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Coconut Husk And Eggshell Liquid Organic Feltilizer Effect On Lettuce Growth And Calcium Levels

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ABSTRACT

Coconut husks and eggshells are common wastes found in society, but they are used less, so they often accumulate. Liquid organic fertilizer (POC) is a solution formed from plant residues, agro-industrial waste, animal dirt, and human dirt that has a content of more than one element. This research aims to find out the effectiveness of the supply of liquid organic fertilizer from coconut seeds and egg shells against the increase in calcium (Ca) and the growth of lettuce plants (*Lactuca sativa l*). The research was conducted at FKIP Muhammadiyah University of Surakarta's Green House Education Biology from January–April 2023. The study used the complete random design (RAL) method of 3 repetitions and two factors: the POC administration concentration used P_0 (POC 0 ml), P_1 (POC 100 mL), and P_2 (POC 150 mL), and the time interval for POC W_1 (once every 3 days), and W_2 (once every 5 days). The results of the research showed that the highest growth and increase in calcium being seen with the treatmentof P_2W_2 (150 ml POC and once every 5 days).

1. INTRODUCTION

Vegetables are a commodity that can support food security in Indonesia. Nationally, vegetable production increases every year. According to the Central Bureau of Statistics (BPS), total vegetable production in Indonesia amounted to 14.80 million tons in 2021, so the demand for vegetables production continues to increase as the population grows. Therefore, in the agricultural sector especially horticulture, specialised vegetables have great opportunities for meeting food needs as a source of vitamins and fibre necessary for health and improving the quality of human resources.

One of the most common types of vegetables consumed by people is lettuce *(Lactuca sativa l).* In addition, lettuce is a vegetable that is easily found in traditional markets or supermarkets. Green vegetables such as lattuce contain a lot of beta-carotene that can protect the body from various diseases and have complete antioxidants to boost the body's immune system. According to (Supriati, 2014) the vitamin content in this lettuce includes vitamins A, C, and E, as well as some types of minerals such as calcium, potassium, magnesium, float acid, iron, phosphorus, and sodium.

Liquid organic fertilizer (POC) is a solution formed from the breakdown of organic materials derived from residues of plants, agro-industrial waste, animal waste, and human waste containing more than one element (Tanti et al., 2020). The benefits of liquid organic fertilisers, in addition to being made of natural materials, make the fertilizer environmentally friendly and non-toxic. Other

advantages are fast work time, being easily soluble in the soil, the ability to repair the structure of soil particles, and ease of absorption by plants (Dita et al., 2022).

Organic fertilizers are liquid with coconut husks raw materials as a waste utilisation that is found in many societies, but its processing is less than the maximum, so a small number of societies make use of cocoa sabut waste. The coconut sable has the elements needed by plants, such as potassium (K), calcium (Ca), sodium (Na), magnesium (Mg), and phosphorus (P) (Suripto et al, 2018). Therefore, coconut seeds can be used as liquid organic fertilizer. Application of coconut soap organic fertilizer from liquid organic soap waste can increase the harvest yield more optimally (Purnamasari et al., 2022).

In addition, the use of eggshells in fertilizer materials is less understood by society. According to research (Dewi, 2021), the POC of the eggshell has a pH content and macro-charge elements (0,19 % N, 6,09 ppm P, 1408,90 ppm K, 1158,33 ppm Ca, and 454,54 ppm Mg). From the results of the analysis, there are elements of potassium in the eggshell POC and elements of nitrogen, phosphorus, calcium, and magnesium. Proved by research (Fatimah et al., 2021), the administration of liquid organic fertilizer of chicken eggshells and nitrogen against the average dry weight of pakcoy showed that treatment D (60 % POC of eggshell + 6 g of nitrogen) gave the best results against the height of the pakcoy plant of 18.97 g. Chicken egg shells have a high calcium content, with each gram of eggshell containing 380–381 mg of calcium (Brun et al., 2013).

The timing of the administration of organic fertilizers made from eggshells and coconut husks to plants is monitored to avoid deficiency and excess fertilizer doses. According to the results of research (Wardana, 2016), the administration of a dose of goat cage fertilizer affects the growth of lettuce plants. With a dose size on goat fertilizer of 20 tons/ha, equivalent to 4 kg/plot, that gives the best results on the observation variable of the number of leaves of the vegetable, and a time interval of application every 5 days provides the best result on the variable observation of the diameter of the stem, the height of the plant, and the amount of the leaves. In addition to the composition content of the liquid organic fertilizer used, the right time and dose of fertilizer play a role in optimal growth. The purpose of this study was to determine the effectiveness of applying liquid organic fertilizer made from coconut husk and eggshells to affect the growth and increase of lettuce plant calcium levels.

