# Growth Response and Yield of Nero Lacinato Kale Plant (*Brassica oleracea var. Palmifolia*) on Composition of Planting Media and Liquid Organic Fertilizer (POC) Dosage of Golden Snail

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**Abstract.** Kale is one of the family plants with collard, cabbage, and broccoli, but not well known by the people because not many farmers have cultivated this plant, but the demand for kale plants continues to increase. This study aims to determine the composition of planting media and the dose of gold snail liquid organic fertilizer for the growth and yield of kale plants, held from April to June 2022 in Sumberkembar Village, Probolinggo Regency. The research design used is the Group Randomized Design (RAK) method which consists of 2 factors, namely the composition of the planting media with 3 levels of treatment, namely: M1 (Soil: Husk Charcoal: Manure = 3: 1: 1), M2 (Soil: Husk Charcoal: Manure = 2: 2: 1), M3 (Soil: Husk Charcoal: Manure = 1: 3: 1) and the provision of POC gold snails as many as 4 levels, namely: P0: Control, P1: 10 ml/Plant, P2: 20 ml/Plant, P3: 30 ml/Plant. Based on the results of the study, it can be concluded that: 1) The treatment of the composition of the planting media M2 (Soil: Husk Charcoal: Manure = 2: 2: 1) provides optimal results on the parameters of root length, 2) The POC dose treatment of gold snails P2 (20 ml/plant) provides optimal results on plant height parameters and the number of leaves and 3) there is no interaction between the treatment of the composition of the planting media (M) and the POC dose of gold snails (P) on all parameters.

**Keywords:** Kale Nero Lacinato · Planting Media · Liquid Organic Fertilizer of Golden Snail

## 1 Introduction

Kale is a horticultural plant that has a body shape close to broccoli and cabbage, but the original leaves of kale are not in the form of a head. The popularity of the kale plant in Indonesia is lacking data on the benefits of the kale plant which has many antioxidants such as vit E, vit C and carotenoids [1].

Kale plants produce quite a lot, around 2000 plants per day due to the large number of requests, both from areas near and outside the city [1]. But the creation of kale is still


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not fulfilling market demands. Therefore, it is necessary to make efforts to increase the production of kale so that in the future kale plants can be known by the wider community and can meet market demands which are increasing every year [2].

The effort to increase the production of a plant is to use a good sowing tool for plants. The sow tool is one of the important factors in supporting good development. The right sowing tool is one of the criteria for the success of plant cultivation, especially cultivation in the media. A good sowing tool has the expertise to provide water, nutrients and peak air. Another effort being made to ensure soil fertility is the use of solid or liquid organic fertilizers. Organic fertilizers are very good and natural soil amendments from artificial or mixed fixing materials. In general, organic fertilizers contain large nutrients N, P, and K, but contain small amounts of micro-nutrients which are very much needed by plant growth. As a soil amendment material, organic fertilizer prevents the formation of abrasion, movement of the soil surface (crusting) and soil cracks, maintains soil flexibility, and improves the settling of dirt (in drainage). Giving organic fertilizers into the soil can be tried like chemical fertilizers. Golden snail liquid organic fertilizer contains protein 52.7%, fat 3.20%, fiber 5.59%, and minerals such as Ca 7,593.81 mg/100 g, Na 620.84 mg/100 g, K 1,454.32 mg/100 g, P 1,454.32 mg/100 g, Mg 238.05 mg/100g, Zn 20.57 mg/100 g and Fe 44.16 mg/100 g.

## 2 Research Methods

The research position is located in Kedung Pawon Hamlet, Sumberkembar Village, Pakuniran District, Probolinggo Regency, which has an altitude of ±100 m above sea level with an air temperature between 26OC–31 OC with rainfall ±1,393 mm/year. The research was attempted from April to June 2022.

This study, the tools used during this study included seedling trays, hoes, polybags, shovels, measuring cups, rulers, jerry cans, scales, stationery, used bottles, hoses, filters, and pounders. Materials used during this study included nero lacinato kale seeds, golden snails, water, soil, goat manure, husk charcoal, EM4, brown sugar, coconut water, rice washing water, insecticides, and biopesticides (as needed).

