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Effect Of Chicken Manure And Volcanic Ash On The Growth And Production Of Shallot (*Allium ascalonicum* L.) And P Availability In Paddy Field

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Abstract

This study aims to determine the effect of applying chicken manure and volcanic ash on the growth and production of shallots (Allium ascalonicum L.) and P availability in paddy fields. This research was conducted in paddy field at Jln. Harmonika Baru Pasar II, Tanjung Sari Urban Village, Medan Selayang Sub-district, Medan with an altitude of ± 30 meters above sea level. This research was conducted from December 2019 to February 2020. This study used a Randomized Group Design (RAK) with 2 treatment factors. The first factor, chicken manure with 4 levels, namely: A0 = Control (without chicken manure), A1 = 3.75 kg/plot (10 tons/ha), A2 = 7.5 kg/plot (20 tons/ha) and A3 = 11.25 kg/plot (30 tons/ha). The second factor is volcanic ash with 4 levels, namely: V0 = Control (no volcanic ash), V1 = 1.88 kg/plot (5 tons/ha), V2 = 3.75 kg/plot (10 tons/ha) and V3 = 5.62 kg/plot (15 tons/ha). The results showed that the treatment of chicken manure doses up to a dose of 7.5 kg/plot significantly increased leaf length, number of bulbs, wet weight of bulbs/plant, wet weight of bulbs/plot, dry weight of bulbs/plant, dry weight of bulbs/plot, base saturation, C-Organic, soil pH, and soil P availability, but had no significant effect on soil CEC. The treatment of vulaknik ash dose had no significant effect on leaf length, number of tubers, wet weight of tubers/plant, wet weight of tubers/plot, dry weight of tubers/plant, dry weight of tubers/plot, soil CEC, base saturation, C-Organic, soil pH and P availability. The interaction between doses of chicken manure and volcanic ash had a significant effect on the wet weight of tubers/plot and dry weight of tubers/plot, but had no significant effect on leaf length, number of tubers, wet weight of tubers/plant, dry weight of tubers/plant, soil CEC, base saturation, C-Organic, soil pH and P availability.

Keywords: Chicken manure, volcanic ash and shallots.

INTRODUCTION

Shallots (*Allium ascalonicum* L.) are one of the horticultural commodities that have high economic value and are often used in flavoring dishes. As a horticultural commodity that is widely consumed by the community, the potential for onion development is still open not only for domestic needs but also abroad. Based on its nutritional content, 100 grams of shallots contain about 80-85% water, 1.5% protein, 0.3% fat and 9.2% carbohydrates as well as other contents such as iron, potassium

minerals, phosphorus, ascorbic acid, naisin, riboflavin vitamin B and vitamin C (Sukmasari & Acep, 2022).

Shallot production in North Sumatra from 2014 to 2018 was 7,810 tons, 9,971 tons, 13,368 tons, 16,103 tons, and 16,337 tons respectively. In the last 5 years, shallot production has increased, but this has not met the consumption needs in 2018 which reached 47,900 tons (BPS, 2019). Onion production in North Sumatra is not enough to meet the increasing market demand for shallots.

Paddy fields can come from dry land that is irrigated and then sown, or from swampy land that is drained by making drainage channels. If the relief or topography of the original land is undulating or sloping, then a bench terrace must first be made. Rice fields whose water comes from irrigation water are called irrigated rice fields, while those whose water source comes from rainwater are called rain-fed rice fields. In tidal areas, tidal rice fields are found, while those developed in swampy areas are called swamp rice fields or lebak rice fields. In connection with the process of making rice fields, the nature of the original soil (virgin soil) may change. On swamp/tidal land there is a process of soil drying, starting from the top layer to the bottom layer. Conversely, on dry land that is sown, there will be a wetting process from the top layer to the bottom. Rice fields that originate from volcanic materials or always get overflow from volcanic activity (volcanoes) are generally more fertile when compared to rice fields that develop from other parent materials (Wahyunto & Fitri, 2014)

Chicken manure can accelerate the decomposition of volcanic ash so as to provide nutrients needed in the growth and production of shallot plants. To accelerate the decomposition process of volcanic ash, it can be done by combining the application of volcanic ash with manure. It is known that volcanic material has not been able to contribute nutrients to plants, because it is a recent material that has not undergone complete weathering and also the dominance of the sand fraction makes this volcanic material unable to retain water (Nurlaeny et al., 2012)

