

The growth response of *Artemisia annua* L. to organic fertilizer type in lowland

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Abstract. *Artemisia annua* L. is a medicinal plant known in long period of time. *Artemisia annua* has a drug content therein, the compound is artemisinin, these compounds are useful as anti-malarial compounds. Growth of *Artemisia annua* L. in normal conditions is on the plateau. Planting can be done in lowland, but there is a risk that must be faced. This study was conducted to evaluate the response of the growth of the plant *Artemisia annua*. conducted in lowland. This research was conducted at the Laboratory Jumantono of the Faculty of Agriculture, University of Sebelas Maret Surakarta. Data were analyzed using analysis of variance and if there is a significant difference continued with Duncan Multiple Range Test (DMRT) level of 5%. The results showed that the application of goat manure has a positive effect on plant height by 201.9 cm, the number of branches by 57, 30.67 ml root volume and root length of 25 cm, and weight 12.4 grams interest.

1. Introduction

Malaria can be prevented by keeping the environment clean so that mosquitoes do not breed. Someone who has been suffer with malaria should immediately get a response. Drugs used to treat malaria may be obtained from various sources and one of them is from the plant *Artemisia annua*. *Artemisia annua* L. is a medicinal plant known in a fairly long period of time. This plant comes from China and has been spread to many countries such as America, Europe, and South America. *Artemisia annua* has a drug content therein, artemisinin compounds, these compounds are useful as antimalarial compounds [1].

Cultivation of *Artemisia annua* L. can be done in generative and vegetative. Growth of *Artemisia annua* L. in normal conditions is on the plateau. Planting can also be done at lower altitudes, but there will be a risk that must be faced. Lowlands is the location with a very different situation from the highlands, ranging from temperature, humidity, and also the intensity of the light received. Indonesia also started planting this plant, but there are still some obstacles. It is a constraint is the content of artemisinin remains low. Another problem is the growing point of the plant, *Artemisia* is a plant that grows in the highlands. Altitude can reach 1,000 m, while in Indonesia mostly been growing vegetables at that height [2].

Planting in the lowlands require special treatment to speed up the production process of the plant *Artemesia annua* L., one of them with organic fertilizers that serve to support the adequacy of nutrients



on plant growth. Organic fertilizer is considered safe for the environment and does not give adverse effects to the environment. Organic fertilizers commonly used in agriculture are manure.

2. Methods

2.1. Location and Time Research

This research was conducted from July 2015 to December 2015. This research was located in Jumantono Laboratory research at the Faculty of Agriculture of March University of Surakarta

2.2. Tools and Materials

The tools used in this research are plastic pots, hoe, and ruler. The materials used are *Artemisia annua* and manure.

2.3. Research Design and Data Analysis

This research used a complete randomized design (CRD) with one levels of treatment and three replications. Data were Analyzed using analysis of variance and if there is a significant difference continued with Duncan Multiple test (Duncan Multiple Range Test) level of 5%.

3. Results and Discussion

3.1. General Conditions Research Sites

Location of planting is situated in the Jumantono Laboratory research at the Faculty of Agriculture of March University of Surakarta in the village Sukosari, District Jumantono, Karanganyar. The exact location of the location is at 7° 37' 42.1" N and 110° 57' 6.9" S. This research location has a height of 196 m above sea level. Laboratory Jumantono has some area with various plants.

3.2. Variable of Plant Growth

Table 1. Treatment of manure application on several variables observation.

Manure	Plant Height (cm)	Number of branch	Roots Volume (ml)	Roots Length (cm)	Flowers Weight(g)
Goat	201.9	57.08	30.67	25	12.47
Chickens	187	53	29.75	24.4	11.2
Cow	147.3	42.5	25.33	22.1	8.07

3.2.1. Plant height Plant height is one of the indicators or parameters used to determine the effect of a given treatment. Plant height can indicate how much nutrients are met from the growing media used. In Table 1 it can be seen that the combination treatment showed the highest plant height was treated by goat manure with an average height of 201.9 cm. While the lowest plant height is shown by the treatment of cow manure with an average height of 147.3 cm. Previous study [3] revealed that the giving of NPK proven to accelerate the growth of plant height. Plants in the vegetative phase requires a high N fertilizer. Nutrient deficiencies can cause a variety of disorders of the plant. Some of them are plant growth may decline, occur yellowish color of the leaves, the process of the formation of chlorophyll disturbed [4].

3.2.2 Number of Branch Number of branches on plants to determine how many leaves and flowers as well as indicators in observing plant growth. The more the number of branches on a plant, the interest earned will also be more. In Table 1, the average number of best branches present in goat manure treatment with the average number of branches 57.08. Treatment using cow manure show the lowest branch with 42.5. In the other study [5], revealed that the use of manure can increase plant height and

number of branches of the plant. This is because the content of Nitrogen, Phosphorus and Potassium that contained in manure. The addition of manure can provide nutrients is quite high, thus affecting the growth of plants and the number of branch plants. Fertilizer given since the plants are still small where the plant is actively growing, making the number of branches increased [6].

