Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

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OPEN ACCESS Asian Journal of Plant Sciences

ISSN 1682-3974
DOI: 10.3923/ajps.2022.32.38

Research Article
Role of Potassium Source from Eco Enzyme on Growth and Production of Shallot (*Allium ascalonicum* L.) Varieties

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Abstract
Background and Objective: The use of shallot varieties and sources of the eco enzyme as organic fertilizer is an alternative effort to increase the productivity of shallot bulbs. The study aims to determine the growth and production response of shallot varieties on the application of potassium sources from the eco enzyme. **Materials and Methods:** This research was conducted in the experimental land of the Faculty of Agriculture, Universitas Sumatera Utara from February-April, 2021, used a factorial randomized block design. The first factor is the variety of shallots from the bulb (Lokananta and Sanren F1) and the second factor is the potassium source from the eco enzyme (control, orange peel 20 ml L^{-1}, chicory 15 ml L^{-1} and pineapple skin 20 ml L^{-1}). **Result:** The results showed that the Lokananta variety has a plant height of 3-7 weeks after planting, wet weight of the bulb and dry weight of bulb higher compared to Sanren F1. The treatment without eco enzyme (control), chicory and orange peel eco enzymes produced a wet weight of shoot, bulb wet weight and bulb dry weight higher compared to pineapple skin eco enzyme. The interaction between Lokananta variety with eco enzyme chicory orange peel and control resulted in bulb wet weight and bulb dry weight higher compared to pineapple skin treatment. **Conclusion:** The use of eco-enzyme chicory in Lokananta increased bulb dry weight by 20.47% compared to control. In the Sanren variety, the application of eco-enzyme chicory orange peel and pineapple skin reduced the bulb dry weight by, respectively 18.41, 37.78 and 26.29%.

Key words: Shallot, eco enzyme, potassium, growth, production, lokananta variety, plant taxonomy

Citation: Hasanah, Y., J. Ginting and A.S. Syahputra, 2022. Role of potassium source from eco enzyme on growth and production of shallot (*Allium ascalonicum* L.) varieties. Asian J. Plant Sci., 21: 32-38.

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Shallots are categorized as a strategic commodity because many Indonesians need them in their daily lives, thus affecting macroeconomics and high inflation rate. Shallots are not only used as a spice in cooking but also have health benefits[1]. Shallot cultivation can be carried out in various agroecosystems, both in the highlands and in the lowlands[2]. Until now, shallot production in Indonesia is still in deficit, therefore efforts are needed to increase shallot production. One of the efforts to increase the production of shallots is the selection of superior varieties. In Indonesia, there are several varieties of shallots that have been successfully developed so that it has a superior genotype and tolerant in the lowlands, including the Lokananta and Sanren F1 varieties. Lokananta varieties have the advantage of large bulb size, high production and resistance to *Fusarium* withering disease, while Sanren F1 varieties have the advantage of a large number of the bulb and high production. so it is expected that the use of these two superior varieties can increase the yield of shallots in the province of Sumatra Utara which is mostly lowland[3,4].

Fertilization is a key to the successful cultivation of shallot plants. One of the elements that shallot plants desperately need is potassium. In shallots, potassium can provide better bulb yield, higher quality and shelf life of tubers and tubers remain solid despite long storage. But excessive inorganic fertilizers have a serious impact on the soil. Inorganic fertilizers if used in the long term can harden the soil and decrease the stability of soil aggregates. In the future this can be a serious impact on environmental damage, lowering the quality of land and productivity of shallot[5]. One alternative solution that can be done is the use of eco enzyme as a source of potassium. Eco enzyme is an organic solution produced through a simple fermentation process of the rest of vegetables and fruits with the addition of brown sugar and water[6], that it can be used as bio sanitiser, floor cleaner, biopesticide and fertilizer for plants[7]. The highest results of the macro eco enzyme content test include potassium (K) 203 mg L^{-1} and phosphorus (P) 21.79 mg L^{-1}. These nutrients play a role in the growth and quality of shallot bulbs. Some market waste that can be used as a source of the eco enzyme includes chicory orange peel and pineapple skin[8].

