

Application of tiens golden harvest fertilizer in *Hibiscus sabdariffa* L.

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Abstract. The research was conducted to determine the effect of Tiens Golden Harvest (TGH) fertilizer concentration and the varieties on growth and yield of Roselle, and also to examine the interaction between the two factors. The research was conducted in the Experimental field of Agriculture Faculty, Syiah Kuala University, Darussalam Banda Aceh, from June 2010 to November 2010. The material used was Roselle seed varieties, manure, TGH, using Factorial Randomized Block Design 4 x 2 in three replications. The first factor used was TGH fertilizer concentration (i.e. 0;5;10;15 ml/l) and the second factor was Roselle varieties (Sabdariffa and Altissima). So, we were conducted 8 combinations of treatments which were designed into 24 units of experiments. The concentration of TGH fertilizer significantly effect on plant height on 15 and 30 days after planting (DAP), the diameter of the base plant's stem on 15 DAP, the number of calyx per plant and the weight of calyx without seeds per plant for 5 times harvest. The best growth and yield of Roselle plant result was found in using TGH 10 ml/l of water. After 5 times harvest, using 10 ml/l TGH we got 54.93 calyx/plant with 43.33 dry weights. Variety significantly effect on the plant length on 15 and 50 DAP, the diameter of the stem on 15 and 50 DAP, and Roselle calyx fresh weight for 5 times harvest. The growth and yield of Altissima variety on this experiment was better than Sabdariffa variety. For 5 times harvest of Altissima variety, the number of calyces per plant was 46.47, the fresh weight was 457.60 g and dry weight was 39.09 g. There was a significant interaction between TGH fertilizer concentration and Roselle varieties on the stem diameter 50 DAP and the fresh weight of calyx. The best growth and yield of Roselle showed on the application of 10 ml/l TGH fertilizer to Altissima variety, with total fresh weight calyx was 457 g.

Key words: Roselle, Sabdariffa, Altissima, TGH, organic fertilizer

Introduction

Nowadays, people concept of "back to nature" is become famous as the new lifestyle for human diet and medical treatment. And the consequences of that, the need for the raw material of herbal medicines increases as natural medicine. Roselle (*Hibiscus sabdariffa* L.) is one of the herbal medicines that become more popular in Indonesia recently. And it seems that the demand of Roselle will be more and more in the future to meet the needs of the herbal medicine (Widyanto & Nelistya, 2008).

Roselle is a short-day plant species of Malvaceae family. It is cultivated in tropical and subtropical at the warm temperature (24-32⁰C) areas. The main part of Roselle that is used for herbal medicine is the calyces. Calyx of Roselle can be used as herbal tea, food coloring, and the young flower can be used as salad due to high fiber content (Amanda & Prima, 2008). Roselle is popular as an alternative to standard Western allopathic medicine for a variety of problems, such us soothes colds, opens blocked nose, clears up mucous, astringent, promotes proper kidney function, helps digestion, general tonic, diuretic, lose weight and helps reduce fever.

Hakim et al., (1986) stated that improving plant growth can be done by improving soil physics, chemist and biology. Biological fertilizer is one type of fertilizer that play an important role on ameliorate soil characteristics and can improve soil microorganism activities. Tiens Golden Harvest (TGH) fertilizer is one kind of biological fertilizer that contained of microorganisms. Biological fertilizer TGH contained of microorganisms that can bound nitrogen, and release nutrients bonded in soil mineral. And those microorganisms are Azotobacter sp, Azospirillum, cellulotic microbes, microbes that release phosphate, Lactobacillus sp, Pseudomonas fluorescent (Suhendar & Ghazali, 2009).

Nowadays, more than 100 varieties of Roselle spread in the world. However, in Indonesia, only two varieties are found popular, i.e. var. Sabdariffa and var. Altissima. Var. Sabdariffa tipicaly has red calyces while var. Altissima has purple calyces as shown in Fig.1 (Maryani & Kristiana, 2007).

