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A NEW METHOD TECHNOLOGY WASTE UTILIZATION AGRICULTURAL GROWTH PRODUCTION

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ABSTRACT.

*Shallots (Allium ascalonicum*L) are included in the superior national product. To increase the production of shallots, fertilizers containing complete nutrients are needed from various agricultural wastes, fermented anaerobically to obtain solid and liquid organic fertilizers. This research method uses a factorial Randomized Block Design (RAK) consisting of 2 factors studied with 16 treatment combinations and two replications. Factor I solid organic fertilizer (P) with a level of 0 kg/plot, 1.5 kg/plot, 2.5 kg/plot, 3.5 kg/plot, and factor 2 liquid organic fertilizer (C) with a level of 0 ml/liter water /plot, 250 ml/liter of water/plot, 450 ml/liter of water/plot, 650 ml/liter of water/plot. Parameters observed were:

- Plant height (cm).
- Wet tuber weight (g).
- Dry tuber weight (g).
- Production conversion per hectare (kg).

The study of the four parameters significantly affected the two treatments. This is what the researcher hopes for, and it is recommended that further research be carried out by providing a higher level of treatment for this research.

Keywords: fertilizer. solid, liquid, shallot, red.

I. INTRODUCTION

Shallots (Allium ascalonicum L) are one of the vegetables that are nationally superior in addition to red chilies and potatoes. Most Indonesian people need the shallots in their daily lives, thus affecting the economic market and high levels of demand (Handayani, 2014).

Shallots are a strategic commodity in Indonesia because changes in the price of shallots can affect inflation. The cause of high inflation can be an increase in the price of shallots. In addition, shallots are also a high-value commodity, so many farmers are engaged in cultivation (Central Bureau of Statistics and Directorate General of Horticulture, 2019).

Problems that often occur in the community's need for shallots are not balanced with production results, so they are not sufficient. The production of shallots is seasonal, so in this condition, it can cause turmoil between supply and demand that continues to occur. Onion production has increased in the last five years. Recorded in table 1, data from the Central Statistics Agency for North Sumatra Province, the development of the harvested area (Ha), production (tons), and demand (tons) of shallots in 2016-2020 can be seen in table 1 below.

Table 1. Harvested Area, Production and Needs of Shallots in North Sumatra 2016-2020.

Tahun	Luas Panen (Ha)	Produksi (ton)	Kebutuhan (ton)
2016	1.538	13.369	41.991
2017	2.090	16.103	37.996
2018	2.083	16.337	40.792
2019	2.246	18.072	48.684
2020	3.038	29.222	43.000

Source: Central Bureau of Statistics of North Sumatra Provinc

As seen in table 1, shallot production has increased for five consecutive years, while the demand for shallots has fluctuated. However, still, production cannot supply shallot needs in the province of North Sumatra. The disparity in a market with shallot production is relatively high, and research institutes must address this from universities to be able to take a role in increasing shallot production.

The development of agribusiness-based farming can be done by increasing production to increase farmers' income. The need for shallot commodities in Indonesia has grown by 5% yearly for domestic consumption and seeds; this condition is in line with the increasing number of people in Indonesia every year (Lucky Novianti. et al., 2020).

In general, shallots are propagated vegetatively by using tubers as seeds. Seeds in the form of tubers have a weakness; they cannot be stored so that after the off-season or rainy season, the supply of seeds for the next season is limited. One potential alternative technologies to be developed to overcome shallot seedlings in Indonesia is the use of botanical seeds (TSS = True Shallot Seed). The advantages of TSS are that it increases the yield of shallot bulbs up to two times compared to the use of tuber seeds (production 26 tons/ha), free from disease and viruses, and the need for TSS shallot seeds is less (2-3 kg/ha) compared to bulb seeds. (about 1-1.2 tons/ha) easier transportation, and longer shelf life than tubers. About 50% of onion seeds from seeds can still germinate after being stored for 1-2 years, while onion seeds from tubers can only be stored for about four months in a warehouse. Based on some of the advantages of TSS, the use of TSS as a seed source of shallots is very prospective to increase the production and quality of shallot bulbs (Susi Deliana Siregar, 2020).

Agricultural waste is defined as materials disposed of in the farming sector such as rice straw, corn straw, soybean straw, peanut straw, livestock manure, coconut fiber and shells, rice bran, and the like. Agricultural waste is generally divided into pre-harvest, post-harvest, and post-harvest waste. Furthermore, post-harvest waste can be classified as before and after processing or agricultural or industrial waste (Ir. I. Ketut Irianto, 2015).