Shallot research to date has mostly been investigated the role of shallot and its properties as medicinal plants[9-11], shallot extract concentration[12,13], application of Sinabung volcanic ash and rice husk[14,1], the effect of paclobutrazol and sulfur[15-17], morphology and taxonomic relationship of shallot cultivars in Indonesia[18] and detection of major viruses infecting shallot and molecular characterization of onion dwarf virus[19]. Studies on the effect of the eco enzyme on the growth and production of shallot have not been reported.

Based on the background, the objective of the research is to determine the growth and production response of shallot varieties on the application of potassium source from eco enzyme.

MATERIALS AND METHODS

Time and location: This research was conducted on the land of the Faculty of Agriculture, Universitas Sumatera Utara, Medan with a height of ±32 meters above sea level, starting in January-April, 2021.

Based on Table 1, it can be seen that the N content in the soil is 0.22%, P is 0.14%, K is 0.01% and the pH is low (4.5). The N content in eco enzyme from lowest to the highest was found in pineapple skin orange peel and chicory, respectively 0.49, 0.68 and 3.12%. The content of P in orange peel and pineapple skin is the same (0.01%), while the chicory has the highest P content (0.10%). The content of potassium in orange peel and pineapple skin is the same (0.11%), while the chicory has the highest potassium content (0.15%). Orange peel has the lowest pH, which is 3.57, followed by pineapple peel (3.58) and the highest pH is found in chicory (3.81). Chicory has the lowest of C-organic (1.94%), then pineapple skin (2.38%) and the highest of C-organic is found in orange peel (2.62%).

Materials: The materials used are shallot bulb of Lokananta and Sanren F1 variety organic waste in the form of pineapple peel orange peel and chicory as a source of eco enzyme, brown sugar, water, polybags, analytical scales and knife.

Research design: The study used a factorial randomized block design with 2 factors and 3 replications. The first factor is the variety, namely V_1 = Lokananta and V_2 = Sanren F1. The second factor is the source of potassium eco enzyme, namely E_0 = control, E_1 = orange peel, E_2 = chicory and E_3 = pineapple skin.

Procedures: The first step is eco enzyme making. The process includes mixing ingredients (chicory orange peel and pineapple peel) with molasses (brown sugar) and water using a ratio of 3:1:10, 3 parts are organic waste, 1 part for molasses (brown sugar) and 10 parts for water. After that the material is put in jerry cans separately, then tightly closed and stored for 2-3 months. Then made a plot with a size of 1×1 m, filled poly bag measuring 5 kg with the composition of soil topsoil: husks are 1:1. In 1 plot there are 5 polybags. Planting is done

Table 1. Results of soil analysis and eco enzymes

Parameter	Soil	Eco enzymes		
		Chicory	Orange peel	Pineapple skin
N (%)	0.22	3.12	0.68	0.49
P (%)	0.14	0.10	0.01	0.01
K-total (%)	0.01	0.15	0.11	0.11
pH	4.50	3.81	3.57	3.58
C-organic (%)	2.72	1.94	2.62	2.38
C/N ratio	12.32	0.60	3.85	4.85

N: Nitrogen, P: Phosphor, K: Potassium, C-organic: Carbon-organic and Source: Socfind's laboratory (2021)

by inserting seedling bulb 1 per planting hole that has been determined. Bulbs are planted by immersing half of the bulbs into the soil. Eco enzyme is given when the shallot is 1-8 Weeks After Planting (WAP) and applied every week. Eco enzyme dose treatment that will be applied among others to eco enzyme chicory with a dose of 15 mL L^{-1} orange peel 20 mL L^{-1} and pineapple skin 20 mL L^{-1} by spraying all over the surface of the leaves. Watering is done every day, morning and evening. At the time of bulb formation, the intensity of watering is increased and carried out to keep the soil wet throughout the day because the plant needs a lot of water to help bulb formation. Pest control is carried out manually or by spraying the insecticide Decis 25 EC (a.i deltamethrin 25 g L^{-1}) with a concentration of 0.5-1 mL L^{-1}. Disease control due to fungus is done by spraying the fungicide Antracol 70 WP (a.i propineb 70%) with a concentration of 2 g L^{-1}. Harvesting is done after 75% of the upper leaves have fallen at the age of 60-70 days after planting, by pulling the bulb carefully, tied and dried for 7 days.

