USE OF ORGANIC FERTILIZER AND SILICATE GRANULE ON OFF SEASON SHALLOT CULTIVATION ON DRY LAND

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Abstract - The phenomenon of off-season onion is generally associated with the scarcity of onion production during the rainy season generated from the main production centers. The scarcity of onion production is certainly cause fluctuations in price volatility. Off-season cultivation of onion in dryland was a technological breakthrough to increase productivity of onion. The aims to increase off season onion productivity in dry land based on organic fertilizer and silicate granule and appropriate varieties. The study was conducted off-season on dry land in Karangsari, Karangrejek, Wonosari, Gunungkidul, Yogyakarta, Indonesia. The design used was Randomized Group Completed factorially with 3 replications. The first factor was 4 varieties of onion (Bima Brebes, Bauji, Batu ijo, and Saptosari variety as local onion Gunungkidul). The second factor were: A. Solid bioslury + organic fertilizer + plastic mulch; B. Solid bioslury + organic fertilizer + Silicate + plastic mulch; C. Organic fertilizer + organic fertilizer + Silicate + plastic mulch; and D. The existing of farmers technology (organic fertilizer + an organic + without plastic mulch. Observations included: number of tubers per hill, weight of tubers per hill, weight per bulb and shallot tuber productivity. The results showed that the components of organic fertilizer technology, silicate granule and the use of plastic mulch can increase the productivity of shallot off season cultivation on dry land. The interaction of off season shallot cultivation technology and shallot varieties significantly increased the number of tubers per hill, the weight of tubers per hill, the weight per bulb and the productivity of the shallot bulbs. The best combination with the highest productivity on CV4 treatment was on the application of organic fertilizer + an organic fertilizer + silica fertilizer + mulch) on local shallot varieties of Saptosari**.**

Keywords - Shallot, Off Season, Organic, Granule Silicate, and Dry Land

I. INTRODUCTION

Shallot (*Allium ascalonicum*) was one of the high value economic commodities that have high risk. Low productivity, frequent pest and disease attacks on off-season shallot crops.

The phenomenon of off-season shallot was generally associated with the scarcity of shallot production during the rainy season resulting from shallot production centers. On the other hand the need continues to increase as the population and the food industry growth. The scarcity of quality shallot at certain times (off season) causes price fluctuations.

Off-season shallot cultivation in dryland was a technological breakthrough to improve farmers' income, because shallot farming in wetland was considered inefficient and unprofitable. One of the constraints of shallot farming off season in dry land was the low level of soil fertility. The low level of soil fertility can be done with the application of organic fertilizer either in the form of organic fertilizer from cow feces that have been fermented and Bioslurry organic fertilizer.

Bioslurry was a final product of cow dung waste processing in the form of solid and liquid which was very useful as a source of nutrients for plants. Fertilizer Bioslurry can improve the physical structure of the soil, increasing soil fertility due to increased activity of development of earthworms and microbes. The addition of organic materials with high CN ratio such as bioslurry fertilizer can cause microorganisms to die and re-release nutrients to the soil. Organic fertilizers that have the decomposition process can suppress the growth of disease in the soil and serve as a provider of nutrients for plant growth in the form of organic compounds. The main requirement to overcome the nutrient deficiency in the soil was the improvement of soil structure through organic fertilization (Hardjowigeno, 1989).

Processing livestock waste, especially cattle dung will produce gas that can be used as energy. Biogas biomass (Bioslurry) was the result of the resulting output in addition to energy. Bioslurry that has no gas contained in a container and can be used as an organic fertilizer for plant growth. Bioslurry has a high organic content.

Benefits bioslurry, in addition to adding nutrients, can also improve soil structure. Soil with bioslurry becomes more crumb, easily binds nutrients and water and can increase the population and activity of soil microorganisms (BIRU Team, 2012). Utilization of bioslurry as an organic fertilizer can be used as a complementary fertilizer in shallot cultivation (*Allium ascalonicum* L.). Other obstacles in off season cultivation are disease (*Alternaria* sp. and *Antraknose* sp.,) as a result of high rainfall that causes high moisture. One of the efforts to control the pest attack was by using silicat granule fertilizer. Silicate granule was a formulated fertilizer containing SiO_2 : 20 -22 % dan P_2O_5 : 10 – 12 %.