The research was conducted to determine the effect of fertilizer concentration Tiens Golden Harvest (TGH) and the varieties on growth and yield of Roselle, and also to examine the interaction between the two factors.



Figure 1. Roselle var. Sabdariffa (on the left) and var. Altissima (on the right)

Materials and Methods

The experiment was conducted in the Experimental Field of Agricultural Faculty, Syiah Kuala University, Darussalam, Banda Aceh, from June 2010 to November 2010. It was designed as Factorial Randomized Blok Design with two factors and three replications. The two factors were four levels of fertilizer concentration (0; 5; 10; 15 ml/l of water) and 2 type Roselle varieties (var. Sabdariffa and var. Altissima) that became 24 experimental units sized 3.2m x 2.6m each. The material used was two rosella seed varieties, manure, TGH fertilizer, and biopesticides.

Roselle seeds were dipped in warm water for 24 hours and the radicle came out the seeds. Then the seeds were grown in the small polybag with mix medium of soil and manure in 1:1 (v/v). Each of polybags was sown one seed and let all the seeds germinated. After four weeks, the seedlings were planted onto experimental units with the plant distance 80cm x 60cm.

Manure was applied as base fertilizer one week after ploughing the soil. The TGH fertilizer was poured to each plant every 10-day on nursery and every 15-day during vegetative growth on experimental units based on each concentration treatment. Watering was done every day, weeds controlled every week, and pest controlled 2 times. Calyces was harvested on 60 DAP.

The data were recorded as follows: plant height (cm), base-plant stem's diameter (cm), number of branches, and number of calyces per plant, fresh weight of calyces with and without seeds as well as dry weight of calyces per plant.

Results and Discussion

Data presented in Table 1 shows that the concentration of TGH fertilizer significantly effect on plant height on 15 and 30 Days After Planting (DAP), and the diameter of the base plant's stem on 15 DAP. In the early growth, increasing the fertilizer concentration from 0 ml/l water to 10 ml/l water would increase the plant height from 23.28 cm to 28.17 cm, but the increasing fertilizer concentration to 15 ml/l water did not increase plant height compare to 10 ml/l water. The diameter base stem increased on the application of TGH fertilizer 5 ml/l water compare to zero TGH fertilizer application, and no more increase for the more concentration added. The data show us that the optimum fertilizer concentration for Roselle plant growth was 10 ml/l water, because more increasing fertilizer concentration will not increase more plant height significantly. Fertilizer concentration on 10 ml/l water gave the optimum soil condition to support plant growth. It is consistent Basri (2005) who stated that soil fertility is soil ability to supply nutrients for plant growth. Optimum TGH concentration gave best respond for Roselle growth, as stated in Agrolestari (2009) that

inform microorganism in TGH fertilizer support soil to be rich of nutrients and microorganism so that increases soil ability to keep water and biological condition.

Table 1. Plant Height, Diameter of Base Stem and Number of Branches per Plant Based on Fertilizer Concentration

Fertilizer concentration	Plant Height (cm)		Diameter of Base Stem (cm)			Number of Branches		
	15 DAP	30 DAP	50 DAP	15 DAP	30 DAP	50 DAP	30 DAP	50 DAP
0 ml/l water (T0)	23.28a	31.44a	62.67	0.36a	0.82	1.52	5.62	10.44
5 ml/l water (T1)	25.67b	36.50b	61.42	0.46b	0.99	1.74	5.94	10.72
10 ml/l water (T2)	28.17c	41.39c	66.28	0.44b	1.12	1.70	6.39	11.39
15 ml/l water (T3)	27.39bc	37.67bc	60.81	0.44b	0.92	1.67	5.78	10.84
BNT0.05	2.24	3.82	-	0.06	-	-	-	-

