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The Effect of Giving Shallot Extract (*Allium Cepa* L) and NPK Fertilizer on the Growth of Green Mustard Plants (*Brassica Juncea* L)

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Abstract: Plant growth and development require nutrients, which can be given through fertilization in the form of organic or inorganic fertilizers. This study aims to determine the effect of providing shallot extract, NPK fertilizer, and a combination of both on the growth of mustard greens. This study used a two-factorial, Completely Randomized Design (CRD) consisting of NPK fertilizer and shallot extract treatments, each using five levels with three replications. The parameters observed were plant height, number of leaves, leaf area, plant fresh weight, and plant dry weight. The data obtained were analyzed using two-way ANOVA and continued with the Duncan multiple range test. The results of the ANOVA test showed that the main factor of NPK fertilizer obtained a value of (sig) < 0.05, the main factor of organic fertilizer was red onion extract, and the interaction factor obtained a value of (sig) > 0.05. The study results showed that the administration of NPK fertilizer can increase plant height, number of leaves, leaf area, wet weight, and dry weight of green mustard plants. The administration of shallot extract can increase plant height and the number of green mustard leaves. Still, it cannot increase green mustard plants' leaf area and wet and dry weight. The administration of a combination of NPK fertilizer and shallot extract cannot increase plant height, number of leaves, leaf area, wet weight, and dry weight of green mustard.

Keywords: Green Mustard Growth; NPK Fertilizer; Shallot Extract.

Introduction

Soil properties and the availability of nutrients in the soil largely determine plant growth and production. Nutrients are one of the critical factors that affect plant growth and development. Land planted continuously without paying attention to soil maintenance can cause the availability of nutrients in the soil to decrease, disrupting growth and production. Efforts to increase the availability of nutrients can be made by fertilization, either inorganic fertilizers or organic fertilizers. Fertilization aims to improve nutrients in the media or soil and is one of the critical efforts to increase plant production growth [1].

Today's society depends on the role of inorganic fertilizers that can provide faster, more practical, and more manageable results. One of the most widely used is NPK fertilizer. However, excessive use of NPK fertilizers can cause negative impacts such as environmental pollution, damaging soil structure, and reducing soil fertility [2].

One effort that can be made to reduce the use of inorganic fertilizers is to combine inorganic fertilizers with organic fertilizers [3]. The use of organic fertilizers can affect the availability of nutrients in the soil, whereas organic fertilizers can contribute organic materials in the soil that function as contributors of nutrients. The more organic materials are given in the soil, the availability of nutrients also increases [4]. Combining organic fertilizers and inorganic fertilizers can provide better growth and results for shoot growth, plant height, number of leaves, leaf area, wet weight, and dry weight of leaves.

Red onion extract can be a source of organic fertilizer to support plant growth. The red onion extract contains potassium, magnesium, phosphorus, iron, and endogenous auxin from the skin and bulbs [5]. Young shoots in red onions produce natural auxin in the form of IAA (Indodole Acetid Acid). This auxin is essential in plant growth, enlargement, elongation, and cell division, affecting nucleic acid and plant metabolism [6].

Shallot extract can be used as a plant growth regulator. Using the proper plant growth regulator will have a good effect on plant growth, but if the amount is too much, it will harm or poison the plant. Plant growth regulators are growth stimulants if given in the right amount. Conversely, if presented in an amount too high for the plant's needs, it will inhibit its metabolism [7]. Shallot extract has not been widely used as an organic fertilizer because people do not know much about the content and benefits of shallot extract in increasing plant growth. Shallots contain active compounds such as phytohormones, vitamins, and other organic compounds that can affect growth. The benefits of giving shallot extract to mustard greens include increasing plant height, shoot growth, number of leaves, leaf width, wet weight, and dry weight of leaves [8].

