Jurnal Online Agroekoteknologi
E-ISSN No. 2337- 6597
Vol.8.No.3, September (22): 142- 146
DOI: 10.32734/jaet.v8i3.6495

Growth response of patchouli (Pogostemon cablin Benth.) with coconut husk composting and coconut soaking concentration.

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ABSTRACT

Along with the increasing demand for patchouli oil, it is necessary to endeavor a sustainable production system that can guarantee the demand and quality of patchouli oil that meets export standards. This research aim was to determine the patchouli growth response on the application of coconut fiber compost and the coconut water concentrate. This research was carried out in the community area of Medan Sampali Subdistrict, Medan, which is ± 32 meters above sea level, from August to October 2017. This research used a randomized block design with 2 factors and 3 replications. The first factor was coconut fiber compost (0; 250; 500; and 750 g / polybag) and the second factor was the coconut water concentrate (0%; 25%; 50%; 75% and 100%) and further testing on randomized block design at the level of α = 5%. The research results showed that the treatment of coconut fiber compost had a significant effect on the number of shoots, shoot length, shoot wet weight, root wet weight, root volume, shoot dry weight and root dry weight. The treatment of coconut water concentrate immersion significantly affected the percentage of live cuttings, the number of shoots, shoot wet weight and root wet weight. The interaction between the two treatments did not significantly affect the number of shoots, shoot wet weight and root wet weight. With the best dose of coconut fiber compost of 750 g / polybag and 50% coconut water concentrate.

Keywords: patchouli, coconut fiber compost, coconut water.

INTRODUCTION

Patchouli (Pogostemon cablin Benth) is the most important producer of essential oils, and Indonesia supplies 90% of the world's needs. The development of cosmetics, perfume and pharmaceutical industries spurred the increasing need for patchouli oil both at domestic and international levels, with an average of 5% annually. The world's need for patchouli oil in 2010 reached 1500 tons. Indonesia supplies 700 tons, China and India 350 tons, so it still lack 450 tons. Along with the increasing demand for patchouli oil, a sustainable production system needs to be sought that can guarantee the demand and quality of patchouli oil that meets export standards (*Balai Penelitian Tanaman Rempah dan Obat - obatan*, 2014).

In the last four years Indonesian patchouli productivity has decreased significantly, namely in 2009 (113.27 kg / ha), in 2010 (90.14 kg / ha), in 2011 (71.15 kg / ha) and in 2012 (87.20 kg / ha). The decline occurred due to imperfect cultivation, inappropriate planting material, poor handling of materials and distillation resulting in low productivity. Patchouli plants are known to require a lot of nutrients, especially N, P and K. To maintain the level of soil fertility, it is necessary to apply nutrients derived from artificial fertilizers and/or organic fertilizers (Directorate General of Plantation, 2012)

Patchouli plants are rare, almost never flowering hence generative propagation is not carried out. The propagation of patchouli plants is carried out vegetatively using branch cuttings that are woody and have short

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sections. To get good cuttings, cuttings come from healthy parent plants, free from disease pests and mother plants aged 6-12 months (Rahardjo and Wiryanta, 2003).

During the growth and development period there are nutrients needed by plants. These nutrients are Nitrogen, Phosphorus and Potassium which function to accelerate root growth and can increase production. The research results by Hermawati (2007), the application of coconut fiber compost 8 kg/ha affected the growth of watermelon plants with an average plant height of 73.3 cm. Coconut fiber contains carbon (C) hence it can be used as activated carbon, K2O contained in coconut fiber ash is 10.25%

Coconut fiber compost contains nutrients needed by plants in the form of Potassium (K). Besides the content of other elements such as Calcium (Ca), Magnesium (Mg), Sodium (Na) and Phosphorus (P), coconut fiber is usually used as a planting medium, as a biopori for soil, with the presence of cavities in the soil can improve air circulation carrying oxygen which is needed by plants, in addition improving aeration on the soil, other benefits of coconut fiber is having the ability to absorb water 6 times from its volume (Maryana, 2015).

Tiwery (2014) stated that coconut water is one of the plant products that can be used to improve plant growth. Coconut water is rich in potassium, minerals, including Calcium (Ca), Sodium (Na), Magnesium (Mg), Ferum (Fe), Cuprum (Cu), and Sulfur (S), sugar, and protein. Besides being rich in minerals, in coconut water there are also two types of natural hormones, namely Auxins and Cytokines which act as supporting cell division.