The volcanic ash layer, which has the potential to contain soil fertilizing nutrients for agriculture, can actually only be utilized about 10 years after the volcanic ash dispersal event. However, a simple technology to accelerate the weathering of volcanic ash can be done by mixing organic materials. Organic materials that contain various types of organic acids are able to release nutrients bound in the mineral structure of volcanic ash. In addition, organic matter is also able to maintain moisture conditions so that physical, chemical and biological weathering takes place

simultaneously to accelerate the release of plant nutrients from mineral nutrient reserves (Pardede et al., 2015)

The results of Malau's research (2018) showed that the application of volcanic ash to shallots on paddy fields with a combination of manure with the treatment of no manure application, with a dose of 5 tons/ha, and 10 tons/ha gave no significant effect on the weight of dry bulbs per clump, and the number of bulbs per clump, while the interaction between Sinabung volcanic ash and chicken manure had a significant effect on the weight of dry bulbs per clump, and the number of bulbs per clump.

Based on the description above, researchers are interested in conducting research on the effect of applying chicken manure and volcanic ash on the growth and production of shallots (Allium ascalonicum L.) and the availability of P in paddy fields.

RESEARCH METHODS

Place and Time of Research

This research was conducted in paddy fields at Jln. Harmonika Baru Pasar II, Tanjung Sari Village, Medan Selayang Subdistrict, Medan with an altitude of ± 30 meters above sea level. This research was conducted from December 2019 to February 2020.

Research Materials and Tools

The materials used in this study were shallot seedlings of Brebes variety, volcanic ash of Mount Sinabung, chicken manure, organic pesticide azadirachtin as a pest repellent poison on shallot plants during the study, organic fungicide as a treatment for shallot seedlings, sample labels as markers on research samples, plastic ropes used to make plot boundaries, sample stakes as a place to attach sample labels.

The tools used in this study are hoes used for processing, loosening, and leveling the soil, machetes used for clearing shrubs and for cutting wood, meters used to measure plots, rulers used to measure the height of sample plants, paddles used for watering shallot plants, cameras as a research documentation tool, analytical scales used to weigh the wet weight of bulbs, sitting scales to weigh chicken manure, stationery as a tool to record parameters during the study.

Research Methods

This research used a Randomized Group Design (RAK) with 2 treatment factors, as follows:

1. The first factor, chicken manure with 4 levels, namely:
   A_0 = Control (without chicken manure)
   A_1 = 3.75 kg/plot (10 tons/ha)

A_2 = 7.5 kg/plot (20 tons/ha)

A_3 = 11.25 kg/plot (30 tons/ha)

2. The second factor, volcanic ash with 4 levels, namely:

   V_0 = Control (without volcanic ash)

   V_1 = 1.88 kg/plot (5 tons/ha)

   V_2 = 3.75 kg/plot (10 tons/ha)

   V_3 = 5.62 kg/plot (15 tons/ha)

The number of treatment combinations is 4 x 4 = 16, namely:

A_0V_0	A_1V_0	A_2V_0	A_2V_0
A_0V_1	A_1V_1	A_2V_1	A_3V_1
A_0V_2	A_1V_2	A_2V_2	A_3V_2
A_0V_3	A_1V_3	A_2V_3	A_3V_3

Number of replicates	: 2 replicates
Number of Plots	: 32 plots
Number of plants/Plot	: 66 plants
Number of sample plants	: 5 plants
Number of destructive samples	: 2 samples
Total number of plants	: 2,112 plants
Total sample plants	: 160 plants
Distance between plots	: 50 cm
Distance between replicates	: 50 cm
Plot area	: 250 cm x 150 cm
Land Area	: 50 m x 5 m

Data Analysis Method

Data analysis was done by variance analysis with the following linear model:

$$Y_{ijk} = \mu + \rho_i + K_j + J_k + (KJ)_{jk} + \varepsilon_{ijk}$$

Description:

Yijk = Observation result of chicken manure factor at the jth level and volcanic ash factor at the kth level in the i-th replication.

μ = Center value

ρ_i = Effect of the i-th replication

Kj = Effect of chicken manure factor at the jth level

Jk = Effect of volcanic ash factor at the j-th level

(KJ)jk = Interaction effect of chicken manure factor at the jth level and volcanic ash factor at the kth level

ε_{ijk} = Error effect on the i-th replication with chicken manure factor at the jth level and volcanic ash factor at the kth level.

