

Application of Five Formula Fertilizer N Slow Release on Growth and Results of Green Mustard Plant (*Brassica juncea* L.)

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Abstract

The research aims to: (1) Determine the correct slow release N fertilizer formula to obtain maximum growth and yield of mustard greens; (2) Determine the amount of green mustard fertilizer in each formula of N slow release fertilizer. The design used in this study was a Complete Randomized Block Design (RCBD) with 1 factor, namely 5 levels of N slow release fertilizer and 1 control, namely F0 (N fertilizer formula as recommended); F1 (formula N fertilizer with a dose of 1.05 g / tan); F2 (formula fertilizer N at a dose of 0.74 g / tan); F3 (formula N fertilizer with a dose of 0.87 g / tan); F4 (formula fertilizer N at a dose of 0.72 g / tan); F5 (N fertilizer formula with a dose of 0.76 g / tan). The results showed the formula of slow-release N fertilizer caused differences in plant height, leaf area, and N uptake of plants with the highest absorption in formula F5 (slow-release N fertilizer with a composition of 7 urea: 2 *Azolla microphylla*: 1 montmorillonite) of 1.35%. Related and highest green mustard yield in F1 (slow-release N fertilizer with composition of 6 urea: 1 *Azolla microphylla*: 1 montmorillonite: 1 gum rosses: 1 humic acid) of 361.08 g / plant.

INTRODUCTION

Vegetable cultivation in Indonesia has considerable development opportunities, supported by suitable agroclimatic conditions and the high public need for fresh vegetables as a daily consumption ingredient. One of the vegetable commodities that is widely cultivated is mustard greens (*Brassica juncea* L.). This plant is widely used in various processed foods and has a relatively high nutritional content. In addition, the affordable price of mustard greens makes it easily accessible to different walks of life (Paling et al., 2019).

Mustard greens belong to the Brassicaceae family, with elongated leaf morphological characteristics, smooth surfaces, hairless and non-cropping. This plant is able to grow in both hot and cool climate conditions, so it can be cultivated from lowlands to highlands (Muthoni & Kabira, 2015). The altitude of the suitable place for the growth of mustard greens ranges from 5–1,200 meters above sea level, although it is generally cultivated in the range of 100–500 meters above sea level. The ideal soil for the growth of this plant is loose, fertile, rich in organic matter, and has a good drainage system (Sidabalok & Herawati, 2023).

The decrease in mustard productivity is generally caused by the application of suboptimal cultivation techniques and degradation of soil quality, especially due to reduced nitrogen content. Nitrogen loss in the soil causes plant growth to not take place optimally. Hasibuan (2022) stated that the low yield of mustard plants is related to the nature of nitrogen fertilizer which is easily oxidized, so that nitrogen quickly evaporates or washes away before being fully absorbed by plants.

Fertilization is one of the important efforts in improving soil fertility while providing nutrients needed by plants. Mustard greens require the availability of sufficient and balanced nutrients to support their growth and production. Nitrogen is one of the nutrients that plays a dominant role in leaf formation and vegetative growth of plants (Suryantini et al., 2023).

As an essential macronutrient, nitrogen is the main limiting factor in determining plant productivity (Trisnawati, 2022). Most of the nitrogen provided into the soil can be lost due to leaching by water flow and the activity of soil microorganisms. As a result, only a small portion of nitrogen is directly available to plants, and even plants are generally only able to absorb about 30% of the applied nitrogen fertilizer (Hanuf et al., 2022). Nitrogen management strategies are needed, especially those that are able to maintain their availability in the soil for a longer period of time.

This research is highly urgent given Indonesian farmers' dependence on imported urea fertilizer, the price of which fluctuates and continues to increase. Developing a slow-release fertilizer based on local ingredients (azolla, abundant in Indonesian waters, montmorillonite as a local clay mineral, Gondorukem as a byproduct of the Gondorukem industry, and humic acid from compost) is a strategic strategy to achieve national fertilizer independence while increasing fertilizer efficiency.

