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Effect of Nutrient Concentration AB Mix and Liquid Organic Fertilizer of BroilerChicken Eggsshell Against Growth and Yieldmustard Plant Caisim (*Brassica juncea* L. Czern. Var. Tosakan) Hydroponically

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Abstract

Along with the increasing population, people's needs for highly nutritious foods, such as vegetables, are increasing but the available agricultural land, especially in urban areas, is increasingly limited.Vegetable crops that have enough economic value besides cabbage crop, cabbage flowers and broccoli are mustard caisim plants. Mustard caisim plants contain many benefits, the content contained in mustard caisimis protein, fat, carbohydrates, Ca, P, Fe, Vitamin K, Vitamin A, Vitamin 10 B, and Vitamin C. Hydroponic farming systems are one alternative that can answer these problems. The purpose of this study was to determine the effect of nutrient concentration of AB MIX and liquid organic fertilizer broiler chickeneggshells on the growth and yield of mustard caisim plants (Brassica juncea L. Czern. Var. Tosakan) hydroponically. The study method was prepared using Mirosoft Excel 2010 followed by a 5% BNT Test, consisting of five treatments and four repeats so that 20 samples were obtained. Treatment K_1 = Nutrition AB Mix, K_2 = AB Mix + 10cc liquid organic fertilizer, K_3 = AB Mix + 20cc liquid organic fertilizer, K_4 = AB Mix + 30cc, liquid organic fertilizerK_5 = AB Mix + 40cc liquid organic fertilizer. The results showed that the highest economic result weight wasobtained from the treatment of AB Mix + 10cc liquid organic fertilizer (K_2) nutrient concentration which was 73.3 g or an increase of 80.86% when compared to the lowest economic result weight at AB Mix + 40cc liquid organic fertilizer (K5) nutrient concentration which was only 40.5 g.

Keywords: Hydroponics, eggsshell, caisim mustard, AB Mix, fertilizer

1. Introduction

Along with the increasing population, people's needs for highly nutritious foods, such as vegetables, are increasing [14]. But the available agricultural land, especially in urban areas, is increasingly limited. The hydroponic farming system is one alternative that can answer these problems. Hydroponic agriculture has various advantages, such as relatively narrow land requirements [26], low levels of pest and disease attacks due to controlled environmental conditions [1], increased plant growth and production due to more controlled nutrition [3][1], saving the use of fertilizer and water [23][2], as well as the avoidance of plants from drought, erosion, and flooding [3]. Vegetables grown by hydroponic methods are also generally cleaner and have a better taste than conventionally grown vegetables [23].

One type of vegetable that is widely consumed and has a lot of nutritional content is mustard caisim (*Brassica juncea* L.) can be consumed fresh or processed in addition, mustard caisim leaves are also often made pickled by the Chinese people. Vegetable cropsthat have enough economic value besides cabbage crop, cabbage flowers and broccoli are mustard caisim plants. Mustard caisim plants contain many benefits, the content contained in mustard caisim is protein, fat, carbohydrates, Ca, P, Fe, Vitamin K, Vitamin A, Vitamin B, and Vitamin C.

In addition to having high economic value, mustard caisim has many benefits. The benefits of mustard caisim are to relieve itching in the throat in cough sufferers, headache healers, blood purifiers, improve kidney function, and improve and facilitate digestion [10]. Mustard caisim (*Brassica juncea* L.) has several varieties such as Shinta, Tosakan, and Dakota. Based on research [25] it was found that of the three mustard varieties, the Tosakan variety had the highest average parameters of plant height, leaf width, fresh weight and dry weight. This is due to the ability of the Tosakan variety to optimally utilize the available nutrients.

Hydroponics is an alternative that can be used to increase plant productivity, especially in narrow land [17]. The Wick system is a hydroponic growing system in which plants are grown on substrates such as cocopeat, rockwool, husk charcoal and perlite. Such tools are connected with wicks that help plant roots absorb nutrient solutions. This system is suitable for small crops such as vegetables [8]. The advantage of the wick system is that the tool used is simple and practical in terms of manufacturing costs because it can be used in the form of used products such as plastic mineral water bottles and paralon pipes. The wick system is considered to have many advantages when compared to conventional methods. Besides being suitable for narrow land, it is also classified as safe from pest attacks because plant pests tend to be fewer, because there is no soil asa medium for the development of these diseases or pests [13].