For factors that have a real or very real effect on the variance analysis test, then the difference of means test is carried out using the DMRT (Duncan Multiple Range Test) at the 5% level and the response curve.

RESULT

Results of Initial Soil Analysis, Chicken Manure and Volcanic Ash

The results of the initial soil analysis, chicken manure and volcanic ash can be seen in Table 1.

Tabel 1. Preliminary Soil, Manure and Volcanic Ash Analysis

No	Analysis Result	Soil	Manure Chicken	Volcanic Ash
1	pH	5,84	8,11	3,84
2	C-org (%)	1,05	34,16	0,58
3	P Bray I (ppm)	9,93		8,73
4	P_2O_5 (%)	-	4,35	48,31
5	K_2O (%)	-	3,98	-
6	Water Content (%)	-	13,99	-
7	K^+ Bray I (ppm)	57,27	-	48,31
8	P HCl 25 % (ppm)	253,51	-	432,89
9	K^+ HCl 25 % (ppm)	236,05	-	868,78
10	Ca ($cmol^{(+)}/kg$)	7,72	-	0,56
11	g ($cmol^{(+)}/kg$)	1,99	-	0,04
12	K ($cmol^{(+)}/kg$)	0,19	-	0,28
13	Na ($cmol^{(+)}/kg$)	0,48	-	0,18
14	CEC ($cmol^{(+)}/kg$)	17,56	-	7,64
15	Base Saturation (%)	59,11	-	13,85
16	S-Total (%)	0,04	0,25	0,21
17	Si-Total (%)	77,46	23,61	88,84
18	Si-Available (ppm)	313,93	-	398,84
19	S-Available (ppm)	6,18	-	187,84

Source: Laboratory of Soil Department, Faculty of Agriculture, IPB, Bogor (2020)

Table 1 shows that the initial soil has a pH of 5.84 (neutral) with C-organic content of 1.05% (low), S-total of 0.04% and Si-total of 77.46%, Si-available of 313.93

ppm and S-available of 6.18%. Chicken manure has a pH of 8.11, C-organic by 34.16% (high), S-total by 0.25% and Si-total by 23.61%. Volcanic ash contains a pH of 3.84 (acidic) with a C-organic content of 0.58% (low).

Leaf Length (cm)

The list of variance showed that the application of chicken manure had a significant effect on the length of shallot leaves at the age of 2, 3, 4 and 5 weeks after planting, while the application of volcanic ash, as well as the interaction between the two treatments had no significant effect on the length of shallot leaves at all observation ages. Table 2 presents the average length of shallot leaves at the age of 2, 3, 4 and 5 weeks after planting due to the application of chicken manure and different volcanic ash.

Tabel 2. Average Leaf Length (cm) of Shallot in the Treatment of Chicken Manure and Volcanic Ash at Age 2, 3, 4 and 5 Weeks After Planting

Treatment	Leaf Length (cm)			
	2 WAP	3 WAP	4 WAP	5 WAP
A_0	20,09a	25,25a	28,79a	33,25a
A_1	23,64b	31,94b	38,33b	43,36b
A_2	24,75b	32,97b	38,81b	44,05b
A_3	25,00b	33,44b	39,35b	43,32b
V_0	23,19	31,04	36,12	41,06
V_1	23,20	30,56	36,47	40,78
V_2	23,32	31,02	35,93	40,65
V_3	23,76	30,98	36,76	41,49

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Tabel 2 menunjukkan bahwa tanaman yang diberi pupuk kandang ayam (A_1, A_2 dan A_3) memiliki panjang daun yang lebih panjang dibandingkan dengan tanaman yang tidak diberi pupuk kandang (A_0).

Number of Tubers

The list of variance shows that the treatment of chicken manure has a significant effect on the number of shallot bulbs. The treatment of volcanic ash had no significant effect on the number of shallot bulbs. The interaction between the two treatments had no significant effect on the number of shallot bulbs. Table 3 presents the average number of shallot bulbs due to different treatments of chicken manure and volcanic ash.

Tabel 3. Average Number of Bulbs of Shallot Plants (cloves) in the Treatment of Chicken Manure and Volcanic Ash

Treatment	V_0	V_1	V_2	V_3	Average

A_0	7,00	7,30	7,00	7,00	7,08a
A_1	9,00	10,10	7,70	9,70	9,13b
A_2	9,10	8,80	8,20	10,65	9,19b
A_3	7,50	9,90	7,80	9,60	8,70b
Average	8,15	9,03	7,68	9,24	

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Table 3 shows that plants treated with chicken manure (A_1, A_2 and A_3) had more tubers than plants not treated with manure (A_0).

