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The Effectiveness of Fertilization Based on Nutrient Requirements and the Production Target of Green Cawri (*Brassica Juncea. L*) In a Hydroganic System

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Abstract. This research aims to evaluate the effectiveness of fertilization based on nutrient requirements and production targets of green mustard (Brassica juncea. L) in a hydroponic system. The study involved varying fertilizer dosages and integrating them into the hydroponic system to assess the growth and production of mustard plants. The results showed that increasing fertilizer dosages in line with production targets could enhance plant growth, such as plant height, leaf count, and leaf width, as well as plant production in terms of wet and dry weights. Integrating fertilizer dosages with the hydroponic system also demonstrated increased effectiveness of fertilization on the growth and production of mustard plants. The interaction between increasing fertilizer dosages and the hydroponic system also positively impacted mustard plant production. The role of the hydroponic system in improving the efficiency of complete fertilizer application in mustard cultivation was evidenced by an increase in production yields of up to 24 tons/ha. These findings indicate that adjusting fertilizer dosages to match plant nutrient requirements and integrating them with a hydroponic system can enhance the growth and production of green mustard plants under hydroponic conditions.

Keywords: Fertilization Effectiveness, Nutrient Requirements, Green Mustard, Production Targets

INTRODUCTION

Fertilization is one way that can be done to meet the availability of soil nutrients needed by mustard plants. However, the problem that often occurs in fertilization today is that fertilizer is not able to provide maximum results due to low fertilization efficiency (less or more doses) caused by nutrients lost due to leaching, binding in the soil, and being transported to the harvest. Apart from that, farmers' knowledge in applying the 5T concept (Right type, Right dose, Right time, Right method, and Right target) of fertilization is very low, especially in providing the wrong type of fertilizer and macro nutrient composition (N, P, K, Mg). .

The mustard plant (Brassica juncea.L) is one of the vegetables that is widely consumed by the public. Mustard greens are vegetables that are in great demand in Indonesia, so they have great opportunities for cultivation. One of the mustard greens that is often cultivated is green mustard greens, which is a commercial variety. Until now, the production of green mustard greens is not maximum because there are still many obstacles in the cultivation method, such as the lack of effective fertilization where nutrients need to be added which is a limiting factor.

The hydroganic system is the answer to reducing weaknesses in soil properties by adding nutrients needed by plants. This technique allows farmers to combine a hydroponic system but use soil as a growing medium and nutrient provider. This technique is a combination of hydroponic and aquaponic systems. Where the technique of raising fish in ponds will

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produce nutrient-rich water from fish waste, which is a source of natural fertilizer to support the growth of mustard plants. One of the fish that is able to support the growth of mustard plants in this system is the sangkuriang catfish. This fish is capable of producing high amounts of waste in a relatively short time.

It is important to provide the appropriate dose of fertilizer. Information on mustard plant nutrient uptake is needed to determine mustard plant fertilizer doses. The right dose of fertilizer will help increase mustard crop production according to the desired production target. Because there has been no research regarding the effectiveness of complete balanced fertilizer on mustard plants with a hydroganic system integrated with sangkuriang catfish, this is an interesting thing to research at this time.

THEORETICAL STUDY

Crop production that is less than optimal is caused by varying levels of soil fertility due to varied (complicated) soil properties. There are 3 (three) properties of soil, namely being able to fix or bind nutrients in the soil, providing or adding nutrients, or not providing nutrients at all. (Utomo et al. 2016).

Materials and Tools

The materials used in this research were superior green mustard seeds (Brassica juncea. tons/Ha), complete fertilizer (Urea, SP36, KCl and Dolomite), two month old sangkuriang catfish seeds, fish feed (pellets), and soil (planting media).

Meanwhile, the tools used are plastic pots, saws, tape measure, scales, slide rule, writing tools, tub measuring 3.8 m × 1.8 m × 0.6 m for fish cultivation, water pump, paralon pipe, pipe. gutters, PE hose, angle iron, filter cloth, thermometer and aerator for oxygen in fish ponds, sponges, rulers and digital cameras.

