

Effect of Organic Fertilizer Water Hyacinth on the Growth and Production Plant Taro (*Colocasia esculenta* L.)

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Abstract

Taro as a source of food that is healthy and safe alternative potential, so that the role of fertilization and media technologies grow to be very important and expected organic fertilizer water hyacinth can increase the production of taro. The purpose of this study was to determine the effect of organic fertilizer dose of water hyacinth on the growth and yield of taro. This research method using Anova by F test and regression analysis. Variable observations were made on the vegetative phase (growth) and the generative phase (production). Variable observation of growth (plant height, number of leaves, leaf area) and production (weight of fresh taro) taro plants. The results showed that; 1) organic fertilizer water hyacinths very significant effect on the variable observation (plant height, number of leaves, leaf area) at the age of 30, 60, 90 days after planting, and 2) the average weight of fresh taro The resulting dose of organic fertilizer water hyacinth 20 tons/ha, which amounted to 2.77 kg but not significantly different with treatment dose of organic fertilizer water hyacinth 15 tonnes / ha, which amounted to 2.69 kg.

Keywords: Organic Fertilizer, Water hyacinth, Taro

1. Introduction

Taro (*Colocasia esculenta* L.) considerable potential as a source of food that is healthy and safe alternative, because it contains a number of vitamins, calories and fiber is high enough, and the amount of carbohydrates and reducing sugar is low. Taro (*Colocasia esculenta* (L.) Schott) is a vegetative plants that spread in the tropics and have a source of mineral nutrients (Mergedus et al., 2015). Taro (*Colocasia esculenta*) is a plant that contains 70-80% starch and antioxidant and anti-inflammatory properties (Kaushal et al., 2015). Taro is the staple food for most of the majority of the local population in Asia and Africa (Ganança et al., 2015).

The low production of taro root in Indonesia allegedly as a result of the low level of farmers on crop management and soil fertility. Generally taro crops grown by farmers in their yards that have characteristic features such as dry land with low soil fertility levels. This phenomenon resulted in taro yield obtained is also low.

Increased production of taro to be achieved apart in terms of quantity as well in terms of product quality. In connection with these efforts role fertilization technology and media grow to be very important. Efforts to improve product quality through organic farming is absolutely necessary organic fertilizer and organic growing media. The use of organic fertilizer and organic growing media are anticipating that the excessive use of artificial fertilizers. Several studies have been conducted in the use of organic materials for fertilizers and growing media, among others, straw, animal manure, peat. Another alternative organic materials that can be used for fertilizer and growing media is water hyacinth. Utilization of water hyacinth (*Eichornia crassipes* (Mart.) Solms) can also be another alternative in coping water hyacinths are often a problem.

Eichornia crassipes (Mart.) Solms, commonly known as the Water hyacinth family pontederiaceae and has a cosmopolitan distribution but are mostly found in warmer areas (Agunbiade et al., 2009). Water hyacinth is a free-floating aquatic weeds which are considered nuisance around the world and very disturbing ecological processes (Robels et al., 2015; Bhattacharya et al., 2015). *Eichornia crassipes* have an environmental impact and socio-economic serious equatic ecosystems from tropical and subtropical regions (Malik, 2007; Villamagna and Murphy, 2009). This plant has a rapid growth, large biomass, and tolerance for many metals / metalloids such as arsenic (Alvarado et al., 2008), cadmium (Agunbiade et al., 2009), chromium (Mishra and Tripathi, 2009), copper (So et al., 2003), iron (Jayaweera et al., 2008), nickel (Hadad et al., 2011), and zinc (Lu et al., 2004). *Eichornia crassipes* is also the plant to reduce and absorb toxic heavy metals and other pollutants from wastewater (Bias et al., 2015). Water hyacinth can be processed into compost, animal feed and the production of biogas (Zimmels et al., 2006; Xia and Ma, 2006; Peres et al., 2015)

Water hyacinth processing through composting technology (decomposition) products in the form of organic material that is softer and has decomposed perfect. The composting process itself is a biological process that involves the activity of microorganisms include bacteria, fungi and protozoa. Past research has shown that the use of water hyacinth as a source of organic material capable of improving the physical structure of the soil, increasing the availability of nutrients, vegetative growth and the production of sweet corn.