Agricultural waste used as compost is rice straw and husks, weeds, corn stalks and cobs, all vegetative parts of plants, banana stems, and coconut husks. Compost is like a multivitamin for agricultural soil; compost will increase soil fertility and stimulate healthy roots. Compost improves soil structure by increasing soil organic matter content and increasing soil's ability to retain soil water content. Soil microbial activity beneficial to plants will increase with the addition of compost. This microbial activity helps plants to absorb nutrients from the soil and produce compounds that can stimulate plant growth. Plants fertilized with compost also tend to be better quality than plants fertilized with chemical fertilizers. For example crop yields are more resistant to storage, heavier, and fresher.

Composting technology to convert agricultural waste and urban organic waste into organic fertilizer (compost) has developed rapidly. Aerobic and anaerobic composting on a small or industrial scale can produce organic fertilizers or organic ameliorants to improve soil fertility, fertilization efficiency, and sustainably increase crop productivity. In this context, the effective use of organic waste will reduce the use of inorganic fertilizers and promote sustainable, environmentally friendly agriculture. In addition, agricultural waste can be used as raw material to produce bioenergy (biogas), food growing media, and animal feed (Prof. Ir. Tualar Simarmata, MP., et al., 2014).

The low production is not proportional to the demand for shallots in the province of North Sumatra. For this reason, the authors conducted research using TSS technology by utilizing several agricultural wastes to increase the growth and production of shallots which are expected to utilize various agricultural wastes used as solid organic fertilizers. Liquid can provide macro, micro, and micronutrients while slowly releasing nutrients over a long period and improving soil structure, water content, and cation exchange capacity (Biratu et al., 2019).

II. LITERATURE REVIEW

2.1. True shallot seed (TSS)

BRed onion is one of the important commodities and is very sensitive to inflation, the development of shallots gets support from the government in the form of a budget in the development of food estate areas in several regions in Indonesia. One of the biggest cost components in the shallot cultivation business is seeds, so it is necessary to pay attention to obtain quality seeds at affordable prices. Most people in North Sumatra still use seeds in the form of onion bulbs with relatively expensive prices. Seeds are the main component in cultivating shallots and farmers are still very dependent and accustomed to using tuber seeds. Now, onion seed technology has developed from seeds or what is known as True shallot seed (TSS) with advantages, namely seed health,

2.2. Agricultural Waste

IndonesiaAs an agricultural country, the agricultural sector plays an important role in people's lives. Agricultural production always produces derivative products, namely waste in the form of remnants of the production process such as leaves, damaged fruit, stems, roots and others including waste from livestock products such as feces, urine, blood, chicken feathers and so on. Waste basically has the same essence, in the agricultural sector waste has three forms, namely solid, liquid and gas waste. As for the solid and liquid waste is waste whose form can be handled. such as pre-harvest, post-harvest and harvest waste. In the management system, solid and liquid waste are generally easily recycled into natural fertilizers because they are organic.

Figure 1 describes the framework for making solid organic fertilizers (POP) and liquid organic fertilizers (POC). Organic fertilizers are fertilizers derived from non-synthetic organic raw materials, including plant and animal by-products, rock powder, algae, inoculants, sewage sludge, manure. animals, and plant residues that have gone through milling, fermentation or other processes (Hammed et al, 2019).

