original through a number of media, which began by training 5 core workers as pioneers, then with the following stages: (1) Taking Trichoderma Sp mother from various sources, (2) Cultivating it on PDA media to purify, (3) Cultivating again on Corn, rice and husk media and (4) Propagation on Corn and Husk media in a larger capacity so that the result is that each member of the farming group is able to develop their own trichoderma reaching 10 kg of media. This guidance was very successful because more than 80% of the members of the "Makmu Beusare" farmer group have been able to make trichoderma from various sources and media with the best source being a mixture of fertile soil, bamboo roots and leaves, while the best breeding media from a number of media used is rice husks. has been used on their banana plants to prevent Fusarium oxysporium wilt disease.

Keywords:
guidance and training; starter; banana; trichoderma; isolate

I. Introduction

Padang Tiji is one of the banana production centers in Aceh, which grows various types of bananas, namely wak bananas, gepok bananas, barangan bananas, ambon bananas, raja bananas and others. So many people consume bananas in various forms of snacks that the demand for bananas is always increasing, this condition certainly has a very significant impact on the income of banana farmers in Padang Tiji District. The income of Padang Tiji farming communities has so far been sufficient to support their families so that some of them send their children to college. Many farming communities in this area depend on their lives by growing bananas which cover an area of 0.5 hectares in a family, but recently their banana plants have been attacked by Fusarium wilt disease which has devastated their banana plantations, almost all banana varieties have been attacked by Fusarium wilt disease which on average results in death. However, at this time the disease can be prevented by administering the antagonist fungus Trichoderma. Trichoderma sp. is a soil saprophytic fungus that naturally attacks pathogenic fungi and is beneficial to plants. Trichoderma sp. able to parasitize plant pathogenic fungi and are antagonistic, because they have the ability to kill or inhibit the growth of other fungi. The use of biological control agents is one of the promising and environmentally safe plant pathogen control options, but until now these agents are still rare.

For several reasons above, we, the teaching staff of the Faculty of Agriculture, took the initiative to carry out community service to help banana farmers in Meukee Village, Padang Tiji District to guide and train how to make Trichoderma Sp biological agents so that these biological agents can be used to control Fusarium wilt disease in banana plant.

II. Review of Literature

Plant pathogen antagonistic agents are microorganisms that intervene in the activity of pathogens in causing disease, these agents cannot pursue hosts that have entered plant tissue, their effectiveness can be seen by the absence of the disease. The antagonistic process of Trichoderma sp. against soil-borne pathogens that work by parasitism, competition and antibiosis(Pasalo et al., 2022). Trichoderma sp. is one of the biological control agents that has been widely used to control plant pathogenic microbes (Suanda and Ratnari, 2015). Trichoderma sp. is a soil saprophytic fungus that naturally attacks pathogenic fungi and is beneficial to plants. Trichoderma sp. is able to parasitize plant pathogenic fungi and is antagonistic, because it has the ability to kill or inhibit the growth of other fungi. The mechanisms that occur in the soil by the activity of Trichoderma sp. are (1) competitors for space and nutrients, (2) antibiosis, namely releasing ethanol which is toxic to pathogens and (3) as a mycoparasite and is able to suppress the activity of pathogenic fungi. Effectiveness of Trichoderma sp. as a biological agent has been widely reported such as the results of research (Karim et al., 2020), that the administration of Trichoderma sp. is very effective in suppressing the development of Phytophthora palmivora disease in durian plants up to 99%.

The results of research (Bukhari and Safridar, 2018 a; BUKHARI and SAFRIDAR, 2018 b ; Bukhari & Safridar, 2020) the administration of Trichoderma Sp can control Fusarium wilt disease in banana plants. It was also reported that the application of Trichoderma sp. on tomato plants can reduce crop loss due to Fusarium wilt infection (Murad et al., 2016). Trichoderma sp. fungi are also able to act as biocontrol agents to control Erwinia sp. bacteria in Aloe vera (Erdiansyah and Anugerah, 2023). In addition to its ability as a biological agent, Trichoderma sp. is also widely used as a plant growth stimulator as expressed by (Muhibuddin et al., 2021)that the use of Trichoderma sp. as a stimulator in composting organic materials can provide good effectiveness in increasing corn production. According (Bubici et al., 2019) Trichoderma sp. can also act as a decomposing fungus, biological fertilizer and as a bioconditioner for seeds. Effectiveness of Several Media (Mukarlina et al., 2013). Trichoderma sp. can grow on various media. The media that is often used today for the propagation of Trichoderma sp. is rice and corn media, but these media for mass propagation require higher costs (Gusnawaty et al., 2017). For this reason, a new alternative media is needed that can be used as a culture medium that has low economic value, sufficient nutrition, is effective, easy to obtain, has abundant raw material availability and can be utilized by Trichoderma sp. to grow and develop.

