



THE EFFECTIVENESS OF GRANULATION OF CHITOSAN PLACUNA PLACENTA SHELLS ON THE GROWTH OF THE LEAVES OF THE PLANTS OF APIUM GRAVEOLENS L.

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ABSTRACT

The use of chitosan as fertilizer can increase nitrogen. Therefore, to improve the quality of the production of *Apium graveolens* L. with solid waste chitosan granules from Placuna placenta Shells on the growth of *Apium graveolens* L. plants in polybags. Pre-experimental design in the form of the post-test only controlled group design which was divided into 3 treatment groups, namely 5% chitosan concentration; 15% and 20% and the control group, namely positive control (x) and negative control by measuring the growth of *Apium graveolens* L. capillaries including plant height (cm), number of leaves (strands), and number of fruit. Data were analyzed using one way ANOVA test. Placuna placenta Shell chitosan granule fertilizer affects plant height and number of leaves on *Apium graveolens* L.. The optimal concentration of Placuna placenta Shell chitosan granules as fertilizer for *Apium graveolens* L. plant which produces the highest value in all measurement parameters is 20% concentration. Chitosan granules from Placuna placenta Shells can be used as an alternative to organic fertilizer for *Apium graveolens* L. with an effective concentration of 20%.

Keywords: number of leaves of *apium graveolens* L; placuna placenta shell chitosan; plant height of *apium graveolens* L.

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INTRODUCTION

The use of chemical fertilizers with high doses continuously if not balanced with the use of organic fertilizers will damage the physical and chemical properties of the soil and will damage the life of soil microorganisms that affect the quality of agricultural production. Solid organic fertilizer is a fertilizer that comes from the weathering of plant remains or organic waste that can take place naturally or artificially. One of the organic wastes that can be used as solid organic fertilizer is shellfish (Sari, SG., Selvia Evie. 2020). Scallop solid waste in the form of shells contains chitin compounds. The derivative of chitin compounds that has been widely developed due to its wide application is chitosan. One of the application developments of chitosan can be used as fertilizer. The use of chitosan as fertilizer can increase nitrogen fixation which significantly affects the growth of soybean plants, vegetative growth of *Apium graveolens* L. and vegetative growth of kemiri sunan plants. Chitosan is also expected to affect the growth and production of *Apium graveolens* L.

METHODS

The main material used is Placuna placenta Shells which are made into granules using a pre-experimental design in the form of the post test only controlled group design using 5 groups,

namely negative control (without chitosan), positive control (x), concentrations of 5%, 15% and 20%. Observations or measurements of these parameters will be carried out starting from 1 day after planting in polybags and will be observed every week for 60 days including plant height, number of leaves.

RESULTS

Placuna placenta Shell Chitin Yield

Table 1.
Results of Chitin Yield of Placuna placenta Shells

Sample weight (g)	Chitin weight (g)	Chitin yield (%)
500	421,5	84,3

Table 1. shows the results obtained are Placuna placenta Shells chitin powder with a weight of 421.5 grams and a yield of 84.3%.

Chitosan Placuna Placenta Shell Yield

Table 2.
Results of Chitosan Placuna placenta Shell yield

Sample weight (g)	Chitosan weight (g)	Chitosan yield (%)
421,5	347,5	88,8

Table 2, it can be seen that the chitin deacetylation process resulted in the percentage of Placuna placenta Shell chitosan yield of 88.8%.

Evaluation Results of Chitosan Placuna Placenta Shell Granules

Table 3.
Evaluation Results of Chitosan Placuna Placenta Shell Granules

Concentration	Flow Rate Test (g/s)	Disintegration Time	Test pH Level Test
5 %	2,02	5 menit 01 detik	7,09
15%	2,03	4 menit 30 detik	7,12
20%	2,03	4 menit 21 detik	7,15

Table 3. shows that the results of the granule flow velocity test at concentrations of 5%, 15% and 20% produced almost the same values, namely 2.02; 2.03 and 2.03 g/s which means the flow properties are good.

Plant Height Gain

Table 4.
The results of the average plant height of *Apium graveolens* L.

Treatment	Average plant height (cm)									
	Week									
	1	±SD	2	±SD	3	±SD	4	±SD	5	±SD
K-	5,3	0,126	6	0,213	7,7	0,344	8,4	1,121	9,1	0,244
K+	10,8	0,315	8,4	0,345	15,7	1,281	16,6	0,345	21,1	0,165
Concentration 5%	10,7	0,315	8,7	1,164	14,1	1,342	16,3	0,213	20,7	0,206
Concentration 15%	12,9	0,218	13,2	0,142	16,9	1,326	18,7	1,234	25,5	1,292
Concentration 20%	15,1	0,245	16,9	0,334	18,2	0,367	21,4	0,367	27,6	0,221

Table 4. shows that the concentration of chitosan has a significant effect on plant height along with the increasing age of *Apium graveolens* L.

Table 5.
One-Way Anova Result

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Significant</i>
<i>Between Groups</i>	21,654	4	6,644	0,167	0,065
<i>Within Groups</i>	767,681	20	44,651		

Based on the results of the ANOVA calculation in table 5. The significant value shows the number 0.065 or $p < 0.05$; then H_0 is accepted or the average plant height is the same. Statistical analysis was continued with the post hoc Scheffe test to find out which groups had significant or insignificant differences. Post hoc analysis can be seen in table 6.

Table 6.
Post Hoc Scheffe *Apium graveolens* L. Result

Treatment (I)	Treatment (J)	significant
Control (-)	Control (+)	0,012
	Concentration 5%	0,043
	Concentration 15%	0,034
	Concentration 20%	0,075

Based on the results of the post hoc test in table 6, the significant values showed significant differences between treatments or $p < 0.05$; said to be significant if the results obtained < 0.05 at the 95% confidence level.