2. MATERIALS AND METHODS

2.1. Time and place of research

The research was conducted at FKIP Muhammadiyah University of Surakarta's Green House Education Biology and BPSMB Surakarta, Test and Certification Hall of Goods from January–April 2023.

2.2. Research tools and materials

The tool used in this research is bascom, digital scales, mistar, 8-liter bucket, knife, measuring glass, spectofotometer, Erlenmeyer 250 ml, 50 ml measuring labyrinth, documentation tool, stripes, and polybags. The materials used in this study were coconut seals, chicken egg shells, EM4, lettuce seeds, coal, and water.

2.3. The experimental plan

This type of research is experimental. The environmental design used is a complete random design (RAL) with three repetitions. Two types of treatment Factor 1: Liquid Fertilizer (P); Factor 2: Fertilizer Time (W):

P_0W_0 (Control) = Only water every days
P_1W_1 = POC 100 ml + once every 3 days
P_2W_1 = POC 150 ml + once every 3 days
P_1W_2 = POC 100 ml + once every 5 days
P_2W_2 = POC 150 ml + once every 5 days

2.4. Production of liquid organic fertilizers

The initial step in making liquid organic fertilizer involves preparing all the tools and materials used. Next, prepare a bucket to insert 2000 g of dried eggshells that have been finely crushed, 1000 g of finely dried coconut husks, 500 g of red sugar, enough EM4, and 50 litters of water. Homogenise until flat, then close the bowl tightly and make sure no air gaps enter. Then, incubate the fertilizer for a week. Check your pH after a week.

2.5. Giving fertilizer to plants

Liquid organic fertilizer is administered to the plant in doses of 100 ml and 150 ml with a fertilising interval of once every 3 days, and once every 5 days. Observation is carried out once every 7 days.

2.6. Test for calcium levels

The procedure for testing calcium using the CPC (O-Cresolpthlein-Complexone) method is based on (National Standardization Agency, 1992): Weigh 1 g of lettuce and place it in a porcelain cup or 100-ml pyrex glass cup. Add with a pipette 100 ml of a solution of magnesium nitrate in ethanol, mixed with a mixer bar. Remove the blender bar and rinse it with 95% ethanol. Evaporate ethanol over a water bath while stirring occasionally, then heat over an electric bath (covering the glass cup with a watch glass). Move the glass cup into a barrel at a temperature of 2000 °C, gradually raise the temperature to 5000 °C for 2 hours, and blur all night at 450–5000 °C. Remove the glass from the barrel and leave it on the asbestos. If there are still carbon residues, after cooling, add 1 ml of water and 2 ml of HNO3 p.a., and then dry over the water boiler. Reheat to a temperature of 5000 °C for 1 hour. Repeat this process until you have white ashes. Add 5 ml of the HCl and HNO3 mixture solution to the ashes through the glass cup wall and heat it over the water boiler until the ashes dissolve. Move the solute quantitatively into a 100-ml measuring labia, then impregnate the labia with boiling water. Filtered with Whatman 540. Working with Blanco using the same agent. Read the absorption of standard solutions, blanko, and lettuce using a spectroscopic photometer. Create a calibration curve with the Y axis as absorption and the X axis as concentration (in ppm). Calculate the calcium content of lettuce.

2.6.1. Calculation of calcium (Ca) levels

The calcium (Ca) content of the vegetable can be calculated using the formula:

$$Calcium\ levels = \frac{C \times P \times V}{W\ (mg/kg)}$$

Where : Calcium levels is calcium content (%), *P* is initial of dilution, *V* is initial volume of solvent (ml), and *W* is weight of lettuce sample (g).

2.7. Data Analysis

The data obtained in this study will be analysed for variants using the Two-Way Anova formula on a complete random drawing (RAL) with SPSS 20.0. It is used to analyze the growth

and calcium levels of salad plants after the administration of liquid fertilizer made from coconut salmon waste and chicken egg shell waste. If the result value is > 0.05, then "there is an effect of concentration on the growth and calcium content of salad plants". If the result value is < 0.05, then "there is no effect on the concentration on the growth and calcium content of lettuce plants".