Data analysis: The data were analyzed using the analysis of variance, if there was a significant effect, further tests were carried out using Duncan's Multiple Distance Test at $\alpha = 5\%$.

RESULTS AND DISCUSSION

Plant length: Based on Table 2. it can be known that the Lokananta variety has a plant length at 3-7 WAP longer compared to the Sanren F1 variety. The control treatment, white chicory eco enzyme and orange peel produced a longer plant length at 5-7 WAP compared to the pineapple skin eco enzyme treatment.

Shoot wet weight: Based on Table 3, it can be known that the Lokananta variety tends to have a higher shoot wet weight than Sanren F1. The wet weight of the shoot on the pineapple skin treatment was significantly lower than the control, chicory and orange peel of eco enzymes. There was a tendency that the treatment without eco enzyme on both Sanren and Lokananta varieties increased the shoot wet weight. The lowest shoot wet weight on the Sanren F1 variety was found in the pineapple peel treatment, while in the Lokananta variety, the lowest shoot wet weight was found in the chicory treatment of eco enzyme.

Shoot dry weight: Lokananta variety tends to have a higher shoot dry weight than Sanren F1. The dry weight of the shoot on orange peel treatment tends lowest among all the eco enzyme treatments. There was a tendency that the treatment without eco enzyme on both Sanren and Lokananta varieties increased the shoot dry weight. The lowest shoot dry weight on the Sanren F1 variety was found in the pineapple peel treatment, while in the Lokananta variety, the lowest shoot dry weight was found in orange peel treatment of eco enzyme (Table 3).

Number of bulb per plant: Based on Table 3. it can be known that the Sanren F1 variety has a higher number of bulb per plant than Sanren F1. The number of bulb per plant on the control treatment was highest than other treatments of eco enzymes. There was a tendency that the treatment without eco enzyme on both Sanren F1 varieties increased the number of bulb per plant. The lowest shoot wet weight on the Sanren F1 variety was found in the pineapple peel treatment, while in the Lokananta variety, the highest number of bulb per plant was found in the chicory treatment of eco enzyme.

Fresh weight of bulb: Lokananta variety has a higher fresh weight of bulb than Sanren F1. The application of pineapple skin treatment is the lowest among all the eco enzyme treatments. The highest fresh weight of bulb on the Lokananta variety was found in the chicory treatment of eco enzyme, while the lowest fresh weight of bulb was found in pineapple skin of eco enzyme. In the Sanren F1 variety, all eco enzyme treatments did not have a significant effect (Table 3).

Table 2: Plant length of shallots 3-7 WAP on the treatment of potassium source from eco enzyme

		Treatments				
WAP	Varieties	Control (E_0)	Orange peel (E_1)	Chicory (E_2)	Pineapple skin (E_3)	Mean
3	Lokananta (V_1)	26.56	24.57	26.13	22.09	24.84^a
	Sanren F1 (V_2)	24.63	23.00	24.12	21.54	23.32^b
	Mean	25.60^a	23.79^b	25.12^{ab}	21.81^c	
4	Lokananta (V_1)	30.57	29.70	29.13	26.62	29.01^a
	Sanren F1 (V_2)	27.11	23.59	26.37	23.57	25.16^b
	Mean	28.84^a	26.64^{bc}	27.75^{ab}	25.10^c	
5	Lokananta (V_1)	32.63	30.54	28.63	27.16	29.74^a
	Sanren F1 (V_2)	28.20	24.93	27.47	22.88	25.87^b
	Mean	30.42^a	27.74^b	28.05^b	25.02^c	
6	Lokananta (V_1)	32.32	31.24	29.29	27.54	30.10^a
	Sanren F1 (V_2)	28.04	24.23	27.32	23.52	25.78^b
	Mean	30.18^a	27.74^b	28.30^b	25.53^c	
7	Lokananta (V_1)	32.55	30.79	30.53	27.46	30.33^a
	Sanren F1 (V_2)	28.60	24.91	27.22	24.01	26.18^b
	Mean	30.58^a	27.85^b	28.87^b	25.73^c	

Numbers followed by a different superscripted letter on the same observation time and column showed significant differences based on Duncan's multiple range test at $\alpha = 5\%$

