

## Management of “Moler” Disease of Shallot with Biomanci Fertilizer

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### ABSTRACT

Shallots are often infected by *Fusarium basal rot* (local name: Moler disease), generated by the soil-borne fungus, *Fusarium oxysporum f. sp. cepae*. Start from the 35-45 days after planting was a vulnerable time for shallot on its disease. However, the infection process can start more early on susceptible seed. Study aims to understand the effectivity of mixture of Indian Bael, Local name Maja fruit (*Aegle marmelos*) and rabbit urine (Biomanci) were used as organic fertilizer and its capability to control Moler disease. Results showed that biomanci fertilizers on all treatments had no effect on the severity and incidence of plant diseases. Although there was a decrease in severity in biomanci treatment 15 and 20% at 6 weeks but it was not significant. The increase in disease severity was triggered by favorable weather for the development of the disease, a high rainfall and by the arrival of flooding at the study site. As a result, the AUDPC value which is in the range > 250 indicates that the plant was at a vulnerable level of resistance. Disease suppression efficacy was 12-18% means that biomanci was less effective in controlling Moler disease. It was concluded that although biomanci can be used as a biopesticide, in this study biomanci acts more as a fertilizer than as a biopesticide in blue Lancor variety, which is susceptible shallot, with a small disease suppression efficacy value of 12.03%.

**Keywords:** biopesticide, *Fusarium basal rot*, maja fruit,

### INTRODUCTION

*Fusarium oxysporum f. sp. Cepae* (FOC) is a common pathogen that infects shallots. Locally it is called Moler or Fusarium Basal Rot Disease (FBR) (Saputri et al., 2018). It is a major and significant soil-borne fungus (Degani et al., 2021). That is a worldwide disease in onion-growing areas, causing severe yield losses in the field either on onion bulbs' infection after harvesting (Arshad et al., 2017).

The disease occurs in all stages of shallot growth (Supyani et al., 2021). The infection of the fungus causes pre- and post-emergence damping-off, root rot of older plants, and stem plate discoloration and basal rot of bulbs in the field and in storage (Etana et al., 2019). Nowadays FOC infection can be observed by decolonization or yellowing and the irregularly curved leaf. Indonesian farmers give the local name to these disease symptoms and based on the shape and irregular direction of the leaf. Based on Etana et al., (2019) the disease's symptoms in the field are usually localized in patches, more spotty appearances in the field and loss of growing regions.

Many control methods have been used to manage this disease (Hartati et al., 2022; Sintayehu, Sakhujia, et al., 2011; Sintayehu et al., 2014). However, based on Hirano & Arie (2006) the utilization of fungicide treatments at the seeds such as methoxyethyl, mercury chloride, carbendazim, maneb, carboxin, prochloraz, tebuconazole, benomyl reported fail to control the pathogen.

Utilizing beneficial microbes are used to reduce the effect of moler, like direct application of the bacterial and fungi (Hartati et al., 2022; Poromarto et al., 2022), volatile organic compounds of some microbes (Wang et al., 2019). Either utilizing the resistance variety (Sintayehu, Fininsa, et al., 2011) and utilizing of biological pesticides (Salamiah & Orbani, 2022). Moreover based on Sintayehu et al., (2014) the utilization of fertilizer from green manure can reduce the FOC infection.

The combination of the beneficial microbe and fertilizer i.e. bio fertilizer has a good opportunity for reducing the plant disease incidence and their severity (Antonius et al., 2021; Aumtong et al., 2023). Based on that fact, research aimed to use Biomanci. It was the fermented Maja Fruit (*Aegle marmelos*) and rabbit urine as fertilizer with combination of local beneficial microbe from the bamboo root.

### METHODOLOGY

#### Isolation and inoculation of *Fusarium oxysporum f. sp.*

*F. oxysporum f. sp. cepae* isolated from the infected shallot leaf and bulb. Isolation was followed by Sintayehu et al., (2014). FOC was obtained after the small samples of shallot infected bulb and leaf were surface-sterilized in 10% sodium hypochlorite (NaOCl) for 5 min, rinsed in sterile distilled water and. The sterile tissue was isolated on the PDA (Hi-



Media). Incubate at room temperature 25±2°C for 7 days. The isolated FOC a powdery colony with white bone color and without the aerial hyphae (Figure 1). Inculcation of FOC was undergo after 7 days after planting, with pouring 10<sup>6</sup> PFU/ml on 10 mL/bulb.

**Preparation of Maja Fruit Extract and Rabbit Urine Mixture (Biomanci)**

Biomanci is done by mixing Maja fruit filtrate and rabbit urine and adding string young bamboo shoot filtrate as a PGPR source (500 g of string bamboo and 2 kg of maja fruit). Then the mix add by 10 liters of water, 500 ml of coconut water and 2 liters of rabbit urine. After which the material stirred until homogeneous and close the container tightly so that air does not enter. Incubated anaerobically for 7-15 days and the product is ready for use.