Vegetables are one of the components of a healthy food menu, so the need for vegetables is increasing along with public health awareness. Among the various types of vegetables that can be cultivated, mustard greens (Brassica juncea L.) are very well-known among consumers. In addition to being used as a plant-based food ingredient,

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mustard greens (Brassica juncea L.) can also be used to treat various diseases, so mustard greens are one of the vegetable groups that have an essential role in meeting the food, nutritional, and medicinal needs of the community. Thus, proper and optimum cultivation techniques are needed for green mustard production. Good plant growth with high productivity can be achieved by showing the growing conditions and carrying out adequate plant maintenance and care. One of the essential plant maintenances is fertilization. Therefore, the dosage of fertilizer and nutrients contained in the fertilizer are significant for adequate fertilization. The high dependence on NPK fertilizer as a source of nutrients can potentially reduce soil productivity, so its use needs to be reduced by utilizing organic fertilizers derived from shallot extract. Based on the description above, research is needed on the effect of red onion extract and NPK fertilizer on the growth of green mustard plants.

Research methods

Types of research

The type of research that has been done is experimental research; experimental research is scientific research where researchers manipulate and control one or more independent variables and observe dependent variables to find variations that arise along with manipulating the independent variables. This experimental research aims to test the possibility of a causal relationship by providing one or more treatment conditions to one or more experimental groups and comparing the results with one or more untreated controls [9].

Time and Place of Research

The research was conducted from August to September, and the research location was at the Ireng Daye Greenhouse, Gunung Sari District. Measurements of plant growth parameters were carried out at the Biology Laboratory of the Faculty of Teacher Training and Education, University of Mataram.

Research Variables

Variables are everything that becomes the object of observation in research. Independent variables are variables that cause dependent variables, and dependent variables are variables that result from the existence of independent variables [10]. The variables in this study include independent variables, namely liquid organic fertilizer of red onion extract with doses of 0 ml, 20 ml, 40 ml, 60 ml, and 80 ml, NPK fertilizer with doses of 0 gr/100 ml of water, 2 gr/100 ml of water, 4 gr/100 ml of water, 6 gr/100 ml of water, 8 gr/100 ml of water. The dependent variables in this study are growth parameters, including plant height, number of leaves, leaf area, wet weight, and dry weight of leaves.

Population and Research Sample

Population is the entire object of research and meets specific characteristics set by the researcher, and the sample is part of the population or small group observed [11]. The population in this study is all green mustard plants. One hundred green mustard plants will be planted in this study. The sample consists of green mustard plants that have been selected and made the object of research. The sample in this study is 75 green mustard plants, and each polybag contains 1 selected plant stem and the best plants.

Observation and Data Collection

Observations were made to show data that describes the observed variables. Measurement of green mustard growth, such as plant height and number of leaves, was done non-destructively. Namely, it can be counted or measured directly without damaging the plant parts [12]. Measurements were made in the last week, the fifth week after planting. Data collection of growth parameters such as leaf area, wet weight, and dry leaf weight was destructive.

Research Design

This study used a factorial Completely Randomized Design (CRD) pattern. Completely Randomized Design (CRD) is used for experiments with homogeneous media or experimental locations, so RAL is widely used for experiments in greenhouses [13].

Data Analysis Techniques

The data obtained were analyzed using a two-way ANOVA (Analysis of Variance) test to determine the effect of treatment on the growth of green mustard. Further testing can be done if the F count > F table or value (sig) < 0.05. Additional testing was used in Duncan's Multiple Range (DMRT) test to determine the treatment that could provide the best green mustard growth response. Data analysis was carried out with the help of the SPSS statistical application [14].

Results and Discussion

Plant Height

Plant height measurements were carried out non-destructively. The effect of giving organic fertilizer of red onion extract and NPK fertilizer on the average height of green mustard plants in observations 35 days after planting (DAP) is summarized in Table 1.

Table 1 shows that the average plant height in the control group was lower than that of the NPK fertilizer, shallot extract, and mixed groups. In the 0 NPK + 0 shallot extract treatment, the plant height was 19.00 cm; in the NPK group, the highest plant was in the 6 gr NPK fertilizer treatment, which was 28.66 cm, and the lowest was in the 8 gr NPK fertilizer treatment, which was 26.33 cm. In the shallot extract group, the highest plant was in the 60 ml and 80 ml shallot extract treatments, 21.66 cm, and the lowest was in the 20 ml shallot extract treatment, 19.66 cm. In the mixed group, the highest plant was in the 6 gr NPK + 60 ml shallot extract treatment, which was 33.00 cm, and the lowest value was in the 4 gr NPK + 40 ml and 3 gr NPK + 20 ml shallot extract treatments, which was 25.66 cm.