Increase in Number of Leaves

Table 7.
Results of Average Growth of Leaf Number of *Apium graveolens* L

Treatment	Average number of leaves (strands)									
	week									
	1	±SD	2	±SD	3	±SD	4	±SD	5	±SD
Control (-)	0	0,000	2	0,171	3,5	0,143	5,5	0,143	7	0,173
Control (+)	2	0,003	4	0,115	4,5	0,132	6	0,172	8,5	0,173
Concentration 5%	1	0,021	2	0,171	3	0,115	5	0,112	8	0,115
Concentration 15%	1	0,001	4	0,147	6	1,142	7,5	0,170	8,5	0,142
Concentration 20%	2	0,021	6	0,170	8	0,175	8	0,123	9	0,116

Table 7 shows that the growth of the largest number of leaves is with the application of 20% concentration of chitosan granule fertilizer, negative control produces the lowest number of leaves because the

Table 8.
Uji One-Way Anova Result

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
<i>Between Groups</i>	8,721	4	3,325	0,522	0,071
<i>Within Groups</i>	118,231	20	4,211		

Based on the results of the ANOVA calculation in table 8, the significant value shows the number 0.671 or $p > 0.05$; then H_0 is accepted or the average plant height is the same. Statistical analysis was continued with the post hoc Scheffe test to find out which groups had significant or insignificant differences. Post hoc analysis can be seen in table 9.

Table 9.
Post Hoc Result

Treatment (I)	Treatment (J)	Nilai signifikan
Control (-)	Control (+)	0,081
	Consentrasiton 5%	0,076
	Consentration 15%	0,021
	Consentration 20%	0,030

Based on the results of the post hoc test in table 9. the significant value indicates there is significant difference between treatments or $p < 0.05$; said to be significant if the results obtained < 0.05 at the 95% confidence level

DISCUSSION

These results are comparable to the research conducted by (Ariyanti, Masruriati, et al. 2019) and (Ariyanti, Fajaryanti, et al. 2019) which resulted in the chitin yield of *Placuna placenta* Shell of 88.32%. According to (Ariyanti, Masruriati, et al. 2019) and (Fadli, A., Drastinawati 2016), this yield is due to the release of the acetyl group contained in chitin. The higher amount of solvent causes the contact area between the solvent and the solid during the process, so that the acetyl group ($-COCH_3$) is separated from the chitin. In addition, the length of the reaction causes more NaOH molecules to be added to the chitin molecule, thereby reducing the yield of chitosan products (Trang Si Trung and Huynh Nguyen Duy Bao 2015) and (Ariyanti, Masruriati, et al. 2019). These results are in accordance with the statement of (Budiasih, Rd. 2020), flow time is the time required by a number of granules and powders to flow in a device. Granules that have good flow will flow from a container with a time of not less than 10 seconds. In granules that have a good flow rate, it produces good weight uniformity.

In table 3. shows the results of the disintegration time of 5% concentration getting 5 minutes 10 seconds, 15% concentration getting 4 minutes 30 seconds and 15% concentration getting 4 minutes 21 seconds. This test is carried out to determine the length of time it takes for the granules to disintegrate when dissolved in water. The results obtained are in accordance with the literature on FI Ed III that the disintegration time should not be more than 15 minutes. Table 3. shows that the test results for pH levels are in the range of 7.09-7.20. pH testing needs to be done because it is one of the factors that affect the activity of microorganisms in the decomposition medium of organic matter. According to (Sartini 2011), pH is an important factor because it affects the availability of minerals needed by plants.

It is proven that the increasing application of organic fertilizer indicates the higher growth of *Apium graveolens* L. plants. According to (Fuad 2010), the addition of organic matter not only adds nutrients to *Apium graveolens* L. plants, but also creates suitable environmental conditions for plants by improving aeration, facilitating root penetration and improving water holding capacity. by the activity of growth hormone that plays a role in stem elongation,

namely auxin. Auxins in *Apium graveolens* L. function to stimulate growth by elongating cells and causing the dominance of tip growth. *Apium graveolens* L. plants treated with chitosan had better plant height gains than those without chitosan treatment on *Apium graveolens* L. This is in accordance with the results of (Trimulyadi 2007), research, that chitosan contains growth and production hormones for plants such as hormones auxins in plants.

Apium graveolens L. plant is allowed to grow by itself without the addition of nutrients in it and only relies on water and nutrients. which is in the ground. According to (Lahadassy. J. 2007), the availability of nutrients in sufficient and balanced quantities for the growth of *Apium graveolens* L. causes the process of cell division, enlargement and elongation to take place rapidly which results in some plant organs growing rapidly while according to (Pribadi 2010), the application of nitrogen at the right dose will increase plant growth, increase plant metabolism, the formation of protein, carbohydrates, resulting in increased plant growth and production while the limited supply of N in the soil has an impact on inhibiting or stopping plant growth. Plants treated with chitosan had a better number of leaves than those without chitosan treatment (control). This is in accordance with the statement of (Rosdiana. 2015), that chitosan is able to increase the function of nitrogen in the soil to produce the number of leaves.

CONCLUSIONS

Placuna placenta Shell chitosan granule fertilizer affects plant height, number of leaves on *Apium graveolens* L. The optimal concentration of Placuna placenta Shell chitosan granules as fertilizer for *Apium graveolens* L. which produced the highest value in all measurement parameters was a concentration of 20%.

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