This research was carried out using the Factorial Random Group Concept (RAK) with 2 aspects, namely the arrangement of sowing tools with 3 treatment levels, namely: M1 (Soil: Husk Charcoal: Manure = 3: 1: 1); M2 (Soil: Chaff Charcoal: Manure = 2: 2: 1) and M3: (Soil: Husk Charcoal: Manure = 1: 3: 1). On the other hand, the two aspects of the POC dose of the younger snail with 4 degrees of treatment, namely P0: Control, P1: 10 ml or Plants, P2: 20 ml or Plants, P3: 30 ml or Plants. If a single factor gives a clear effect until further trials are attempted using the 5% BNT trial and if the treatment interactions show a significant effect, then the 5% DMRT follow-up test is continued.

The research procedure, which was carried out for the first time, was to make POC golden snail by preparing as much as 5 kg of golden snail, 800 ml of EM4, 1000 g of brown sugar, 5 l of coconut water and 5 l of water, then crush the golden snail by mashing it and then mix all the ingredients. With the other ingredients, after everything is mixed, put it in the jerry can and then close it tightly, put a hole in the lid of the jerry can the size of a hose, then tape tightly and insert a small hose into the jerry can, connect it to the remaining mineral bottles half filled with clean water, then save and let stand for 15 days

in a quiet place and before it is ready to be used, filter it first to separate the golden snail pulp, then the POC is ready to be used.

The next step, seeding using a seedling tray with a sowing tool of soil and humus. Prepare the sowing tool by combining the soil sowing tool, rice husk charcoal, and goat manure according to the treatment then put the mixture into a poly bag with dimensions of 35 × 35 cm. After the kale seedlings have 4–5 leaves, the kale seedlings are ready for transplanting. Kale planting was carried out in the morning following the level of treatment of the existing planting media composition.

Kale plant maintenance during research such as replanting, watering, weeding, fertilizing, planting, and controlling pests and diseases. The harvest of kale plants is done at the age of 60 HST, with an average height of 25 cm and a leaf area almost as wide as the palm of an aged person. The benchmarks observed in this research were plant length, number of leaves, leaf width, root length, wet stover, and dry stover.

## 3 Results and Discussion

### 3.1 Plant Length

The composition of the growing medium had no significant effect on the plant length parameter. Based on the test results for the nitrogen content in the planting medium, it has the same nitrogen content, a moderate average of 0.156% (Table 1).

The concentration of golden snail liquid organic fertilizer by administering a dose of 20 ml/l of water (P2) [1], a dose that matches the wishes of kale plants is shown by

**Table 1.** Average plant length (cm) as a result of the treatment of the composition of the growing media and the dosage of the liquid organic fertilizer of golden snail

| Treatment | Average plant length (cm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 Days After Planting | 27 Days After Planting | 34 Days After Planting | 41 Days After Planting | 48 Days After Planting | 55 Days After Planting | 62 Days After Planting |
| M1 | 14,96 a | 19,95 a | 24,29 a | 33,69 a | 40,37 a | 45,57 a | 49,11 a |
| M2 | 17,06 a | 22,23 a | 26,66 a | 36,07 a | 43,84 a | 48,79 a | 52,78 a |
| M3 | 16,11 a | 21,09 a | 25,46 a | 34,60 a | 41,86 a | 46,69 a | 50,36 a |
| BNT 5% | - | - | - | - | - | - | - |
| P0 | 14,31 a | 19,33 a | 24,05 a | 33,23 a | 40,36 a | 46,00 a | 49,49 a |
| P1 | 16,07 ab | 21,23 ab | 25,60 a | 35,10 a | 42,33 a | 47,47 a | 51,32 a |
| P2 | 17,89 b | 23,08 b | 27,54 a | 37,34 a | 44,98 a | 49,97 a | 53,92 a |
| P3 | 15,90 a | 20,72 ab | 24,71 a | 33,47 a | 40,44 a | 44,70 a | 48,27 a |
| BNT 5% | *1,9421* | *2,5930* | - | - | - | - | - |

Note: The numbers followed by the same letter in the row show no significant difference in the Least Significant Difference Test at the level of $\alpha = 5\%$.

the development of larger or larger plants. POC snail brother is able to practice large and micronutrient factors and the presence of beneficial microorganisms such asazotobacter, azopril donate N, microbial solventphospat, staphylococcus, and pseudomonas [3].