The novelty of this research lies in the testing of five slow-release N fertilizer formulas with varying compositions of local chelating agents, and the use of specific dosages adjusted based on preliminary test results. No previous research has tested formulas with a ratio of 6 urea:1 azolla:1 montmorillonite:1 Gondorukem:1 humic acid (F1) or 7 urea:2 azolla:1 montmorillonite (F5) on mustard greens at optimized dosages. Furthermore, this study also measured N uptake (%) as a direct indicator of fertilizer efficiency.

One approach that can be done is to develop a nitrogen fertilizer that is slow release, so that nitrogen can be released gradually according to the needs of plants. The application of slow-release nitrogen fertilizer is expected to increase fertilization efficiency and support the increase in mustard green crop yields. Research on the use of five slow-release nitrogen fertilizer formulas was carried out to obtain the best formulation that can optimally increase the growth and yield of mustard green plants.

This study aims to: 1) Determine the right slow-release N fertilizer formula to obtain maximum growth and yield of mustard greens, 2) Determine the amount of N absorption of mustard greens in each slow-release N fertilizer formula.

METHOD

This research was carried out in the period from January to March 2023. Research activities were carried out in the Garden The experiment of the Faculty of Agriculture, Jenderal Soedirman University which is located in Grendeng Village, North Purwokerto District, Banyumas Regency. Plant sample analysis was carried out at the Agronomy and Horticulture Laboratory, Faculty of Agriculture, Jenderal Soedirman University. The ingredients used in the study include five slow-release nitrogen fertilizer formulas formulated from local ingredients, namely *Azolla microphylla*, humic acid, urea, montmorillonite, and Gondorukem. In addition, mustard green seeds, soil as a planting medium, water, and supporting inorganic fertilizers in the form of urea, SP-36, and KCl are used.

The experiment was arranged using a Complete Group Random Design (RAKL) with one treatment factor in the form of a slow-release nitrogen fertilizer application consisting of five levels of treatment and one control. Each treatment was repeated four times so that 24 experimental units were obtained. Each experimental unit consists of three plants, so that the total number of plants used is 72 plants.

The treatment provided included F0 as a control (urea 0.5 g/plant, SP-36 1.25 g, and KCl 1 g), F1 (6 urea: 1 *Azolla microphylla*: 1 montmorillonite: 1 Gondorukem: 1 humic acid) with a dose of 1.05 g/plant, F2 (7 urea: 1 *Azolla microphylla* : 1 montmorillonite : 1 Gondorukem) dosis 0,74 g/tanaman, F3 (7 urea : 1 *Azolla microphylla* : 1 montmorillonite : 1 asam humat) dosis 0,87 g/tanaman, F4 (7 urea : 1 *Azolla microphylla*: 1 Gondorukem : 1 humic acid) dose of 0.72 g/plant, and F5 (7 urea: 2 *Azolla microphylla*: 1 montmorillonite) dose of 0.76 g/plant.

The variables observed included plant height, number of leaves, leaf area, fresh and dry crown weight, fresh and dry root weight, fresh and dry plant weight, nitrogen absorption, and leaf greenness measured using SPAD. The observation data was analyzed using the F test at a confidence level of 5%. If there is a real influence, the analysis is continued with Duncan's Multiple Range Test (DMRT) at the level of 5%.

RESULTS AND DISCUSSIONS

The research conducted obtained the following results:

Table 1. Results of Analysis of Observation Variables

Yes	Observation Variables	Test F
1	Plant Height (cm)	
	Observation 1 (7 hst)	tn
	Observation 2 (14 hst)	Sn
	Observation 3 (21 hst)	n
	Observation 4 (28 hst)	tn
	Observation 5 (35 hst)	tn
2	Number of Leaves (strands)	
	Observation 1 (7 hst)	tn
	Observation 2 (14 hst)	tn
	Observation 3 (21 hst)	tn
	Observation 4 (28 hst)	tn
	Observation 5 (35 hst)	tn
3	Leaf Area (cm ²)	n
4	Fresh Root Weight (g)	tn
5	Fresh Title Weight (g)	tn
6	SPAD	tn
7	Dry Root Weight (g)	tn
8	Dry Heading Weight (g)	tn
9	N absorption	n
10	Fresh Plant Weight (g)	tn
11	Dry Plant Weight (g)	tn

Remarks: sn = very real, n = real, tn = no real difference in the F test with an error rate of 5%.

