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Growth and Production of Samosir Local Shallots (Allium ascalonicum L.) with Various Sulfur Doses

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ABSTRACT

The production of Samosir Local Shallots has been decreasing due to land area reduction and the application of cultivation technologies such as fertilization which have not been applied intensively. Sulfur application is expected to be able to increase the growth and production of Samosir local shallots. This research aim was to determine the growth and production of Samosir Local Shallot (*Allium ascalonicum* L.) on various doses of sulfur. This research used a non-factorial completely randomized design, namely sulfur dose (S) with four levels of; S0 = No Sulfur, S1 = 6 g / plot, S2 = 12 g / plot, S3 = 18 g / plot, number of replications = 6 replications, number plot = 24 plots. The results showed that the application of sulfur to the growth and production of shallots was higher than without sulfur, application of sulfur at a dose of 0, 6.12, and 18 g / plot was not significantly different from the parameters of plant height, number of leaves, number of tubers, and significantly different from the parameters of tuber fresh weight, and tuber dry weight. The level of sulfur (S) in the shallot at the end of the research ranged from 0.129 to 0.158 mg/kg.

Keywords: Samosir, local shallot, doses, sulfur.

INTRODUCTION

Shallot is a type of vegetable spice commodity that is used as a flavoring in various types of cuisine, but it can also be eaten raw or as fresh vegetables. The dishes that are given shallots taste more tasty and delicious. The young shallot leaves are also commonly used as vegetables. Therefore, shallots have important economic value for the community, so that the demand on shallots continues to increase (Rismunandar, 2001).

Data from the BPS (central bureau of statistics) of Sumatera Utara Province (2015), Indonesia has a harvest area, production and productivity of shallots in 2014 was 120704 ha, 1233983 tons and 10.22 tons / ha. For Sumatera Utara Province alone, the area of harvest, production and productivity of shallots in 2014 was 1003 ha, 7810 tons and 7.79 tons / ha experienced a decrease in productivity from 2013, namely harvested area of 1048 ha, production of 8305 tons, and productivity of 7, 92 tons / ha. Likewise in Samosir District, experienced a decline in 2013 with harvested area 223 ha, production of 1384 tons and productivity of 6.21 tons / ha when compared to 2013 with a harvested area of 167 ha, production of 1114 tons and productivity of 6.67 tons / ha.

Shallot production in Sumatera Utara in 2014 amounted to 7810 tons, having a decrease of 495 tons (5.96%) compared to 2013. The decrease in production was due to the decline in harvested area by 45 hectares (4.29%) and productivity by 0.14 tons per hectare (1.74%) (BPS of Sumatera Utara, 2015).

For samosir local shallot, almost every year the production decreases. This

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is due to the reduced land area of production in the Samosir area and the application of cultivation technologies such as spacing and fertilization that have not been applied intensively. While the consumers' demand for samosir local shallot is still very high.

One way to increase the production of shallots is the addition of nutrients S (sulfur) absorbed by plants in the form of $SO4^{2-}$. Shallots are one type of plant that requires a lot of sulfur. Sulfur (S) holds a function in plant metabolism which is related to several nutritional quality parameters for vegetable crops (Schung 1990). The amount of sulfur (S) needed by plants is equal to the amount of phosphorus (P) (Yamaguchi 1999). On the other hand, according to Hilman and Asgar (1995), shallot requires S as much as 120 kg S / ha (Sumarni and Hidayat, 2005).

Plants need sulfur in amounts almost equal to phosphorus. Therefore, to support optimal plant growth, sufficiently high sulfur availability is needed in the soil. According to Hamilton et al. (1998) the sharpness of the shallots' aroma correlates with the availability of S in the soil. The research results showed that the critical limit of sulfate for shallots varied between 50-90 ppm depending on the type of soil.

Furthermore, it was also revealed that sulfur is a protein constituent and is thought to be closely related to nitrate reduction, so that sulfur deficient plants are characterized by nitrate accumulation (Trudinger, 2001).

The S source comes from: (i) The overhaul of soil organic matter, because 90% in the soil is in the organic form, (ii) S fertilizer, compost and biosolid, (iii) Sulfur which is bound in the anion exchange site of Al and Fe oxides, (iv) Deposition of atmosphere, industry and rain. Sulfur can also come from volcanoes, namely volcanic craters.

The N fertilizer is given as a basic fertilizer in research and sulfur nutrients as a treatment to increase the growth and production of shallots. This was supported by Trudinger (2001) which stated that sulfur (S) also acts as the main food ingredient for producing protein, forming enzymes and vitamins, assists the formation of chlorophyll, improves root growth and seed production, assists fast growth of plants and improve the resistance to cold.

Another benefit of sulfur (S) can also add to the aroma of shallots. This is supported by the literature of Tisdale et al (2000) which stated that the function of sulfur for shallot plants is: forming amino acids containing S elements such as cystine, cysteine and methionine. Amino acids such as cystine, cysteine and methionine affect the distinctive aroma of shallots. The higher the content of the three amino acids, the better the quality of the shallot produced.

