RESPONSE OF SOME ORGANIC FERTILIZER AND DOSE OF VESICULAR ARBUSCULAR MYCORRHIZAL (VAM) ON GROWTH AND YIELD OF TEMULAWAK(*Curcuma xanthorrhiza* Roxb.)

Pengaruh Beberapa Pupuk Organik dan Dosis Mikoriza Vesikular-Arbuskular (VAM) Terhadap Pertumbuhan dan Hasil Temulawak (Curcuma xanthorrhiza Roxb.)

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ABSTRAK

Pertumbuhan dan hasil temulawak dipengaruhi oleh banyak faktor seperti ketersediaan hara tanaman dan penyerapan nutrisi karena pupuk organik terapan dan mikoriza vesikular-arbuskular (VAM). Tujuan dari penelitian ini adalah untuk mengetahui pengaruh pupuk organik dan VAM pada pertumbuhan dan hasil temulawak. Penelitian ini dilakukan di Desa Sindukarto, Kecamatan Eromoko, Kabupaten Wonogiri dari Juni 2013 sampai Maret 2014. Penelitian ini dilakukan dalam Rancangan Acak Lengkap (RAL) dengan 3 ulangan. Pengobatan menggunakan beberapa jenis pupuk: (1) tidak ada pupuk kandang (kontrol), (2) pupuk puyuh, (3) kotoran kambing, (4) kotoran sapi dan inokulum dosis MVA (0 g/tanaman, 5 g/tanaman, 10 g/tanaman, dan 15 g/tanaman). Temulawak ditanam di polybag dengan diameter 30 cm, ditempatkan di rak berukuran 50 cm, panjang 13 m dan lebar 2 m. The polybag ditempatkan di rumah paranet dengan 55% naungan. Media tanam diisi dengan tanah: pupuk kandang: sekam (2:2:1) sesuai dengan pengobatan. Hasil penelitian menunjukkan bahwa penggunaan pupuk organik memiliki peningkatan yang signifikan terhadap tinggi tanaman, diameter batang, jumlah daun, jumlah anakan dan rimpang berat segar. Sementara pengobatan VAM tidak signifikan terhadap semua variabel. Tidak ada interaksi antara pupuk organik dan pengobatan VAM.

Kata kunci: *temulawak, Curcuma xanthorrhiza, pupuk organik, mikoriza vesicular-arbuskular*

ABSTRACT

Growth and yield of temulawak were influenced by many factors such as crop nutrient availability and nutrient absorption due to applied organic fertilizer and Vesicular Arbuscular Mycorrhizal (VAM). The objective of the research was to find out the effect of organic fertilizer and VAM on growth and yield of temulawak. The research was conducted at Sindukarto Village, Sub District Eromoko, Wonogiri Regency from June 2013 to March 2014. The experiment was done in a Completely Randomized Design (CRD) with 3 replications. The treatment used three types of manure: (1) no manure (control), (2) quail manure, (3) goat manure, (4) cow manure and three inoculum dose of VAM (0 g/plant, 5 g/plant, 10 g/plant, and 15 g/plant). Temulawak was planted in polybag with a diameter of 30 cm, placed on a shelf of 50 cm size, length of 13 m and width of 2 m. The polybag were placed in paranet house with 55% shade. Planting media were filled with soil:manure:husk (2:2:1). The results showed that application organic fertilizer had significant increase on plant height, stem diameter, number of leaves, tiller number and rhizome fresh weight. While the treatment of VAM had no significance to all of variables. No interaction between organic fertilizer and VAM treatment were observed.

Key words: temulawak, Curcuma xanthorrhiza, organic fertilizer, vesicular arbuscular mycorrhizal

INTRODUCTION

Temulawak (*Curcuma xanthorrhiza* Roxb.) a medicinal plant native of Indonesia is also known as *Curcuma javanica*. Temulawak is included in the family of Zingiberaceae with part of the benefit is the rhizome. This plant grows well and can adapt in the open or under trees perpendicular to floor 40% shade. Distribution temulawak is closely linked to the movement or mobility of the population, especially for the Javanese (Prana, 2008). Temulawak expansion in Indonesia is included 13 provinces, namely North Sumatra, Riau, Jambi, Jakarta, West Java, Central Java, DI Yogyakarta, East Java, Bali, West Kalimantan, East Kalimantan, North Sulawesi and South Sulawesi (Rahardjo, 2010) .

Rhizome is a part of *Curcuma javanica* plant that are harvested and used for food and traditional medicine. *Curcuma javanica* rhizome contains an active ingredient such as xanthorrizol, curcuminoids and essential oil that are potential for health (Rahardjo, 2010). The results of the study (Yusron and Januwati, 2005) showed that the fresh temulawak rhizome production reached 11.04 tons/ ha, while the other temulawak productivity in East Java reached 12.5 tons/ha. Potency of temulawak production could reach 20-30 tons/ha. If the expansion is not followed by the development of temulawak cultivation in a good way, the purpose of acquiring and producing of high quality active ingredients can not be achieved optimally.