Nutrients are needed for plant growth. Generally, the nutrients used in hydroponics are AB Mix nutrients. These nutrients consist of Solution A and Solution B which contain complete nutrients for plants [4]. AB Mix Hydroponic Nutrient Composition: A set of AB Mix hydroponic nutrients consists of 2 parts (bag A and bag B) content: NO_3: 9.90 %, NH_4; 0.48 %, P_2O_5 : 4.83 % K_2O : 16.50 %, MgO : 2.83 %, CaO : 11.48 %, SO_3 : 3.81 %, B : 0.013 %, Mn : 0.025 %, Zn : 0.015 %, Cu : 0.002 %, Mo : 0.003 % Fe : 0.037 % [11].

Based on research by [11], different concentrations of AB Mix nutrients have a significant impact on plant growth. The nutrient concentration of AB Mix 5 mL/L howed the highest yield in terms of leaf count, leaf area, and wet weight of the mustard variety Tosakan. Therefore, in this study, the concentration of AB Mix 5 mL/L nutrients was used [29]. AB Mix nutrition is offered ata fairly expensive price. The high cost of AB Mix nutrition has an impact on the high cost of production and requires innovation to reduce cultivation costs, one of which is the use of liquid organic fertilizer. This is because it is obtained from household waste obtained for free which is fermented so that it is available at an affordable price [9].

One of the organic materials that can be used as a nutritional additive to AB Mix mixture to reduce production costs is liquid organic fertilizer with the main ingredient of eggshells. The eggshell contains 98.2% calcium carbonate, 0.9% magnesium and 0.9% phosphorus. The shell membrane consists of 69.2% protein, 2.7% fat, 1.5% water, and 27.2% ash. Therefore, researchers want to conduct research on making liquid organic fertilizer from broiler chicken egg shells as the main ingredient. It is expected that with this mixture a liquid organic fertilizer is obtained that has complex nutrients that can help plant growth.

The primary objective of this study was to determine the effect of nutrient concentration of AB MIX and liquid organic fertilizer broiler chicken eggshells on the growth and yield of mustard caisim plants (*Brassica juncea* L. Czern. Var. Tosakan) hydroponically. The hypothesis proposed in this study is that the application of liquid organic fertilizer broiler egg shells with a concentration of 30cc provides the best growth and results for mustard production (*Brassica juncea* L. Czern. Var. Tosakan) hydroponically.

2. Material and Methods

The research was conducted at the green house in Kesiman Petilan Village, East Denpasar District, Denpasar City, Bali from April to June 2023. The research site is a lowland area with an altitude of 20 meters above sea level. With a rainfall of 2,757 mm, the air temperature is between 20 - 30°C.

The material used in this study was mustard seeds caisim var. Tosakan, rockwool, AB Mix nutrients, broiler chicken eggshell flour, EM-4, brown sugar, and water. The tools used in this study were greenhouses, basins, stoves, pots, trays, blenders, scales, plastic bottles, netpots, netpot hole boards, wick system hydroponic tubs (20 pieces), measuring cups, TDS meters, pH meters, flannel cloths, toothpicks, stationery, measuring instruments, wood, plastic, nails, ropes, barrels or jerry cans, buckets, and cameras.

This study used a Completely Randomized Design (CRD) with one factor, namely the application of liquid organic fertilizer broiler egg shells with 5 treatments that is K_1 = Nutrients AB Mix, K_2 = AB Mix + 10cc liquid organic fertilizer, K_3 = AB Mix + 20 cc liquid organic fertilizer, K_4 = AB Mix + 30 cc liquid organic fertilizer, and K_5 = AB Mix + 40 cc liquid organic fertilizer repeated 4 repetitions. With 5 treatments and 4 repetitions, 20 mustard plants are needed.

3. Results and Discussion

Based on the results of statistical analysis, it was found that the nutrient concentration of AB Mix and liquid organic fertilizer broiler egg shells had a very significant effect (P<0.01) on maximum plant height, maximum number of leaves, fresh weight of harvest, fresh weight of economic results, and dry weight of economical oven results. While the effect is not significant (P>0.05) on the fresh weight of the root, fresh weight of the stamp, dry weight of the root oven, anddry weight of the stash oven.

Table 1
Significant effect of nutrient concentration of AB Mix and liquid organic fertilizer eggshell of broiler chickens on all observed variables.