Apart from fertilization systems, environmental factors also affect plant growth and development. According to Rahayu and Berlian (2000) shallot cannot stand dryness because of their short roots. During the growth and development of tubers, considerable water is needed. However, shallot plants cannot stand the waterlogged place.

One of the efforts to manipulate the environment is by giving mulch. Mulching is a way to improve soil air conditioning and also the availability of water for plants (can be repaired). Besides that, mulch application can accelerate the growth of newly planted plants. The advantage of using plastic mulch in agriculture, especially vegetable crops is because it can increase and repair the yields quality, allowing off-season planting and

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improvement of cultivation techniques (Barus, 2006).

Based on Maharaja's (2015) research, it was stated that the type of mulch application had a significant effect on the length parameters of plants aged 2-8 weeks after planting, the number of leaves at the age of 2 - 3 weeks after planting, number of tillers at 3 weeks after planting, wet weight of tuber per plot, and dry weight of tuber per plot.

From the description above, the author was interested in conducting a research on the growth and production of local samosir shallot (Allium ascalonicum L.) on various doses of sulfur.

MATERIALS AND METHOD

This research was carried out on the community land area at Pasar 1 Tanjung Sari, Medan Selayang Subdistrict, with a height of ± 25 meters above sea level, starting in September 2017 until January 2018.

The materials used in this research were Samosir local variety of shallot tubers taken from Samosir District, 12 g / plot of sulfur in S1 treatment, 16 g / plot in S2 treatment, and 18 g / plot in S3 treatment, compost (5 tons / ha or 500 g / plot), urea fertilizer (200 kg / ha or 20 g / plot) as basic fertilizer, Mankozeb active fungicide, trace label samples and other materials that supported this research.

The tools used in this research were hoes, rakes, plastic ropes, knives, broach, wood stick, buckets, meters, scales, plank names, labels, cameras, stationery, data books and other tools that supported this research.

This research used a Non Factorial Completely Randomized Design (CRD), namely: Sulfur Dosage (S) with 4 levels namely S0 = 0 g / plot, S1 = 6 g / plot, S2 = 12 g / plot, and S3 = 18 g / plot.

Data from the research result that showed a significant effect, continued by a mean difference test based on Duncan Multiple Range Test with a level of 5% (Steel and Torrie, 1995).

Implementation of the research which done were the cultivation of land, the making of plots and drainage canals, application of sulfur 4 weeks before planting according to the treatment, installation of mulch, preparation of shallot tuber derived from samosir, planting, plant maintenance and harvesting.

The observed parameters were plant height, number of leaves, number of tubers, fresh weight of tubers, dry weight of tubers, and sulfur content.

RESULTS AND DISCUSSION

Plant Height

The results of variance test showed that sulfur application had no significant effect on increasing plant height from the ages of 2, 3, 4, 5, and 6 weeks after planting. Data observation on plant height starting at ages 2, 3, 4, 5, and 6 weeks after planting can be seen in Table 1.

In plant height parameters, at 6 weeks after planting, S1 treatment (6 g / plot) was not significantly different from S2 treatment (12 g / plot) and S3 (18 g / plot) but significantly different from S0 (0g / plot) treatment. It is suspected that sulfur application had a positive effect on the shallot plant growth. This was in accordance with the literature of Schung (1990) which stated that shallots are one type of plant that requires a lot of sulfur. Sulfur plays an important role in plant metabolism which is related to several parameters determining the nutritional quality of vegetable plants.

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Table 1. Height of shallot plants aged 2 - 6 weeks after planting (WAP) by the application

Treatment	Height of shallot				
	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP
	....................................cm..................................				
S0 (0 g/plot)	14.54	18.02	18.9	20.15	19.36
S1 (6 g/plot)	15.77	20.52	22.73	24.77	24.39
S2 (12 g/Plot	14.79	18.45	21.3	23.11	23.11
S3 (18 g/plot)	15.38	19.58	21.42	23.67	23.29

Number of Leaves

The results of the analysis of variance showed that sulfur application had no significant effect in increasing the number of leaves starting from the ages of 2, 3, 4, 5, and 6 weeks after planting. Data observation on the number of leaves starting at ages 2, 3, 4, 5 and 6 weeks after planting can be seen in Table 2.

Table 2. The number of leaves starting at ages 2, 3, 4, 5 and 6 weeks after planting

Treatment	Number of leaves				
	2 WAP	3 WAP	4 WAP	5 WAP	6 WAP
	....................................cm..................................				
S0 (0 g/plot)	29.69	31.67	36.64	31.62	28.17
S1 (6 g/plot)	32.01	37.74	46.15	43.79	38.52
S2 (12 g/Plot	28.95	33.74	40.9	39.48	37.8
S3 (18 g/plot)	31.2	36.16	44.03	42.78	41

In the parameters of the number of leaves in all treatments at the age of 5-6 weeks after planting had decreased in number. This was allegedly caused by plants at this age attacked by late blight (anthracnose) which causes a reduction in the number of leaves. This was in accordance with the BPPT (Agency for Technology Assessment and Application) literature (2007) which stated that to be able to grow and develop well shallots require open space and lighting as much as 70%, as well as air humidity as much as 80 - 90%, and rainfall at 300 - 2500 mm / year.