The results of the analysis on the plant height variable showed that in observations 1, 4, and 5 there was no real influence on the variables, while in observation 2, and observation 3 there was a real influence on the plant height variable. The variables of leaf count, SPAD / leaf greenness, fresh root weight, dry root weight, fresh crown weight, dry crown weight, fresh plant weight, and dry plant weight obtained unreal results and for the variables of observation of leaf area and N absorption obtained real results in this study.

Table 2. Data on Plant Growth and Number of Mustard Leaves on the Application of Five Types of Slow Release Nitrogen Formulas

Formula	Observation Variables									
	TT					JD				
	TT1	TT2	TT3	TT4	TT5	JD1	JD2	JD3	JD4	JD5
F0	19,25a	24,83a	33,33from	38,17a	42,42a	7,75a	9,17a	11,75a	14,33a	19,00a
F1	20,92a	27,42bc	34,08bc	39,83a	42,58a	8,33a	10,25a	12,58a	15,4a	21,00a
F2	20,83a	27,50c	34,67bc	41,25a	45,67a	7,83a	9,17a	11,67a	15,33a	19,33a
F3	21,83a	29,50d	36,17c	39,17a	42,92a	8,00a	10,08a	11,83a	14,67a	19,75a
F4	20,00a	25,92from	31,67a	39,25a	42,33a	8,00a	9,17a	11,08a	14,58a	18,83a
F5	21,25a	28,08cd	34,92bc	40,75a	43,67a	7,92a	9,50a	11,92a	14,58a	19,58a
F count	2,17	10,03	4,47	1,01	2,39	1,02	1,41	1,43	0,64	0,34
CV	6,04	3,81	4,25	5,65	3,8	5,02	8,69	6,8	7,5	13,41
Remarks	tn	sn	n	tn	tn	tn	tn	tn	tn	tn

Remarks: TT= Plant Height, JD= Number of Leaves, sn= very real, n= real, tn= not different real. Numbers followed by the same letter on the same variable did not differ significantly on the DMRT test with an error rate of 5%.

Table 3. Growth and Yield Data of Mustard Mustard on the Application of Five Types of Slow Release Nitrogen Formulas

Formula	Observation Variables								
	BOTTOMS	BTTS	SPAD	LOOK	BTKK	LD	SN	BTS	BTK
F0	37,42 a	260,92a	41,10a	8,50a	19,00a	156,75a	0,77a	298,33a	27,50a
F1	51,83 a	309,25a	41,15a	10,17a	25,50a	206,53b	1,17bc	361,08a	35,50a
F2	38,17 a	317,17a	43,92a	8,17a	22,50a	210,58b	1,24bc	355,33a	30,67a
F3	40,83 a	293,75a	42,25a	10,92a	22,58a	194,93b	1,20bc	334,58a	33,50a
F4	42,42 a	296,33a	45,17a	9,167a	22,50a	184,33from	1,13b	338,75a	31,67a
F5	45,75 a	286,50a	42,47a	9,92a	22,00a	194,43b	1,35c	332,25a	31,92a

F count	1,61	0,64	0,93	0,81	2,3	3,37	10,2	0,69	1,66
CV	19,85	16,59	7,78	24,65	12,18	11	10,6	15,69	13,19
Remarks	tn	tn	tn	tn	tn	n	n	tn	tn

Description: BAS= Fresh Root Weight, BTTS= Fresh Plant Crown Weight, BKA= Dry Root Weight, BTTK= Dry Plant Crown Weight, LD= Total Leaf Area, SN= N Absorption, BTS= Fresh Plant Weight, BTK= Dry Plant Weight, SPAD= Greenness of Leaves, sn= very real, n= real, tn= no real difference. F0 = Control (N = Urea (0.5 g/ton), P = SP-36 (1.25 g), and K = Potassium (1 g)); F1 = (6 urea: 1 *Azolla microphylla* : 1 montmorillonite: 1 Gondorukem: 1 humic acid) (1.05 g/ton); F2 = (7 urea: 1 *Azolla microphylla* : 1 montmorillonite: 1 Gondorukem) (0.74 g/ton); F3 = (7 urea: 1 *Azolla microphylla* : 1 montmorillonite: 1 humic acid) (0.87 g/ton); F4 = (7 urea : 1 *Azolla microphylla* : 1 Gondorukem : 1 humic acid) (0.72 g/ton) ; F5 = (7 urea: 2 *Azolla microphylla* : 1 montmorillonite) (0.76 g/ton).