III. Research Method

The method for making trichoderma Sp during community service implementation uses a Completely Randomized Design in a factorial pattern with different source sources and media through the following stages:

1. Taking the first isolate of natural Trichoderma from bamboo roots or the top layer of soil from fertile unused land or dry corn cobs that have been overgrown with trichoderma sp and then cultured on corn media that has been steamed for 20 minutes in a glass tube that has been washed with alcohol and rinsed with distilled water for 1

week, then identified against the growing trichoderma, identification is carried out on the difference in the color of the isolates formed, each isolate is then refreshed on PDA media for three weeks.

2. The corn media that has been steamed for 15 minutes is then air-dried, then weighed 30 g to be put into a bottle, then covered with aluminum foil. Furthermore, 1 (one) colony with a diameter of 5 mm is taken and inoculated with Trichoderma sp fungi into the rice bran media for observation.
3. Observations were made since the inoculation of Trichoderma sp. until the media was filled with Trichoderma sp. Approximately 2 weeks, then 10 g of culture was mixed with 100 g of corn flour for each package. 4. Several variables observed in this practice were: Trichoderma sp. incubation period, percentage of Trichoderma sp. growth, difference in media weight before and after Trichoderma sp. inoculation, and the number of spores/conidia produced by Trichoderma sp. on the propagation media to calculate the Conodia Density. 5. Trichoderma sp. incubation period, namely the time required for Trichoderma sp. to reproduce on each media (time since Trichoderma sp. inoculation on the media until Trichoderma sp. begins to reproduce). The percentage of Trichoderma sp. growth on the propagation media is based on the percentage of the area of the media covered by Trichoderma sp. seen visually. The difference in media weight before and after Trichoderma sp. inoculation is calculated based on the weight of the media before Trichoderma sp. inoculation minus the weight of the media after Trichoderma sp. reproduce. The number of spores/conidia produced by Trichoderma sp. on each propagation medium used to calculate the Conidia Density/mg calculated using the following formula.

$$K = \frac{t \; x \; p}{0.25 \; x \; n \text{ x } 106}$$

Description: K = Conidia density (conidia/mg)
P = Dilution factor
t = Number of conidia
n = Number of boxes observed
0.25 = Constant
106 = Conidia density constant

IV. Results and Discussion

The mother plant was taken from bamboo roots, original fertile soil and bamboo leaf itter that had fallen to the ground. Meanwhile, the mother plant from the source of empty corn cobs was not available at the PKM Location. From the incubation results of the three mother plant sources used when purified on PDA media, it was seen that there were differences in the percentage of mother plant growth between sources, the difference in isolate weight during the 2-week incubation period, the length of the incubation period and the density of conidia on each type of propagation media. These differences are presented in Tables 1, 2, 3 and 4.

From Table 1, it can be seen that there are differences in the percentage of growth in each incubation period, where in all incubation periods the growth of Trichoderma is better when the three source sources are mixed, but it does not appear to be much different between the sources of fertile soil, bamboo leaves and a mixture of the three source sources in incubation periods 1 and 1. 2 weeks, but in the 3 week period it was seen that the mixed

incubation source showed better growth of isolates than the other three sources and was very different from isolates originating from bamboo roots.

Table 1. Percentage of Isolate Growth on PDA Media (%) at each incubation period from Various Source

o	Starter Souce	Incubation Period (1 M)	Incubation Period (2 M)	Incubation Period (3 M)
	Bamboo Root	32 a	62 a	78 a
	Original fertile land	40 bc	65 a	92 bc
	Bamboo folio	37 ab	64 a	90 b
	Root + Soil + Bamboo folio	45 c	70 b	95 c
	BNJ 0,05	5,2	3,1	4,3

Table 2. Average Difference in Weight of Isolates for 2 Weeks (g)

o	Starter Souce	Before incubation (BI) Bottle Weight+ Isolate	Incubation Period (1 M) Wight Difference With BI	Incubation Period (2 M) Wight Difference With BI
	Bamboo Root	500	23,67 a	57,67 a
	Original fertile land	500	31,33 b	76,00 b
	Bamboo folio	500	32,00 b	76,33 b
	Root + Soil + Bamboo folio	500	30,67 b	75,00 b
	BNJ 0,05	-	6,22	10,3

From Table 2, it can be seen that there were differences in the weight of isolates from each source in each incubation period, where in all incubation periods, the average weight of trichoderma isolates from three sources, namely fertile soil, bamboo leaves and a mixture of the three sources, looked much heavier than bamboo roots. However, there was no visible difference in weight between the fertile soil source, bamboo leaves and the mixture of the three root sources in the two incubation periods observed.

