Enhance the Grouth and Flowering of Roses (*Rosa galica* L.) Due to Composted Waste Coffee Powder and Gibberellins Concentration

[1*]Elly Kesumawati, [2]Feri Affriadi, and [1]Mardhiah Hayati

[1]Department of Agrotechnology, Faculty of Agricultural, Syiah Kuala University, Darussalam, Banda Aceh 23111, Indonesia;
[2]Allumnay of Department of Agrotechnology, Faculty of Agricultural, Syiah Kuala University, Banda Aceh 23111, Indonesia;
**Corresponding Author*: ekesumawati@yahoo.com

Abstract
This study aims to determine the effect of composted waste coffee powder and gibberellins concentration on the growth and flowering of roses (*Rosa galica* L.) as well as the interaction between the two factors. Research conducted at the Experimental Farm of the Faculty of Agriculture Syiah Kuala University, Banda Aceh. This study used a Randomized Block Design (RAK) in factorial arrangement; there are two factors with three replications. The first factor is composted waste coffee powder consisting of: soil + composted waste coffee powder (1:1), soil + composted waste coffee powder (1:2), sand + composted waste coffee powder (1:1), sand + composted waste coffee powder (1:2). The second factor is the concentration of gibberellins consisting of: 0, 100, 200, and 300 ppm. The results showed that the composition of the growing media composted waste coffee powder has no significant effect on all parameters observed. Planting media composition tends to be better found in sand + composted waste coffee powder (1:1). The concentration gibberellin very significant effect on the number of branches at the age of 60 days after planting (DAP), significant effect on plant height, stem diameter and number of rose plants flower, at the age of 45 and 60 DAP. The best growth and flowering of roses was found on concentration of 200 ppm gibberellin. There was no significant interaction between composted waste coffee powder with gibberellin concentration on all parameters observed.
Keywords: composted waste coffee powder, gibberellins, roses

Introduction

Roses are plants that are favored by people cause of the aroma, beauty, size, and the variety of the flower color. This plant has a high economic value and a good prospect for cultivated (Rosana, 2011). Based on the utility, roses can be grouped into a sowing roses, cosmetic roses, cut roses, potted roses and rose garden (Kartapradja, 1995). Cut roses have a high volume of requests compared to the other cut flowers and demand is increasing especially on big days. In Jakarta, roses had third ranks demand for cut flowers after orchids and gladiolus. The production centers of roses in Indonesia are North Sumatra, West Java, Central Java and East Java (Marlina dan Euis, 2009).

Roses grow well in the porous planting medium. Planting medium serves as a place to grow and provide macro and micro nutrients needed by plants. Media also must not contain weed seeds and pathogens (Muhit dan Laily, 2006). Organic waste is remnant from a natural product derived from plants or animals. Some types of organic agricultural waste can be used as a growing medium in the cultivation of roses, such as the coconut husks, bagasse, palm bunches, waste coffee powder, and others.

Today in Banda Aceh there are many coffee shops, so that produced too much waste coffee powder. Based on the surveys, the average of coffee shop was produces 5-15 kg per day waste coffee powder, equivalent to 150-450 kg per month. A buildup of coffee powder waste in final disposal can cause environmental pollution, the solution to overcome this problem is to use the waste coffee powder into organic growing media. Waste coffee powders have long been used as a growing medium for plants. Nutrients contained in waste coffee powder require time to be fermentated in order to be used for the plant with the help of microorganisms (Shanegenziuk, 2012). According Musatto *et al*., (2011) composted waste coffee powder containing 1,2-2,3% N, 0,02-0,5% P dan 0,30% K.

Beside the used of growing media, giving of nutrients in the cultivation of roses is necessary, for example, the using of growth regulator (PGR). PGR is useful to encourage the growth and development of plants. PGR consist of auxin, cytokinin, abscisic acid and gibberellins (Yentina, 2011). Gibberellins (GA) are a hormone that can be found throughout the plant lifecycle. Giberelin serves to break dormancy or stunted growth of plants so that the plants can grow normally by accelerating the process of cell division, increase flowering, stimulate seed germination process, and play a role in cell elongation (Santoso, 2010).