1. N absorption

The results of the variety analysis showed that there was a difference in nitrogen (N) absorption in mustard plants that were given five types of N fertilizer formulas. Data in Table 2 showed that the F5 treatment produced the highest N absorption value, which was 1.35%, while the lowest value was obtained in the control treatment with an absorption of 0.77%. Pamungkas & Prasetya (2017) stated that the N nutrient content in fertilizers for horticultural crops is generally in the range of 0.14%–0.47%. This range is relatively low, so the N content needs to be increased beyond the critical limit so that the mineralization process can take place optimally. If the N level is at or below the critical level, then the process that occurs is the immobilization of nutrients.

The F5 treatment showed a higher N absorption value than the control, indicating that the application of fertilizer formulas with locally sourced chelates was able to suppress nitrogen loss due to leaching and volatilization. Sequentially, the absorption value of N in the F0 treatment was 0.77%, F1 was 1.17%, F2 was 1.24%, F3 was 1.20%, F4 was 1.13%, and F5 was 1.35%. Increased N absorption in all fertilizer formula treatments showed better results than controls. This is in line with the opinion of Hartatik *et al.*, (2020) who stated that the use of slow-release type nitrogen fertilizers can increase fertilization efficiency by farmers by around 20–30%. In addition, Rosniawaty *et al.* (2021) explained that an increase in soil organic matter content will be followed by an increase in cation exchange capacity (KTK), so that nutrient absorption becomes more optimal and has an impact on increasing plant photosynthesis results.

2. Plant Height

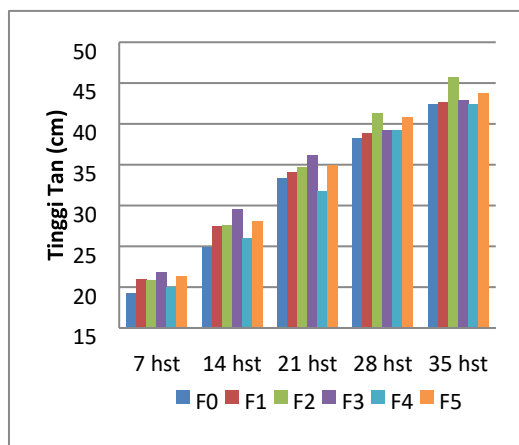


Figure 1. Crop Height Graph

The results of the variety analysis showed that in observations 1, 4, and 5 there was no real influence on the plant height variable in the 5 N fertilizer formulas, while in observations 2, and 3 there was a real influence on the plant height variable in the 5 N fertilizer formulas. This is suspected because the F3 fertilizer formula is able to meet the needs of mustard greens more than other formulas, so that it supports optimal plant growth and development and can increase the plant height variables.

According to Salman and Suntari (2023), F3 fertilizer formula is chelated by local ingredients such as azolla which contains N nutrients, also chelated by humic acid and montmorillonite which have a high KTK so that it can bind nitrogen (NH₄⁺). Azolla biomass has a high N nutrient content because it is symbiotic with Anabaena in binding free nitrogen in the air. Humate material has a high cation exchange capacity (KTK) which is an organic material that is considered the result of the decomposition of plant and animal materials. Humate materials function as soil improvers that are involved in complex reactions and can affect soil fertility by changing the physical, chemical and biological conditions of the soil (Milawati, 2022). According to the Institution and Simanjuntak (2020), the nitrogen content in humic acid ranges from 25%. Thus, humate ingredients have the potential to increase the N-total of fertilizer ingredients or formulas.

Plant growth occurs due to the event of division and elongation of the stem or outer cells. The process is the synthesis of proteins obtained by plants from the environment such as organic matter in the soil. The addition of fertilizers or formulas that contain high N will affect the total N levels and help activate plant cells and maintain the course of the photosynthesis process which ultimately the high growth of plants can be affected. Figure 2. Leaf Number Graph According to Febriani et al., (2021), the dose of fertilizer given to plants will affect the amount of nutrient content, but it is not possible to guarantee that the larger the dose given, the more likely it is to increase plant growth. This is because plants have limitations in the absorption of nutrients for their life needs.