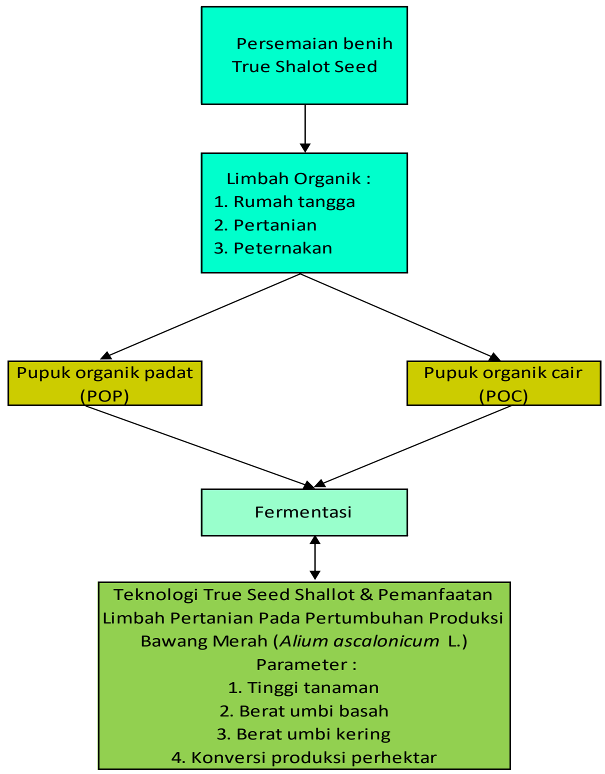

Figure 1. POP and POC Creation Framework

Organic fertilizers are generally insoluble in water and nutrients are available gradually as with the processes carried out by microorganisms. Abundance of macro and micro nutrients is also found in liquid organic fertilizers and these two types of fertilizers are often applied to plants because organic fertilizers are very effective at absorbing dissolved components as nutrients in plants (Phibunwatthanawong and Riddech, 2019).

Table 2. Nutrient Content of Organic Waste Materials.

Bahan Limbah Organik	Kandungan Hara Makro (%)					Kandungan Hara			
	N	P	K	Ca	Mg	Na	Zn	Cu	Mn
Limbah kotoran Ayam	3,75	5,92	3,27	-	-	-	-	-	-
Limbah pelepah K. Sawit	2,9	0,19	1,3	0,7	0,45	-	-	-	-
Limbah tankos K. Sawit	2,34	0,31	5,53	1,46	0,96	-	-	-	-
Limbah kotoran Sapi	1,3	0,52	0,95	1,06	0,86	0,17	122 ppm	20 ppm	334 ppm
Limbah bulu Ayam	7,23	0,52	0,39	-	-	-	-	-	-
Limbah Eceng Gondok	3,41	0,19	0,57	0,21	0,31	-	0,008 ppm	0155 ppm	0,009 ppm
Limbah buah-buahan	3,35	0,36	0,46	0,12	0,02	-	-	-	-
Limbah sabut Kelapa	0,28	0,01 ppm	10,25	140 ppm	170 ppm	-	-	-	-
Limbah batang Pisang	0,02	-	-	-	-	-	-	-	-
Limbah air cucian Beras	0,02	16,4	0,02	2,94	14,25	-	-	-	-
Total	24,6	24,41	22,74	6,49	16,85	0,17	122,008 ppm	20,155 ppm	334,009 ppm

Source: Data processed 2021

Table 2 the nutrient content of agricultural waste materials sourced from the literature by fermenting organic waste to make POP and POC takes 21-30 days by involving microorganisms in anaerobic fermentation, with the hope that the fermentation results get high organic nutrient content, based on the explanation above referring to literature sources, the researchers conducted research with TSS technology and the utilization of agricultural waste was expected to increase the growth and production of shallots.

2.3. Observed Parameters

This research is to obtain data so that the data can be processed statistically so that the results can be discussed and then conclusions are made, so the researchers have determined the parameters to be measured, namely:

1. Plant height (cm)

Measurement of shallot plant height was carried out 2 weeks after planting with an interval of 1 week measurement until the age of the plant was 5 weeks after planting.

2. Wet tuber weight (g)

Observation of the weight of wet bulbs was carried out by weighing in plot units from each treatment, with a harvest age of 10 WAP or with the characteristics of fallen onion leaves ranging from 75%. The treatment of onion harvest before weighing is done, the plants are cleaned of soil and weeds in order to obtain pure weight of wet bulbs.

3. Dry tuber weight (g)

Observation of dry tuber weight was carried out by weighing in plot units of each treatment. After getting the data from weighing the wet weight, then the shallot bulbs were air-dried for 1 week and then weighed to get the data to be processed.

4. Production conversion per hectare (kg)

Knowing the production yield with an area of 1 hectare, the data on the dry tuber weight yield in plot units is converted to a unit area of 1 hectare using the production conversion analysis method.

III. METHODS

The implementation of this research is by carrying out the stages of the procedure in a sequential and structured manner, starting early with the preparation of TSS seeds followed by making TSS seedling media that is sterile from disease by mixing the seedling media with trichoderma then TSS is planted on the seedling media which is then covered with a lid or shade. which every day controlled humidity by pouring water in the nursery media when it started to dry. TSS nursery takes 40-45 days to be ready for transplanting. In the TSS nursery process, researchers carried out the process of making POP and POC using some of the existing agricultural waste, by identifying the nutrients contained in the agricultural waste through a literature study. The process of making POP and POC takes 21-30 days with an anaerobic process. Then the researchers carried out land preparation for the research demonstration plot by cultivating the soil by mixing and rotating so that the soil became loose and the demonstration plot area was left for 1 week to be exposed to sunlight to sterilize pests and diseases on the demonstration plot area. The research area must measure the pH of the soil to determine whether the soil is neutral, if it is acidic or alkaline, the research area must be treated. Then the research area was plotted with an area of 1 meter x 1 meter, then POP treatment was applied according to the data analysis method, after 1 week the shallot seeds were ready to transplant and then POC treatment was given according to the method and then the parameters were monitored periodically.

