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Optimisation of Rice Production on Tidal Lands through Ameliorant Technology

Mulyadi[1,*)], Sutikarini[2]
Universitas Panca Bhakti, Pontianak, Indonesia
mulyadi@upb.ac.id[1], sutikarini@upb.ac.id[2]
[*)]*Corresponding author*

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Optimisation; Tidal Land; Rice Production; Ameliorant Technology

ABSTRACT
The research aims to identify organic ameliorant technology for increasing rice production in tidal areas. This research used a Completely Randomized Design method with 7 treatment levels were repeated 3 times. Ameliorant technology includes: A0 (Dolomite 10 tons/ha) A1 (husk charcoal 10 tons/ha), A2 (rice straw at a dose of 10 tons/ha), A3 (cow manure at a dose of 10 tons/ha), A4 (husk charcoal 10 tons/ha + Trichoderma 600 kg/ha), A5 (rice straw 10 tons/ha + Trichoderma 600 kg/ha), and A6 (cow manure at a dose of 10 tonnes/ha + Trichoderma 600 kg/ha). The rice seeds used were the Inpari 24 variety. The results of the research showed that the Amelioran technology treatment had no significant effect on plant growth observations, namely, plant height and number of rice tillers. Treatment A3 (10 tons/ha cow manure) had the highest average plant height of 102.52 cm. Treatment A6 (cow manure 4 kg/plot + Trichoderma 240 g) had the lowest plant height, namely 89.93 cm. Treatment A1 (Charcoal husk 10 tons/ha) had the highest average number of tillers at 35.3 tillers. Treatment A6 (4 kg cow manure + 240 g Trichoderma/plot) had the lowest number of calves, namely 21.7. This was thought to be due to the framing effect, namely complex interactions between living organisms in the soil, both those in cow manure and Trichoderma. The negative framing effect that occurs is that plant growth is hampered, and some plants have stem rot, which causes some plants to wilt and die.

INTRODUCTION

Rice (*Oryza sativa* L.) is an important crop with strategic value. Food crops are the main priority in agricultural development, because national food needs have not been met (Ghani & Husin, 2011). An increase in rice prices or a lack of national rice stocks will harm the social and economic conditions of society in this country (Ghani & Husin, 2011). Tidal lands have special characteristics, such as changes in sea level, high salt levels, and limited nutrient availability, which are obstacles in achieving optimal rice production in tidal lands (Masganti & Syamsuar, 2010; Khairullah et al., 2021).

Ameliorant technologies such as dolomite, husk charcoal, rice straw, organic fertiliser, and other organic materials, to improve soil conditions, increase nutrient availability, and reduce the impact of salinity on rice plants (Annisa & Nursyamsi, 2016; Suhardjo & Agus, 2007). Further research is needed to optimise ameliorant technology in tidal fields to increase rice production.

The urgency of this research is to provide solutions for optimising rice production in tidal areas. High rice production can meet people's food needs and improve farmers' welfare (Brawijaya University SPP Team, 2017; Mulyono & Syaiful, 2016; Mulyadi et al., 2020). By identifying the type and dosage of ameliorant technology for rice production, this research provides a practical guide for farmers in implementing ameliorant technology effectively.

Ameliorant technology is combined with *Trichoderma*, a decomposer fungus and a biological agent, to control various plant diseases, such as blast disease, tungro, and bacterial leaf disease in rice plants in tidal areas. According to Mala and Syarifuddin (1999), the production of grain weight/crop of plants treated with *Trichoderma sp*. was higher than the control, with a difference of 42.45 grams. In addition, Baon et al. (2005), the treatment given by *Trichoderma* has the potential to increase pH, P, and K elements and reduce Fe in acid sulfate fields. This is important in maintaining the sustainability of rice production on tidal lands and conserving natural resources (Noor, 2001; Saharjo, 2014).

The research aims to identify organic ameliorant technology for increasing rice production in tidal areas. Research on ameliorant technology in general has been widely carried out, but in this research, the proposer tries to provide innovation and technology by adding *Trichoderma*, which is able to fertilise the soil because one of its functions is as a decomposer. *Trichoderma* functions as a renovator of organic matter, nitrification, denitrification, P and K solvents, and other IAA providers (Sabri & Rachim, 1998). In addition, Harman et al. (2004) used *Trichoderma* to accelerate the decomposition of organic matter and as a fertiliser supplement. According to Mala and Syarifuddin (1999), the production of grain weight/crop of plants treated with *Trichoderma sp*. was higher than the control, with a difference of 42.45 grams. In addition, Masulili et al. (2014), the treatment given by *Trichoderma* has the potential to increase pH, P, and K elements and reduce Fe in acid sulfate fields. It is hoped that the superiority and novelty of this research can contribute significantly to solving the problem of optimising rice production in tidal areas.