Table. 1. Average Height of Mustard Greens

Group	Dose	Plant Height (cm)
Control	0 gr NPK + 0 ml BM	19.00 f
NPK	2 grams	27.00 bcd
	4 grams	26.66 bcd
	6 grams	28.66 abc
	8 grams	26.33 bcd
Red Onion Extract	20 ml	19.66 f
	40 ml	21.66def
	60 ml	21.66 defs
	80 ml	20.66 ef
Mixture Red Onion Extract NPK+	2 gr NPK + 20 ml	30.33 abc
	2 gr NPK + 40 ml	30.33 abc
	2 gr NPK + 60 ml	27.66 abc
	2 gr NPK + 80 ml	30.66 abc
	4 gr NPK + 20 ml	32.00 abc
	4 gr NPK + 40 ml	25.66 cde
	4 gr NPK + 60 ml	32.00 abc
	4 gr NPK + 80 ml	33.00 a
	6 gr NPK + 20 ml	25.66 cde
	6 gr NPK + 40 ml	27.33 abc
	6 gr NPK + 60 ml	33.00 a
	6 gr NPK + 80 ml	31.00 abc
	8 gr NPK + 20 ml	30.33 abc
	8 gr NPK + 40 ml	26.66 bcd
	8 gr NPK + 60 ml	30.00 abc
	8 gr NPK + 80 ml	30.33 abc

Note: Numbers followed by the same letter mean no significant difference at the 5% DMRT test level.

The difference in each treatment can be seen from the Average value of different plant heights in the same or other notations. NPK fertilizer treatment is in the same notation as the shallot extract treatment, meaning that the effect of NPK fertilizer treatment is not significantly different from that of shallot extract treatment. The results of the Duncan Multiple Range Test 5% in Table 1. show that the control treatment with a mixed group of 4 gr NPK + 40 ml shallot extract, which is significantly different from other treatments, is the optimum dose for the height of mustard greens. However, it is not substantially different from the treatment of 6 gr NPK + 60 ml shallot extract. The effect of the control treatment on plant height has the same value as the higher dose treatment.

The growth of mustard plants is greatly influenced by the availability of nutrients in the soil, as shown by the results of organic fertilizer with shallot extract and NPK fertilizer. The growth of mustard plants is seen from the increase in plant height, number of leaves, leaf area, wet weight, and dry weight of mustard plants, measured 35 days after planting (DAP). The average growth of mustard plants that are only given NPK fertilizer produces higher results than plants that are only given shallot extract. This is because the amount of Nitrogen, phosphorus, and potassium in the NPK fertilizer used is higher than the nutrient content in shallot extract. The NPK fertilizer used contains high macronutrients, namely N (16%), P2O5 (16%), and K2O (16%).

NPK fertilizer can supply certain nutrients in the form of inorganic compounds with high concentrations and can be immediately utilized by green mustard plants; this is an advantage of NPK fertilizer, which responds more quickly in plants. The continuous use of NPK fertilizer without being balanced with the use of organic materials causes a decrease in soil quality physically, chemically, and biologically. The accumulation of mineral content in NPK fertilizer can kill microorganisms responsible for decomposing the soil. As a result, the soil becomes stiff and less able to retain water and nutrients. The solution that can be done to overcome this problem is to combine the right inorganic and organic fertilizers [15].

Nutrients in organic fertilizers are limited and insufficient in providing the nutrients plants need, so they are unsuitable for plant growth and development. The study's results showed that in the provision of a combination treatment of 8 grams of NPK and 80 ml of shallot extract, the average growth of green mustard plants was the highest compared to other treatments. This follows research [16], which states that providing organic fertilizer combined with inorganic fertilizer can improve soil conditions and fertility.