Nitrogen is a major essential nutrient that is very important for plant development where the growth of plant size is greatly influenced by the availability of nitrogen factor because nitrogen factor plays a role in triggering plant vegetative growth [4].

As explained that plant growth will be maximized if the nutrients needed are available in quantities and forms that match the needs of the plant. The development and creation of plants is closely related to the availability of nutrients in sufficient and balanced quantities [5].

### 3.2 Number of Leaves

The composition of the growing medium for the treatment of M2 (Soil: Charcoal Husk: Manure = 2: 2: 1) is a balanced planting medium composition in absorbing water and air. In line with this opinion if the air and water balance in the sowing device, then the base of the plant will absorb nutrients in sufficient quantities so that plant growth will increase. Soil with a good system will also have good drainage and aeration conditions, and make it easier for plant root systems to absorb nutrients and water, resulting in better plant growth [6] (Table 2).

The increase in the number of leaves is related to the distance of the plant where a plant continues to grow apart so that more and more leaves are produced. This is consistent with the opinion that the taller or longer the plant, the number of segments that will form new leaves also increases [7].

**Table 2.** Average Number of Leaves (strands) Due to Single Factor Treatment Composition of the growing media and the dosage of the liquid organic fertilizer of golden snail

| Treatment | Average number of leaves (pieces) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 Days After Planting | 27 Days After Planting | 34 Days After Planting | 41 Days After Planting | 48 Days After Planting | 55 Days After Planting | 62 Days After Planting |
| M1 | 6,51 a | 8,51 a | 10,13 a | 11,65 a | 13,64 a | 15,90 a | 15,88 a |
| M2 | 7,38 a | 9,64 a | 10,76 a | 12,58 a | 15,30 a | 17,81 a | 17,14 a |
| M3 | 6,68 a | 8,78 a | 10,61 a | 11,69 a | 13,87 a | 16,08 a | 16,30 a |
| BNT 5% | - | - | - | - | - | - | - |
| P0 | 6,20 a | 8,27 a | 9,60 a | 11,66 a | 13,66 a | 15,06 a | 15,83 a |
| P1 | 6,97 a | 9,21 a | 10,57 a | 12,38 a | 14,40 a | 16,94 a | 16,34 a |
| P2 | 7,49 b | 9,87 b | 11,43 a | 13,03 a | 15,28 a | 17,88 a | 17,30 a |
| P3 | 6,77 a | 8,57 a | 10,40 a | 11,63 a | 13,74 a | 16,50 a | 16,28 a |
| BNT 5% | *0,8850* | *1,1788* | - | - | - | - | - |

Note: The numbers followed by the same letter in the row that show no significant difference in the Least Significant Difference Test at the level of $\alpha = 5\%$.

Treatment of the golden snail POC dose of 20 ml/liter of water (P2) was able to meet the nutrient needs of plants. The amount of nutrients in the soil and the fertilizer used both have an impact on plant growth [5]. The amount of nutrients in the soil has an impact on how fast a plant grows and develops, in order to maximize plant development and produce the best results through fulfilling nutrients for a plant [3].

Reported that plants will develop productively and give good results if the required nutrient factors are in sufficient quantities and in balance, but if the POC dose given exceeds the focus desired by the plant, plant yields can decrease because it is no longer effective and efficient again [8].

### 3.3 Leaf Area

The composition of the planting medium at the treatment level of M2 (Soil: Charcoal Husk: Manure = 2: 2: 1) is a balanced planting medium composition in absorbing water and air. The expertise of the soil in supplying water to plants is important for the physiological methods carried out by plants. This is supported who reported that the rate of leaf production in plants whose water needs were met was consistent over time when compared to those facing water shortages whose leaf development was slow [9] (Table 3).

While the average value of leaf area at the treatment of the golden snail POC dose of 20 ml/liter of water (P2) gave the best results. This is because the POC snail abang has large nutrient factors such as nitrogen, phosphorus, and potassium, and micronutrient factors, namely calcium [3]. Nitrogen plays a role in increasing vegetative growth, so that plant leaves become wider, greener in color, and of higher quality [1].