2. Methodology

This research was conducted in the Village Rejomulyo, Kediri city beginning in January 2014 until June 2014 and is located at 83 m above sea level, on the land or the type of sandy loam soil with soil organic C content: 0.37;

Cation Exchange Capacity Value: 16.74 and PH: 7. Materials used in this study are organic fertilizer water hyacinth, seed taro leafy 2. Research using environmental design used was a randomized block design consisted of 3 groups, while the design of the treatment is a single treatment. The treatment consists of six levels, namely:

1. E0 = Without organic fertilizer water hyacinth
2. E1 = Organic fertilizer water hyacinth dose of 5 tons / ha
3. E2 = Organic fertilizer water hyacinth dose of 10 tons / ha
4. E3 = Organic fertilizer water hyacinth dose of 15 tons / ha
5. E4 = Organic fertilizer water hyacinth dose of 20 tons / ha

Observations made during the growth of both the phase Vegetative and generative. Data variable observation of growth (plant height, number of leaves, leaf area) and production (fruit weight per fruit) plant taro to answer hypothesis made F test in Anova, followed Least significant Difference (LSD) 5 % and regression analysis.

3. Result and Discussion

3.1. Plant Height

Results of analysis of variance showed a significant influence treatment dose of organic fertilizer water hyacinth with the plant height at the age of 30, 60, and 90 days after planting shown in Table 1.

Table 1. Average plant height (cm) influences the dose of organic fertilizer water hyacinth with at the age of 30, 60, and 90 days after planting

Treatment	High average plant at age (days after planting)		
	30	60	90
E ₀	37,50a	98,23a	127,07a
E ₁	38,73b	102,67b	132,57b
E ₂	39,66b	103,90b	133,27b
E ₃	40,77c	105,27b	135,70b
E ₄	41,87d	108,40c	138,70c
Value LSD 5%	0,97	3,09	3,26

Table 1 shows that the height of crops produced by the treatment dose of organic fertilizer water hyacinth 20 tons/ha (E4) and significantly different from other treatments, this is due to a dose of 20 tons/ha of land will get the nutrients more for growth and besides that the soil will be better so that the roots of plants grow well and can absorb more nutrients for the growth of plant height.

Table 1 shows the soil is not fertilized with organic produce most short plant height and significantly different from all the soil fertilized organic fertilizer. It is suspected the water hyacinth fertilizer will greatly affect soil fertility, besides the nutrient content in manure water hyacinth is very helpful in plant growth and development, so that plant growth is better and faster. This is in accordance with the opinion of Primantoro (1999) which says, organic fertilizer containing macro and micro elements in small amounts, however, organic fertilizers are superior compared to inorganic fertilizers, because it has the function of improving soil structure, increase the absorptive capacity of the soil to the elements N granted, raise the living conditions on the ground and source of food for plants.

3.2. Number of leaves

Results of analysis of variance showed that there is a very real effect of treatment dose of organic fertilizer water hyacinth on the number of leaves at the age of 30, 60, and 90 days after planting shown in Table 2.

Table 2. The average number of leaves (pieces) the effect of the dose of organic fertilizer water hyacinth with at the age of 30, 60, and 90 days after planting

Treatment	Average number of leaves at age (days after planting)		
	30	60	90
E ₀	3,34a	4,72a	3,53a
E ₁	4,40b	5,78b	4,38b
E ₂	4,46b	5,83b	4,43b
E ₃	4,68b	6,06b	4,66b
E ₄	5,63c	6,72c	5,60c
Value LSD 5%	0,90	0,59	0,67

Table 2 shows that the highest number of leaves produced by perlakuan organic fertilizers water hyacinth as much as 20 tons/ha (E4) and significantly different from other treatments. It is caused by fertilizers 20 tons/ha crop needs for macro and micro nutrients can be fulfilled so as to form a leaf more.

Organic fertilizer showed significant differences with the not fertilized (E0). It is suspected the influence of macro and micro nutrients contained in fertilizer plants water hyacinth result showed better growth and fertile.