Variable	Nutrient Concentration (K)
1. Oven Dry Weight Economical Results (g)	**
2. Fresh Weight Economical Results (g)	**
3. Fresh Harvest Weight (g)	**
4. Maximum Plant Height (cm)	**
5. Maximum number of leaves (Sheet)	**
6. Fresh Weight of Roots (g)	Ns
7. Dry Weight Oven Root (g)	Ns
8. Fresh Weight of Safes (g)	Ns
9. Dry Weight Oven Trimming (g)	Ns

Description : ns : Not significant (P>0,05)
* : Significantly influential (P<0,05)
** : Very significant effect (P<0,01)

AB Mix + 10cc liquid organic fertilizer (K_2) nutrient concentration treatment gives the highest economic oven dry weight of 14.37 g or an increase of 187.98% when compared to the lowest economic result oven dry at AB Mix + 40cc liquid organic fertilizer (K_5) nutrien concentration of only 4.99 g. The increased dry weight of the oven economic yield in the K2 treatment is supported

by the increased weight of the economic yield (Table 2). In the weight variable, the highest economic result was obtained from K_2 treatment, which was 73.3 g or an increase of 80.86% when compared to the lowest economic result weight at AB Mix + 40cc liquid organic fertilizer (K5) nutrient concentration, which was only 40.5g.

The increase in economic yield weight and fresh weight of harvest in K2 treatment is supported by an increase in the average maximum plant height and maximum number of leaves. In the variables of maximum plant height and the highest maximum number of leaves obtained in K_2 treatment, namely 41.38 cm and 12.75 strands or an increase of 55.40% and 30.77% compared to K_5, which is only 26.63 cm and 9.75 strands (Table 2). The increase in average maximum plant height and maximum number of leaves in K_2 treatment was also supported by the increase in variable weight of fresh harvest. The highest fresh harvest weight was obtained in K_2 treatment, which was 68.8 g or an increase of 45.21% compared to K_5, which was only 47 g (Table 2).

Table 2

The average oven dry weight economical results (g), fresh weight economical results (g), fresh harvest weight (g), maximum plant height (cm), maximum number of leaves (sheet), fresh weight of roots (g), dry weight oven root (g), fresh weight of safes (g), and dry weight oven trimming (g) influenced the dose of nutrient concentration Ab Mic and liquid organic fertilizer.

Treatment	Oven Dry Weight Economical Results (g)	Fresh Weight Economical Results (g)	Fresh Harvest Weight (g)	Maximum Plant Height (cm)	Maximum number of leaves (Sheet)	Fresh Weight of Roots (g)	Dry Weight Oven Root (g)	Fresh Weight of Safes (g)	Dry Weight Oven Trimming (g)
K1 = Nutrients AB-Mix	13,92 a	59,0 b	67 a	41,13 a	11,75 a	3,53 a	0,3 a	0,12 a	0,96 a
K2 = AB-Mix + 10cc liquid organic fertilizer	14,37 a	73,3 a	68,75 a	41,38 a	12,75 a	5,55 a	0,46 a	0,79 a	1,68 a
K3 = AB-Mix + 20cc liquid organic fertilizer	9,68 b	51,0 b	51,75 b	37,13 b	10,75 b	4,73 a	0,18 a	0,34 a	1,12 a
K4 = AB-Mix + 30cc liquid organic fertilizer	9,66 b	50,0 b	48,5 b	32,88 b	10 b	4,48 a	0,13 a	0,18 a	0,70 a
K5 = AB-Mix + 40cc liquid organic fertilizer	4,99 c	56,5 b	47 b	26,63 c	9,75 b	3,18 a	0,08 a	0,22 a	0,55 a
BNT 0.05	2.63	10.88	11.85	3.61	1.60	-	-	-	-

Note: The mean value followed by the same letter treatment and the same column means that the difference is not significant at the 5% BNT test level.

Higher yields produced by dry weight oven economic results are supported by increasedvariable yield components as in this study fresh weight of economic yield, maximum plant height, maximum number of leaves, and fresh weight of harvest. The increase is inseparable from the influence of the treatment given, especially the function of nutrients contained in eggshell liquid organic fertilizer. Nutrients in hydroponic cultivation can be fulfilled with the addition of AB Mix nutrients. But in this study, in addition to AB mix nutrition, broiler chicken eggshell fertilizer was also added. This is because according to [19] fertilizer is added to plants to maintain a constant level of nutrients in the media. Phosphorus is an element that plays an important role in increasing plant height, because it helps the growth of root tips which are plant growing points. The moreroots to absorb nutrients, the growth of other plant parts will be higher.