Silicon does not include essential nutrients of plants in general, because the physiological function is not yet known. But Si was required to make the plant has an upright leaf shape (not droop), so that the leaf

effectively captures solar radiation and was efficient in the use of N nutrients that determine the height or low yield of the plant. Plants with Si enough have leaves that were coated with silicates well, making them more resistant to attacks of various diseases caused by fungi and bacteria. Plants that lack Si lot of water loss from plants (high transpiration), because the surface of the leaves less protected silicate, so the plants easy to dryness. Application of Si causes plants to be more drought resistant. Although not including plant nutrients, Si can increase production because Si is able to improve the physical properties of plants and affect the solubility of P in the soil (Rosmarkam and Yuwono, 2002). The addition of silicates to rice plants can increase the number of grains per panicle and the weight of grain content per hill (Takahashi 1995). The increase in silicate uptake can keep the leaves upright so that photosynthesis from the canopy can increase to 10% (Cock and Yoshida 1970 in Yoshida 1981). Research has shown that silicates can suppress pest attacks such as stem borers, brown plant hopper, green leafhoppers, and white back pests (Ma and Takahashi 2002 in Makarim *et al*.,2007). Larvae that feed on plants containing high levels of SiO2 cause their mouths to wear out, so the plants are spared from their attacks (Sasamoto 1961 in Makarim *et al*., 2007). SiO2 compounds can be formulated in the form of fertilizers.

In addition to these technological breakthroughs, the technological support of selecting the right varieties was one of the determinants of the success of off-season shallot farming in dry land. The choice of these varieties did not rule out the origin of either superior varieties or local varieties. Based on these matters, this research was conducted with the aim to increase off season shallot productivity in dry land through assembled technology based on organic fertilizer and silicate granule as well as appropriate varieties.

II. DETAILS EXPERIMENTAL

Materials and Procedures

The study was conducted on off-season shallot cultivation in dry land of Gunungkidul Yogyakarta, Indonesia in September until December 2017. The research uses silver black plastic mulch, bioslury fertilizer from biogas waste, silicate granule fertilizer, organic fertilizer, NPK fertilizer, Urea, KCl, lights trap and yellow trap as assembled technology component of shallot off season cultivation.

The design used was Randomized Group Completed factorially with 3 replications. The first factor was 4 varieties of shallot (Bima / V1, Bauji / V2, Batu ijo / V3, and Local Saptosari / V4), the second factor is:

A. Solid bioslury padat 6 ton/ha + An organik fertilizer + silver black plastic mulch

B. Solid bioslury 6 ton/ha + An organik fertilizer + Granule Silicate + silver black plastic mulch

C. Organik fertilizer + An organik fertilizer + Granule Silicate + silver black plastic mulch

D. Indegeneous farmer technology (Organic fertilizer + An Organic fertilizer).

Dosage of solid bioslury fertilizer = 6 ton / ha was based on previous research by Gustriana (2014) which stated that the application of 6 - 8 ton / ha solid bioslury fertilizer gives better result on shallot cultivation. The dosage of organic fertilizer were N 80 kg / ha; P_2O_5 110 kg / ha; K_2O 110 kg / ha; second N fertilizer 170 kg / ha. The dose of silicate granule was 400 kg / ha.

III. RESULTS AND DISCUSSION

The results of the analysis variance of yield components, including the number of tubers per hill, bulb weight per hill, weight per bulb and productivity were presented in Table 1, Table 2, Table 3, and Table 4. All components of the crop were significantly in the treatment of varieties and fertilizer treatment, except in the treatment of fertilizer was not significantly on number of tubers per hill and weight per bulb. The interaction of the two treatments (varieties treatment with fertilizer treatment) was significant on all of observation variable. Each variety shows its genetic potential that was influenced by the environment as a result of the application of organic fertilizer, bioslury, silicate granule and silver black plastic mulch.

Based on analysis of variance can be seen that the interaction of varieties and the organic fertilizer treatment was significantly affect on the number of tubers per hill. The highest number of tubers per hill was obtained by AV4 treatment (treatment A (Bioslury + anorganic fertilizer +silver black mulch plastic) on Saptosari local varieties (V4 The lowest number of tubers per hill was achieved by DV3 treatment (treatment D / indigeneous farmer technology without mulch) on Batu ijo varieties (V3). Each variety shows its genetic potential that was influenced by the environment as a result of the application of organic fertilizer, bioslury, silicate granule and silver black plastic mulch. All treatment D, which was farmers indegeneous technology, shows a low number of tubers per hill, one of which is no or not yet using a black silver plastic mulch.