The data collection technique of this research was carried out in three ways, namely by the method of observation or direct observation of the object under study, in this case the observed parameters. Furthermore, with the document study method, namely the collection of data from parameter observations which are then processed according to the data analysis method and then the last one with the literature study method, where the processed data are supported by theories obtained from literature or literature studies so that this research can account for.

This study uses a plot area of 1 meter x 1 meter or called a square area using a spacing of 20 cm x 20 cm so that a population of 16 plants is obtained in 1 plot, while the sampling technique is carried out randomly with a simple random sampling model or the sampling process is carried out by using a simple random sampling method. giving equal opportunity to each population of shallot plants in each plot there are 16 plants, so the number of samples taken is 10 plants.

IV. RESULTS

4.1.Results

There are 4 parameters observed in this study, 1 vegetative parameter, namely the plant height parameter by measuring the height of the shallot plant starting from the standard stake to the highest tip of the plant, this observation was carried out 5 times with a measurement interval of once a week and the results are in table 3 below.

a. Parameters Plant height (cm)

Table 3. Average Plant Height Age 2, 3, 4, 5 and 6 Weeks After Planting.

Treatment	Plant Age				
	2 MST	3 MST	4 MST	5 MST	6 MST
POP (P)					
P0	25.20 aA	29.66 aA	33.44 bB	37.17 bB	37.57 cC
P1	25.67 aA	29.86 aA	33.84 bB	37.33 bB	38.56 cB
P2	26.14 aA	30.93 aA	36.61	38.79 bB	40.19
P3	26.66 aA	31.77 aA	39.03 aA	42.91 aA	44.14 aA
POC (C)					
C0	25.27 aA	29.44 aA	34.44 bA	37.27 bA	38.61 bA
C1	25.34 aA	30.19	34.93 abA	37.47 bA	38.77 bA
C2	26.54 aA	31.32 aA	35.73 abA	39.21 abA	40.24 abA
C3	26.76 aA	31.39 aA	37.83 aA	42.25 aA	42.84 aA

Explanation : significantly different level of 5% (lowercase) and very significantly different level of 1% (uppercase).

Table 3 shows that the average plant height (cm) due to POP application at the age of 6 weeks after planting has a very significant effect. The highest mean of POP administration was found in the P3 treatment, which was very significantly different from the P2, P1 and P0 treatments. The formulation of some agricultural waste that has become organic fertilizer shows very good results from the plant height parameters and can be seen in Figure 2.