The Crude Extract diluted to 5%, 10%, 15%, and 20%. It applied for 5x in each treatment pot. The volume for each plant in one applied is 10-15 ml, it poured on the planting media in the treatment whit in order : Bw+ 0% biomanci -Fo, Bw+0% biomanci -Fo, Bw+10% biomanci + Fo, Bw +10% biomanci -Fo, Bw + 20% biomanci +Fo, Bw+ 20% biomanci-Fo. Each treatment was repeated five times and one polybag contained four plants.

**Shallot planting**

Soil media preparation was carried out before planting by mixing husks, soil and manure in a ratio of 1:1:2.

The soil was sterilized steamed sterilizer. Polybags used for planting were 50 × 50 cm. Each polybag add by 3 g of SP-36 base fertilizer was added. Onion planting was done with a planting depth as high as the bulb. The seedling bulbs were cut 1/3 of the way with the tip of the bulb on top and the cut marks flat on the soil surface. The bulb was covered with thin soil and then watered with water to make the soil moist. The shallots used were the blue variety.

**Incidence and Severity of Moler Disease Observation**

The disease development observation began when symptoms appeared, and were observed weekly for 6 weeks. Observations were made on 10 leaves/plant clump from a total of 105 polybags x 4 plants. Disease severity (KP) was calculated by the formula:  $KP = \frac{\sum(n \times v)}{Z \times N} \times 100\%$ , and  $IP = \frac{\sum(n \times v)}{Z \times N}$  with KP, disease intensity expressed in %; n, number of plants per attack category; N, number of plants observed; v, scoring value of attack category; Z, scoring value of the highest attack category. Scoring was followed Nugroho, Hadiwiyono, & Sudadi (2015) on the Table 1.

**Disease Rate Observation**

Disease Reta observed by follow van der Plank formula:

$$X_t = X_0 \cdot e^{rt} \text{ atau } r = \frac{2,3}{t} \left( \log \frac{X_t}{X_0(1-X_0)} - \log \frac{X_t}{1-X_t} \right)$$

Where, X = proportion of disease at any time, X<sub>0</sub> = the amount of critical inoculum, r = average infection rate, t = time during which infection occurred



Figure 1. Isolated *F. oxysporum*

Table 1. Score of Moler Disease

SCORE	GEJALA
0	No Symptom Appear
1	0 < x ≤ 20% leaf part infected
2	20 < x ≤ 40% leaf part infected
3	40 < x ≤ 60% leaf part infected and bulb infected
4	>60% leaf part infected and bulb infected

**AUDPC**

The quantitative summary of disease intensity over time observed based on The AUDPC (Area Under Disease Progress Curve) count by Shaner and Finney formula

$$nAUDPC = \sum^n \left[ \frac{(Y_i + 1 + Y_{i+1})}{2} \right] [X_{i+1} - X_i]$$

Y<sub>i</sub> = Disease Severity (%) on the observation and X<sub>i</sub> = observation time (day(s))

**Disease Suppression Efficacy**

Disease Suppression Efficacy is the level of control effectiveness of a control technology against pathogens. The calculation of disease suppression efficacy can be calculated by the formula =  $\frac{Dic - Dib}{Dic} \times 100\%$ . Dic = AUDPC on the control treatment, Dib = AUDPC on the treatment.

**RESULT AND DISCUSSION**

Symptoms of molar disease are characterized by decay that occurs from the tip of the leaf to the base of the leaf, in addition to twisted leaves and a pale yellow color. Further symptoms cause shallot bulbs to rot, leading to death (Figure 2). Mild symptoms of molar disease appeared after

one week of treatment. At week 6, the plants appeared to be infected with all with resistance from susceptible to moderately susceptible to *F. oxysporum* although not significant (Figure 3).

The high AUDPC value and low disease suppression efficacy value indicate that the application of Biomanci in all treatments is less able to control *F. oxysporum*, the cause of molar disease in shallot plants (Table 2). Saputri *et al.*, (2018) stated that molar disease is difficult to control because the pathogen is soil borne and easily develops in wet soil moisture. Related with that, based on (Prakoso *et al.*, 2017) It is known that the Shallot Biru variety has a small bulb shape and does not have many layers on the bulb so that the fungus easily penetrates and causes the appearance of the fastest symptoms, so the blue variety is also included in the "heavy attack" category (44-77%).

This is contrary to Efendi (2020) who found that 20% Biomanci with 4 times application could reduce the severity of yellow curl disease in red chilies by 25.2% with a disease suppression effect of 5.30%. However, in Table 2 the effectiveness of control with the use of 20% Biomanci is 12.03% and it is higher than This means that the application of 20% Biomanci twice has not been able to reduce disease severity by 61% compared to other treatments. The smaller efficacy value of disease suppression means that using Biomanci is ineffective.