3.2.3 Roots volume Root on plant become a very important part of the growth. The process of absorption of water and nutrients also be an important basis for growth is done by root. Plants can stand tall and live in various soil conditions caused by roots that can sustain a good crop in the field or in pots. In table 1 shows that the root volume is highest in the treatment of goat manure. As for treatment with the use of cow manure showed the smallest volume. Manure on crops can provide a positive influence is the increasing volume of the roots of plants. That is because the provision of P fertilizer to the plants, of P into nutrients essential for reproductive role in the development section [7].

3.2.4. Length of the root Length of the plant roots become one of the important indicators to determine growth. Conditions normal root can help the absorption of nutrients and water from the soil, so that plants grow better. Long roots can absorb more nutrients and water when compared with short rooted plants. In Table 1 indicate that goat manure showed the average length of the roots of the best that is 25 cm. whereas treatment with the shortest root is with cow manure by 22.1 cm. The study [8] revealed that the organic fertilizer can help the growth of the roots and make the plant roots become longer. This can provide benefits for the plant because the roots have a wider range to take nutrients. It is also in accordance with the conclusions from [9], which revealed that the addition of goat and chicken manure can increase the growth.

3.2.5. Flowers weight Flowers weight on the plant became one of the important indicators in the study the response of *Artemisia annua* in the lowlands. Plants that generate a lot of interest indicates that the plant can grow well. *Artemisia annua* is a plant that can be propagated with flowers. In Table 1 goat manure treatment showed the greatest result with 12.47 g. The treatment of cow manure has only average with 8.07 g. Treatment of manure give real effect and gives good results on the weight of the *Artemisia annua* flowers. This is according to the previous study [10] that the use of an assortment of manure showed significantly different results to the flowers.

4. Conclusions

The treatment of manure increased the growth of the observed variables in plant height, number of branches, root volume, and flowers weight. Goat manure gives the best results compared to other fertilizers.

Acknowledgement

This research was supported by the Ministry of Research Technology and Higher Education and Dr. Ir. Yuli Widyastuti as field from Research Centre for Medicinal Plant and Traditional Drug, Tawangmangu, Indonesia. *Artemisia annua* seeds in this research were obtained from B2P2TOOT, Tawangmangu, Karanganyar.

References

- [1] Bhakuni R S, Jain D C, Sharma R P, Kumar S 2001 Secondary metabolites of *Artemisia annua* and their biological activity *Current science* **80**(01) 35-48
- [2] Lestari E G, Purnamaningsih R, Gratitudo M, Yunita R 2010 Diversity somaklonal to repair the plant artemisia (*Artemisia annua* L.) through in vitro culture *Journal agro.biogen* **6**(01) 26-32
- [3] Napitulu D, Winarto L 2010 Effect of N and K fertilizer application on the growth and production of red onion *Horti Journal* **20**(1) 27-35

- [4] Ruhnayat A 2007 Determination of basic needs nutrients NPK plant growth vanilla (*Vanillaplanifolia* Andrews) *Littro Bulletin* **18**(1) 45-59
- [5] Baskoro D, Purwoko B S 2011 Influence of Plant Propagation Material and Organic Fertilizer Types Against Binahong Plant Growth (*Anredera cordifolia* (Ten.) Steenis) *J. of Horti Indonesia* **2**(1) 6-13.
- [6] Susanti H, Aziz S A, Jasmine M 2007 Production of biomass and bioactive ingredient ginseng (*Talinumtriangulare* (Jacq.) willd) of various origin seedlings and doses of chicken manure *Agronomy Bulletin* **36**(1) 48-55.
- [7] Noor A 2003 Influence of natural phosphates and phosphate solvent bacteria combination with manure on available P and soybean growth in Ultisol *Agronomy Bulletin* **31**(3) 100-106
- [8] Rizqiani N F, Ambarwati E, Yuwono N W 2007 The effect of dose and frequency of administration of liquid organic fertilizer on growth and yield of beans (*Phaseolusvulgaris*L.) lowlands *J. of Soil and Environ. Sci.* **7**(1) 43-53
- [9] Agus M 2014 Growth, leaf biomass production, and secretory structures bitter (*Andrographispanicula* Ness.) in the shade treatment and organic fertilizer *Essay. Agricultural Institute of Bogor* Bogor Asrob 2010
- [10] Susilowati Y E, Tujiyanta 2008 Use of Various Organic Fertilizers on results Several varieties of strawberries *Agron. J.* **30**(2) 126-139