Tuber Wet Weight/Plant (g)

The list of variance showed that the treatment of chicken manure had a significant effect on the wet weight of tubers/plant. The treatment of volcanic ash had no significant effect on the wet weight of tubers/plant. The interaction between the two treatments had no significant effect on the wet weight of tubers/plant. Table 4 presents the average wet weight of tubers/plant due to different treatments of chicken manure and volcanic ash.

Tabel 4. Average Wet Weight of Tubers/Plant (g) in the Treatment of Chicken Manure and Volcanic Ash

Treatment	V_0	V_1	V_2	V_3	Average
A_0	62,50	69,50	77,90	87,10	74,25a
A_1	142,90	149,20	131,20	184,50	151,95b
A_2	169,80	163,10	115,20	119,95	142,01b
A_3	140,40	156,40	104,10	109,70	127,65b
Average	128,90	134,55	107,10	125,31	

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Table 4 shows that plants treated with chicken manure (A_1, A_2 and A_3) had heavier wet weight of tubers/plant compared to plants not treated with manure (A_0). The heaviest wet weight of tubers/plant was found in the A1 treatment, followed by A_2 and A_3, while the lowest wet weight of tubers/plant was found in the A_0 treatment.

Tuber Wet Weight/Plot (g)

The list of variance showed that the chicken manure treatment and the interaction between the two treatments significantly affected the wet weight of tubers/plot, while the volcanic ash treatment did not significantly affect the wet weight of tubers/plot. Table 5 presents the wet weight of tubers/plot due to different treatments of chicken manure and volcanic ash.

Tabel 5. Average Wet Weight of Tubers/Plot (g) in the Treatment of Chicken Manure and Volcanic Ash

Treatment	V_0	V_1	V_2	V_3
A_0	1302.50a	1697.50ab	2289.50bcd	2385.50bcd

A_1	2464.50bcd	2797.00cd	4056.00e	2522.50bcd
A_2	3144.50d	2115.50abc	2176.00abc	1742.00ab
A_3	2152.00abc	2232.00bc	1270.50a	1298.50a

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Table 5 shows that the largest wet weight of bulbs per plot of shallots is found in the A_1V_2 treatment combination, which is significantly different from all other treatment combinations. The smallest wet weight of bulbs per plot was found in the A_3V_2 treatment combination.

Tuber Dry Weight/Plant (g)

The list of variance showed that the dose of chicken manure treatment significantly affected the dry weight of tubers/plant, while the volcanic ash treatment did not significantly affect the dry weight of tubers/plant. The interaction between the two treatments had no significant effect on the dry weight of tubers/plant. Table 6 presents the average dry weight of tubers/plant due to different doses of chicken manure and volcanic ash treatments.

Tabel 6. Average Dry Weight of Tubers per Plant (g) in the Treatment of Chicken Manure and Volcanic Ash

Treatment	V_0	V_1	V_2	V_3	Average
A_0	38,80	40,10	45,10	49,10	43,28a
A_1	82,30	92,50	82,60	105,60	90,75c
A_2	103,60	95,00	68,40	59,88	81,72bc
A_3	79,80	80,60	60,50	61,70	70,65b
Average	76,13	77,05	64,15	69,07	

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Table 6 shows that plants treated with chicken manure (A_1, A_2 and A_3) had significantly heavier tuber dry weight per plant compared to plants not treated with manure (A_0). The heaviest tuber dry weight was found in the A_1 treatment, significantly different from A_0 and A_3, but not significantly different from A_2.

Tuber Dry Weight/Plot (g)

The list of variance showed that the chicken manure treatment and the interaction between the two treatments significantly affected the dry weight of tubers/plot, while the volcanic ash treatment did not significantly affect the dry weight of tubers/plot. Table 7 presents the average dry weight of tubers/plot due to different treatments of chicken manure and volcanic ash.

