



The Growth of Rice Plants on Combination of Liquid Organic Fertilizer Based of the Water Hyacinth

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: This study aims to obtain a combination of liquid organic fertilizer (LOF) concentrations of palm wine and water hyacinth on the growth of rice plants.

Study Design: This research used a randomized block design with thri (3 replications).

Place and Duration of Study: This research was conducted in Baolan District, Tolitoli Regency, Central Sulawesi Province with an altitude of 20 meters above sea level (MSL) from September 2022 to January 2023.

Methodology: consisting of six treatments, namely Ao = control, A1 = 80 ml LOF of water hyacinth + 20 ml LOF of palm wine + 900 ml of water, A2 = 70 ml LOF of water hyacinth + 30 ml palm wine + 900 ml water, A3 = 50 ml water hyacinth + 50 ml palm wine + 900 ml water, A4 = 40 ml water hyacinth +60 ml palm wine + 900 ml water, A 5 = 30 ml water hyacinth + 70 ml of palm wine + 900 ml of water. Each treatment was applied to the pot as media and each pot was planted with 1 seed.

Results: The results of the study was shown that the combination of water hyacinth and palm wine had a significant effect on plant height, number of tillers, panicle length and grain weight per panicle.

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Conclusion: Application of liquid organic fertilizer with a combination of water hyacinth and palm wine can increase rice plant growth, increase the number of tillers, panicle length and seed weight per panicle.

Keywords: Rice growth; liquid organic fertilizer; eichhornia crassipes.

1. INTRODUCTION

Nutrients are one of the limiting factors for the growth of plant, including food crops such as rice plants which are the basic ingredients of the staple food of most Indonesian people. Various efforts have been made to increase plant growth and production. The rare and the high cost of fertilizers demand innovation in fulfilling fertilizers, both liquid and solid fertilizers to reduce farming costs [1].

The use of high doses of inorganic (synthetic) fertilizers causes an imbalance in the biological ecosystem of the soil which reduces the quality of paddy fields, to increases production costs and it is dependence on the availability of inorganic fertilizers [2]. Several efforts have been made to increase or maintain soil fertility including utilizing organic materials from nature, which are able to improve soil fertility both directly and indirectly.

Local organic materials such as palm wine which contain 1.37% N (Nitrogen), 0,25% P (Phosphorus) and 8,07% K (Potassium) [3]. weeds for rice plants growing wild in swamps and ditches or waterways are able to absorb heavy metals, sulfide compounds, but have an organic matter content of 78,47%, 21,23 organic C, 0,28% total N, total P, 0,11% and 0,016% total K [4] besides that it contains more than 11.5% protein which is easily decomposed because it contains high cellulose.

“Making organic fertilizers based on water hyacinth and palm wine can be in the form of liquid organic fertilizers and solid organic fertilizers, but liquid organic fertilizers have a higher economic value than solid fertilizers. Giving liquid organic fertilizer to plants will accelerate the synthesis of amino acids and proteins, thus accelerating plant growth” [5].

“The use of organic fertilizers is a solution to fulfilling fertilizers and reducing dependence on inorganic fertilizers, which can fertilize plants [6]. The use of organic fertilizers is the main option for soil fertility in sustainable farming systems. Functioning to maintain the physical, chemical

and biological properties of the soil and beneficial for plant growth, the environment requires the input of organic matter which decomposes into nutrients used by plants”, [7]. Based on the description above, a study was carried out with the aim of knowing the effect of giving several concentrations of organic fertilizer a combination of water hyacinth and palm wine on the growth of paddy rice plants in potting media.

2. MATERIALS AND METHODS

This research was conducted in Baolan District, Tolitoli Regency, Central Sulawesi Province with an altitude of 20 meters above sea level (MSL) from September 2022 to January 2023. The tools used in this study were hoes, shovels, machetes, rulers, nets (from), pot, sacks, scales, tarpaulins, waring, thermometers, calipers, measuring cups, sprayers, stationery and cameras. While the materials used are Mekongga rice seeds, plastic buckets, palm wine liquid organic fertilizer which has been mixed with water hyacinth Liquid organic fertilizer.