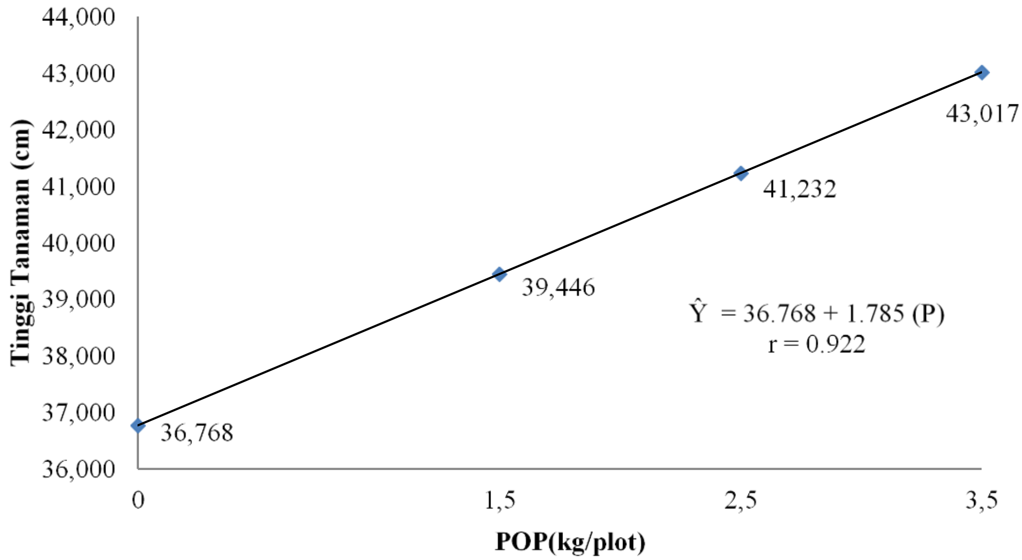

Figure 2. Graph of Plant Height (cm) Giving POP 6 Weeks After Planting

Furthermore, POC treatment on plant height parameters (cm) aged 6 weeks after planting had a significant effect. The highest mean at the C3 treatment level which is significantly different at the C2, C1 and C0 treatment levels can be seen in Figure 3.

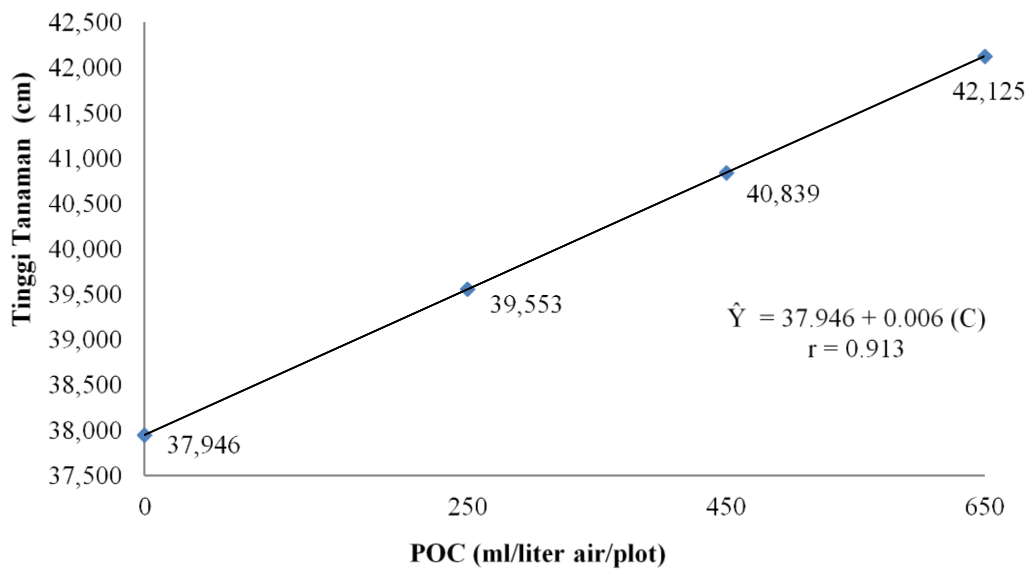

Figure 3. Graph of Plant Height (cm) Giving POC 6 Weeks After Planting

b. Wet Bulb Weight (g)

c.

Table 4. Average Wet Bulb Weight (g) of Shallot Plants

Treatment	Wet Bulb Weight (g)
POP (P)	
P0	58.40 bB
P1	63.58 bB
P2	69.83 abAB
P3	80.98 aA
POC (C)	
C0	61.29 bB
C1	64.58 chapter
C2	67.18 bA
C3	79.74 aA

Table 4 shows that the average wet tuber weight (g) due to POP application at harvest age 64 days after planting has a very significant effect. The heaviest average of POP administration can be seen in the P3 treatment which is very significantly different from the P2, P1 and P0 treatments. This shows that agricultural waste that has been processed into POP shows very good results from the wet tuber weight parameter (g) and can be seen in Figure 4.