Table 3: Growth and production of shallot varieties on the application of potassium source of eco enzyme

Treatments	Shoot wet weight (g)	Shoot dry weight (g)	Number of bulb per plant (bulb)	Fresh weight of bulb (g)	Dry weight of bulb (g)
Variety (V)					
Lokananta (V_1)	10.23	1.32	5.14^b	55.36^a	43.20^a
Sanren F1 (V_2)	9.80	1.09	6.49^a	37.64^b	28.32^b
Potassium source of ecoenzyme (E)					
Control (E_0)	13.31a	6.17	6.17	54.45^a	41.69^a
Orange Peel (E_1)	9.51a	5.22	5.22	46.72^a	39.09^a
Chicory (E_2)	10.18a	5.94	5.94	56.22^a	41.09^a
Pineapple Skin (E_3)	7.06^b	5.92	5.92	28.61^b	21.19^b
V×E					
V_1E_0	14.68	1.90	5.00	62.91^{ab}	47.69^{ab}
V_1E_1	9.72	1.30	4.33	58.13^{bc}	49.07^a
V_1E_2	11.44	1.35	6.00	77.66^a	59.97^a
V_1E_3	5.06	0.71	5.22	22.73^e	16.08^d
V_2E_0	11.94	1.47	7.33	45.98^{cd}	35.68^{bc}
V_2E_1	9.30	0.91	6.11	35.31^d	29.11^c
V_2E_2	8.91	0.95	5.89	34.78^d	22.20^d
V_2E_3	9.06	1.01	6.63	34.49^{de}	26.30^{cd}

Numbers followed by a different superscripted letter on the same treatment and column showed significant differences based on Duncan's multiple range test at $\alpha = 5\%$

Dry weight of the bulb: Lokananta variety has a high dry weight of bulb than Sanren F1. The application of pineapple skin treatment was the lowest among all eco enzyme treatments. The highest dry weight of bulb on Lokananta variety was found in chicory treatment but it is not significantly different with control and eco enzyme from orange peel, while the lowest dry weight of bulb was found in eco enzyme from pineapple skin. In the Sanren variety, the highest dry weight of bulb was found in the treatment of control but it is not significantly different with eco enzyme from chicory and pineapple skin (Table 3).

DISCUSSION

The results showed that the treatment of Lokananta variety (V_1) has a plant length longer compared to the Sanren F1 (V_2) variety (Table 2). This is presumably because the Lokananta variety is more adaptive to environmental factors than Sanren F1 varieties so the growth rate is higher. This is supported by Devy *et al.*[20] which has stated that the character of plants can be influenced by genetic and environmental factors. Differences in plant growth can be caused by the inherited properties of each parent. In addition. coupled with adaptation to the environment will produce different phenotypes.

Sanren F1 variety produced a higher number of bulbs than Lokananta (Table 2). This is following the description of the Sanren F1 variety which can produce a higher number of bulbs per plant than Lokananta, presumably because of this genetic factor which causes the yield of Sanren F1 variety from bulb to be higher than Lokananta, Sanren variety from seed was able to produce 3-4 bulbs per plant[4].

Lokananta variety produced wet weight bulbs and dry weight bulbs are higher compared to the Sanren F1. This is due to the larger size of the bulb of the Lokananta variety that is influenced by genetic factors. This result is in line with the research of Saidah *et al.*[3] which stated that the weight of bulb and diameter of a bulb of Lokananta variety give higher results compared to Sanren F1. Andraini *et al.*[21] stated that crop productivity, in addition to being determined by growing environmental factors, is also influenced by the ability to adapt varieties to the environment. The genetic potential of a variety is very supportive of the success of farming. However, on the observed variable of the number of the bulb. Sanren F1 variety had more bulbs Lokananta. This is following the description of the Sanren F1 variety can produce a higher number of bulb per plant than Lokananta.