The design used in this study was a randomized block design (RBD) with a single factor consisting of 6 treatment levels labeled A0 = control (without giving LOF), A1 = 80 ml of water hyacinth + 20 ml of palm wine + 900 ml of water, A2 = 70 ml water hyacinth + 30 ml palm wine + 900 ml water, A3 = 50 ml water hyacinth + 50 ml palm wine + 900 ml water, A4 = 40 ml water hyacinth + 60 ml palm wine + 900 ml water, A5 = 30 ml of water hyacinth + 70 ml of palm wine + 900 ml of water. Each treatment was repeated 3 times so that there were 18 experimental units, so there were 54 experimental units and all of them were used as sample plants.

The data obtained were analyzed using ANOVA. If the treatment being tried has an effect then it will be further tested by using Honest Significant Difference (JSA) analysis at the 5% level.

2.1 Procedure Methodology

2.1.1 Preparation of research sites

The research location uses a land area of 4 x 5 meters as a pot. The distance between pots is 20

cm, while between replicates using a distance of 40 cm. The research location was cleaned of weeds and leveled beforehand. To avoid stagnant water and pests, a ditch is made around it and a net fence for the pots.

The LOF that will be prepared consists of 2 ingredients, namely 1 liter of LOF of water hyacinth and 1 liter of LOF of palm wine. Before using the two LOF, 100 grams of gambier powder was added with the aim of inhibiting microbial growth.

2.1.2 Pot filling and treatment

The media pot is filled with top soil that has been loosened and cleaned of weeds and roots and has been air-dried for 2 days. The entire bucket is filled with soil and organic fertilizer (chicken manure) as basic fertilizer with a ratio of 1:5 (1 part fertilizer: 5 parts soil) then flooded 2 cm high for 1 week before planting before further treatment is labeled according to the treatment. The LOF was applied 4 times, namely on plants aged 2, 4, 6 and 8 weeks after planting. Giving LOF is done by pouring according to the treatment dose.

Weed control is done manually, namely removing weeds that interfere with plants. Pest control is carried out by mechanical means, namely by taking pests that attack plants.

2.1.3 Planting and watering

Planting is done by immersing the seeds in the pot shallowly, 1 seed per pot. The pot is flooded with water as high as 1 cm to 5 HST, then the height of the puddle is increased to a height of 2 cm. The height of the puddle is maintained by observing every morning and evening. Drying was carried out 7 times at 11-15, 26-30, 41-45, 56-60, 71-75, 86-90 and 96 Day After Planting (DAP) until harvest

2.2 Observation Parameters

1. Plant height (cm). Plant height measurements were carried out four times, starting at weeks 2, 4, 6 and 8 of plant growth, several weeks after planting. Measurements are made using a ruler, starting from the base of the stem to the growth of the plant.
2. The number of tillers is checked by counting all the tillers formed at the age of 8 weeks after planting.

3. Panel length (cm) Panicle length was measured 112 days after planting, namely from the base of the first node where rice emerged to the tip of the last panicle.
4. Seed weight per panicle (g). Seed weight per panicle is determined by weighing each panicle at the age of 112 days after planting, without drying, the seeds have been separated from the panicle

3. RESULTS AND DISCUSSION

3.1 Plant Height

The results of the study showed that the combined treatment of water hyacinth and palm had a significant effect on the growth of rice at WAP 2 and 6 WAP, but no significant effect at WAP 4 and WAP 8. In addition, the plant height according to the observed number can be seen in Fig. 1.

3.2 Number of Tiller

Observational data on the number of tillers of rice plants showed that the combination of water hyacinth and palm wine had a significant effect on the number of tillers. The average number of tillers can be seen in Fig. 2.

3.3 Panicle Length

The combination of water hyacinth and wine palm has a significant effect on panicle length. The average length can be seen in Fig. 3.

3.4 Grain Weight Per Panicle

The results of the analysis of variance showed that the combination of water hyacinth and palm wine had a very significant effect on grain weight per panicle. The average grain weight per panicle can be seen in Fig. 4.

Fig. 1 shows that each difference in dose gives an increase in plant height. "It can be said that the higher the dose concentration given, the plant will respond well to the age of 8 WAP when compared to the control. The highest plants were in treatment A5 = 70 ml of palm wine + 30 ml of water hyacinth + 900 ml of water". One of the parameters often observed in lowland rice plants is plant height because it can indicate the influence of the environment or the treatment given. Plant growth is not only influenced by N nutrients, but other essential nutrients such as P, Zn and Fe. The combination of higher liquid