Eggshells contain elements of nitrogen, potassium, and magnesium which play a role in the formation of chlorophyll molecules, resulting in an increase in the rate of photosynthesis. Calcium plays a role in root hair formation and root elongation, and phosphorus (P) plays a role in the breakdown of carbohydrates for energy, thereby increasing the amount of leaf chlorophyll useful in the process of photosynthesis. The length of plant roots shows that the roots are more active in absorbing nutrients in the nutrients that have been provided. Long and numerous plant roots occur due to high nutrient uptake by the roots. In this case, the roots function as nutrient absorbers, where

the longer and more roots, the more nutrients absorbed, so that the nutrient needs needed by plants will be increasingly fulfilled. [20] Good plant growth is also influenced by the smooth process of root respiration so that plants produce a lot of energy for the formation of plant growth components such as height, number of leaves, leaf area [18]. Based on research by [24] in dosing eggshell flour, the number of leaves increased from K_2 treatment, this is because eggshells contain nitrogen (0.01%), potassium (0,05%), and magnesium (0,09%) elements which play a role in the formation of chlorophyll molecules, resulting in an increase in the rate of photosynthesis. Higher photosynthesis results affect the number of leaves more and wider leaf blades.

Table 2 shows that an increase in liquid organic fertilizer eggshell dose from 20 cc to 40 cc dose causes all observed variables to decrease. This is because each plant has a limit on the concentration of different amounts of nutrient needs. Laeybig also states that plant yield is not determined by the nutrients N, P and K needed in large quantities but by minerals such asmagnesium and other chemicals such as oxygen, phosphorus which are needed in small amounts for growth [19]. States that the failure of a plant to maintain its life can be determined by the lack or excess of several factors that are close to the limit of tolerance [19]. Not only in small or low amounts that are limiting but also in excessive or high amounts [19], in this case in accordance withthe treatment of 20 cc, 30 cc, and 40 cc (K3, K4, K5), because excessive intake of nutrients makes plants unable to grow properly. Each addition of liquid organic fertilizer to AB Mix causes an increase in the concentration of the solution resulting in an impact on the EC (PPM) of the solution. Plant height gain is affected by phosphorus elements. PPM, which stands for "Part Per Million", is a unit for measuring the concentration of a liquid solution. In a hydroponic system, PPM is used to measure the concentration level of the nutrient solution.

Phosphorus accelerates the growth and development of root tips and plant growing points. The role of phosphorus for plants includes spurring root growth and good root system division from seeds and young plants, accelerating fruit and seed ripening, and accelerating the percentage of flower formation into fruit [5]. Excess P causes the absorption of other elements, especially microelements such as iron (Fe), copper (Cu), and zinc (Zn) to be disrupted. But the symptoms are not physically visible in plants. Eggshells also contain 0.3% posphore and contain microelements (magnesium, sodium, potassium, zinc, manganese and copper) as much as 0.3% [14]. Therefore, in the nutrient medium must contain enough nutrients for plant growth. Just like P, excess K causes impaired absorption of Ca and Mg. Plant growth is inhibited. so that the plant is deficient. In this study, mustard plants were obtained in a hydroponic system, plants were not able to absorb nutrients applied at high doses. If the PPM value exceeds the ideal value in the nutrient solution, it results in reduced water absorption by mustard plants so that it disrupts the process of food formation (photosynthesis). Meanwhile, if the PPM value is smaller than the ideal value, it will cause the growth process of mustard plants to be hampered [16]. Added that the high concentration of nutrient solutions can affect the maximum absorption of nutrients by plant roots [27]. This can be due to decreased nutrient uptake by plant roots due to high concentration of nutrient solutions. Based on the results of research that has been done shows that the right treatment to useis the K2 treatment (AB Mix + 10cc liquid organic fertilizer).

4. Conclusion

Based on the research that has been done, it can be concluded that the effect of nutrient concentration of AB Mix and liquid organic fertilizer broiler egg shells has a very real effect ($P<0.01$) on maximum plant height, maximum number of leaves, fresh weight of harvest, fresh weight of economic results, and dry weight of economical oven results. While the effect is not real ($P>0.05$) on the fresh weight of the root, fresh weight of the stamp, dry weight of the root oven, anddry weight of the container oven.

The highest economic result weight was obtained from the treatment of AB Mix + 10 cc liquid organic fertilizer (K_2) nutrient concentration which was 73.3 g or an increase of 86.80% when compared to the lowest economic result weight at AB Mix + 40cc liquid organic fertilizer (K_5) nutrient concentration which was only 40.5g.

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