METHOD

The research was carried out at the Pal 9 tidal land, Sungai Kakap District, Kubu Raya Regency. This research used a Completely Randomized Design field experiment method, which consisted of 7 treatment levels and 3 replications, so that there were 21 plots (Jones & Montgomery, 2019; SAS Institute, 2018). Ameliorant treatments include: A0 (Dolomite at a dose of 10 tons), A1 (husk charcoal 10 tons/ha), A2 (rice straw at a dose of 10 tons/ha), A3 (cow manure at a dose of 10 tons/ha), A4 (husk charcoal 10 tons/ha + *Trichoderma* 600 kg/ha), A5 (rice straw 10 tons/ha + *Trichoderma* 600 kg/ha), and A6 (cow manure 10 tons/ha + *Trichoderma* 600 kg/ha). The rice seeds used were the Inpari 24 variety. The area of each plot was 2 m x 2 m with a planting distance of 30 cm x 30 cm. Each plot had 49 clumps. A total of 9 clumps/plots were used as observation samples. Ameliorant as a treatment was given 2 weeks before planting, along with *Trichoderma*. Statistical analysis was carried out on several observation variables consisting of observations of plant height and the number of productive tillers. The supporting factor that was observed for soil fertility was soil pH.

RESULTS AND DISCUSSION

The results of the diversity analysis showed that the Amelioran technology treatment had no significant effect on plant growth observations, including both plant height and number of rice tillers.

***Fig. 1** Plant Height Measurement*

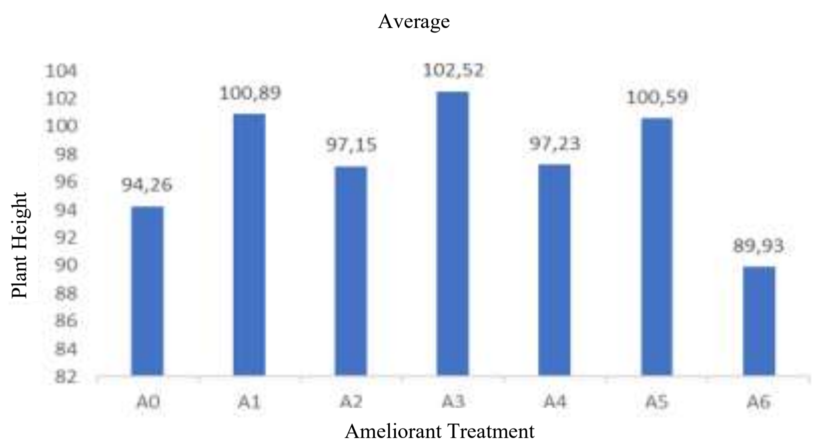

***Fig. 2** Average Plant Height*

***Fig. 3** Calculating the Number of Productive Tillers*

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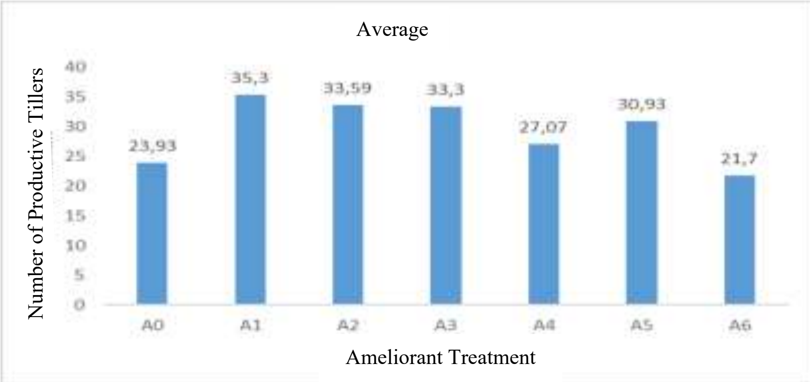

***Fig. 4** Average Number of Productive Tillers*

Treatment A6 (cow manure 4 kg/plot + *Trichoderma* 240 g) had the lowest plant height, namely 89.93 cm. Treatment A1 (Charcoal husk 10 tons/ha) had the highest average number of tillers at 35.3 tillers. Treatment A6 (4 kg cow manure + 240 g *Trichoderma*/plot) had the lowest number of calves, namely 21.7 (Fig. 1 – 4). This was thought to be due to the framing effect, namely complex interactions between living organisms in the soil, both those in cow manure and *Trichoderma*. The negative framing effect that occurs is that plant growth is hampered, and some plants have stem rot, which causes some plants to wilt and die (Syamsiyah et al. 2024).