MATERIALS AND METHODS

This research was carried out in the citizen garden in Meteorologi 3 street, Medan Sampali Subdistrict, with an altitude of ± 25 meters above sea level, starting in August until October 2017.

The material used in this research is the middle cuttings of Tapaktuan varieties as planting material, polybag, topsoil as a planting medium, sand as a mixture of planting media, coconut fiber, cow dung and mollase as compost decomposers, water for watering compost material and soaking coconut fiber, EM4 as an activator for composting, and Urea, KCL, TSP as basic fertilizer for Dithane M-45 Fungicide, and plastic.

The tools used in this research were machetes, banners and tarps, hoes, sieves, cutters, measuring cups, buckets, rulers, hand sprayers.

This research used a factorial randomized block design (RBD) with 2 factors and 3 replications. Factor I: coconut fiber compost (K) with 4 levels, consisting of K0 = No compost, K1 = 250g / polybag, K2 = 500g / polybag, K3 = 750g / polybag. Factor II: coconut water concentrate with 5 levels, A0 = 0%, A1 = 25%, A2 = 50%, A3 = 50%, and A4 = 100%.

The research implementation began by determining the area of agricultural land to be used as research land with an area of 18 m x 5 m, the area was cleared from weeds then plots were made. Then made shade from the leaves of oil palm and bamboo skeletons with a shade height of 2 meters. Prepared planting media in the form of a mixture of top soil and sand, top soil and sand stirred until evenly mixed and included in 3 kg polybag. Then coconut fiber compost was applied in accordance with each treatment, the planting medium was incubated with Dithane M-45 fungicide (2 g / l water) until moist which was done a week before planting the patchouli.

The cuttings to be planted are prepared according to the criteria, the cuttings are tied and put into containers that already contain coconut water according to the treatment for ± 2 hours. The material for planting cuttings that have been soaked is immediately planted

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in the prepared planting media and given a lid hence the media moisture can be maintained. Plant maintenance included watering carried out in the afternoon, embedding carried out when one week after planting, weeding is done manually by removing grass in the polybag, controlling pests and diseases carried out using the M-45 dithiane fungicide.

The observed variables were number of shoots, shoot wet weight, and root volume.

RESULTS AND DISCUSSION

Number of Shoots

Observation data on the number of shoots of patchouli plants at the age of 3-12 weeks after planting with the application of coconut fiber compost and coconut water concentrate significantly affected the number of shoots, while the interactions of both had no significant effect on the number of shoots. The average of the number of shoots at 12 weeks after planting on coconut fiber compost and coconut water concentrate can be seen in Table 1.

The best dose of coconut fiber compost to increase patchouli growth was a dose of 750 g / polybag (K3). This was presumably because the dosage was sufficient to meet the nutrient requirements of the plant, which made the plant's growth and production optimal. According to Hermawati's statement (2007) coconut fiber contains Nitrogen (N) 2.366%, Phosphor (P) 0.77% and Potassium (K) 0.41% which are used as the manufacture of liquid fertilizer, and as planting media. Coconut fiber compost is usually used as a planting medium, which contains macronutrient compounds that are very necessary to increase soil fertility or for plant growth that is able to increase the number of shoots of patchouli plants because the active tissue conditions continue to divide to form new shoots. The more number of shoots that open perfectly, the photosynthesis process runs smoothly.

The highest number of patchouli cuttings was obtained at 50% immersion concentrations (A3), at 50% of coconut water concentrate, hormone conditions that stimulate meristematic division are quite optimal. According to Kristina's statement (2012), the addition of coconut water concentrate can increase growth and tissue initiation because it contains hormones such as cytokinins 5.8 mg / l, auxin 0.07 mg / l and gibberellins.

One element found in coconut water is nitrogen. Nitrogen functions as a constituent component of amino acids that will form enzymes and hormones. According to Tiwery's statement (2014), the content of auxin and cytokinin contained in coconut water has an important role in the process of cell division, which helps the formation of shoots.

Table 1. The number of patchouli shoot cuttings at the age of 12 weeks after planting with coconut fiber compost and coconut water concentrate application.