The use of black silver plastic mulch was able to hold the rate evaporation of water in the soil and protect the soil from rainfall, so that the physical, chemical and biological conditions of the soil were maintained. This conditions encourage shallot plants that have fiber roots to form a more optimal root system, so as to absorb nutrients and water with more optimal then the plant was able to process photosynthesis optimally. This is according to Sembiring (2013), the color of silver serves to reflect sunlight, so the light received by the leaf was more leverage and plants are able to process of photosynthesis optimally. Agoes (1994), that the use of mulch is able to maintain the

physical, chemical and biological properties of the soil.

Fertilizer Treatment	Shallot Variety				
	V1 : Bima	V2 : Bauji	V3 : Batu Ijo	V4: Local Saptosari	**Average**
A = Solid bioslury padat 6 ton/ha + An organik fertilizer + silver black plastic mulch	5.80 ef	9.53a-d	4.67f	11.67a	7.92a
B = Solid bioslury 6 ton/ha + An organik fertilizer + Granule Silicate + silver black plastic mulch	9.13 a-d	9.07a-d	3.67f	9.93abcd	7.95a
C = Organik fertilizer + An organik fertilizer + Granule Silicate + silver black plastic mulch	8.00 cde	10.33abc	4.27f	10.87ab	8.37a
D = Indegeneous farmer technology (Organic fertilizer + An Organic fertilizer).	7.47de	8.87bcd	3.47f	8.47bcd	7.07a
Average	7.60b	9.45a	4.02c	10.23a	
Description: The numbers followed by the same letter on the same row and column are not significantly different according to Duncan Multiple Range Test at 5%					

Table 1. Number of tubers per hill on varieties treatment and fertilizer treatment

The physical properties of the soil, ie the soil remains loose and has good drainage. Chemically, soil nutrients remain awake from evaporation and awake from rainwater, and biologically, able to maintain soil temperatures that cause soil microorganisms capable of decomposing nutrients become available to plants.

The treatment of fertilizer in the form of organic fertilizer and solid bioslury fertilizer and silicate granule fertilizer and the use of black silver plastic mulch besides positively affect the number of tubers per hill (Table 1) also affect the weight per tuber (Table 2), weight per tuber (Table 3) , and productivity (Table 4). The highest productivity was obtained by CV4 treatment (C. organic fertilizer + organic fertilizer + silicate granle + mulch) on local varieties Saptosari / V4, followed by AV1 treatment and CV2 treatment. Kumolantang in Anisyah (2013) says that organic matter was one of the important soil components for soil ecosystems, where organic matter was a source and nutrient binder and as a substrate for soil microbes.
Silica fertilizer to make plants become stronger so resistant to fall, pest and disease attack. This was evident from the percentage of leaf damage (Table 5).

Fertilizer Treatment	**Shallot Variety**				
	V1 : Bima	V2 : Bauji	V3 : Batu Ijo	V4: Local Saptosari	**Average**
A = Solid bioslury padat 6 ton/ha + An organik fertilizer + silver black plastic mulch	21.57b	32.14ab	32.37ab	41.72ab	31.95ab
B = Solid bioslury 6 ton/ha + An organik fertilizer + Granule Silicate + silver black plastic mulch	45.18a	29.32ab	27.89ab	36.67ab	34.77ab
C = Organik fertilizer + An organik fertilizer + Granule Silicate + silver black plastic mulch	34.89ab	42.33ab	33.53ab	47.53a	39.57a
D = Indegeneous farmer technology (Organic fertilizer + An Organic fertilizer).	29.94ab	28.43ab	23.53b	30.74ab	28.16b
Average	32.89ab	33.06ab	29.33b	39.17a	
Description: The numbers followed by the same letter on the same row and column are not significantly different according to Duncan Multiple Range Test at 5%					

Table 2. Tuber weight per hill (g) in the treatment of varieties and fertilizer.

Fertilizer Treatment	**Shallot Variety**				
	V1 : Bima	V2 : Bauji	V3 : Batu Ijo	V4: Local Saptosari	**Average**
A = Solid bioslury padat 6 ton/ha + An organik fertilizer + silver black plastic mulch	3.88c	4.11c	7.33a	4.75bc	5.02a
B = Solid bioslury 6 ton/ha + An organik	4.77b	3.83c	7.45a	3.92c	4.99a

fertilizer + Granule Silicate + silver black plastic mulch	c				
C = Organik fertilizer + An organik fertilizer + Granule Silicate + silver black plastic mulch	4.24c	4.59bc	8.05a	4.89bc	5.44a
D = Indegeneous farmer technology (Organic fertilizer + An Organic fertilizer).	4.21c	3.44c	6.88ab	4.28c	4.70a
Average	4.27b	3.99b	7.43a	4.46b	