Soil nutrient measurements were carried out at the Soil Chemistry and Fertility Laboratory, Faculty of Agriculture, Tanjungpura University. The results of soil pH analysis due to the influence of Ameliorant can be seen in Fig. 5.

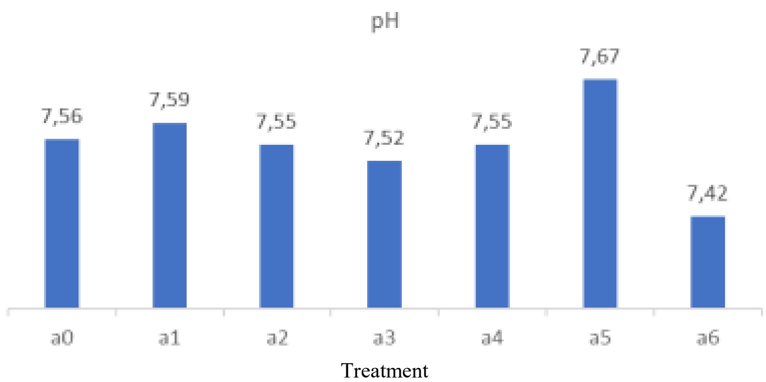

***Fig. 5** Soil pH Treatment*

The initial pH value of the soil is 5.38; this pH condition is classified as acidic. After being given Ameliorant technology, there was an increase in soil pH in the range of 7.42 - 7.67. The average pH of 7.55 is ideal for the growth of rice plants in tidal soil. In this way, Amelioran can increase the pH value of the soil, which will ultimately have the impact of providing nutrients for rice plants in tidal areas.

According to Abdillah and Widiyastuti (2021), weathering of organic materials can bind or chelate Al and Mn by the organic acids produced, thus improving the plant growth environment, especially on acidic soils. Park et al. (2016) stated that the presence of organic compounds allows chelation to occur, namely organic compounds that bind to metal cations (Fe, Mn, and Al) at acidic soil pH, the result of the breakdown of organic materials, including basic cations such as Ca, Mg, K and Na. Yu et al. (2023) stated that the general reaction of carbonate lime produces hydroxyl ions, which bind acid cations (H and Al) so that they can increase soil pH.

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The results of soil pH analysis were carried out at the Soil Chemistry and Fertility Laboratory, Faculty of Agriculture, Tanjungpura University. The initial pH value of the soil is 5.38; this pH condition is classified as acidic. After being given Ameliorant technology, there was an increase in soil pH in the range of 7.42 - 7.67. The average pH above 7.55 is ideal for the growth of rice plants in tidal soil. In this way, Amelioran can increase the pH value of the soil, which will ultimately have the impact of providing nutrients for rice plants in tidal areas. The research was carried out outside the planting season (single crop), so the obstacles faced were attacks by rodents and birds so which prevented the harvest from being observed.

CONCLUSIONS

The results of the research showed that the Amelioran technology treatment had no significant effect on plant growth observations, namely, plant height and number of rice tillers. Treatment A3 (10 tons/ha cow manure) had the highest average plant height of 102.52 cm. Treatment A6 (cow manure 4 kg/plot + *Trichoderma* 240 g) had the lowest plant height, namely 89.93 cm. Treatment A1 (Charcoal husk 10 tons/ha) had the highest average number of tillers at 35.3 tillers. Treatment A6 (4 kg cow manure + 240 g *Trichoderma*/plot) had the lowest number of calves, namely 21.7. This was thought to be due to the framing effect, namely complex interactions between living organisms in the soil, both those in cow manure and *Trichoderma*. The negative framing effect that occurs is that plant growth is hampered, and some plants have stem rot, which causes some plants to wilt and die.

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