The control treatment, eco enzyme chicory and orange peel produce plant length, the wet and dry weight of the shoot is higher compared to the treatment of pineapple skin eco enzyme. with the highest results found in the control treatment. It is suspected that the content of very acidic pH as well as application through the leaves, cause damage to the wax layer on the leaf tissue so that the growth of plants given eco enzyme treatment becomes disrupted. The results of pH analysis in the soil and the three sources of the eco enzyme are very low (Table 1), namely orange peel eco enzyme (E_1) pH 3.57, chicory (E_2) pH 3. 81, and pineapple skin (E_3) pH 3.58 and the result of the soil analysis pH is also quite low (pH 4.5). This is in line with Sun *et al.*[22] which stated that plants doused with water containing vinegar acid grow can not be normal, a bit dwarf and growth is not optimal. The wax coating on the leaves is damaged so that the nutrients disappear causing the plant to be impervious to cold conditions. fungi and insects. Root growth is slow so fewer nutrients can be taken. and important minerals become lost. However, it is suspected that the nutrients provided through foliar application can still be absorbed by plants. this is evidenced by the treatment of eco enzyme orange peel and chicory that produces longer plant length compared to the treatment of eco enzyme pineapple skin. This is due to the content of N in pineapple skin eco enzyme (0.49%) which is an important nutrient in plant growth is lower compared to eco enzyme orange peel (0.68%) and chicory (3.12%). Tomar and Kalra[23] stated that the leaves absorb nutrients in low concentrations, low nutrient absorption through the leaves because the leaves have an adaptive response to the environment.

The control treatment, eco enzyme chicory and orange peel produce a wet and dry weight of bulb are higher compared to eco enzyme pineapple skin (Table 3). This is predicted to be related to the role of nitrogen, phosphor and potassium nutrients which are higher in chicory and orange peel compared to pineapple skin, where potassium plays a very important role in the bulb formation process. This is in line with the research of Rahnama *et al.*[24] which tested various methods of fertilizer application (without fertilizer, application through the soil, fertigation, foliar application and a combination of foliar spray and application through the soil) on palm oil seedlings. In his research, the absorption of foliar application showed vegetative growth that is not as optimal as fertilizer application with fertigation and a combination of applications through soil and leaves. The main vegetative parameters that differ significantly are plant height, stem diameter, leaf length and chlorophyll index. Based on this reason, it can be suspected that the application of sources of potassium eco enzyme through the leaves, not only damage plant tissue due to low pH but also less optimal nutrient absorption compared to applications through the soil.

The results of statistical data analysis showed the interaction of Lokananta varieties with the provision of sources of potassium eco enzyme chicory. orange peel and control are known to produce wet weight bulbs and dry weight bulbs (Table 3) higher compared to eco enzyme pineapple skin. It is suspected that differences in varieties as well as low pH in the treatment of several sources of eco enzyme, become an important factor in determining the results obtained. In addition, low nutrient absorption through the leaves causes results that do not significant difference between control treatment and other sources of potassium eco enzyme. This is characterized by some observed variables in control treatment that tends to be higher compared to other eco enzyme treatments. It is following the stated by Saidah *et al.*[3] that each variety has different potential results and characters. While Fernández and Eichert[25] has stated that the low absorption of nutrients through the leaves is because the leaves have an adaptive response to the environment. Therefore, when environmental conditions do not support nutrient absorption becomes less optimal.

CONCLUSION

The Lokananta variety has a higher plant length, wet weight of bulb and dry weight of bulb compared to the Sanren F1 variety. Treatment without eco enzyme (control). chicory and orange peel result in a higher plant length, wet weight of the bulb, wet weight of shoot, dry weight of shoot, wet weight of bulb and dry weight of bulb compared to pineapple skin. The interaction of Lokananta variety with sources of potassium eco-enzyme chicory orange peel and control showed that the wet weight bulb and dry weight of bulb were significantly higher than pineapple skin eco-enzyme.

SIGNIFICANT STATEMENT

This research has discovered findings that there are differences in the interaction of shallot varieties and source of potassium from eco enzyme on the growth and production of shallot. The research will assist researchers and farmers to use the concentration of eco enzyme application on shallot varieties. Based on the research the new theory has been obtained that the use of eco-enzyme chicory in Lokananta variety increased tuber dry weight by 20.47% compared to control (without eco enzyme). However, the application of eco-enzyme from pineapple peel reduced the dry weight of shallot bulb by 66.28%. In the Sanren variety, the use of eco-enzyme chicory orange peel and pineapple peel reduced the dry weight of shallot bulb by, respectively 18.41, 37.78 and 26.29%.

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