organic fertilizer (LOF) doses of palm wine and water hyacinth can affect the height of rice plants, because they contain high and complete nutrient levels [8]. “The concept of growth when associated with the combined dosage of palm wine and water hyacinth can be considered relevant starting from a dose of 20 ml of palm wine + 80 ml of water hyacinth + 900 ml of water up to a dose of 70 ml of palm wine + 30 ml of water hyacinth + 900 ml of water” [9,3]. States

that “the use of 5.25 liters/ha of liquid organic fertilizer for palm wine can increase the growth of lowland rice plants up to 43 days after planting as high as 77.44 cm”. Moi (2015) stated that “the use of water hyacinth liquid organic fertilizer doses of 10 – 40 ml/liter of water had an effect on the growth of mustard plants”. “Water hyacinth can increase the height of rice plants because it contains higher N” [10].

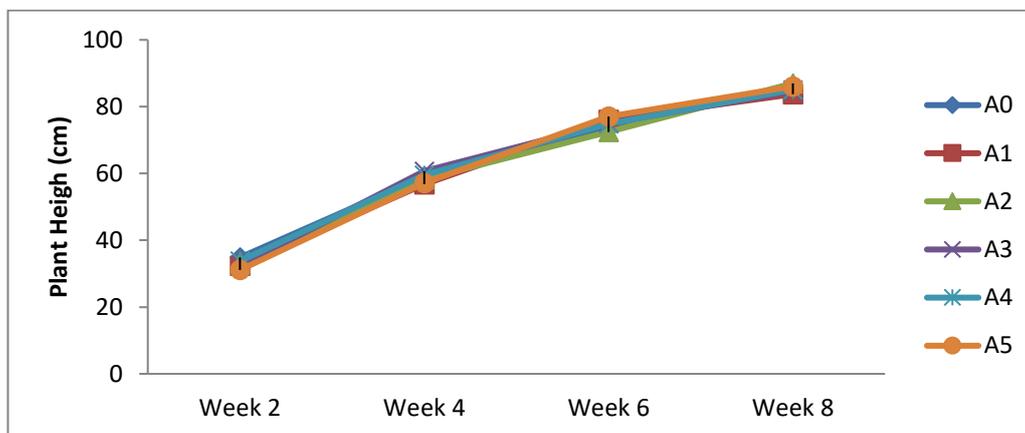


Fig. 1. Rice plant height at 2 WAP, 4, 6 and 8 WAP

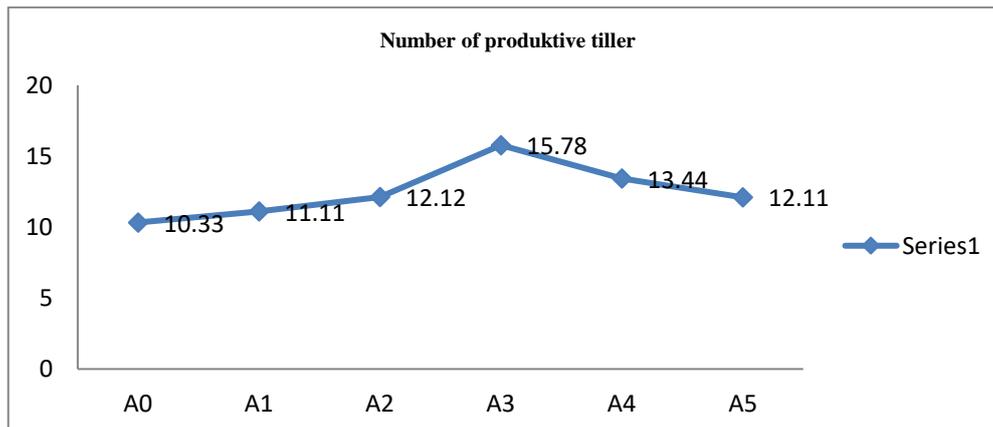


Fig. 2. Number of tillers of rice plants aged 8 WAP

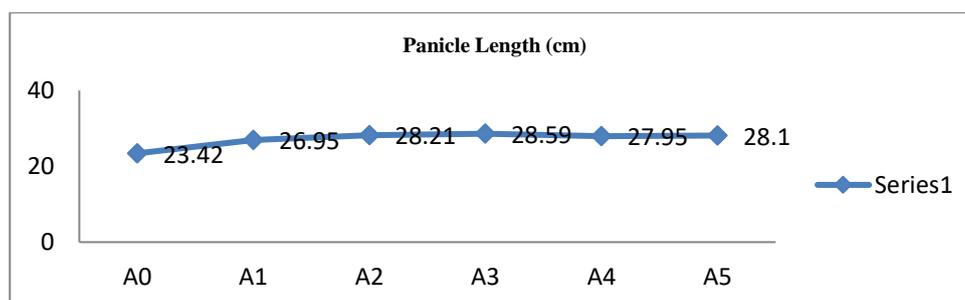


Fig. 3. Panicle length of 112 DAP rice plants

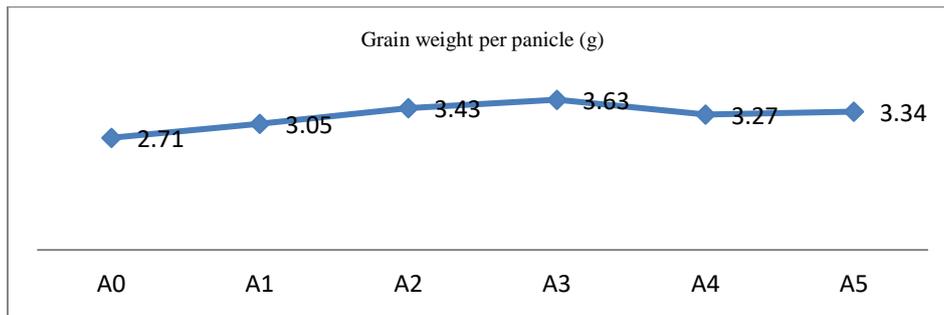


Fig. 4. Weight of grains per panicle of rice plants aged 112 days after planting

“The highest number of tillers was in the treatment of using 50 ml of palm wine + 50 ml of water hyacinth +900 ml of water, with an average value of 15.78 more tillers than the other treatments” [9]. Bernas et.al [10] reported that the tillers of rice plants that were given water hyacinth compost were able to produce 17 tillers. The lower number of tillers compared to rice plants planted in paddy fields was due to limited space to grow because this experiment used pot media. Based on the classification of the number of productive tillers of the Mekongga variety rice, an average of 13–16 tillers, this illustrates that the number of tillers in this study was in the average range. The composition of 50% palm wine and water hyacinth gave the plants room to form the most tillers, maximum tiller formation was achieved at a balanced nutrient composition, the unbalanced composition caused the formation of tillers to decrease in this experiment. The number of tillers of a rice plant will be maximized if it has good genetic traits, genetic factors are an illustration of the potential of a plant