In the rose plant, the important quality characteristics of cut flower is the flower stem length and diameter of the flower. The concentration of 300 ppm gibberellin can improve the quality of roses *Cherry brandy,* the stem length increased from 35.21 cm to 63.62 cm which belong to the super class (increase stem length of 43.7%). Concentration of 300 ppm gibberellin has the highest value in the number of node, node length, and enhanced the formation of flowers for 10 days. Giving 300 ppm gibberellin can maintain the freshness of flowers up to 1-3 days than usual (Wuryaningsih *et al.,* 1995). This study aims to determine the effect of composition of organic growing media composted waste coffee powder and the concentration of gibberellins and interaction among these factors on the growth and flowering of roses.

Materials and Methods

This research was conducted from Juni to August 2013 at the farm land of the Faculty of Agriculture, University of Syiah Kuala, Banda Aceh. The materials used were 48 plants of local varieties of red roses (*Rosa galica* L.). The plants were 1 month aged, and have 2 branches, the height 10-20 cm and not flowering. The planting medium that used were soil 50 kg, 100 kg of sand and 50 kg of composted waste coffee powder, 100 ml alcohol, 1 bottle EM-4, and 100 ml gibberellin. This study uses a randomized block design (RAK) with three replications. Factors studied were the composition of organic growing media composted waste coffee grounds and the concentration of gibberellins. Factors the composition of organic growing media composted waste coffee powder (K) consists of 4 levels; K_1 = soil + composted waste coffee powder (1:1), K_2 = soil + composted waste coffee powder (1:2), K_3 = sand + composted waste coffee powder (1:1) and K_4 = sand + composted waste powder coffee (1:2). The concentration of Giberelin (H) consists of 4 levels: H_0 = 0 (control), H_1 = 100 ppm, H_1 =200 ppm and H_3 = 300 ppm. From these two factors obtained 16 combinations with three replications, total had 48 units of experiment.

The composition of the material used for composted waste coffee powder was coffee powder 50 kg, rice husk 40 kg and manure 50 kg. Technique of composted waste coffee powder was, the first layer insert raw husks 10 kg, the second layer insert manure 10 kg, the third layer insert the waste coffee grounds 10 kg and then doused with EM-4 300 ml previously mixed with 5 L of water and 300 ml brown sugar that diluted. This technique was repeat five times. Composted waste coffee powder was stirred every week and flush with 5 L water. The composted process was conducted over 2 months. Planting medium used in the research is soil, sand and composted waste coffee grounds. All the planting medium is mixed until homogeneous (the ratio by volume) in accordance with the treatment. Selected healthy roses were planted into polybag in the afternoon, and then put in the shade place, and gived water irrigation.

Growth regulator of gibberellin was given to the plants at the age 10, 20, 30, 40 days after planting (DAP). Gibberellin was applied to the plants accordance with the treatment, each plant was spraying with 10 ml of water by using handspayer. Gibberellin concentration used is obtained through dilution to make a stock solution first. Stock solution was prepared by mixing 100 ml giberelin into 900 ml of water to obtain a stock solution giberelin as 1liter. When applaid to the plant, it must be dilution again by dissolving 1 ml stock solution of giberelin into 999 ml of water. Plants maintenance included irigation 2 times a day and weed control. Observations were made on plant height, stem diameter, and number of branches, each performed at 15, 30, 45 and 60 days after planting (DAP), and the number of flowers at the plant ages 45 and 60 DAP.

Results and Discussion

1. Effect of Composition Composted Waste Coffee Powder on The Growth and Flowering of Rose Plants

Analysis of variance showed that the composition of the planting medium organic composted waste coffee powder had no significant effect on plant height, stem diameter, number of branches at 15, 30, 45 and 60 days after planting (DAP) and the number of flowers of roses at the age of 45 and 60 HST. Table 1 showed that the treatment sand + composted waste coffee powder with a ratio of 1:1 (K3) tend to show better results although statistically not significant with other treatments. In this experiment the composition of sand+ composted waste coffee powder, in both ratio (1:1 and 1:2) increased the number of roses flower.

This is presumably because the composted waste coffee powder slowly available to plants, so that the plants have not been able to absorb the nutrients optimally for growth and flowering. This is in accordance with the opinion of Handayani (2008) which states that the nutrients contained in organic fertilizers can not be directly used by plant maximally. This is presumably also because the plant has

not been able to absorb the nutrients nitrogen supplied of composted waste coffee powder in the soil maximally. Composted waste coffee powder containing of 4-10% N, 0, 14% P and 0.2% K (Shanegenziuk, 2012). Nutrient N is a key element needed by plants, especially during the vegetative, nutrient deficiencies can lead to inhibited plant growth (Lingga, 1986). Marschner (1986) states that, nutrient N had a role in the flowering, but the role of N are not too much as well as the role of nutrients P in the formation of flowers.