The number of calyces per plant and weight of calyces with and without seeds per plant for 5 time harvests was significantly different (Table 2). The TGH concentration on 10 ml/l water produced the highest number of calyces per plant (54.93) and the highest fresh weight of calyces with seeds (523.45 g) and without seeds (245.32 g). The increasing TGH concentration to 15 ml/l water did not increase the yield component. Fertile and crumble soil has good temperature and humidity for supporting soil microorganism to decompose the mineral and organic matter so the soil nutrient will be available (Marsono & Sigit, 2001)

Table 2. Number of Calyces, Fresh Weight of Calyces with Seeds, Fresh Weight of Calyces without seeds, Dry Weight of Calyces, Water Content per Plant of Five Times Harvest Based on Fertilizer Concentration

Fertilizer concentration	Number of Calyces	Fresh Weight of Calyces with seeds (g)	Fresh Weight of calyces without seeds (g)	Dry Weight of calyces (g)	Water Content (%)
0 ml/l water (T0)	36.87a	329.40a	162.36a	27.59	82.99
5 ml/l water (T1)	41.43ab	411.15b	191.07ab	33.10	82.54
10 ml/l water (T2)	54.93c	523.54c	245.32c	43.33	82.75
15 ml/l water (T3)	47.47bc	425.66b	207.28bc	35.91	82.55
BNT0.05	7.63	64.68	41.04	-	-

Variety significantly effect on plant height at 15, 30 and 50 DAP, the diameter of base stem on 15 and 50 DAP (Table 3). Roselle var. Altissima was better on early plant growth than var. Sabdariffa while at 50 DAP Roselle var. Sabdariffa was better on plant growth than var. Altissima. On 50 DAP, plant height of var. Sabdariffa (65.81 cm) was higher than var. Altissima (59.78 cm) and also diameter of base stem was also higher on var. Sabdariffa (1.77 cm) than var. Altissima (1.55 cm).

Table 3. Plant Height, Diameter of Base Stem and Number of Branches per Plant Based on Variety

Variety	Plant Height (cm)			Diameter of Base Stem (cm)		Number of Branch		
	15 DAP	30 DAP	50 DAP	15 DAP	30 DAP	50 DAP	30 DAP	50 DAP
Sabdariffa (V1)	24.14a	34.06a	65.81b	0.40a	0.88	1.77b	5.78	10.83
Altissima (V2)	28.11b	39.45b	59.78a	0.45b	0.98	1.55a	6.08	10.86
BNT0.05	1.59	2.70	4.52	0.04	-	0.132	-	-

Yield component of Roselle based on variety was only significantly different on fresh weight of calyces with seeds for 5 times harvest (Table 4). The highest fresh weight of Calyces with seeds was on Roselle var. Altissima (457.60 g). Based on Sadjad (1993), the difference on growth ability among varieties is depending on genetic factor. Also Gardner *et al.* (1991) stated that specific characteristic of plant growth especially influenced by genetic factor then the other characteristic influenced by environmental factors.

Table 4. Number of Calyces, Fresh Weight of Calyces with Seeds, Fresh Weight of Calyces without seeds, Dry Weight of Calyces, Water Content per Plant of Five Times Harvest Based on Fertilizer Concentration

Variety	Number of Calyces	Fresh Weight of Calyces with seeds (g)	Fresh Weight of calyces without seeds (g)	Dry Weight of calyces (g)	Water Content (%)
Sabdariffa (V1)	43.89	387.28a	190.32	30.88	83.76
Altissima (V2)	46.47	457.60b	212.69	39.09	81.67
BNT0.05	-	45.74	-	-	-

Conclusions

The best growth and yield of Roselle plants result were found on using TGH 10 ml/liter of water. At these concentrations after 5 times harvest we got 54.93 petals/plant and 245.32 g dry weight. The best growth and yield of rosella was Altissima variety. After 5 times harvest of Altissima variety we got 46.47 petal /plant, and 39.09 g dry weight. The best growth and yield of rosella plants were found on the application of 10 ml/liter TGH in Altissima varieties with 618 g fresh petals in 5 times harvest.

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