Hardjowigeno (1987) also stated organic fertilizer can increase the levels of nutrients N, P and K in the soil, in addition to organic fertilizer can also improve soil physical properties and provide development opportunities microorganisms in the soil.

3.3. Broad leaf

Results of analysis of variance showed that there is a very real effect of treatment dose of organic fertilizer water hyacinth against leaf area at the age of 30, 60, and 90 days after planting shown in Table 3.

Table 3. The average leaf area (cm²) of organic fertilizer dose influence water hyacinth with at the age of 30, 60, and 90 days after planting

Treatment	The average leaf area on cm ² (days after planting)		
	30	60	90
E0	624,87a	1516,70a	1511,42a
E1	740,57b	1891,17b	1885,89b
E2	743,49b	1894,09b	1888,81b
E3	792,07c	1931,30bc	1926,02bc
E4	802,40c	2007,63c	1993,11c
Value LSD 5%	39,47	107,12	102,29

Table 3 shows the dosage of fertilizer organic water hyacinth 20 tons/ha (E4) resulted in greater leaf area and significantly different from other treatments. It is suspected the crop needs for macro and micro elements are met by fertilizers water hyacinth thus better vegetative growth of plants. Water hyacinth organic fertilizers will improve soil structure, increase the absorptive capacity of the soil to the nutrients supplied, raise the living conditions on the ground and food source for plants for metabolic processes so that a greater leaf area.

3.4. Fresh taro weight

Results of analysis of variance showed that there is a very real effect of treatment dose of organic fertilizer water hyacinth to the weight of the fresh taro age of 150 days after planting in Table 4. The fresh taro photo effect dose of organic fertilizer water hyacinth after harvest age of 150 days after harvest as in Figure 1.

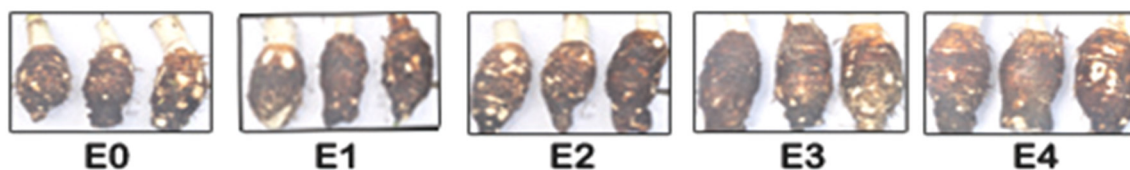


Figure 1. Fresh taro effect dose of organic fertilizer water hyacinth after harvest age of 150 days after harvest Table 4. The average weight of fresh taro (kg) dose of organic fertilizer influence water hyacinth after harvest age of 150 days after harvest

Treatment	The average weight taro Fresh (kg) After the Harvest Age 150 days after harvest
E0	1,83a
E1	2,27b
E2	2,43b
E3	2,69c
E4	2,77c
Value LSD 5%	0,19

Table 4 shows that the treatment dose of organic fertilizer water hyacinth 20 tons/ha (E4) generating fresh taro weight 3.30 Kg greatest and not significantly different with treatment dose of organic fertilizer water hyacinth 15 tons/ha (E3), this is due the effect of the nutrient content of the organic fertilizer which can improve the vegetative growth of plants and generative growth of plants so that the plants are able to produce a heavy crop of fruit is greater. Table 4 shows the significant differences between non-organic fertilized (E0) with fertilized organic fertilizer, organic fertilized soil also produces taro fresh weight is greater. This means that by fertilizing manure water hyacinth can increase fruit/ taro due to fertilizer organic fertilizer water hyacinth in the form of compost contains a number of nutrients and organic matter that can improve the physical, chemical and biological soil. The availability of nutrients in the soil, soil structure and soil good air system greatly influenced the development and root growth as well as the ability of plant roots to absorb nutrients. Good rooting developments determine the vegetative growth of the plants, which in turn determines also the reproductive phase and crops. Good vegetative growth that will support the generative phase is also good. According to Buckman and Brady (1982), the larger soil pores will enhance root development and traffic roots absorb water and nutrients, which in turn may affect the growth and yield of crop fruit whose weight is greater. Furthermore, according to Mansthur (2001), the role of organic fertilizer to improve its ability to retain water, helps provide nutrients to the plants, improve soil structure

and neutralize the pH of the soil. has the ability to hold water by 40-60%. This is because of the structures that have spaces that can absorb and store water, so as to retain moisture. Quadratic trend model or organic fertilizer dose influence on taro fresh weight are shown in Figure 2.