The study showed that the combination treatment of 2 grams of NPK fertilizer with 20 ml of shallot extract experienced an insignificant average decrease from the treatment with the highest average plant growth. Giving chemical fertilizers in excessive amounts will suppress the rate of plant growth. This is following the results of the study [17]. Stated that giving fertilizer with a specific concentration limit will cause plant growth to increase while providing fertilizer with a concentration exceeding a particular limit will cause plant growth to decrease and can cause plants to die because they cannot absorb excessive fertilizer content. This is also in line with the study [18]. As directed at cucumber plants with different main stem lengths, this is because the treatment (Bokashi chicken manure) provides or supplies different nutrients; the more treatment is given, the more nutrients will be available to plants. Furthermore, the nutrient that plays a significant role in vegetative growth is the nitrogen nutrient.

Number of Leaves

The calculation of the number of leaves was done non-destructively. The effect of giving organic fertilizer of red onion extract and NPK fertilizer on the average number of green mustard leaves in the observation of 35 days after planting (DAP) is summarized in Table 2.

Table 2. This shows that the average number of leaves in the control group is lower than in the NPK fertilizer treatment group, shallot extract, and mixed group. In the 0 NPK + 0 shallot extract treatment, there were 9 leaves; in the NPK group, the most leaves were in the 4 gr NPK fertilizer treatment, namely 11.67 leaves, and the least were in the 2 gr NPK fertilizer treatment, 9.67 leaves. In the shallot extract group, the most leaves were in the 20 ml and 40 ml shallot extract treatments, namely 11.67 leaves, and the least were in the 80 ml shallot extract treatment, namely 9.33 leaves. In the mixed group, the most leaves were in the 8 gr NPK + 80 ml shallot extract treatment, namely 23.50 leaves, while the least was in the 6 gr NPK + 40 ml shallot extract treatment, namely 9 leaves.

Table 2. Average Number of Green Mustard Leaves

Group	Dose	Number of Leaves
Control	0 gr NPK + 0 ml BM	9.00 d
NPK	2 grams	9.67cd
	4 grams	11.67abcd
	6 grams	11.33abcd
	8 grams	10.67 abcd
Red Onion Extract	20 ml	11.67 abcd
	40 ml	11.67 abcd
	60 ml	10.33abcd
	80 ml	9.33cd
Mixture NPK + Red Onion Extract	2 gr NPK + 20 ml	9.67cd
	2 gr NPK + 40 ml	10.33abcd
	2 gr NPK + 60 ml	10.33abcd
	2 gr NPK + 80 ml	11.00 a.b.c.d
	4 gr NPK + 20 ml	10.33abcd
	4 gr NPK + 40 ml	11.33abcd
	4 gr NPK + 60 ml	13.00 abcd
	4 gr NPK + 60 ml	10.00 bcd
	6 gr NPK + 20 ml	12.67 a b c d
	6 gr NPK + 40 ml	9.00 d
	6 gr NPK + 60 ml	14.67abc
	6 gr NPK + 80 ml	15.33 ab
	8 gr NPK + 20 ml	12.67 a b c d
	8 gr NPK + 40 ml	11.67 abcd
	8 gr NPK + 60 ml	11.67 abcd
	8 gr NPK + 80 ml	23.50a

Note: Numbers followed by the same letter are not significantly different at the 5% DMRT test level.

The difference in each treatment can be seen from the average value of the number of different leaves in the same or other notations. The NPK fertilizer treatment is in the same notation as the shallot extract treatment, meaning that the effect of the NPK fertilizer treatment is not significantly different from the effect of the shallot extract treatment. The results of the Duncan Multiple Range Test 5% in Table 2. show that the control treatment with a mixed group of 6 gr NPK + 40 ml shallot extract, which is significantly different from other treatments, is the optimum dose for the number of mustard greens. However, it is not substantially different from the treatment of 6 gr NPK + 60 ml shallot extract. The effect of the control treatment on the number of leaves has the same value as the higher dose treatment.