3. Results and Discussion

Based on the research that has been carried out, the data obtained from the observation of the growth of lettuce plants over four weeks with different fertilizer concentrations and time intervals has different results. The measurement parameters used are the number of leaves, the height of the stem, wet weight, and calcium content. Here are the sensory tests obtained, as follows:

Table 1. Results of sensory testing

Treatment	Rare number of leaves (strands)	Rate of height (cm)	Wet Weight Average of Plants (g)	Average Level of Calcium (%)
P0W0 (Control)	5,33	9**	4**	0,028**
P1W1	5**	10,66	5,33	0,044
P1W2	5,33	11,66	5,66	0,063
P2W1	5,66	12,66	7	0,089
P2W2	7*	16,66*	11,66*	0,129*

Description :
* Plant growth with the highest average value.
** Plant growth with the lowest average value

Figure 1 shows that the sensory test data results in the study have different average values for each parameter. The highest number of leaves in treatment P_2W_2 with 7 leaves, the highest ratio in stems in treatment P_2W_2 with a height of 16.66 cm, the greatest wet-weight ratio of plants in treatment P_2W_2 with a weight of 11.66 g, and the most high calcium treatment ratio in treatment P_2W_2 in celandine with a total of 0.129 % The results of the sensory trial P_2W_2 treatment (POC 150 ml + once every 5 days) showed that the higher the dose of fertilizer and the ideal time for fertilization delivery, the more optimally the vegetable develops in weight, height, and quantity. This is because the supply of liquid organic fertilizer from the combination of coconut seals and egg shells has an effect on the vegetable.

Figure. 1 Lettuce plant height measurement a. P_0W_0 (Control), b. P_1W_1, c. P_1W_2 , d. P_2W_1, e. P_2W_2

3.1. The hight plant

Plant growth can be visualized from the various physical characteristics of plants. One of the parameters that can be used is the length or height of the plant. Based on figure 2, it can be seen

that the high addition of plants is best for the treatment of U1 P_2W_2 (POC 150 ml once every 5 days). While the highest addition of plants is the lowest on the control treatment, which concentrates POC at 0 %. The more fertilized, the faster the plant will grow. However, when the dose in the fertilizer administration is excessive, it can slow growth, and there is potential root damage due to high fertiliser salts. Proper fertilizer can stimulate the growth of new shoots from the roots. (Xu et al., 2020). To show the comparison of high growth of lettuce plants with different treatments can be presented in the graph as follows:

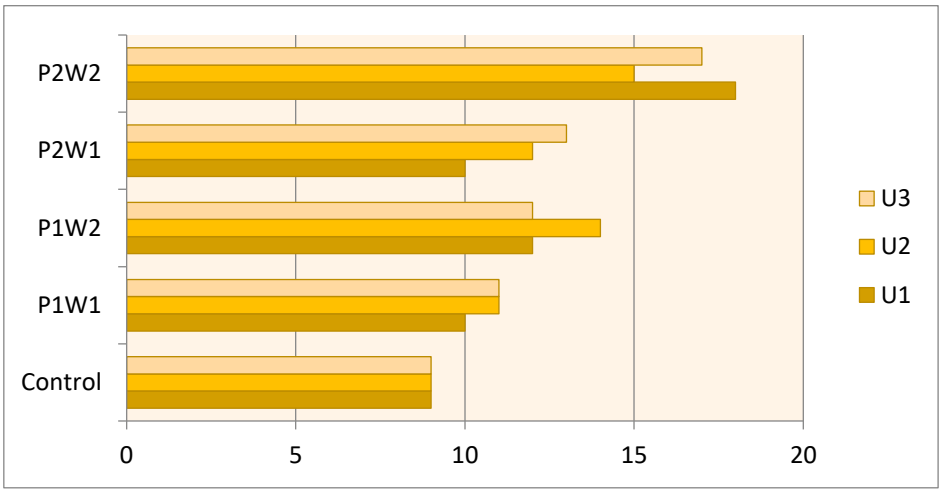

Figure. 2. Graphic chart The hight plant

The high-additional plant data was tested using the two-way Anova test data analysis technique to test the hypothesis. Here are the results of high-hypothesis testing of plants using the Anova Two-Way technique. Based on table 2, it is possible to know the high significance value of the plant 0.044 compared with the level of significance 0.05, so the value obtained 0.044 < 0.05 then It can be understood that the concentration of fertilizer and the time of fertilisation affect the high significance value of the plant lettuce.