3. Number of Leaves

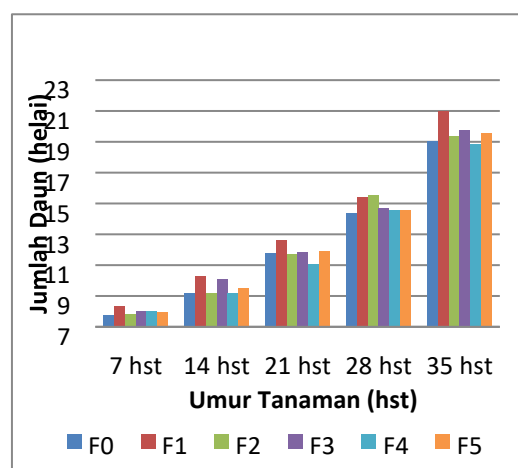


Figure 2 The results of the variety analysis

The results of the variety analysis showed that the fertilizer formula was not different from the variable number of leaves in the 5 N fertilizer formulas. This is suspected because the F1 formula of nitrogen fertilizer coated with local ingredients such as *Azolla microphylla*, urea,

humic acid, montmorillonite, and Gondorukem can affect the number of leaves, but the dose of fertilizer used is not in accordance with the needs of mustard greens plants.

Azolla and urea contain high N nutrients, while humic acid, Montmorillonite, and Gondorukem can temporarily attract nitrogen. Low nitrogen content in the soil, with the presence of nitrogen fertilization can increase the nitrogen content in the soil. Arumsari (2018) The addition of nitrogen fertilizer is expected to increase the number of leaves because nitrogen adds enzyme cofactors for the formation of carbohydrates. Nitrogen fertilizer triggers leaves which act as an indicator of plant growth in the process of photosynthesis. The research was conducted using a dose of urea in each formula of 100 kg/ha. According to research by Sarif et al. (2015), a dose of urea fertilizer of 200 kg/ha is able to supply nitrogen elements according to the amount needed for the growth and development process of mustard plants, because nitrogen nutrients play a role in vegetative growth of plants, such as plant height and number of mustard plant leaves.

4. Weight of Fresh Roots and Dried Roots

The results of the fingerprint analysis showed that the observations made did not have a real effect on the variable of fresh weight of roots in 5 formulas of N fertilizer. This is suspected because the dosage fertilizer formula specified for mustard plants has provided maximum development in root growth. So, the root development of the plant does not increase significantly.

Another thing that can be suspected is that the high value of the diversity coefficient causes the results of the statistical test to not differ significantly. The higher the diversity coefficient value, the wider or more heterogeneous the population diversity being measured. On the other hand, if the diversity coefficient value is low, then the population measured has a narrow or more homogeneous diversity value (Nintania et al., 2021).

Other factors such as ingesting can cause the properties that appear diverse from a plant. A variety has the ability to provide high yields (high potential), but if the environmental conditions are not suitable, then the variety cannot show the potential yield it has. Environmental conditions such as temperature, humidity and light intensity are constantly changing, leading to decreased productivity. The worst consequences that can be caused are plant death (Zamharir et al., 2016). The results of the variety-analysis showed that there was no real effect between the dry weight of the roots against the 5 N fertilizer formulas.

Based on table 2, the highest value of the root dry weight variable is in the F3 treatment, which is 10.92 g. This is suspected because the fertilizer formula with the prescribed dosage for mustard greens plants has a maximum influence on root growth, so that root development does not increase significantly. The dry weight of a plant depends on the volume of leaves, stems and the number of roots of the plant itself, so the amount of volume and number of roots has a lot of effect on the dry weight of the roots (Alfin et al., 2020). According to Hapsari & Chalimah (2013), macronutrients are needed for the growth of vegetative parts of plants such as roots, stems, and leaves. If the availability of macro and micro nutrients is incomplete, it can hinder the growth and development of the plant

According to Ichwan et al., (2020) the application of fertilizers or organic matter that has sufficient N content when the plant can maintain a good beginning of plant growth, so that it can increase the number of roots. According to Kogoya et al., (2018) that if the roots are good,

the growth of other parts of the plant will also develop well, because the roots can absorb nutrients needed by plants.