From Table 3 it can be seen that there are differences in the length of the incubation period for the four source sources used. The longest average incubation period for isolates was seen in the bamboo root source, namely 13.75 days, followed by fertile soil 12.5; 11.84 and a mixture of bamboo roots, fertile soil and bamboo leaves had an average incubation time of isolates of 11.50 days, which is a source of the culprit with a shorter incubation period. Meanwhile, the influence of the media on the length of incubation is also more visible, PDA is a culture medium with a longer average incubation of 22.25, but this media is very good for use as a purification medium. Meanwhile, the other three media showed an average incubation period that was not much different from the incubation period for rice, corn and husk media, which were 9.33; 9.08 and 8.92 days.

Table 3. Average Length of Incubation Period to Cover Surface Area on All Types of Media (Days)

o	Starter Souce	PDA Media	Rice Media	Corn Media	Rice husks Media	Average
	Bamboo Root	24,00	10,67	10,33	10,00	13,75 b
	Original fertile	22,67	9,33	9,00	9,00	12,50 ab

	land					
	Bamboo folio	21,33	8,67	8,67	8,67	11,84 a
	Root + Soil + Bamboo folio	21,00	8,67	8,33	8,00	11,50 a
	Average	22,25 b	9,33 a	9,08 a	8,92 a	-

The best combination for the length of the incubation period to cover the surface area of all types of media is a mixture of root sources, fertile soil and bamboo leaves, this combination can fill the media in just 8 days. So it can be said that a better source for producing trichoderma is a mixture of roots, fertile soil and bamboo leaves with rice husk as a breeding medium.

Table 4. Conodia Density on each Type of Propagation Media (conadia/mg)

	Starter Souce	Rice Media	Corn Media	Rice husks Media
	Bamboo Root	35,6 x 10^8 a	32,4 x 10^8 a	72,9 x 10^8 a
	Original fertile land	39,8 x 10^8 ab	38,5 x 10^8 b	79,7 x 10^8 ab
	Bamboo folio	38,3 x 10^8 ab	37,2 x 10^8 ab	82,9 x 10^8 b
	Root + Soil + Bamboo folio	41,6 x 10^8 b	38,4 x 10^8 b	85,9 x 10^8 b
	BNJ 0,05	5,3 x 10^8	5,8 x 10^8	6,9 x 10^8

From Table 4, it can be seen that there are differences in the density of conodia from various source sources when cultured on several types of media, the density of conodia is higher on the sources taken from roots, fertile soil and bamboo leaves with density values on each medium respectively 41 .6 x 10^8; 38.4 x 10^8 and 85.9 x 10^8. Meanwhile, the lowest conodia density was shown by the bamboo root source which showed a conodia density of only 35.6 x 10^8 respectively; 32.4 x 10^8 and 72.9 x 10^8. Differences in conodia density were also seen in incubations with different types of media, where denser conadia were found in culture media that used husks. The results of this research are in line with (Gusnawaty et al., 2017). The best combination of root source and type of media is also shown by a mixture of roots, fertile soil and bamboo leaves with rice husk culture media.

V. Conclusion

5.1 Conclusion

1. The best source of starter is a mixture of bamboo roots, fertile native soil and bamboo leaves.
2. The best culture medium to use is rice husks.
3. The best combination of root source and type of media is a mixture of roots, fertile soil and bamboo leaves with rice husk culture media.

5.2 Suggestion

1. It is better to collect trichoderma naturally using a bamboo box, without sterilizing it with alcohol. When sterilized with alcohol, even though it has been rinsed several times, trichoderma still does not appear.
2. Innovation technology obtained from universities, such as making new trichoderma, can be applied to farming communities by simplifying it first, such as an autoclave that can be replaced with a steamer.

3. For the sake of effectiveness and benefits from PKM, training must be carried out in stages, namely by selecting several creative young people to be trained as pioneers who can later be used directly to help implement PKM

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