The combination of red onion extract and NPK fertilizer cannot increase the number of leaves because the nutrients are not enough to support the formation of new leaves, and the active compounds in red onions cannot stimulate growth. Leaf areas tend to increase due to optimal nutrition, where broad leaves can improve photosynthesis and light absorption.

Leaf Area

Leaf area calculation was done destructively. The effect of giving organic fertilizer of red onion extract and NPK fertilizer on the average leaf area of green mustard greens in observations 35 days after planting (DAP) is summarized in Table 3.

Table 3 shows that the average leaf area in the control group is undoubtedly lower compared to the NPK fertilizer treatment group, shallot extract, and mixed group. In the 0 NPK + 0 shallot extract treatment, the area was 77.87cm. In the NPK group, the most expansive leaf area was in the 8gr NPK fertilizer treatment, 366.87cm, and the smallest was in the 2gr NPK fertilizer treatment, 188.78cm. In the shallot extract group, the most expansive leaf area was in the 80ml shallot extract treatment, 239.04cm, and the smallest was in the 60ml shallot extract treatment, 92.32cm. The most expansive leaf area in the mixed group was in the 6gr NPK + 80ml shallot extract treatment, which was 439.63cm. The smallest was in the 2gr NPK + 20ml shallot extract treatment, which was 195.23cm.

Table 3. Average Leaf Area of Mustard Greens

Group	Dose	Leaf Area
Control	0 gr NPK + 0 ml BM	77.87a
NPK	2 grams	188.78 deg
	4 grams	222.19 abcdefg
	6 grams	298.31 ab cd
	8 grams	366.87 a b c d
Red Onion Extract	20 ml	112,081 efg
	40 ml	161.24 defg
	60 ml	92.32 fg
	80 ml	239.04 abcdefg
Mixture NPK + Red Onion Extract	2 gr NPK + 20 ml	195.23 deg
	2 gr NPK + 40 ml	358.97 a b c d
	2 gr NPK + 60 ml	305.64 ab cd
	2 gr NPK + 80 ml	311.35 abcde
	4 gr NPK + 20 ml	340.07 a b c d
	4 gr NPK + 40 ml	256.92 abcdefg
	4 gr NPK + 60 ml	217.06 bcdefg
	4 gr NPK + 80 ml	214.87 bcdefg
	6 gr NPK + 20 ml	307.61 abcdef
	6 gr NPK + 40 ml	295.31 abcdef
	6 gr NPK + 60 ml	363.00 abcd
	6 gr NPK + 80 ml	439.63 a
	8 gr NPK + 20 ml	402.19 abc
	8 gr NPK + 40 ml	355.16 abcd
	8 gr NPK + 60 ml	424.83 ab
	8 gr NPK + 80 ml	370.25 a b c d

Note: Numbers followed by the same letter mean no significant difference at the 5% DMRT test level.

The differences in each treatment can be seen from the average value of the leaf area, which is different in the same or other notations. The NPK fertilizer treatment is in the same notation as the shallot extract treatment, meaning that the effect of the NPK fertilizer treatment is not significantly different from the effect of the shallot extract treatment. The results of the Duncan Multiple Range Test 5% in Table 3 show that the control treatment and 6 gr NPK + 80 ml shallot extract, which are significantly different from other treatments, are the optimum doses for the area of green mustard leaves, although not substantially different from the 6 gr NPK + 60 ml shallot extract treatment. The effect of the control treatment on the leaf area has the same value as that of the higher-dose treatment.

Green mustard plants require sufficient and available nutrient fertilization for their growth and development to produce maximum production. According to [19], Nitrogen

is one of the nutrients that plays a major role in leaf growth. Nitrogen functions to increase growth so that plant leaves become broader and greener. This is in line with the research results showing that the widest leaf in the treatment of 6gr NPK + 80 ml of shallot extract was 439.63cm, meaning that the availability of nutrients needed by plants is sufficient. This follows the research results [20], which state that if essential nutrients are available less than the amount plants need, the metabolic process and plant growth will be inhibited. Nutrient deficiency symptoms can be recognized visually as inhibited root, stem, leaf growth, and dead tissue in specific plant organs.