Coconut Fiber Compost (g/polybag)	Coconut Water Concentrate (%)					Average
	A_0(0)	A_1(25)	A_2(50)	A_3(75)	A_4(100)	
K_0 : 0	16,80	13,27	17,73	15,80	15,73	15,87c
K_1 : 250	17,53	15,47	18,87	15,27	18,93	17,21ab
K_2 : 500	18,67	15,87	19,13	16,47	15,67	17,16b
K_3 : 750	19,00	17,40	17,60	17,47	18,47	17,99a
Average	18,00ab	15,50c	18,33a	16,25bc	17,20b	

Description: The numbers followed by the same letters in the same column and row show no difference in Duncan's Multiple Range Test at the level of α = 5%

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Table 2. The patchouli's shoots wet weight at the age of 12 weeks after planting with coconut fiber compost and coconut water concentrate application

Coconut Fiber Compost (g/polybag)	Coconut Water Concentrate (%)					Average
	A_0(0)	A_1(25)	A_2(50)	A_3(75)	A_4(100)	
	----------g----------					
K_0 : 0	9.24	7.38	9.19	7.81	8.23	8.37c
K_1 : 250	9.73	8.20	9.68	8.50	9.98	9.22b
K_2 : 500	9.85	8.65	10.48	8.92	8.55	9.29ab
K_3 : 750	9.96	9.06	9.77	9.24	10.05	9.62a
Average	9.70b	8.32e	9.78a	8.62d	9.20c	

Description: The numbers followed by the same letters in the same column and row show no difference in Duncan's Multiple Range Test at the level of α = 5%

Shoots Wet Weight

In the parameters of shoot wet weight, the highest concentration of coconut water was obtained at 50% (A2) immersion concentration of 38.78 and the lowest concentration at the treatment concentration of 25% (A2) i.e. 33.29. The coconut water concentrate has different fluctuations in the number of each parameter observation. This was in accordance with Wati's (2013) statement that coconut water application at different concentrations can cause different effects on a target cell and on coconut water application with the same concentration can have different effects on different target cells, this is due to differences in the content of auxin and cytokinin in coconut water.

The application of coconut fiber compost has a significant effect in increasing shoot wet weight. Coconut fiber contains nutrients needed by plants in the form of Potassium (K), in addition to the content of other elements such as Calcium (Ca), Magnesium (Mg), Sodium (Na) and Phosphorus (P), based on the results of compost analysis can be known that the macronutrient content contained in coconut fiber compost is sufficiently fulfilled.

Observation data of patchouli wet weight at the age of 12 weeks after planting with application of coconut fiber compost and coconut water concentrate significantly affected the number of shoots, while the interaction of both has no significant effect on the number of shoots.

Root Volume

Observation data of patchouli root wet weight and its variability showed that the application of coconut fiber compost had a significant effect on root volume parameters but the coconut water concentrate had no significant effect while the interactions of both did not significantly affect root volume..

The application of coconut fiber compost can increase the volume of patchouli root patches, where root volume will continue to increase along with the increase in the dose of coconut fiber. In the process of photosynthesis water is needed hence it will spur the growth of roots to look for water. This was in accordance with the statement of Purwanti (2008) which stated that good growth in the upper part of the plant will stimulate growth at the bottom hence the volume will enlarge and expand the reach of roots to obtain more food. Thus, these parenchymal cells can become meristem cells, i.e. cells that actively divide into real roots.

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Table 3. The root volume of patchouli cuttings at the age of 12 weeks after planting with the application of coconut fiber compost and coconut water concentrate.

Coconut Fiber Compost (g/polybag)	Coconut Water Concentrate (%)					Average
	A_0(0)	A_1(25)	A_2(50)	A_3(75)	A_4(100)	
	ml					
K_0 : 0	3,25	2,31	2,97	2,43	2,73	2,74d
K_1 : 250	2,92	3,08	3,13	2,89	3,53	3,11c
K_2 : 500	4,31	3,40	3,85	3,71	3,45	3,74b
K_3 : 750	4,22	3,95	4,22	3,77	4,68	4,17a
Average	3,68	3,18	3,54	3,20	3,60	

Description: The numbers followed by the same letters in the same column show no significant difference in Duncan's Multiple Range Test at the level of α = 5%

CONCLUSION

The use of 750 g / polybag of coconut fiber compost can increase the growth of patchouli plants, namely the number of shoots, shoot wet weight, and root volume.

The immersion of coconut water concentrate has a significant effect on the growth of patchouli plants at a concentration of 50% can increase the growth of the number of shoots, shoots wet weight. Whereas the interaction of coconut fiber compost with coconut water concentrate did not increase the growth of patchouli.

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