Jurnal Online Agroekoteknologi
E-ISSN No. 2337- 6597
Vol. 8.No.1, January (10): 63- 68
DOI: 10.32734/jaet

The Effect of Various Sources of Biochar and Kieserite Fertilizer Application on Growth and Production of Shallots (Allium ascalonicum L.) Plant

Bintua Simbolon*, Lisa Mawarni, Jonis Ginting
Agrotechnology Study Program, Faculty of Agriculture, USU - Medan 20155
*Corresponding author: bintuawednesday@gmail.com

ABSTRACT

Shallot is one of vegetable commodities that have an important for the community, both from the economic value and the nutritional content. This research was carried out in the paddy field of Medan Selayang Subdistrict with an altitude of +25 m above sea level, starting from April 2018 to July 2018. This research used factorial randomized block design (RBD) with two factors. Factor I was a biochar source with 3 types of biochar with a dose of 10 tons / ha, named: B1: paddy husk, B2: paddy straw and B3: oil palm empty fruit bunches. Factor II was kieserite fertilizer with 4 levels, named K0: 0 g/m^2, K1: 5 g/m^2, K2: 10 g/m^2 and K3: 15 g/m^2, hence obtained 12 treatment combinations. The resulted of statistical analysis showed that the application of various biochar sources significantly affected the height of plants aged 7 and 8 weeks after growth (wag), the number of tillers aged 3 and 7 wag and the dry weight of tubers per sample. Treatment of kieserite fertilizer has no significant effect on all parameters of observation and interaction. The application of paddy straw biochar was the best treatment, while the treatment of kieserite fertilizer with a dose of 15 g/m^2 was the best fertilizer application.

Keywords: biochar, kieserite, shallot

INTRODUCTION

Shallot is one of the important vegetable commodities in Indonesia, both seen from its high economic value, as well as from its nutritional content. In the last decade, the demand for shallots for consumption and for domestic seeds has increased hence Indonesia must import it to meet those needs (Sumarni, 2005).

Based on the results of data collecting and processing on Horticulture Agricultural Statistics in 2016-2017, the total production of shallots in Sumatera Utara has increased. The production of shallots in 2016 was 7810 tons, increase 27.67% of production in 2017 which amounted to 9971 tons. National production in 2016–2017 has increased by 1.7%, 2016 national production was 1.45 million tons and national production in 2017 was 1.47 million tons (BPS, 2018).

Harvest waste from paddy plants such as paddy husks, paddy straw and oil palm empty fruit bunches are left without any further processing. Hence utilizing these harvest waste such as paddy husk ash as a substitute for potassium fertilizer is one step in reducing the use of chemical fertilizers. In addition, it can also reduce pollution caused by this waste i.e. water pollution and air pollution.

The application of soil conditioners made from biochar with a dose of 2.5 tons/ha tends to increase the percentage of soil aggregation. Improvements in soil aggregation did not have an impact on improving the percentage of available pore water and slow drainage pores (Dariah, 2012).

Organic OPEFB waste has N content of 1.5%, P 0.5%, K 7.3% and 0.9% Mg, has substantial potential to be used as a substitute for fertilizers by applying the waste on land around oil palm plants. The utilization of OPEFB waste was considered by PT. REA

Jurnal Online Agroekoteknologi
E-ISSN No. 2337- 6597
Vol. 8.No.1, January (10): 63- 68
DOI: 10.32734/jaet

Kaltim Plantations is very efficient and can reduce the cost of purchasing organic fertilizer up to 60% with the optimum results of Fresh Fruit Bunches (FFB). From the utilization, the costs of FFB production can be reduced significantly and environmental problems that arise in palm oil mill can be overcome without spending costs and can even benefit in terms of costs (Haryanti, 2014).

Kieserite fertilizer is a single fertilizer containing magnesium and sulfur. Kieserite fertilizer is commonly called magnesium sulfate fertilizer. Kieserite fertilizer has a function to increase the soil pH hence the acid soil will increase its pH. In addition to increase soil pH, it can also increase the absorption of nutrients K and P by plants. The S nutrient which is present in Kieserite fertilizer was for shallots to improve the aroma, size and taste of the tuber.