Cultivation of medicinal plants in general, included temulawak was not only aimed for high biomass productivity, but also to the high quality of active ingredients. Productivity and quality of the active ingredient of temulawak is influenced by factors such as: (1) growing environment, (2) nature of crops (varieties), (3) availability of nutrients (fertilizer), (4) protection of plants against pests, and (5) post-harvest handling (Rahardjo, 2010).

Needs of temulawak for traditional medicine industry (IOT) and small industry of traditional medicine (IKOT) ranked first in East Java and Central Java. *Curcuma javanica* is used as a traditional medicine and believed to cure 24 kinds of diseases (Rahardjo, 2010). By 2006, the government through the Food and Drug Administration (POM) launched the Encouragement to drink temulawak (Anonim, 2006). Based on the results of another survey showed that out of 609 herbal products, 176 contains temulawak that used for 12 groups of diseases (Rahardjo, 2010). Based on the preclinical evaluation, temulawak could be used as hepatoprotector, anti-inflammatory, anticancer, antidiabetic, antimicrobial, antihiperlipidemia, anti-cholera, anti-bacterial, and antioxidant (Rukayadi *et al*., 2006).

Organic cultivation method are generally produced lower biomass compared to inorganic farming. However, organic farming has more valueable because it is free of the contamination of hazardous chemicals (Rahardjo and Ajijah, 2007). Therefore it is necessary to use an environmentally friendly fertilizer, such as organic manure (organic fertilizer). The balance of nutrients, especially N, P and K greatly affect the production and quality of temulawak rhizome (Sugiarti, 2005).

Quail manure contains higher nitrogen than cow, buffalo, horses or goats manures. Nutrient content of quail manure is relatively high, due to fact that the liquid (urine) is mixed with the solid manure. N element contained in liquid form is generally higher than the compact form (Hardjowigeno, 1993).

Utilization of mycorrhizal arbuscula has proven to increase nutrient absorption capacity and crop resistance to drought and pathogens which are able to increase plant productivity (Rahayu and Akbar, 2003). Mycorrhiza Vesicula Arbuscula in plant growth be able to absorb nutrient elements both a macro or micro. directly influence the development of

plant roots. Mycorrhiza is a term used to refer to mushrooms that symbiosis with the roots of plants .

Mycorrhizal Vesicula Arbuscula is one type of mushroom-forming mycorrhizals (symbiotic associated with plant roots and fungi). Association between plant roots and fungi provide excellent benefits for the soil and crop hosts because the fungus is grown and bred. The working principle of this is the infection of mycorrhizal to host plants rooting system produces hyphae in intensive linkages containing mycorrhizal plants. This will increase the capacity of absorption of nutrient elements (Iskandar, 2002).

Mycorrhizal fungi can improve the soil structure. The formation of good soil structure is the capital of the improvement of the other physical properties of the soil. Physical properties of soil are improved due to the formation of good soil structure such as porosity soil improvement, soil improvement and increase of permeability soil air. Improvement of soil structure will also directly influence the development of plant roots.

The purpose of this study was to determine the effect and interaction of MVA application and some types of manure on growth and yield of temulawak.

MATERIALS AND METHOD

Research was conducted in the District of Wonogiri, Central Java from June 2013 to March 2014 . The laboratory analysis was conducted in Ecology and Management Plant Production Laboratory, Chemical and Soil Fertility Laboratory of Sebelas Maret University, Surakarta.

Materials

The plant material used in this study was temulawak plant seedlings. Other materials used were paranet, polybag, organic fertilizer (quail manure, goat manure and cow manure), and arbuscular mycorrhizal fungi. Equipment used included tools for land preparation, planting, maintenance and observations.

Method

Research used Completely Randomized Design (CRD) consisting of two factors with 16 treatment combinations and each was repeated 3 times. The first factor was growing medium, made up of four kinds, namely P0 = soil without manure , P1 = soil + quail manure, P2 = soil + goat manure, P3 = soil + cow manure. The second factor was the VAM (Vesicula Arbuscular Mycorrhizae), consisting of 4 levels i.e. M0 = without VAM, M1 = with VAM 5 g/plant , M2 = with VAM 10 g/plant , and M3 = with VAM 15 g/plant.

Observations included plant height, leaf number, tiller number, stem diameter and fresh weight of rhizomes.

Data were analyzed using analysis of variance (ANOVA) F-test at 5% level, and if there was a significant difference it was followed by Duncan's Multiple Range Test (DMRT) at the 5% level.