5. Weight of Fresh Titles and Dry Titles

The results of the variety analysis showed that the observations made did not have a real effect on the variable weight of fresh crown in 5 N fertilizer formulas.

Based on Table 2, the highest value of the fresh weight variable of the crown was in the F2 treatment, which was 317.17 g. This is suspected because the fertilizer formula with the prescribed dosage for mustard plants has provided maximum development in the growth of mustard plants. So, the development of plants does not increase significantly. In addition, the unreal results on the variable of the crown weight of fresh plants were caused by the lack of sunlight during the day and towards the evening because the study took place in the rainy season, every afternoon the sky was cloudy and dark so that the intensity of light required by mustard greens was reduced.

The availability of sufficient nutrients can increase the number of mustard plant cells so that it can increase the fresh weight of plant consumption. According to Ezward & Haitimi (2022), these nutrients also spur the photosynthesis process, so that the results of photosynthesis can be translocated to other organs that affect the fresh weight of plants suitable for consumption. Dimun et al, (2023), stated that the high level of organic matter optimizes the nutrient absorption process and the more photosynthetic results are produced by plants.

Light intensity affects the rate of plant photosynthesis, because plants need light in the photosynthesis process. Saktiono (2021) stated that the increasing rate of photosynthesis causes carbohydrate synthesis to also increase. The formation of carbohydrates caused by the rate of photosynthesis increases the vegetative growth of plants, including the tall growth of plants. If there is a decrease in the rate of photosynthesis, the vegetative growth of plants will be inhibited.

The results of the variety analysis showed that the observations made did not have a real effect on the dry crown weight variable in 5 N fertilizer formulas. This is suspected because the weight of the dry crown is obtained from the results of drying the fresh crown, where the weight of the fresh crown also has a result that is not significantly different from the control. This conjecture is in accordance with the statement of Arrusy (2021), that the weight of dry plant crowns is an accumulation of photosynthesis from the results of the photosynthesis process as well as the weight of fresh crowns. The weight of dry crop tops is a variable that can be used as a parameter of crop yield and the result of the balance between CO₂ uptake for the photosynthesis process and O₂ output for the respiration process. The weight of the dry crown will be reduced if the respiration rate is higher than the rate of photosynthesis.

The weight of the dry crown can be used to determine the relative moisture content of the leaves which is a parameter of resistance to drought stress. The process of photosynthesis in most plants will begin to be depressed if the water content value is relatively lower than 70%. A decrease in the relative moisture content value of the leaves will cause the loss of leaf turgor so that eventually there will be wilting, stomata closure, decreased photosynthesis and affecting other basic metabolic processes (Siddiq, 2021).

According to Handayani & Maryanto (2020), the dry weight of a plant reflects the number and size of cells that are the basis of growth. Through a series of events involving water, carbon dioxide and organic salts converted into living materials include the processes of

photosynthesis, absorption and translocation, the preparation and overhaul of complex proteins and fats. Dry weight of a plant is a picture of the amount of nutrient absorption and utilization of solar radiation available during growth by the plant crown and the most important organs in the absorption of solar radiation by the leaves. A plant that has a high dry weight means that the plant is experiencing good growth. Organic fertilizers usually show a clearly visible nitrogen reaction. The effects of phosphorus and potassium are usually not so obvious. Element P can increase the dry weight of plants (Khaliriu, 2020).

6. Soil Plant Analysis Development (SPAD)

The results of the analysis showed that the observations made showed that there was no real effect between leaf greenness (SPAD) on 5 N fertilizer formulas. This is suspected because the fertilizer formula with the prescribed dosage for mustard greens plants has a maximum influence on leaf growth, so leaf development does not increase significantly. The greenness of the leaves indicates the amount of chlorophyll that the plant has. Growth is better when the leaves have a higher chlorophyll content (Syafputri & Aini, 2018). The process of photosynthesis, there are 3 main functions of chlorophyll, the first is to utilize solar energy, the second spurs the fixation of CO₂ into carbohydrates and the third provides an energetic basis for the ecosystem as a whole. Carbohydrates produced by photosynthesis through the process of anabolism are converted into proteins, fats, nucleic acids, and other organic molecules (Ningrum, 2015).