The chemical formula of Kieserite fertilizer is $MgSO_4H_2O$. The basic material used in making this fertilizer is $Mg(OH)_2$, which is called brucite and $MgCO_3$ which is called magnesite. Pure Kieserite content consists of 29% Mg and 23% S. However, in the market, the level drops to 27% Mg and 22% S. Kieserite is a greyish white crystal and is rather difficult to dissolve in water. It is acidic hence if used continuously it can cause acid soils (Sihombing, 2011).

Based on these explanations, the authors were interested in conducting research on the effect of paddy straw biochar, paddy husk biochar, oil palm empty fruit bunch biochar and kieserite fertilizer application on the growth and production of shallots in paddy fields.

MATERIALS AND METHODS

This research was carried out in the paddy fields of Medan Selayang District with an altitude of + 25 meters above sea level, started on April to July 2018.

The materials used in this research were onion seeds from Bima Brebes variety, biochar from paddy husks, paddy straw, and oil palm empty fruit bunches and also Kieserite fertilizer as treatment materials.

This research used factorial randomized block design (RBD) consisted of 2 factors and 3 replications. Factor I: Kieserite fertilizer (K) with 4 levels, consisted of K0: without fertilizer, K1: 50 kg/ha, K2: 100 kg/ha K3: 150 kg/ha. Factor II: Biochar (B) with 3 levels, consisted of B1: paddy husk biochar = 1 kg/plot, B2: paddy straw biochar = 1 kg/plot, B3: oil palm empty fruit bunches biochar : 1 kg/plot.

Data that had a significant effect after being analyzed were then followed by Duncan's Multiple Range Test at the level of 5%.

RESULTS AND DISCUSSION

Plant length (cm)

Based on observational data and variance analysis of shallot plants aged 1-6 weeks after planting (MST), it was found that the treatment of various sources of biochar and kieserite fertilizers and their interactions had no significant effect on plant length. However, at the age of 7 and 8 MST, the application treatment of biochar had a significant effect on plant length and the application treatment of kieserite fertilizer had no significant effect on the plant length.

The application of paddy husk, paddy straw and oil palm empty fruit bunches biochars had no significant effect on 1-6 MST and had a significant effect on 7-8 MST on the shallot plant height. This was because the availability of nutrients from biochar was not yet available and decomposed for plants in the early stages of plant growth. This was in accordance with Makmur (1985) statement, who said that the growing environment does affect the appearance of plants. Biochar plays a very large role in improving soil physical and chemical properties, such as increasing the ability of soil to bind water, increase organic

Jurnal Online Agroekoteknologi
E-ISSN No. 2337- 6597
Vol. 8.No.1, January (10): 63- 68
DOI: 10.32734/jaet

carbon, reduce nitrogen leaching and increase the availability of Ca and Mg in the soil.

Number of tillers (tubers)

Based on observational data and variance analysis of the number of tillers aged 6-8 MST, it was identified that the application treatment of various biochar had a significant effect on plant age 3 MST and had a very significant effect on plant age 7 MST.

The application of various biochar sources had a significant effect on 3 and 7 MST and had no significant effect on age 1, 2, 4, 5, 6, and 8 MST on the number of tillers of shallots. Biochar was able to give significant results to the parameters of the number of tillers of shallot plants at ages 3 and 7 MST. The highest mean value of the number of tubers in plant age 3 MST was in OPEFB biochar application treatment (3.23) and the lowest was in paddy husk application treatment (2.70). At the age of 3 MST was the period of growth and development of shallot tubers. This was in accordance with Riadi's (2010) statement which stated that the application of paddy husk biochar can improve the physical properties of the soil. Hence, with the improvement in physical properties of the soil will affect the availability of K and paddy husk biochar will assist to increase P, Ca and Mg uptake by plants.

Tubers Dry Weight per Sample (g)

Based on the observational data and variance analysis of tuber dry weight per shallot plant sample, it was found that the application of various biochar treatments significantly affected the tubers dry weight of shallot plant per sample. The application of Kieserite fertilizer and the interaction of various biochar sources and Kieserite fertilizer application had no significant effect on the tubers dry weight of shallot plant per sample.