Table 1. The average plant height, stem diameter, number of branches at the aged 15, 30, 45 and 60 days after planting (DAP) and the number of flowers 45 and 60 DAP in compositions of organic growing media composted waste coffee powder

Parameter		Composition organic composted waste coffee powder			
		K_1	K_2	K_3	K_4
Plant height	15 HST	16,70	18,47	18,99	15,78
	30 HST	18,75	21,38	20,50	18,98
	45 HST	20,62	23,36	22,68	20,83
	60 HST	24,44	25,95	25,63	23,98
Stem diameter	15 HST	4,32	4,00	3,73	4,15
	30 HST	4,52	4,22	3,89	4,33
	45 HST	4,84	4,88	4,50	4,86
	60 HST	5,54	5,79	5,73	5,44
The number of branches	15 HST	4,25	4,00	4,50	4,00
	30 HST	5,00	4,42	5,42	4,50
	45 HST	5,08	5,08	5,33	5,00
	60 HST	7,17	7,67	8,25	7,33
The number of flowers	45 HST	4,75	5,08	4,75	5,08
	60 HST	11,84	11,67	14,33	14,25

2. Effect of Gibberellin Concentration on The Growth and Flowering of Rose Plants

Analysis of variance showed that the concentration of gibberellins significant effect on the number of branches at the age of 60 HST, significantly affected to the plant height, stem diameter and number of flowers at the age of 45 and 60 days after planting (DAP). Gibberellin concentration had no significant effect on plant height and stem diameter at the age of 15 and 30 DAP, the number of branches at 15, 30 and 45 DAP.

Table 2 showed that the gibberellin concentration of 200 ppm (H_2) had very significant effect on the plant height, stem diameter, and the number of flowers at the age of 45 and 60 DAP, as well as the number of branches at the age of 60 DAP. It is presumed that gibberellin concentration of 200 ppm can promote the growth of all parameter observed to the maximum, thus providing a significant effect with other treatments. This is similar with Zuhriyah (2004) which states that at a concentration of 200 ppm, gibberellin able to increase the growth of plant height, leaf number, and leaf area on *Chrysanthemum*.

Table 2. The average plant height, stem diameter, number of branches at the aged 15, 30, 45 and 60 days after planting (DAP) and the number of flowers 45 and 60 DAP at various concentrations of gibberellin

Parameter		Concentration of Gibberellin (ppm)				$BNJ_{0,05}$
		Control(H 0)	100 (H1)	200 (H2)	300 (H3)	
Plant height	15 HST	17,11	16,63	18,17	18,03	-
	30 HST	19,79	19,96	19,79	20,06	-
	45 HST	20,28 a	21,14 a	24,15 b	21,82 a	2,55
	60 HST	23,37 a	24,07 a	27,78 b	24,79 a	3,03
Stem diameter	15 HST	4,00	4,19	4,12	3,90	-
	30 HST	4,08	4,34	4,46	4,10	-
	45 HST	4,38 a	4,81 a	5,30 b	4,58 a	0,63
	60 HST	5,10 a	5,41 a	6,24 b	5,75 a	0,72
The number of branches	15 HST	4,58	4,00	3,83	4,34	-
	30 HST	5,08	5,08	4,33	4,84	-
	45 HST	5,30	5,42	4,58	5,17	-
	60 HST	6,50 a	6,67 a	9,34 b	7,67 a	1,70
The number of flowers	45 HST	3,92 a	5,17 a	6,75 b	3,83 a	2,04
	60 HST	11,89 a	12,08 a	16,67 b	11,42 a	3,66

Remarks: Figures followed by the same letters in the same column not significant at the 5% level opportunities (test $BNT_{0.05}$)

In the treatment without giving giberelin (H_0) plant growth was not optimal, as well as the provision of gibberellin treatment with a concentration of 100 ppm (H_1) has not been able to increase the growth of roses. It is suspected that gibbereblin concentration was low for the roses. This conditions similar with the research of Rosmadelina (2000) which states that the cabbage palm seeds germinate longest contained in the pulp removed and the treatment by administering gibberellin concentration of 100 ppm, it is suspected concentration of gibberellin has not been able to optimally support the growth of sprouts.