RESULTS AND DISCUSSION

Plant Height

A analysis of variance showed that the organic manure increased the plant height of temulawak. But effect of the quail manure, goat manure, and cow manure were not significantly different. Table 1 shows that the use of manure significantly affect on plant height.

N content in the manure was a major factor for vegetative growth, stems, and leaves (Zuhud *et al*., 2001). N was macro nutrient that was absorbed by the plant, before K and P (Jumin, 2002). High nitrogen in animal manure can improve the quality and quantity of the chrysanthemum cuttings. Nitrogen serves to accelerate the growth and stimulate germination, especially to improve the quality of protein, a source of food for the microbes around the plants (Setiawan, 2000).

Table 2 shows that application of VAM with various doses (5 g/plant, 10 g/plant, 15 g/plant) were not able to increase plant height.

Several doses of VAM to temulawak did not affect each other. Advantages of infected plants by mycorrhizal was to increase some nutrients such as P, K, Zn, and S (Hardjowigeno, 1993).

Stem Diameter

Quail manure, goat manure, and cow manure significantly influenced stem diameter of temulawak.

Table 1 shows that manure increased diameter of the temulawak plant. Results of analysis of variance showed that quail manure, goat manure and cow manure gave significantly different results in the increase of stem diameter.

Table 1. Results of analysis of variance showed that VAM dose was not significantly different effect on stem diameter.

Number of Tillers

Table 1 shows that manure increased the amount of temulawak tillers. Analysis of variance showed that quail manure, goat manure, and cow manure significantly affected the number of tillers of temulawak. Manure was applied as fertilizer can increase crop yields and quality compared to conventional cultivation with the use of inorganic fertilizers. Application of animal manure increased uptake of nitrogen, phosphorus, potassium, sulfur (Sarin, 1982).

Provision of real VAM showed no effect on the growth of temulawak. Table 2 shows that the application of VAM with a dose of 5 g/plant, 10 g/plant and 15 g/plant did not show any different.

Table 1. Effects of application of organic manure

Treatment	Plant Height (cm)	Stem Diameter (mm)	Number of Leaves	Number of Tillers	Fresh Weight of Rhizome (g)
P0 (without manure)	126,63 a	1,81 a	4,25 a	0,00 a	212,92 a
P1 (quail manure)	280,26 b	3,95 b	17,42 b	2,92 b	861,58 b
P2 (goat manure)	272,67 b	3,87 b	17,50 b	2,33 b	924,67 b
P3 (cow manure)	266,10 b	3,87 b	18,25 b	2,75 b	903,08 b

Description : Numbers followed by the same letter were not significantly different on Duncan test at 5% level.

Number of Leaves

Quail manure, goat manure and cow manure significantly affected the number of leaves of temulawak.

Table 1 shows that manure increased the number of leaves. Results of analysis of variance showed that quail manure, goat manure, and cow manure significantly different results in the growth of the number of leaves.

Table 2 showed that VAM doses did not significantly affect the number of leaves.

Table 2. Effect of application of VAM

Treatment	Plant Height (cm)	Stem Diameter (mm)	Number of Leaves	Number of Tillers	Fresh Weight of Rhizome (g)
M0 (without VAM)	242,71 a	3,52 a	15,25 a	2,00 a	675,08 a
M1 (VAM 5 g/plant)	239,85 a	3,31 a	14,25 a	1,83 a	850,50 a
M2 (VAM 10 g/plant)	236,20 a	3,39 a	14,08 a	1,67 a	697,50 a
M3 (VAM 15 g/plant)	226,89 a	3,29 a	13,83 a	2,50 a	679,17 a

Description : Numbers followed by the same letter were not significantly different on Duncan test at 5% level.

Fresh Weight of Rhizome

Manure application was able to increase fresh weight of temulawak rhizome. Table 1 showed that quail manure, goat manure, and cow manure differ significantly. Organic manure contained both macro and micro nutrients, such as N, P, K, Ca, Mg, and S (Rahayu and Akbar, 2003). N nutrient is indispensable in improving the production of rhizomes. Humus and cow/goat manure, significantly affect the growth and production of ginger at least two times greater than the control (Gusmaini and Trisilawati, 1998).

Table 2 shows the VAM did not increase the fresh weight of temulawak rhizome. Analysis of variance showed that the application of 5 g/plant, 10 g/plant, and 15 g/plant VAM were not significantly different on the fresh weight of rhizomes compared without VAM.

CONCLUSION

Manure application increased growth and yield of temulawak. Mycorrhizal treatment at a dose of 0 g/plant, 5 g/plant, 10 g/plant and 15 g/plant gave no noticeable effect on each variable. There was no interaction between manure application and mycorrhizal dose treatment on variables of growth and yield of temulawak.

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