Wet Weight

The wet weight calculation was carried out destructively. The effect of giving organic fertilizer of red onion extract and NPK fertilizer on the average wet weight of green mustard plants in observations 35 days after planting (DAP) is summarized in Table 4.

Table 4 shows the average wet weight of mustard greens in the control group is undoubtedly lower compared to the NPK fertilizer treatment group, shallot extract, and the mixed group. In the 0 NPK + 0 shallot extract treatment, the wet weight was 14.23 gr. In the NPK group, the heaviest plant weight was in the 8 gr NPK fertilizer treatment, 110.47 gr and the least in the 2 gr NPK fertilizer treatment, 50.73 gr. In the shallot extract group, the heaviest plant weight was in the 80 ml shallot extract treatment, 82 gr, and the least in the 60 ml shallot extract treatment, 22.77 gr. In the mixed group, the heaviest plant weight was in the 6 gr NPK + 80 ml shallot extract treatment, 148.33 gr, and the least in the 4 gr NPK + 80 ml shallot extract treatment, 31.83 gr.

Table 4. Average Wet Weight of Mustard Greens

Group	Dose	Wet weight (gr)
Control	0 gr NPK + 0 ml BM	14.23 f
NPK	2 grams	50.73 brief
	4 grams	81.40 abide
	6 grams	94.80 abide
	8 grams	110.47 abc
Red Onion Extract	20 ml	27.17 def
	40 ml	46.00 brief
	60ml	22.77 of
	80 ml	82.90 abide
Mixture NPK + Red Onion Extract	2 gr NPK + 20 ml	73.47 abide
	2 gr NPK + 40 ml	122.20 ab
	2 gr NPK + 60 ml	92.17 abide
	2 gr NPK + 80 ml	47.77 abide
	4 gr NPK + 20 ml	91.33 abcdef
	4 gr NPK + 40 ml	87.21 abcdef
	4 gr NPK + 60 ml	73.53 abcdef
	4 gr NPK + 80 ml	31.83 cdef
	6 gr NPK + 20 ml	82.10 abcdef
	6 gr NPK + 40 ml	89.93 abcdef
	6 gr NPK + 60 ml	109.63 abc
	6 gr NPK + 80 ml	148.33 a
	8 gr NPK + 20 ml	112.33 abc
	8 gr NPK + 40 ml	107.17 abcd
	8 gr NPK + 60 ml	147.37 a
	8 gr NPK + 80 ml	136.57 a

Description: Numbers followed by the same letter mean no significant difference at the 5% DMRT test level.

The difference in each treatment can be seen from the average value of the wet weight, which is not significantly different. The NPK fertilizer treatment is in the same notation as the shallot extract treatment, meaning that the effect of the NPK fertilizer treatment is not substantially different from the effect of the shallot extract treatment. The results of the Duncan Multiple Range Test 5% in Table 4. show that the treatment of 6 gr NPK + 80 ml of shallot extract, 8 gr NPK + 60 ml of shallot extract, and 8 gr NPK + 80 ml of shallot extract, which are significantly different from other treatments are the optimum doses for the wet weight of mustard greens, although not substantially different from other treatments. The control treatment's effect on plants' wet weight has the same value as the higher dose treatment.

Based on the results of the study, it was shown that the wet weight of the plant with the heaviest weight was in the combination treatment of 6gr NPK + 80 shallot extract, namely 148.33 gr, while the lowest weight was in the control treatment, namely 14.23 gr. These results indicate that the treatment without fertilization does not provide sufficient nutrients for plant growth because mustard greens rely only on the planting medium's nutrients. This follows the study's results [21], which state that the availability of nutrients plays an essential role in plant growth and development, thus affecting wet weight. Wet weight consists of all parts of the mustard greens plant, and the more leaves, the wet weight of the plant will also increase. Plant height also affects the damp weight of the plant; the higher the mustard greens plant and the more leaves it has, the wet weight will also increase.