**Table 3.** Average Leaf Area ($cm^2$) Due to Single Factor Treatment Composition of Growing Media and the dosage of the liquid organic fertilizer of golden snail

| Treatment | Average Leaf Area ($cm^2$) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 Days After Planting | 27 Days After Planting | 34 Days After Planting | 41 Days After Planting | 48 Days After Planting | 55 Days After Planting | 62 Days After Planting |
| M1 | 37,71 a | 55,29 a | 80,17 a | 110,15 a | 134,21 a | 161,77 a | 146,75 a |
| M2 | 43,97 a | 61,86 a | 82,61 a | 118,73 a | 146,65 a | 166,52 a | 159,60 a |
| M3 | 41,87 a | 61,76 a | 77,52 a | 114,42 a | 141,35 a | 160,18 a | 148,10 a |
| BNT 5% | - | - | - | - | - | - | - |
| P0 | 34,85 a | 52,47 a | 73,05 a | 112,53 a | 130,88 a | 158,13 a | 153,27 a |
| P1 | 39,94 a | 60,17 b | 80,57 ab | 115,14 a | 140,13 a | 166,97 a | 148,05 a |
| P2 | 47,29 b | 66,97b | 87,71 b | 120,41 a | 155,34 a | 173,33 a | 160,46 a |
| P3 | 42,68 b | 58,94 ab | 79,07 a | 109,61 a | 136,59 a | 152,86 a | 144,17 a |
| BNT 5% | *7,6686* | *7,7803* | - | - | - | - | - |

Note: The numbers followed by the same letter in the row show no significant difference in the Least Significant Difference Test at the level of $\alpha = 5\%$.

The availability of N, P, and K nutrients for plants can increase the amount of chlorophyll, the increase in chlorophyll will increase assimilation activity and increase leaf growth [10]. Meanwhile, calcium functions in the separation and elongation of cells, as well as organizing the distribution of assimilation results, where if there is a lack of calcium nutrients in plants it will cause changes in leaf shape such as curling and small leaves [11].

### 3.4 Root Length

The composition of the planting medium at the treatment level of M2 (Soil: Charcoal Husk: Manure = 2: 2: 1) is the composition of the planting medium with the highest average root length, namely 19.32 cm. This is predictable because the M2 sprinkler arrangement is a sprinkler arrangement that is balanced in absorbing water and air. A balanced arrangement of sowing tools can provide a good tool shape for the development of the base of the plant. The aspect of the sowing tool is closely related to it carrying capacity for root development as a tool that functions to absorb water and nutrients [8].

The treatment with the golden snail POC dose of 30 ml/plant (P3) was able to provide the longest root length among the other treatments, although analytically it was not significantly different from the treatment without the golden snail POC dose (P0). This means that without giving golden snail POC doses, the planting medium is able to meet the nutrients for plant root growth.

The availability of nutrients has a very significant role to support the growth of a plant. This is in line with the opinion states that plant growth will be maximized if the nutrients needed are available in quantities and forms that match the needs of plants, growth, and production of plants is closely related to the availability of nutrients in the soil and nutrients available in sufficient quantities and balance [5] (Table 4).

**Table 4.** Average root length (cm) as a result of the treatment of the composition of Growing Media and the dosage of the liquid organic fertilizer of golden snail

| Treatment | Average root length (cm) |
|---|---|
| M1 | 17,36 a |
| M2 | 19,32 b |
| M3 | 18,77 a |
| BNT 5% | *1,6331* |
| P0 | 18,92 a |
| P1 | 17,53 a |
| P2 | 18,73 a |
| P3 | 19,85 a |
| BNT 5% | - |

Note: The numbers followed by the same letter in the row that show no significant difference in the Least Significant Difference Test at the level of $\alpha = 5\%$.

### 3.5 Wet Stove Weight (g)

Based on the average yield of wet stover kale plants, the composition of the growing media for M2 (Soil: Charcoal Husk: Manure = 2: 2: 1) showed the highest average of 90.58 gr. The composition of the planting medium has a high porosity level and is not dense causing faster absorption of water by the roots so that the weight of wet stover is more optimal in M2 planting media conditions compared to other treatments.