Table 1. Shallot plants length in the treatment of various sources of biochar and kieserite fertilizer

MST	Biochar Sources	Kieserite (g/plot)				Mean/Average
		K0:0	K1:5	K2:10	K3:15	
		……cm..……..……..				
1 MST	Paddy Husk	11.81	14.07	13.71	13.29	13.22
	Paddy Straw	14.33	12.90	13.44	13.69	13.59
	OPEFB	13.24	13.44	14.05	13.68	13.60
	Mean	13.13	13.47	13.74	13.55	
2 MST	Paddy Husk	22.01	22.81	21.61	21.65	22.02
	Paddy Straw	21.85	21.95	22.71	22.66	22.29
	OPEFB	22.52	21.54	21.93	21.62	21.90
	Mean	22.12	22.10	22.08	21.98	
3 MST	Paddy Husk	24.29	26.39	24.89	24.15	24.93
	Paddy Straw	25.52	25.54	26.01	26.12	25.80
	OPEFB	26.05	24.36	24.78	24.87	25.01
	Mean	25.28	25.43	25.23	25.04	
4 MST	Paddy Husk	26.31	28.35	27.95	26.50	27.28
	Paddy Straw	27.68	27.21	27.81	28.15	27.71
	OPEFB	28.43	25.95	25.96	27.06	26.85
	Mean	27.47	27.17	27.24	27.24	

Jurnal Online Agroekoteknologi
E-ISSN No. 2337- 6597
Vol. 8.No.1, January (10): 63- 68
DOI: 10.32734/jaet

	Paddy Husk	29.21	32.17	32.31	30.35	31.01
5 MST	Paddy Straw	32.55	31.07	32.11	32.86	32.15
	OPEFB	30.29	29.85	29.79	30.57	30.13
	Mean	30.68	31.03	31.4	31.26	
	Paddy Husk	32.35	33.18	33.73	33.55	33.20
6 MST	Paddy Straw	36.05	32.93	34.33	34.29	34.40
	OPEFB	32.23	33.09	33.63	33.63	33.15
	Mean	33.54	33.07	33.90	33.83	
	Paddy Husk	33.94	33.95	34.51	34.89	34.32a
7 MST	Paddy Straw	37.71	35.17	36.42	36.65	36.49a
	OPEFB	34.87	35.34	35.73	36.04	35.50b
	Mean	35.51	34.82	35.55	35.86	
	Paddy Husk	34.89	35.03	35.31	35.38	35.15c
8 MST	Paddy Straw	38.80	36.40	37.46	37.63	37.57a
	OPEFB	36.15	36.67	36.89	37.17	36.72b
	Mean	36.61	36.03	36.55	36.73	

Description: Numbers followed by the same letters in the same column showed no significant difference according to Duncan's Multiple Range Test at the level of α = 5%

Table 2. Number of tillers in the treatment of various biochar and kieserite fertilizers

MST	Biochar Sources	Kieserite (g/plot)				Mean
		K0:0	K1:5	K2:10	K3:15	
		……..…..…...tillers……...……				
	Paddy Husk	2.40	2.93	3.13	2.33	2.70c
3 MST	Paddy Straw	3.00	2.67	3.27	3.33	3.07b
	OPEFB	3.20	3.27	3.13	3.33	3.23a
	Mean	2.87	2.96	3.18	3.00	
	Paddy Husk	3.87	4.60	4.67	4.00	4.28
4 MST	Paddy Straw	4.53	4.20	5.00	5.33	4.77
	OPEFB	4.93	5.07	4.20	4.73	4.73
	Mean	4.44	4.62	4.62	4.69	
	Paddy Husk	5.60	5.93	5.60	5.13	5.57
5 MST	Paddy Straw	5.20	5.00	6.07	6.00	5.57
	OPEFB	5.33	5.87	5.07	5.80	5.52
	Mean	5.38	5.60	5.58	5.64	

Jurnal Online Agroekoteknologi
E-ISSN No. 2337- 6597
Vol. 8.No.1, January (10): 63- 68
DOI: 10.32734/jaet