Dry Weight

The calculation of dry weight was carried out destructively. The effect of giving organic fertilizer of red onion extract and NPK fertilizer on the average dry weight of green mustard plants in observations 35 days after planting (DAP) is summarized in Table 5.

Table 5 shows the average dry weight of mustard plants in the control group is undoubtedly lower compared to the NPK fertilizer treatment group, shallot extract, and the mixed group. In the 0 NPK + 0 shallot extract treatment, the dry weight was 2.23 gr. In the NPK group, the heaviest plant weight was in the 8 gr NPK fertilizer treatment, namely 6.27 gr, and the least in the 2 gr NPK fertilizer treatment, namely 3.67 gr. In the shallot extract group, the heaviest plant weight was in the 80 ml shallot extract treatment, namely 5.67 gr, and the least in the 20 ml and 60 ml shallot extract treatments, namely 2.90 gr. In the mixed group, the heaviest plant weight was in the 8 gr NPK + 60 ml shallot extract treatment, 10.53 gr, and the least in the 4 gr NPK + 80 ml shallot extract treatment, 2.57 gr.

The differences in each treatment can be seen from the average dry weight of different plants in the same or other notations. The NPK fertilizer treatment is in the same notation as the shallot extract treatment, meaning that the effect of the NPK fertilizer treatment is not significantly different from the effect of the shallot extract treatment. The Duncan Multiple Range Test results are 5% in Table 5.

The control treatment and 4gr NPK + 80 ml shallot extract, which are significantly different from other treatments, are the optimum doses for the dry weight of mustard greens, although not substantially different from the 2gr NPK + 20 ml shallot extract treatment. The effect of the control treatment on the dry weight of plants has the same value as the higher dose treatment.

Table 5. Average dry weight of green mustard

Group	Dose	Dry weight (gr)
Control	0 gr NPK + 0 ml BM	2.23 e
NPK	2 grams	3.67cde
	4 grams	4.13 abcde
	6 grams	6.07 abcde
	8 grams	6.27 abcde
Red Onion Extract	20 ml	2.90 de
	40 ml	4.13 cde
	60 ml	2.90 de
	80 ml	5.67 bcde
Mixture NPK + Red Onion Extract	2 gr NPK + 20 ml	4.43bcde
	2 gr NPK + 40 ml	5.87 abcde
	2 gr NPK + 60 ml	5.83 blade
	2 gr NPK + 80 ml	3.87 cde
	4 gr NPK + 20 ml	7.73 abc
	4 gr NPK + 40 ml	6.10 abcde
	4 gr NPK + 60 ml	6.17 abcde
	4 gr NPK + 80 ml	2.57 e
	6 gr NPK + 20 ml	5.87 abcde
	6 gr NPK + 40 ml	6.43 abcde
	6 gr NPK + 60 ml	4.37bcde
	6 gr NPK + 80 ml	8.23abc
	8 gr NPK + 20 ml	7.40 abcd
	8 gr NPK + 40 ml	6.13 abcde
	8 gr NPK + 60 ml	10.53 a
	8 gr NPK + 80 ml	8.97 ab

Description: Numbers followed by the same letter mean no significant difference at the 5% DMRT test level.

Based on the results of the study, it was shown that the dry weight of the plant with the heaviest weight was in the treatment of 8gr NPK + 60 shallot extract, and the lowest weight was in the control treatment, which was 2.23 gr. These results indicate that the treatment without fertilization does not provide sufficient nutrients for plant growth because mustard greens rely only on the planting medium's nutrients. This is following the results of the study [21]. Which states that the availability of nutrients plays a vital role in plant growth and development, thus affecting the dry weight of the plant. Dry weight consists of all parts of the mustard greens plant; the more leaves there are, the more dry weight the plant will increase. The number of leaves can affect the increase in the dry weight of the plant because the leaves are where the results of plant photosynthesis are collected.

The Duncan 5% Multiple Range Test results showed that the effect of various doses of shallot extract was not significantly different from that of multiple doses of NPK fertilizer in increasing the growth of green mustard plants. This is because each shallot extract and NPK fertilizer can meet the nutrients available directly, so they are suitable for green mustard plants with a short life.