Tabel 7. Average Dry Weight of Tubers/Plot (g) in the Treatment of Chicken Manure and Volcanic Ash

Treatment	V_0	V_1	V_2	V_3

A_0	879.00abc	1250.50abcde	1475.50bcdef	1560.50cdef
A_1	1761.50ef	1962.50efg	2513.00g	1628.00def
A_2	2018.00fg	1225.00abcde	1442.00abcdef	977.50abcd
A_3	1299.00abcdef	1328.00abcdef	752.50ab	708.50a

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Table 7 shows that the largest tuber dry weight/plot was found in the A_1V_2 treatment combination, significantly different from A_0V_0, A_1V_0, A_3V_0, A_0V_1, A_2V_1, A_3V_1, A_0V_2, A_2V_2, A_3V_2, A_0V_3, A_1V_3 A_2V_3 and A_3V_3, but not significantly different from A_2V_0 and A_1V_1.

P availability (ppm)

The analysis of variance showed that the chicken manure dose treatment significantly affected soil P availability, while the volcanic ash treatment and the interaction between the two treatments did not significantly affect soil P availability. Table 8 presents the average availability of soil P due to different doses of chicken manure and volcanic ash treatments.

Tabel 8. Average Soil P Availability (ppm) in Chicken Manure and Volcanic Ash Treatments

Treatment	V_0	V_1	V_2	V_3	Average
A_0	31,48	25,04	40,85	26,76	31,03a
A_1	174,45	294,15	344,59	275,50	272,17b
A_2	369,57	125,53	241,36	307,60	261,02b
A_3	302,28	297,39	288,16	350,80	309,66b
Average	219,44	185,53	228,74	240,17	

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

In Table 8, it can be seen that in the chicken manure treatment, the highest soil P availability is found in the A_3 treatment, significantly different from A_0, but not significantly different from A_1 and A_2. Soil P availability in A_2 and A_1 treatments is significantly different from A_0.

Soil CEC (cmol(+)/kg)

The list of variance showed that the doses of chicken manure and volcanic ash, as well as the interaction between the two treatments had no significant effect on soil CEC. Table 9 presents the average soil CEC due to different doses of chicken manure and volcanic ash.

Tabel 9. Average Soil CEC (cmol(+)/kg) in the Treatment of Chicken Manure and Volcanic Ash

Treatment	V_0	V_1	V_2	V_3	Average
A_0	23,47	22,38	22,93	19,82	22,15

A_1	22,52	28,67	27,52	23,83	25,64
A_2	20,82	20,78	24,38	19,71	21,42
A_3	19,91	24,50	22,08	20,81	21,83
Average	21,68	24,08	24,23	21,04	

Table 9 shows that in the chicken manure treatment, the highest soil CEC is found in the A_1 treatment and the lowest in A_2. Volcanic ash treatment had no significant effect on soil CEC. The highest soil CEC was found in the V_2 treatment and the lowest in the V_3 treatment.

Base Saturation (%)

The list of variance showed that the dose of chicken manure treatment had a significant effect on soil base saturation, while the volcanic ash treatment and the interaction between chicken manure and volcanic ash had no significant effect on soil base saturation. Table 10 presents the average soil base saturation due to different doses of chicken manure and volcanic ash.

Tabel 10. Average Soil Base Saturation (%) in Chicken Manure and Volcanic Ash Treatments

Treatment	V_0	V_1	V_2	V_3	Average
A_0	53,78	54,66	51,97	55,51	53,98a
A_1	82,19	86,09	95,05	93,37	89,17b
A_2	127,37	85,07	85,01	100,17	99,41b
A_3	110,90	95,75	89,52	121,46	104,41b
Average	93,56	80,39	80,39	92,63	

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Table 10 shows that in the chicken manure treatment, the highest soil base saturation is found in the A_3 treatment, significantly different from A_0, but not significantly different from A_1 and A_2. Soil base saturation in the A_2 treatment was significantly different from A_0, but not significantly different from A_1.

Soil C-Organic Content (%)

The list of variance showed that the dose of chicken manure treatment significantly affected soil C-organic content, while the volcanic ash treatment and the interaction between chicken manure and volcanic ash had no significant effect on soil C-organic content. Table 11 presents the average soil C-organic content due to different doses of chicken manure and volcanic ash treatments.