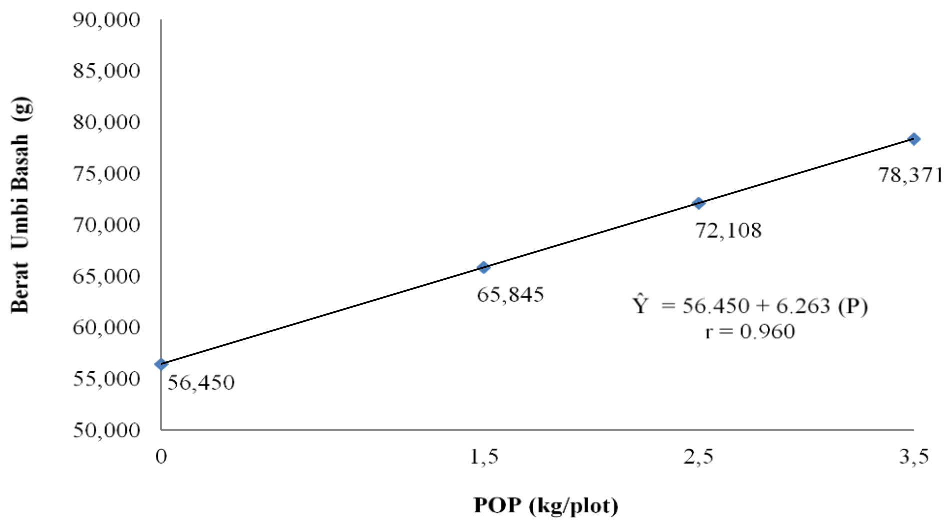

Figure 4. Graph of wet tuber weight (kg/plot) Giving POP

Then the POC treatment on the parameters of wet tuber weight (g) at harvest age 64 days after planting had a very significant effect. The heaviest average at the C3 treatment level which was significantly different at the C2 treatment level and very significantly different at the C1 and C0 levels can be seen in Figure 5.

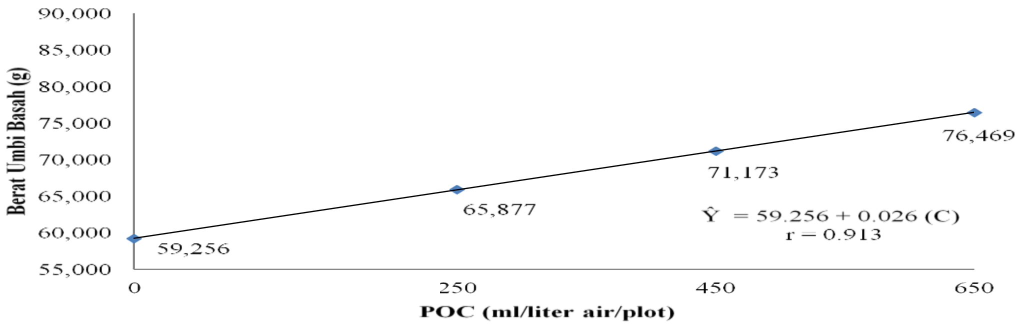

Figure 5. Graph of wet tuber weight (g) Administration of POC

The results of this study indicate that by using seeds from seeds on shallot plants by providing POP and POC treatments according to the level, this shows the results expected by researchers based on data from the 4 parameters observed, this becomes a basis that researchers are able to increase onion production. red, but further research needs to be done by providing a level of treatment that exceeds this treatment because the research results are still responsive to the level of treatment. The following can be seen in Figure 6 a comparison of the physiological sizes of shallot plants at each treatment level of POP.

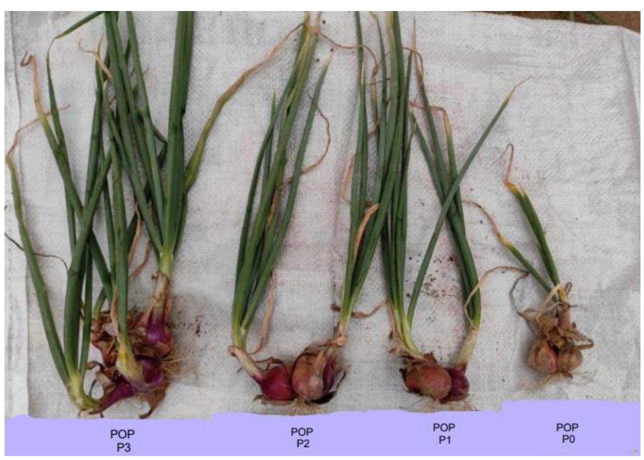

Figure 6. Onion plants in POP . treatment

Furthermore, Figure 6 shows a comparison of the physiological size of shallot plants based on POC treatment.

Figure 7. Onion plants in POC . treatment

V. CONCLUSION

The research on red onions of the Sanren F1 variety using seed origin for the POP treatment produced significant consequences for four parameters. In contrast, the POC treatment on plant height parameters had effective results, while the parameters of wet tuber weight (g), dry bulb weight (g), and production conversion per hectare (kg) yield are genuine. The results of this study suggest that further research be carried out by increasing the level of treatment for both POP and POC. This is based on the potential production of shallots of the Sanren F1 variety can be up to 20-25 tons/ha. In comparison, the conversion yield of output per hectare is more than 8 tons/ha for the level of P3 treatment at POP, while POC at the C3 treatment level obtained more than 7 tons/ha.

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