In addition to the availability of nutrients, environmental factors such as soil pH can affect the growth of mustard greens. The research showed that soil pH measurements during 5 weeks of observation ranged from 6.8 to 7.0. This aligns with the opinion of [24] that the optimum soil pH conditions for mustard greens growth range from 6-7. Environmental temperature also affects mustard greens' development because it directly affects photosynthesis. In the research results, measurements of the environmental temperature of the research location are still classified as optimal, ranging from 28˚c-29˚c. This is in line with the opinion of [25] that mustard greens can grow well at temperatures of 27˚c-32˚c.

The combination of shallot extract and NPK fertilizer also cannot increase the number of leaves because the nutrients are insufficient to support the formation of new leaves, and the active compounds in shallots cannot stimulate growth. The leaf area tends to increase due to optimal nutrition; broad leaves can increase photosynthesis and light absorption. In terms of wet weight, this fertilizer combination cannot produce a higher weight, indicating that the plants get enough water and nutrients, and the increase in dry weight of the plant also reflects better accumulation. The combination of organic fertilizer, shallot extract, and NPK fertilizer cannot increase the growth and yield of mustard greens by a significant increase in all of the above parameters. This is in line with the results of research [26], which states that shallot extract as a natural growth regulator can accelerate the process of root growth in plants. NPK fertilizer, as one of the compound fertilizers, can be an alternative to adding nutrients to the planting medium. NPK fertilizer also has a massive role for plants because it can accelerate growth and green leaves and increase plant production.

Table 6. Summary of ANOVA Test of the Effect of Giving Red Onion Extract and NPK Fertilizer on the Growth of Green Mustard Greens

No	Growth Parameters	P Value (Sig)		
		NPK Fertilizer	Red Onion Extract	NPK*Shallot Extract
1	Plant Height	0.000	0.005	0.168
2	Number of Leaves	0.000	0.032	0.418
3	Leaf Area	0.000	0.342	0.674
4	Wet Weight	0.000	0.445	0.359
5	Dry Weight	0.000	0.720	0.151

Description: Significantly influential at a 5% error level

The results of the ANOVA test showed that the main factor of NPK fertilizer obtained a p-value (sig) < 0.05, the main factor of organic fertilizer of shallot extract, and the interaction factor obtained a p-value (sig) > 0.05 based on this it can be concluded that the main factor of NPK fertilizer has a significant effect. The main factor of organic fertilizer of shallot extract and the interaction factor of organic fertilizer of shallot extract and NPK fertilizer did not significantly affect plant height, number of leaves, leaf area, wet weight, and dry weight of green mustard.

The results of the ANOVA test on the combination treatment of organic fertilizer of shallot extract and NPK fertilizer showed no interaction that supported each other on the performance of the two factors that were able to increase all growth parameters of green mustard plants. This follows the study's results [21], which stated that the administration of shallot extract and NPK fertilizer was only used as a growth regulator and could increase nutrient absorption; NPK fertilizer could accelerate and maximize growth that stimulates root development.

Conclusion

Based on the research results and discussion, it can be concluded that administration of NPK fertilizer can increase plant height, number of leaves, leaf area, wet weight and dry weight of green mustard plants, administration of shallot extract can increase plant height and number of green mustard leaves, but cannot increase leaf area, wet weight and dry weight of green mustard plants. Administration of a combination of NPK fertilizer and shallot extract cannot increase plant height, number of leaves, leaf area, wet weight, and dry weight of green mustard.

Author's Contributions

Diah Harun Irnawati: Conducting research to obtain factual, detailed information and compiling marine data. Dra. Kusmiyati, M. Si.: as an academic supervisor and supervisor, I. Provided conceptual contributions in developing theories or concepts that form the basis of research and provided motivation, support, and constructive input in guidance. Drs. H. Ahmad Raksun, M. Si: as supervisor II lecturer who contributed to the planning, implementation, and analysis of research data and provided constructive direction and input.

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