In the gibberellin with a concentration of 300 ppm (H_3) rose plant growth is inhibited. This is presumably due to excessive giving gibberellins inhibit growth. This is supported by the statement of Claudia (2009) which states that the plants flower sheath lowest *Spatifilum* contained in gibberellin concentration of 300 ppm, it is presumably because the plants *Spatifilum* experience obstacles in growth, caused by the excessive concentration of gibberellins. Giberelin proper concentration is very helpful in supporting the growth and development of plants. If the concentration is given is not right then it will inhibit plant growth. Gibberellin application at appropriate concentrations, not only improves the performance of plants, but can also result in the plant having a faster flowering period.

3. Effect of Interaction

The results showed that there was no significant interaction between the composition of organic growing media composted waste coffee powder with gibberellin concentration of all parameters observed.

Conclusions

1. The composition of organic growing media composted waste coffee powder no significant effect on all parameters. Growth and flowering roses tend to be better in the planting medium sand + composted waste coffee powder (1: 1).
2. The concentration of gibberellins very significant effect on the number of branches plants at the age of 60 HST, significantly affected in plant height, stem diameter and the number of flowers at the age of 45 and 60 HST, no significant effect on plant height and stem diameter at the age 15 and 30 DAP, the number of branches at 15, 30 and 45 DAP. The best growth and flowering of roses was found at concentration of 200 ppm Giberelin.
3. There is no significant interaction between the compositions of organic growing media composted waste coffee powder with gibberellin concentration on all the parameters.

References

Claudia, L. (2009). Pengaruh Aplikasi Giberellin (GA_3) Terhadap Pertumbuhan dan Pembungaan Dua Varietas Spatifilum (*Spathiphyllum wallisii*). Institut Pertanian Bogor. Bogor.

Handayani, P. (2008). Inventori Diversitas Makro Fauna Tanah pada Pertanaman Wortel (*Daucus carota* L.) yang Diberi Berbagai Imbangan Pupuk Organik dan Anorganik. Skripsi. Fakultas Pertanian Universitas Sebelas Maret. Surakarta.

Kartapradja, R. (1995). Botani dan Ekologi Mawar. Balai Penelitian Tanaman Hias. Jakarta.

Marlina, N., Euis, R. (2009). Teknik Perbanyakan Mawar dengan Kultur Jaringan. Balai Penelitian Tanaman Hias. Cianjur.

Marschner, H. (1986). Mineral Nutrition in Higher Plants. Academis Press. London.

Muhit, A., Laily, Q. (2006). Respon Beberapa Kultivar Mawar (*Rosa hybrida* L.) pada Media Hidroponik Terhadap Pertumbuhan dan Produksi Bunga. http://ftp.pustaka-deptan.go.id/publikasi/bt111067.pdf [14 Januari 2013].

Mussatto, S.L., Carneiro, L.M., Silva, J.P.A., Roberto, I.C., Teixeira, J.A. (2011). A study on chemical constituents and sugars extraction from spents coffee grounds. Carbohydrate polymer 83, 368-374.

Rosana, N. (2011). Teknik Penggunaan Beberapa Media Tanam pada Beberapa Klon Mawar Mini. Balai Penelitian Tanaman Hias. Cianjur.

Rosmadelina, P. (2000). Pengaruh Perlakuan Mekanis dan Konsentrasi Giberellin Serta Lama Perendaman Terhadap Perkacambahan Biji Palem Kol (*Licuala grandis*). Universitas Sumatra Utara. Medan.

Santoso, B. (2010). Giberellin. Fakultas Pertanian Universitas Mataram. Mataram.

Shanegenziuk. (2012). From Coffee Grounds To Lawn Fertilizer. http://groundtoground.org/2012/01/18/from-coffee-grounds-to-lawn-fertilizer [15 Januari 2012].

Wuryaningsih, S., R. Kartapradja dan M. M. Tiwar. (1995). Pengaruh Jumlah Batang Utama dan Giberellin Terhadap Pertumbuhan dan Hasil Mawar Kultivar Cherry Brandy. Sub Balai Penelitian Hortikultura. Cipanas.

Yentina, E. (2011). Pengakaran Setek Batang Mawar Mini (*Rosa hybrida* L.) Menggunakan Kombinasi Konsentrasi Auksin (IBA dan NAA) yang berbeda. Institut Pertanian Bogor. Bogor.

Zuhriyah, D. T. (2004). Pengaruh konsentrasi giberelin (GA_3) dan pupuk daun terhadap pertumbuhan dan hasil tanaman krisan *(Chrysanthemum Morifolium Ram).* J. Sains dan Teknologi. 10 (1): 18-19.