Table 3. Weight per bulb (g) on the treatment of varieties and fertilizer

Fertilizer Treatment	**Shallot Variety**				
	V1 : Bima	V2 : Bauji	V3 : Batu Ijo	V4: Local Saptosari	**Average**
A = Solid bioslury padat 6 ton/ha + An organik fertilizer + silver black plastic mulch	26.75ab	13.92c	16.17abc	13.17c	17.50ab
B = Solid bioslury 6 ton/ha + An organik fertilizer + Granule Silicate + silver black plastic mulch	19.08abc	15.25bc	13.58c	18.50abc	16.60b
C = Organik fertilizer + An organik fertilizer + Granule Silicate + silver black plastic mulch	20.50abc	26.67ab	15.67abc	27.08a	22.48a
D = Indegeneous farmer technology (Organic fertilizer + An Organic fertilizer).	17.91abc	17.917abc	15.75abc	17.93 bcd	17.37ab
Average	17.67ab	18.44ab	15.29b	22.56a	
Description: The numbers followed by the same letter on the same row and column are not significantly different according to Duncan Multiple Range Test at 5%					

Table 4. Productivity of shallot (ton / ha) on the treatment of varieties and fertilizer

Fertilizer Treatment	**Shallot Variety**				
	V1 : Bima	V2 : Bauji	V3 : Batu Ijo	V4: Local Saptosari	**Average**
A = Solid bioslury padat 6 ton/ha + An organik fertilizer + silver black plastic mulch	46.67a-d	36.67a-d	20.00d	16.67d	30.00b
B = Solid bioslury 6 ton/ha + An organik fertilizer + Granule Silicate + silver black plastic mulch	25.00cd	43.33a-d	15.33d	46.67abcd	32.58b
C = Organik fertilizer + An organik fertilizer + Granule Silicate + silver black plastic mulch	45.00a-d	33.33bcd	16.67d	26.67cd	30.42b
D = Indegeneous farmer technology (Organic fertilizer + An Organic fertilizer).	80.00a	66.67abc	40.00a-d	76.67ab	65.83a
Average	49.17a	45.00a	23.00b	41.67a	
Description: The numbers followed by the same letter on the same row and column are not significantly different according to Duncan Multiple Range Test at 5%					

Table 5. Percentage of leaf damage (%) in the treatment of varieties and fertilizer treatment

Table 5 shows that the percentage of leaf damage in general ranges from 30-65.83%. The results of this study showed differences in leaf performance was influenced by each treatment. Treatment D, leaf damage to 68%, while other treatments still below 32%. The interaction treatment between varieties and fertilizer treatment showed that the highest percentage of leaf damage was DV1 treatment combination. This is understandable because treatment D was an indigenous technology or farmer habits that have not used mulch and no silicate granule fertilizer.

In addition to the plant being strong, it also increases the availability of P. Sufficient availability of Si can suppress Fe and Mn in plants so P becomes more available (Badan Penelitian Tanah, 2011). Although Si was not including plant nutrients, Si can increase production because Si was able to improve the physical properties of plants and affect the solubility of P in the soil (Rosmarkam *dan* Yuwono, 2002). Therefore, the addition of Silica fertilizer can increase the productivity of shallot tubers. The result of analysis from Palm Oil Research Center (2014) rice husk ask has silica content in the form of high

chemical compound silicon dioxide (SiO2) which is needed by tuber formation. Based on the above matters, application of organic fertilizer in dry land in the form of solid bioslury and cow dung that has fermentation and the application of silica granule fertilizer and the use of black silver plastic mulch can increase the productivity of shallot.

CONCLUSIONS

Application of organic fertilizers and silicates granule can increase the productivity of off-season shallot on dry land. Assembled technology off season shallot cultivation on dry land through the application of organic fertilizer and silicate granule on the right shallot varieties significantly increase the number of tubers per hill, bulb weight per hill, weight per bulb and productivity of shallot. The best combination with the highest productivity on CV4 treatment was on the application of organic fertilizer + an organic fertilizer + silica fertilizer + mulch) on local shallot varieties of Saptosari. .

ACKNOWLEDGMENTS

Thank you to the Indonesian Agency for Agricultural Research and Development (IAARD), Ministry of Agriculture of the Republic of Indonesia through SMARTD Fund that this research has been funded by SMARTD through open competition of Research Activity, Assessment and Development of Strategic Agricultural (Kerjasama Penelitian, Pengkajian, dan Pengembangan Pertanian = KP4S 2017).

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