Table 2. High Hypothesis Test Results

Tests of Between-Subjects Effects

Dependent Variable: The hight plant

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	99.067[a]	4	24.767	19.553	.000
Intercept	1967.213	1	1967.213	1553.063	.000
Doses_P	18.750	1	18.750	14.803	.003
Time_W	36.750	1	36.750	29.013	.000
Doses_P * Time_W	6.750	1	6.750	5.329	.044
Error	12.667	10	1.267		
Total	2320.000	15			
Corrected Total	111.733	14			

a. R Squared = ,887 (Adjusted R Squared = ,841)

Table 2 shows that treatment in the supply of liquid organic fertilizer and delivery time intervals influenced the high growth of plants. According to the study (Purwadi, 2017), the administration of POC of liquid waste tea and coconut husks to lettuce plants with varied volumes and watering times can significantly affect the height and weight of the plant base. This is because the provision of organic fertilizer in liquid coconut sabbats and egg shells provides the content of hara, N, P, and K that is absorbed by plants and responds to their development (Novianto et al., 2020). The availability of nutrient in plant organs can be fully met by applying liquid organic fertilizer to plants, compared to plants without the supply of fertilizers (Marpaung et al., 2014).

3.2. Number of Leaves

Lettuce is a plant that uses its leaves, so it needs a suitable nitrogen element so that the vegetative phase of the selada plant can be stimulated more dominantly. The leaves are an important organ for growth because they are the main organ for the process of photosynthesis. The number of leaves is closely related to the height of the plant because the leaves are located on the stems of the selada (Manuhuttu et al., 2014). In this study, we obtained data on the number of leaves of plants lettuce with various behaviours as follows:

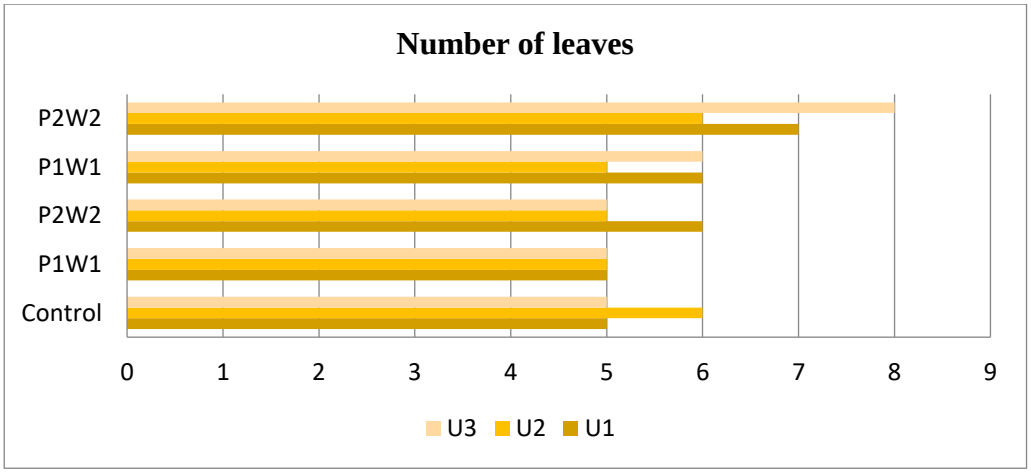

Figure. 3. Graphic chart Number of leaves

Based on the data from the observation results, the number of leaves of the plant varied with the concentration of fertilizer and the intervals of time between the different fertilizers. Based on figure 3, the best results were obtained with the treatment of P_2W_2 (a fertilizer treatment of 150 ml with a time interval of once every 5 days) with an average of 7 strips of leaves on U3. The lowest number of leaves with an average of 5 strings is at POC 0 % and P_1W_1 (POC 100 ml and interval time once every 3 days).

Table 3. the results of hypothesis testing the number of leaves

Tests of Between-Subjects Effects

Dependent Variable: Number of leaves

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	7.333[a]	4	1.833	4.583	.023
Intercept	450.104	1	450.104	1125.260	.000
Doses_P	2.083	1	2.083	5.208	.046
Time_W	4.083	1	4.083	10.208	.010
Doses_P * Time_W	.750	1	.750	1.875	.201
Error	4.000	10	.400		
Total	493.000	15			
Corrected Total	11.333	14			

a. R Squared = ,647 (Adjusted R Squared = ,506)

Based on table 3, it is possible to know the value of significance of the influence of fertilizer concentration and the time interval of fertiliser delivery on the plant height of 0.201 compared with the level of significance of 0.05 so that the sig value of 0.20 > 0.05. It can be understood that fertilising and fertilisation delivery time do not affect the growth of the number of leaves of the vegetable. The number of leaves on the plant is one of the most important visual features that depicts its development and growth. This makes it possible to assess growth and relate it to plant health and potential outcomes. However, there is no evidence that the number of leaves directly affects the growth of plants. (Farjon et al., 2021). This is consistent with research (Maunte, 2018) showing that the POC treatment given to the celery plant did not have a real effect on the parameter of the number of leaves. Due to its low dosage and the hera elements needed by plants in POC, nutritional fulfilment is limited.