Tabel 11. Average Soil C-Organic Content (%) in Chicken Manure and Volcanic Ash Treatments

Treatment	V_0	V_1	V_2	V_3	Average
A_0	1,56	2,35	1,50	1,40	1,70a

A_1	2,40	2,94	3,43	2,59	2,84b
A_2	3,52	2,39	2,84	2,72	2,87b
A_3	2,61	2,98	2,80	2,80	2,80b
Average	2,52	2,67	2,64	2,38	

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Table 11 shows that in the chicken manure treatment, the highest soil C-organic content was found in the A_2 treatment, significantly different from A_0, but not significantly different from A_1 and A_3.

Soil pH

The list of variance showed that the dose treatment of chicken manure had a significant effect on soil pH, while the volcanic ash treatment and the interaction between chicken manure and volcanic ash had no significant effect on soil pH. Table 12 presents the average soil pH due to different doses of chicken manure and volcanic ash treatments.

Tabel 12. Average Soil pH in the Treatment of Chicken Manure and Volcanic Ash

Treatment	V_0	V_1	V_2	V_3	Average
A_0	5,24	5,09	5,28	5,31	5,23a
A_1	6,29	6,72	6,60	6,54	6,53b
A_2	6,57	6,29	6,57	6,53	6,49b
A_3	6,74	6,65	6,27	6,59	6,56b
Average	6,21	6,19	6,18	6,24	

Notes : Numbers followed by the same letter in the same column and group mean not different based on Duncan test at 5% level.

Table 12 shows that in the treatment of chicken manure, the highest soil pH is found in treatment A_3 significantly different from A_0, but not significantly different from A_1 and A_2. soil pH in treatment A_2 significantly different from A_0, but not significantly different from A_1. soil pH in treatment A_1 significantly different from A_0.

DISCUSSION

The results showed that the application of chicken manure at a dose of 7.76 kg/plot was able to increase the maximum leaf length by 45.26 cm, significantly longer than without the application of manure (33.25 cm). Application of chicken manure at a dose of 7.08 kg/plot produced a maximum number of bulbs of 9.41 cloves, significantly more than without application of chicken manure (7.08 bulbs). Application of chicken manure at a dose of 6.85 kg/plot produced a maximum wet weight of tubers per plant of 155.19 g, significantly heavier than without application of chicken manure (74.25 g). Application of chicken manure at a dose of 3.75 kg/plot produced a wet weight of tubers per plot of 2960 g significantly heavier than the dose of chicken manure 7.50

kg/plot (2294.50 g), the dose of chicken manure 11.25 kg/plot (1738.25 g) and without application of chicken manure (1918.75 g). Application of chicken manure at a dose of 6.56 kg/plot produced the maximum dry weight of tubers per plant of 90.81 g, which was significantly heavier than without application of chicken manure (43.28 g). Application of chicken manure at a dose of 3.75 kg/plot produced a tuber dry weight per plot of 1966.25 g significantly heavier than the dose of chicken manure 7.50 kg/plot (1415.63 g), the dose of chicken manure 11.25 kg/plot (1022.00 g) and without application of chicken manure (1291.38 g). The dry weight of bulbs per plot of shallots produced was 1966.25 g (7.37 tons/ha) which is still lower than the description of the production of the Bima varietsa shallots which can reach 9.9 tons/ha. This is because the fertilizer used in this study is organic fertilizer whose effect on shallot production is lower than the provision of inorganic fertilizers, but the provision of organic fertilizers can improve the soil. The application of chicken manure can improve the physical properties of the soil to become looser, so that root growth becomes better. Better root growth will increase nutrient uptake by plant roots used in the photosynthesis process. Increasing the rate of photosynthesis will be able to accumulate optimally in growth organs such as roots, stems, leaves and shallot bulbs. This is supported by research Nasution et al. (2016) showed that the application of chicken manure at a dose of 25 tons/ha produced the highest fresh weight of bulbs per plant and per plot.

The results showed that the application of chicken manure at a dose of 9.64 kg/plot produced maximum soil base saturation of 104.82% significantly higher than without application of chicken manure (53.98%). Application of chicken manure at a dose of 7.69 kg/plot resulted in a maximum soil C-Organic content of 3.02% significantly higher than without application of chicken manure (1.70%). Application of chicken manure at a dose of 8.03 kg/plot resulted in a maximum soil pH content of 6.71 significantly higher than without application of chicken manure (5.23). Application of chicken manure at a dose of 8.84 kg/plot resulted in maximum soil P availability of 313.96 ppm significantly higher than without chicken manure application of 31.03 ppm. This shows that the application of chicken manure can improve soil physical properties (base saturation, C-organic content and soil pH. This is because the breakdown of organic matter in chicken manure will increase soil C-organic and soil pH. The increase in soil pH after application of chicken manure is thought to be caused by organic matter contained in chicken manure which has functional groups that can adsorb cations to be greater.