7. Leaf Area

The results of the fingerprint analysis showed that the observations made had a real influence on the leaf area variable in 5 N fertilizer formulas. This is suspected because the fertilizer formula with the prescribed dosage for mustard greens has a maximum influence on leaf growth, so that leaf development increases. The application of nitrogen fertilizer is able to supply nutrients for vegetative growth such as plant height, number of leaves, and growth in stem diameter (Jayati & Susanti, 2019). In addition, nitrogen elements can also form plant leaves to increase in width and expand the surface available for the photosynthesis process (Prमितasari *et al.*, 2016). If photosynthesis takes place well, the photosynthate that is formed increases to be translocated to the vegetative parts of the plant to form new organs (Sandari & Yulian, 2016).

The environment can cause the properties that arise from a plant. A variety that has the ability to provide high yields (high potential), but if the environmental conditions are not suitable, the variety cannot show the potential yield it has. Environmental conditions such as temperature, humidity and light intensity are constantly changing, leading to decreased productivity. The worst consequences that can be caused are plant death (Haniati, 2021).

8. Weight of Fresh Plants and Dried Plants

The results of the fingerprint analysis showed that the observations made did not have a real effect on the weight variable of fresh plants in 5 N fertilizer formulas. Based on table 2, the highest value of the variable weight of fresh plants was in the F1 treatment, which was 361.08 g. This is suspected because the formula (F1) contains all slow-release N fertilizer ingredients such as *Azolla microphylla*, urea, humic acid, montmorillonite, and Gondorukem. The N levels

contained in fertilizers are higher than other treatments. Other factors that affect the F1 treatment show the highest value, namely the number of leaves and the relatively high height of the plant, which affects the fresh weight of the plant a lot.

According to the results Sabrina's (2018) research, the results of the analysis of N absorption in kailan plants, F0 treatment contains 3.89% N, F1 treatment contains 3.33% N, F2 treatment contains 3.90% N, F3 treatment contains 4.32% N, F4 treatment contains 3.62% N, and F5 treatment contains 3.60% N. All treatments have the same effect on the fresh weight of plants. Element N plays a role in the formation of chlorophyll and protoplasm in the weight parameters of fresh plant tops. Nitrogen is generally absorbed by plants in the form of NH_4^+ or NO_3^- , which is influenced by the nature of the soil. In soil with good drying such as *Inseptisols* soil used in this study, theoretically the element N is absorbed by plants in the form of nitrate ions, because there can be a change in the shape of NH_4^+ to NO_3^- (Rahman, 2019).

The results of the fingerprint analysis showed that the observations made did not have a real effect on the variable weight of dry plants on 5 N fertilizer formulas. This is suspected because the dry weight of plants is influenced by the weight of fresh plants and the number of leaves because leaves are the place where plant photosynthesis results accumulate.

The increase in the photosynthesis process will also increase the results of photosynthesis in the form of organic compounds that will be translocated to all plant organs and affect the dry weight of plants. This is in agreement with Anni *et al.*, (2013) that the dry weight of plants is influenced by the process of photosynthesis in the plant.

CONCLUSION

Based on the research results, it can be concluded that the most suitable slow-release N fertilizer formula for the growth and yield of mustard greens is F1 with a composition of 6 urea: 1 *Azolla microphylla*: 1 montmorillonite: 1 Gondorukem: 1 humic acid at a dose of 1.05 g/plant, which produces the highest plant fresh weight (361.08 g/plant). However, for the highest N uptake, the F5 formula with a composition of 7 urea: 2 *Azolla microphylla*: 1 montmorillonite at a dose of 0.76 g/plant produces N uptake of 1.35%, superior to the other formulas. The N uptake values in each formula are F0 (0.77%), F1 (1.17%), F2 (1.24%), F3 (1.20%), F4 (1.13%), and F5 (1.35%). Not all observation variables show significant differences; The number of leaves, root weight, and SPAD value were not significantly affected by the treatment, indicating that these variables were more determined by genetic factors than N availability.

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