6 MST	Paddy Husk	6.33	6.33	5.73	5.60	6.00
	Paddy Straw	5.53	5.40	6.20	6.13	5.82
	OPEFB	5.67	6.07	5.27	5.93	5.73
	Mean	5.84	5.93	5.73	5.89	
7 MST	Paddy Husk	7.07	6.80	6.60	6.60	6.77a
	Paddy Straw	5.87	5.93	6.33	6.53	6.17b
	OPEFB	5.67	6.07	5.27	5.93	5.73c
	Mean	6.20	6.27	6.07	6.36	
8 MST	Paddy Husk	7.40	6.93	7.00	6.93	7.07
	Paddy Straw	6.13	6.13	6.73	7.20	6.55
	OPEFB	6.13	6.27	6.13	6.73	6.32
	Mean	6.56	6.44	6.62	6.96	

Description: Numbers followed by the same letters in the same column showed no significant difference according to Duncan's Multiple Range Test at the level of α = 5%

Table 3. Tuber dry weight per shallot plant sample in the treatment of various biochar sources and kieserite fertilizer

Biochar Sources	Kieserite (g/plot)				Mean
	K0:0	K1:5	K2:10	K3:15	
	……..…….....g……..…...……				
Paddy Husk	34.03	38.77	38.89	36.60	37.07a
Paddy Straw	44.61	35.46	37.19	42.60	39.97a
OPEFB	35.86	36.70	33.34	31.02	34.23b
Mean	38.17	36.98	36.47	36.74	

Description: Numbers followed by the same letters in the same column showed no significant difference according to Duncan's Multiple Range Test at the level of α = 5%

CONCLUSION

The application of paddy husk, paddy straw and OPEFB biochars had a significant effect on plant lengths of 7-8 MST, number of tillers aged 3 and 7 MST and has a significant effect on the parameters of tubers dry weight per sample and has no significant effect on other parameters. Paddy straw biochar application was the best treatment for the growth and production of shallots. The application of kieserite fertilizer had no significant effect on all observational parameters. The application of kieserite fertilizer with a dose of 15 g/plot was the best treatment for the growth and production of shallots. The interaction of the two treatments had no significant effect on all parameters.

REFERENCES

BPS. 2018. Statistik Pertanian 2018. Pusat Data dan Sistem Informasi Pertanian

Jurnal Online Agroekoteknologi
E-ISSN No. 2337- 6597
Vol. 8.No.1, January (10): 63- 68
DOI: 10.32734/jaet

Kementerian Pertanian Republik Indonesia. Jakarta.

Dariah, A. 2012. Pemanfaatan Biochar Untuk Meningkatkan Produktivitas Lahan Kering Beriklim Kering. Balai Penelitian Tanah. Bogor.

Haryanti,A. 2014. Studi Pemanfaatan Limbah Padat Kelapa Sawit. Fakultas Teknik Universitas Mulawarman. Samarinda.

Makmur A. 1985. Pokok-Pokok Pengantar Ilmu Pertanian. Jakarta.

Riadi, Y.A. 2010. Pengaruh Komposisi Media Tanam dan Pupuk Organic Cair Terhadap Pertumbuhan Dan Hasil Tanaman Kacang Hijau. Artikel Ilmiah Jurusan Budidaya Pertanian. Universitas tanjung pura Pontianak.

Sihombing, R. 2011. Pemberian Kieserit dan Kotoran Ayam terhadap Produksi Sawi (*Brassica juncea* L.) Pada Tanah Ultisol Asal Simalingkar. Fakultas Pertanian. USU Press. Medan. Pp: 1- 5.

Sumarni , N.,Achmad, H. 2005. Budidaya Bawang Merah. Balai Penelitian Tanaman Sayuran. Bandung.Frans. J.A.S. 2015. Respons Pertumbuhan dan Produksi Bawang Merah (Allium Ascalonicum L.) Terhadap Pemberian Pupuk Kandang Ayam dan Urine Sapi. USU Press. Medan. Pp: :1703 – 1712.

Thammasom, N. 2016. Biochar and Rice Straw have Different Effects on Soil Productivity Greenhouse Gas Emission and Carbon Sequestration in Northeast Thailand Paddy Soil. Faculty of Agriculture.