The results showed that the response of plant growth and production to the application of chicken manure was cubic. This plant response to the application of chicken manure is also very dependent on the balance of nutrient availability in plants. When nutrients are available in the soil, plants do not respond to the application of chicken manure and vice versa if the supply of nutrients is reduced, plants will respond to the application of manure.

Volcanic ash dose treatment had no significant effect on leaf length, number of tubers, wet weight of tubers per plant, wet weight of tubers per plot, dry weight of tubers per plant, dry weight of tubers per plot, soil CEC, base saturation, C-Organic, soil pH and P availability. This is because volcanic material has not been able to contribute nutrients to plants, because it is a new material (recent material) that has not undergone complete weathering. Volcanic material is dominated by the sand fraction, so it cannot retain water. Volcanic ash will undergo physical and chemical weathering with the help of water and organic acids in the soil. The natural weathering process takes a long time. The use of organic fertilizers can reduce the metal content in volcanic ash as a nutrient provider. Research by (Nakhmiidah et al., 2016) showed that the addition of volcanic ash up to a dose of 30% in the planting medium did not have a significant effect on the growth and yield of sweet corn plants.

Manure application without volcanic ash at a dose of 6.75 kg/plot resulted in a maximum wet weight per plot of 2987.54g. In volcanic ash application at a dose of 1.88 kg/plot, manure application up to a dose of 3.75 kg/plot increased the wet weight of tubers per plot. At the application of volcanic at a dose of 3.75 kg/plot, the application of manure up to a dose of 4.24 kg/plot resulted in a maximum wet weight per plot of 3374.22g. At a dose of 5.63 kg/plot, applying manure up to a dose of 0.40 kg/plot resulted in a maximum wet weight per plot of 2449.90g.

Without volcanic ash application, manure application up to a dose of 6.34 kg/plot produced a maximum dry weight per plot of 2004.20g. When volcanic ash was applied at a dose of 1.88 kg/plot, the increase in manure dose increased at a dose of 3.75 kg/plot, then decreased at a dose of 7.50 kg/plot and increased again at a dose of 11.25 kg/plot. In the volcanic application at a dose of 3.75 kg/plot, the application of manure up to a dose of 4.22 kg/plot resulted in a maximum wet weight per plot of 2146.22g. The treatment of volcanic application at a dose of 5.63 kg/plot, the provision of increasing doses of manure will reduce the dry weight of tubers per plot.

From the description above, it can be seen that the application of chicken manure accompanied by the application of volcanic ash can increase the wet weight of bulbs per plot and the dry weight of bulbs per plot, but the application of volcanic ash dose of 5.62 kg/plot (V_3) cannot increase the wet weight of bulbs per plot and the dry weight of bulbs per plot. The application of chicken manure accelerates the decomposition of volcanic ash so that it provides the nutrients needed by shallot plants. Although most of the parameters showed no significant results from the addition of volcanic ash and chicken manure, it can be seen that organic matter is directly proportional to the improvement of soil chemical properties such as soil C-organic, CEC, KB and others. The very low pH of volcanic ash is a barrier to available P. For this reason, it is necessary to normalize the pH of volcanic ash by applying dolomite as a neutralizer, so that the mineral content stored in volcanic ash can be used by plants in their growth process.

CONCLUSION

1. The treatment of chicken manure dose up to 7.5 kg/plot significantly increased leaf length, number of tubers, wet weight of tubers/plant, wet weight of tubers/plot, dry weight of tubers/plant, dry weight of tubers/plot, base saturation, C-Organic, soil pH, and soil P availability, but had no significant effect on soil CEC.
2. Volcanic ash dose treatment had no significant effect on leaf length, number of tubers, wet weight of tubers/plant, wet weight of tubers/plot, dry weight of tubers/plant, dry weight of tubers/plot, soil CEC, base saturation, C-Organic, soil pH and P availability.
3. The interaction between doses of chicken manure and volcanic ash significantly affected the wet weight of tubers/plot and dry weight of tubers/plot, but had no significant effect on leaf length, number of tubers, wet weight of tubers/plant, dry weight of tubers/plant, soil CEC, base saturation, C-Organic, soil pH and P availability.

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