3.3. Wet Weight

The wet weight of the plant indicates the water content of the plant tissue. At the end of the observation, the most optimal wet weight is shown at the treatment P_2W_2 (POC 150 ml with a time interval of once every 5 days), while the base weight is low at the control. Due to the fact that the plant lettuce control has a lack of micro-charge elements that function, the element macro-charge is easy to absorb by the soil, influencing the weight of the cells of plants and making their weight not optimal (Fitriani & Haryanti, 2016). Here is the graph of the results of the weight comparison of the bases on the plants of lettuce.

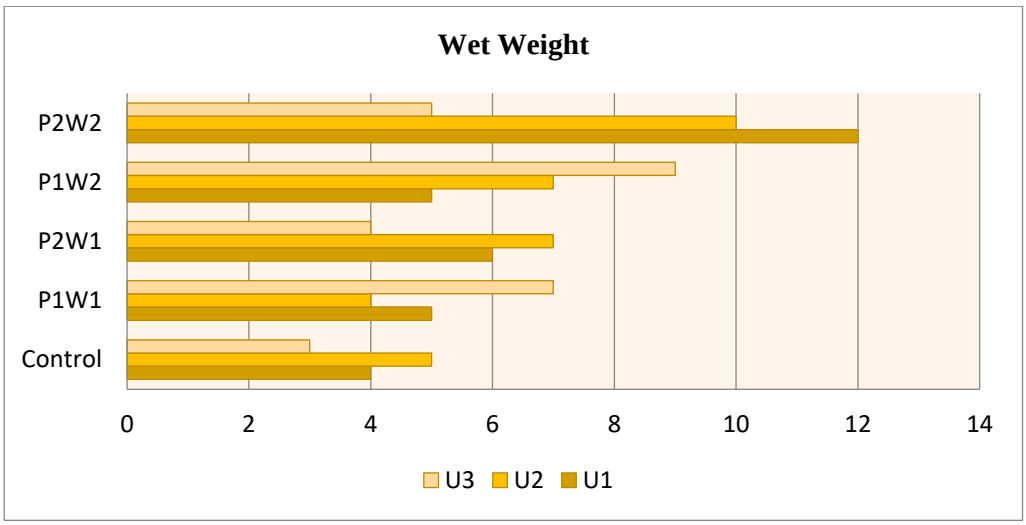

Figure. 4. Graphic chart of wet weight

Based on Figure 4, the wet weight of plants treated with POC U1, U2, and U3 is optimum compared to plants without POC. This is directly compared to the high growth of plants, which is also more optimal on plants given fertilizer treatment than plants without 0 % POC fertiliser. In this study, data were obtained for the highest average value of 11.66 grammes on the treatment of P_2W_2 (POC 150 ml + once every 5 days). And the lowest average value on treatment P_0W_0 with a wet weight of 4 grammes.

Table 4. Hypothesis of Wet Plant Weight

Tests of Between-Subjects Effects

Dependent Variable: wet plan weight

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	104.933[a]	4	26.233	10.931	.001
Intercept	584.311	1	584.311	243.463	.000
Doses_P	18.750	1	18.750	7.813	.019
Time_W	44.083	1	44.083	18.368	.002
Doses_P * time_W	14.083	1	14.083	5.868	.036
Error	24.000	10	2.400		
Total	809.000	15			
Corrected Total	128.933	14			

a. R Squared = ,814 (Adjusted R Squared = ,739)

Based on Table 4, the results of the test of the hypothesis of the influence of fertilizer concentration and time interval of fertiliser administration on wet weight using the Two-Way Annova technique (sig.) So that less than the level of significance of 0.05 > 0.036, H0 is accepted. There is therefore an interaction between the treatment of fertilizer concentration levels and time intervals of fertiliser administration and the weight of the cellar plant base. Based on research (Shaleh, 2017), there was an influence of the administration of POCs of coconut sable waste and

tauge extract on the wet weight of the teaspoon of salvia, with an average wet weight of 7.19 g, and the height of the plant.