Methods

The research was carried out in the form of an experiment arranged according to a Factorial Completely Randomized Design (CRD) with the following treatments:

Factor 1. Providing Complete Fertilizer with Urea, SP 36, Kcl, and Dolomite

P0 : 0 gr/pot (Without Fertilizer)

P1: 1.54 gr/pot (Production Target 5 Tons/Ha)

P2: 3.09 gr/pot (Production Target 10 Tons/Ha)

Factor 2. Factor Based on Nutrient Index

B1 = 0.50 (Fertilizer dose reduced by 50%)

B2 = 0.75 (fertilizer dose reduced by 25%)

B3 = 1 (100% Standard Nutrient Index)

To determine the nutrient requirements of green mustard greens, an analysis of the nutrient requirements of N, P, K and Mg was carried out with a sample of 10 green mustard plants (Brassica juncea L.). The sample tested contained N=3.857%; P=0.721%, K=3.827%; and Mg=0.366%. In this research, urea fertilizer was used as a source of N, SP-36 fertilizer was used as a P source, KCl fertilizer was used as a K source and Dolomite fertilizer was used as a Mg source. Calculations of nutrient requirements for production targets can be seen in Appendix 1.

Number of treatment combinations 3 x 3 = 9 treatments:

P0B1 P0B2 P0B3

P1B1 P1B2 P1B3

P2B1 P2B2 P2B3

Number of research plots: 9 treatment combinations repeated 3 times to obtain 27 experimental units with a planting distance of 20 x 20 cm. The data analysis used is in accordance with the linear model as follows: $\mathbf{Yijk = \mu + \alpha i + \beta j + (\alpha\beta)\, ij + \varepsilon ijk}$

Yijk: Observation results of factor P at the ith level, factor B at the jth level and in the kth replication

μ : General average

αi: Influence of factor P at level i

βj : Influence of factor B at the jth level

(αβ) ij : interaction effect of factor P and factor B

εijk: Error on factor P of the ith level, factor B of the jth level and repetition of the kth

The data obtained was analyzed statistically based on analysis The variance in each observed variable was measured and further tested for real treatments using the Duncan Multiple Range Test (DMRT) at the 5% level and at the 1% level

RESULTS AND DISCUSSION

From the conversion results it can be seen that the hydroganic system is able to increase the efficiency of complete fertilizer fertilization with a production target of 10 tonnes/ha. Based on the production target of 10 tons/ha, the results from the wet weight of mustard plants, if

converted in 1 ha, can produce 24 tons/ha with a total dose of complete fertilizer of 309 Kg/ha. Utilization of catfish waste is able to provide maximum results in this hydroganic system with mustard crop yields of 10 to 11 tons/ha without giving complete fertilizer.

Table 1. Conversion of mustard crop yields

Treatment	Fertilizer Dosage	Wet Weight Results	Fertilizer Dosage Conversion	Wet Weight Conversion Yield
	Grams/Sample	Grams/Sample	Kg/Ha	Tons/Ha
P0B1	0	113.33	0	11
P0B2	0	108.33	0	10
P0B3	0	113.33	0	11
P1B1	0.77	141.67	77	14
P1B2	1.16	156.67	116	15
P1B3	1.55	183.33	155	18
P2B1	1.55	191.67	155	19
P2B2	2.32	221.67	232	22
P2B3	3.09	248.33	309	24

Description: Conversion of 1 Ha with a Mustard Plant Population of 100,000 plants

Catfish waste water can play a role in increasing soil fertility, increasing soil productivity, providing nutrients for plants, improving the physical and biological properties of soil, and increasing plant production. This can be seen from the production of wet weight and dry weight of mustard plants, which shows that giving fertilizer added with catfish waste water is able to provide very good production results compared to those who are not given fertilizer and only get nutrients from catfish waste water. This is in accordance with the literature of Saparinto and Susiana (2014) which states that catfish water waste plays a very important role in increasing soil fertility, will determine soil productivity, provide nutrients for plants, improve the physical and biological properties of the soil, and increase plant production.

Based on the results above, the hydroganic system is able to efficiently administer complete fertilizer doses and provide better production results compared to normal doses. Providing a total fertilizer dose of 309 kg/ha with a production target of 10 tonnes/ha was able to produce 24 tonnes/ha, a much better result compared to BPS data (2018) which states that the administration of Urea, SP-36, Kcl, And Dolomite as much as 750 Kg/ha produces 10.42 Tons/ha.

From the results above, the hydroganic system is capable of producing mustard greens without applying fertilizer by utilizing catfish waste water. If converted into 1 ha of mustard planting, it produces 11 tonnes/ha. This result is better than the national average production of 10.42 tonnes/ha.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

1. The interaction between increasing fertilizer doses and the hydroganic system can increase the production of mustard greens.
2. The role of the hydroganic system is to increase the efficiency of complete fertilizer application in mustard planting by increasing production yields from mustard plants to 24 tons / ha.

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