Figure 2. Molar Symptom on the each treatments. (a) control (b) biomanci 5%, (c) biomanci 10%, (d) biomanci 15%, (e) biomanci 20%

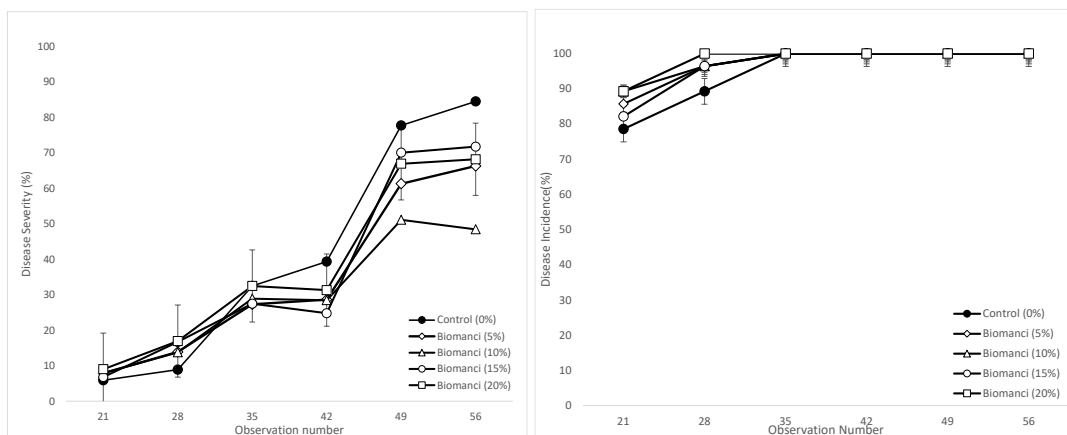


Figure 3. Disease Severity and Incidence Molar Disease after twice application of Biomanci

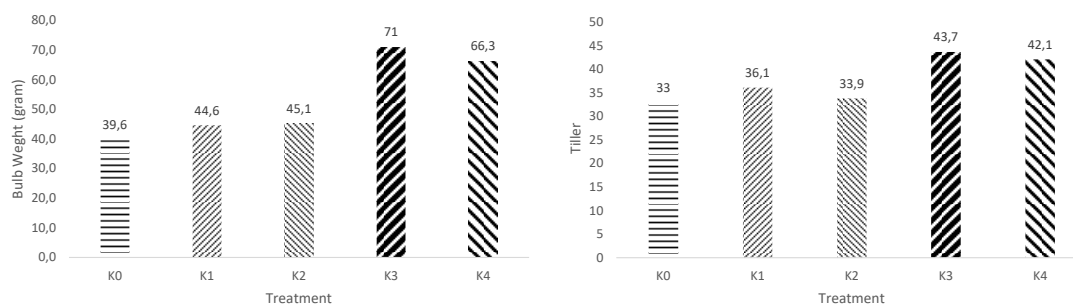


Figure 4. Weigh of shallot Bulb and tiller. (Right) the Mean number of tillers/repetition and (Left) mean wet weight of tubers/repetition. K0 (0% control), K1 (5% Biomanci), K2 (10% Biomanci), K3 (15% Biomanci), K4 (20% Biomanci)

Table 2. Infection Rate, AUDPC and Disease Suppression Efficacy

Treatment	Infection Rate (unit per hari)	Resistance Criteria (Van der Plank, 1963)	AUDPC	Disease Suppression Efficacy (%)
Control (0%)	0,1275 a	Suceptible	251,995 a	-
Biomanci (5%)	0,0894 b	Moderate	208,443 b	17,82
Biomanci (10%)	0,0883 b	Moderate	208,742 b	17,88
Biomanci (15%)	0,0905 bc	Moderate	212,421b	15,70
Biomanci (20%)	0,0797 c	Moderate	221,669 c	12,03

The increase in disease severity was triggered by favourable weather for disease development, including high rainfall and flooding at the study site. Consequently, AUDPC values in the range of >250 indicate that the plants are at a vulnerable level of resistance. (Santoso et al., 2007). The disease suppression efficacy of between 12-18% means that Biomanci's less effective in controlling moller disease, especially under these conditions. Based on Wityaningsih (2011) Shallot Biru Variety were planted in Nganjuk paddy fields during the rainy season showed high disease intensity and rapid infection rates, resulting in low bulb yields.

Biomanci 15 and 20% can increase the number of tillers per treatment or an average of 7 tillers per replication compared to the other treatments of 5-6 tillers per replication. Similarly, the total bulb weight in the 15 and 20% fertilisers was more (70-80 g/plant) than the other treatments (50 g/plant) (Figure 4). It seems that biomanci plays more of a role as a fertiliser in the formation of tillers and bulb weight rather than acting as a biopesticide.

### CONCLUSION

It was concluded that although Biomanci can be used as a bio pesticide, but in this study the sissy in the blue variety of Lancor shallot, which is classified as susceptible, acts more as a fertilizer than as a bio pesticide with a small disease suppression efficacy value of 12.03%.

Disimpulkan bahwa meskipun pupuk biomanci dapat digunakan sebagai biopestisida, tetapi pada penelitian ini biomanci pada bawang merah varietas biru Lancor yang memang tergolong rentan, lebih berperan sebagai pupuk

daripada berperan sebagai biopestisida dengan nilai efikasi penekanan penyakit yang kecil yaitu 12.03%.

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