Number of Tubers per Clump

The results of variance test analysis showed that the application of sulfur did not significantly affect the increasing the number of shallot tubers.

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Table 3. The Average number of shallot tubers with various doses of sulfur application.

Treatment	Average
............tubers.............	
S0 (0 g/plot)	13.13
S1 (6 g/plot)	16.31
S2 (12 g/Plot	14.33
S3 (18 g/plot)	16.45

In the production parameters, namely the number of tubers per clump, fresh weight per clump, and dry weight per clump, it was found that the application of 18 g / plot dosage had a positive effect when compared to all treatments. This is suspected because sulfur plays a role in the formation of shallot tubers. This was in accordance with the literature of Anggraini (2011) which stated that in summary, the function of sulfur in plants is as follows: the main food ingredient for producing protein, forming enzymes and vitamins, assists the formation of chlorophyll, improves root growth and seed production, assist fast growth of plants.

Fresh Weight of Tuber per Clump

The Analysis of Variance results showed that sulfur application had no significant effect on increasing the fresh weight of tubers.

Table 4. The average rate of the tuber fresh weight of shallot per clump by various doses of sulfur application.

Treatment	Average
..........g............	
S0 (0 g/plot)	11.81c
S1 (6 g/plot)	18.49ab
S2 (12 g/Plot	17.30ab
S3 (18 g/plot)	19.08a

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%

Based on the results of the research that has been done, it was found that at a dose of 18 g / plot showed the highest results in the parameters of the number of tubers, fresh weight of tubers, and dry weight of tubers on shallot tubers. It was suspected that the shallot plant requires sulfur nutrients. This was in accordance with the literature of Trudinger (1986) which stated that plants need sulfur in amounts almost equal to phosphorus. Therefore, to support optimal plant growth, high availability of sulfur in the soil is needed. According to Prasad and Power (1997), sulfur in soil is found in organic and inorganic forms. Inorganic S forms are important in the soil because most of the sulfur is taken by plants in the form of SO42- (sulfate), as well as organic

S is also important in the soil because it can increase the total S in the soil.

Dry Weight of Tuber per Clump

Based on Table 5. it was known that the treatment of various doses of sulfur produced tuber dry weight with the highest average at S3 (18 g / plot) treatment which is equal to 15.26 g and the lowest average at S0 (0 g / plot) treatment is equal to 9.45 g. However, the difference in dry weight of the tuber is not significantly different. This was in accordance with the literature of Anggraini (2011) which stated that in summary, the function of sulfur in plants is as follows: the main food ingredients for producing protein, forming enzymes and vitamins.

Table 5. The average rate of tuber dry weight of shallot clump by various doses of sulfur application.

Treatment	Average
............g............	
S0 (0 g/plot)	9.45c
S1 (6 g/plot)	14.79ab
S2 (12 g/Plot	13.84ab
S3 (18 g/plot)	15.26a

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%

Sulfur Content (mg / kg)

Based on Table 6. it was known that the treatment of various doses of sulfur produced shallot sulfur content with the highest average of S1 (6 g / plot) treatment which is equal to 0.158 mg / kg and the lowest average at S0 (0 g / plot) treatment is 0.129 mg / kg. This was suspected because shallot requires sulfur. This was in accordance with Hamilton et al. (1998) which stated that the sharpness of shallots aroma correlate with the availability of S in the soil.

Table 6. Sulfur content of shallots by various doses of sulfur application using 9 samples per treatment.

Treatment	Number of leaves						Average
	I	II	III	IV	V	VI	
	............................cm..........................						
S0 (0 g/plot)	0.15	0.092	0.132	0.167	0.127	0.106	0.129
S1 (6 g/plot)	0.15	0.164	0.171	0.124	0.146	0.19	0.158
S2 (12 g/Plot	0.139	0.15	0.263	0.143	0.124	0.124	0.157
S3 (18 g/plot)	0.139	0.122	0.136	0.136	0.15	0.157	0.14

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CONCLUTION

Sulfur application had an effect on the growth and production of shallots, but not significantly different in the treatment of sulfur application, higher than without sulfur application. Sulfur application with doses of 0, 6, 12 and 18 g / plot was not significantly different from the parameters of plant height, number of leaves, number of tubers, but significantly different from the parameters of fresh weight of tubers and dry weight of tubers. The level of sulfur (S) in the shallots at the end of the research ranged from 0.129 to 0.158 mg / kg.

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