This is in line that the weight of the wet stover of plants almost entirely due to the collection of water by plants. Approximately 80–90% of the fresh weight of cells and plant tissues consists of water, and an additional 10–15% consists of dissolved organic and inorganic substances or in colloidal form. The treatment of golden snail POC, showed that the nutrients, especially nitrogen contained in the POC of the abang snail, could not be used by plants, as a result, the assimilation method did not work properly. This resulted in a low plant weight of wet stover, the factor that is very functional in the increase in plant size, wet stover, and dry stover plants is Nitrogen. The availability of N nutrients in the soil which is absorbed by plants will be used to organize cell macromolecules or their constituent parts such as amino acids, proteins, and enzymes and consequently, will enhance plant growth [12].

Nitrogen nutrients for plants function in the way of absorbing light through the manufacture of chlorophyll which functions as an assimilation antenna or as an energy collector. The energy that has been collected can be seen in the number of leaves, the number of agents, and the size of the leaves. The low number of leaves or the narrower the size of the leaves obtained is a symptom of the limited ability of plants to make assimilates on the other hand, assimilate is the energy used for development, therefore if the energy obtained is small, the ability of the plant to carry out the differentiation is also small and in conclusion results in the low amounts of agents, the size of the leaves, or the fresh weight of the entire plant obtained [13] (Table 5).

**Table 5.** Average Weight of Wet Stoves (g) Due to the Treatment of the Composition of Growing Media and the dosage of the liquid organic fertilizer of golden snail

| Treatment | Average Weight of Wet Stoves (g) |
|---|---|
| M1 | 82,43 a |
| M2 | 90,58 a |
| M3 | 82,50 a |
| BNT 5% | - |
| P0 | 79,69 a |
| P1 | 82,30 a |
| P2 | 84,12 a |
| P3 | 94,57 a |
| BNT 5% | - |

Note: The numbers followed by the same letter in the row that show no significant difference in the Least Significant Difference Test at the level of $\alpha = 5\%$.

### 3.6 Dry Stove Weight (g)

Plants that are able to absorb nutrients in a maximum way will create a weight of dry weight that continues to be heavy. Treatment Arrangement of M. sowing tools2 (Soil: Husk Charcoal: Manure = 2: 2: 1) and the golden snail POC dose of 20 ml/liter of water (P2) was able to produce the highest dry stover weight but did not have more biomass compared to the other treatments. The greater the amount of nutrients supplied, the greater the weight of the dry plant stover. Nutrient factors that have been absorbed by the base contribute to the development of the dry weight of all parts of the plant [10].

Dry plant corpses are a marker of ongoing development which is the result of the assimilation process. The availability of nutrients for plants in the process of photosynthesis will increase the photosynthate obtained by plants, especially nitrogen which is very functional in the process of making carbohydrates, nucleic acids, chlorophyll, organic compounds, and proteins in plants which are the parts that makeup plant dry weight [14].

In the treatment of the POC dose of the brother snail, the different results were not clear. It is predicted that the nutrients contained in the snail POC such as Nitrogen are not absorbed properly by plants because these nutrients cannot act as enzyme activators in the process of growth in plants. In addition, this is most likely due to the plants not receiving enough nutrients from the soil to meet their needs and being leached because at the time of the study, the rainfall was very high. This is in line with the opinion reported that liquid organic fertilizer is volatile (ammonia) and is easily leached by rainwater, as a result only a small amount is absorbed and cannot meet the needs of plants [15] (Table 6).

**Table 6.** Average Dry Stoves (g) Due to the Treatment of the Composition of Growing Media and the dosage of the liquid organic fertilizer of golden snail

| Treatment | Average Dry Stoves (g) |
|---|---|
| M1 | 11,10 a |
| M2 | 11,22 a |
| M3 | 11,23a |
| BNT 5% | - |
| P0 | 10,70 a |
| P1 | 11,02 a |
| P2 | 11,23 a |
| P3 | 11,37 a |
| BNT 5% | - |

Note: The numbers followed by the same letter in the row that show no significant difference in the Least Significant Difference Test at the level of $\alpha = 5\%$.

## 4 Conclusions

The treatment of the arrangement of the M2 sowing apparatus (Soil: Husk Charcoal: Manure = 2: 2: 1) gave optimal results on the root length parameter. The treatment of the golden snail POC dose of 20 ml/plant (P2) gave maximum results on the size of the plant and the number of leaves and there was no interaction between the treatment of the sow arrangement (Meter) and the POC dose of the abang snail (P) in all benchmarks.

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