to produce the desired product, both in the form of plant results in the form of vegetative parts and seed yields, [11,12]. One of the environmental factors that affect the growth of lowland rice plants is the availability of nutrients, [13] the nutrients needed to increase the number of tillers of rice plants are nutrients N (Nitrogen) P (phosphorus) and K (Potassium) [14]. “Fertilizers that contain complete nutrients will give a good response to the process of forming tillers of rice plants, water hyacinth and palm wine contain complete nutrients so that they have a real effect on tiller formation” [9].

From Fig. 3, it can be seen that the maximum panicle length was in the A5 treatment, namely 28-29 cm. The panicle length was very significantly influenced by the water hyacinth treatment compared to the control, namely 20-25 cm. This difference in panicle length is due to better nutrition which can be provided by mixing

30ml water hyacinth + 70ml palm wine + 900ml water so that the panicle length exceeds 28-29cm. The length of the panicle of Mekong rice varieties varies between 24.59 to 27.57 cm [15]. Hatta [16] in his research showed that panicle length is determined by genetic factors in different species rather than environmental factors.

From Fig. 4, it can be seen that the maximum grain weight was in treatment A5, namely 4.4 g to 5 g/panicle, which had a significant effect on the control, namely 2.0 to 2.5 g/panicle. The difference in seed weight per panicle is caused by the combination of 30 ml water hyacinth + 70 ml palm wine + 900 ml water, which means this combination can provide better nutrition and increase grain/panicle weight up to 4.4 g – 5 g, and up to 2 – 2.5 g/panicle compared to control. The longer the panicle, the greater the chance of rice grain formation [17]. Liquid organic fertilizer (LOF) is more easily absorbed by plants through stomata and plant roots so that the plant's need for nutrients is met, which is then used for assimilation for plant growth and development grain quality [18], Salawati et al. [19].

4. CONCLUSION

Application of liquid organic fertilizer with a combination of water hyacinth and palm wine can increase rice plant growth, increase the number of tillers, panicle length and seed weight per panicle.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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