3.4. Calcium

Calcium plays an important role in the human body. Calcium is a global mineral that is found in the body; it accounts for 2 % of the total body mass; 99 % of calcium can be found in hard tissue, teeth, and bones; while 1 % is located in the blood and spreads within the body. (Kurniawan, 2015). Calcium levels in salad plants were tested using spectrophotometry with a wavelength of 422.7nm.

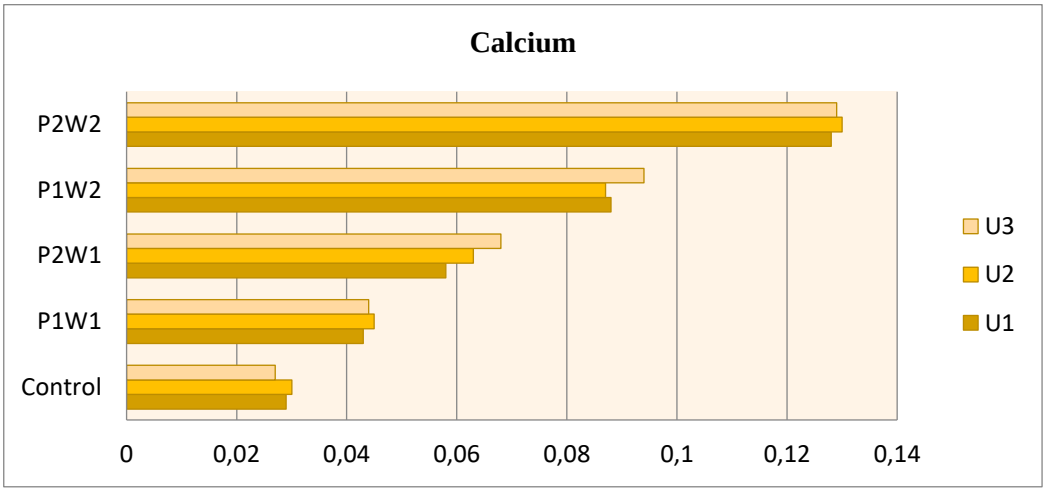

Figure. 5. Graphic chart of Calcium

Based on Figure 5, there is a difference in the amount of calcium in plants with the treatment of POC administration and certain time intervals. In this study, it was found that the highest average rat in the selada plant was 0.129 % in the treatment of P_2W_2 (POC 150 ml and interval once every 5 days). And calcium is lowest with an average of 0.028 %, which is in the POC control plant at 0 % and treatment P_1W_1.

Table 5. The Calcium Hypothesis Test

Tests of Between-Subjects Effects

Dependent Variable: Calcium

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	.019[a]	4	.005	540.813	.000
Intercept	.062	1	.062	7068.152	.000
Doses_P	.003	1	.003	292.223	.000
Time_W	.009	1	.009	1070.849	.000
Doses_P * Time_W	.000	1	.000	35.506	.000
Error	8.733E-005	10	8.733E-006		
Total	.094	15			
Corrected Total	.019	14			

a. R Squared = .995 (Adjusted R Squared = .994)

The results of the test hypothesis of plant calcium levels can be known. The value of significance of the influence of fertilizer concentration and time interval of fertiliser delivery is

0,000 compared with the significance level of 0.05 to the value of sig 0.000<0.05. It can be understood that there is an interaction between the increase in calcium and the fertilizer dosage and the time interval of fertiliser administration. One of the POC ingredients that researchers used to increase calcium is chicken egg shells. Eggs have a high nutrient content. (Hasibuan et al., 2021). In a study (Suhastyo & Raditya, 2021), it was stated that in the shell of chicken eggs there is a high calcium content of as much as 97 %. This is in accordance with research (Wahyuni & Asngad, 2018) showing that the administration of POC saliva waste and chicken egg shell waste can increase the calcium content in sawi plants.

4. CONCLUSIONS

Based on the results of the research that has been carried out, it can be concluded that the application of liquid organic fertilizer from coconut seals and egg shells effectively improves the growth and productivity of the cellar crops grown using polybags, with the highest growth and increase in calcium being seen with the treatment of P_2W_2 (150 ml POC and once every 5 days). This research is basic research developed in the field of the manufacture of liquid organic fertilizers. It's not necessary to conduct further research on the content of elements in the media and fertilizer. You can not he same research with different variables.

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