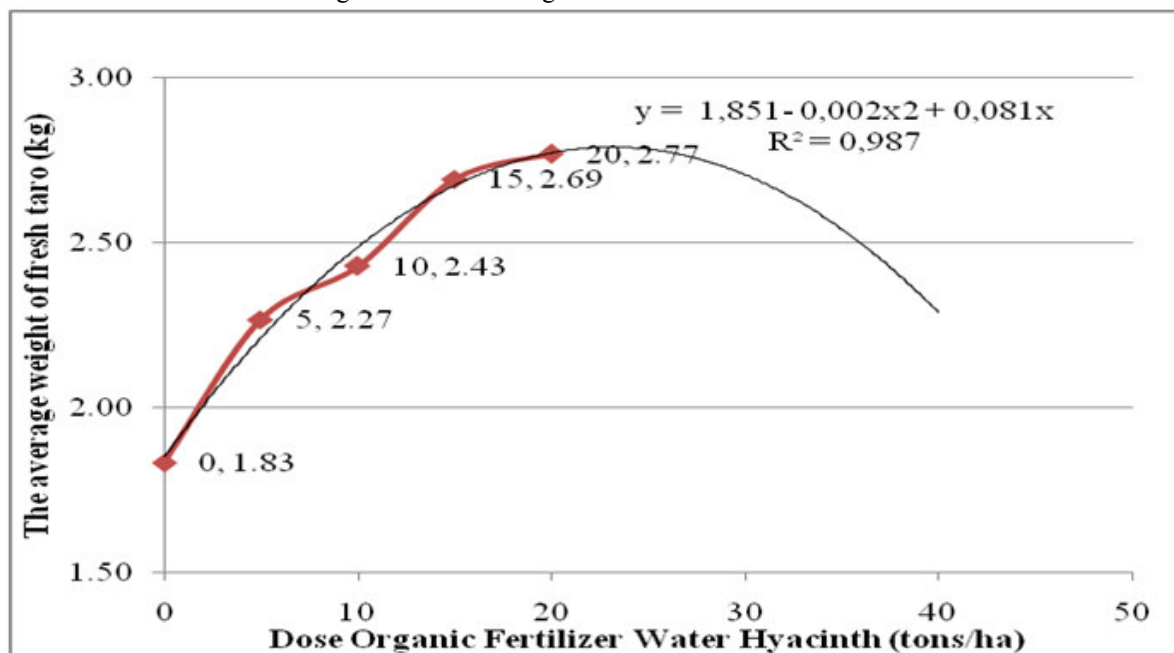


Figure 2. Effect of organic fertilizer dose water hyacinth on fresh taro weight after harvest age of 150 days after planting

Figure 2 shows the effect of a dose of organic fertilizer water hyacinth against taro fresh weight as indicated by the model quadratic with the equation $Y = 1,851 - 0,002X^2 + 0,081X$ with a value of $R^2=0.987$, where Y is the variable weight of fresh taro and X is an organic fertilizer water hyacinth. From the equation it can be seen the optimum dose of organic fertilizer water hyacinth, which amounted to 20.25 tons/ha.

4. Conclusion

Organic fertilizers water hyacinths very significant effect on the observation variables: plant height, number of leaves, leaf area age 30, 60, 90 days after planting; and the weight of fresh taro after harvest age of 150 days after planting. The average weight of the largest fresh taro produced dose of organic fertilizer water hyacinth 20 tons/ha, which amounted to 2.77 kg but not significantly different with treatment dose of organic fertilizer water hyacinth 15 tons/ha, in the amount of 2.69 kg.

Suggestions in this experiment is the use of organic fertilizers water hyacinth can be applied to other types of bulbs, because it can provide benefits on improving crop productivity and minimize environmental waste. In addition it is necessary to research on the use of fertilizers water hyacinths with other inorganic fertilizer on the growth and yield of taro, so that will obtain optimal results.

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