

Application of urea fertilizer and baglog oyster mushroom waste compost for vegetative growth of Montong Durian (*Durio Zibethinus* Murr.) seedlings

Rahmaniah¹, Azwana²

¹ Department of Agrotechnology, Universitas Pembinaan Masyarakat Indonesia, Indonesia

² Department of Agrotechnology, Faculty of Agriculture, Universitas Medan Area, Indonesia

Abstract

Montong durian has high economic value, but the availability of superior seeds is still limited. This study aims to test the effect of urea fertilizer and oyster mushroom baglog waste compost on the vegetative growth of Montong durian seedlings. The study was conducted in Amplas Village, Medan, using a Random Design of Factorial Groups with two factors, namely the dose of urea fertilizer (0, 10, 20, and 30 g/polybag) and the proportion of baglog waste compost (0, 750, 1500, and 2250 g). The results showed that the application of urea fertilizer and baglog waste compost did not really affect plant height, number of leaves, stem diameter, and leaf area. Suboptimal fertilizer doses and low compost quality, including nitrogen and phosphorus content cause this ineffectiveness. It is recommended to increase the duration of composting and adjust the dose of urea fertilizer to support the optimal growth of Montong durian seedlings.

Keywords: Urea, composite baglog, Durian Montong

Introduction

Durian, known as *the "king of fruit"*, has a high economic value due to its distinctive flavor in high demand. (Nainggolan *et al.*, 2019 ^[15]; Sanjaya *et al.*, 2019) ^[20]. Indonesia has more than ten types of local superior durians, but Montong durian stands out for its thicker flesh, sweetness, and smooth texture. (Amir *et al.*, 2019 ^[1]; Harefa & Ibrahim, 2022) ^[11]. This makes the development of Montong durian a business with high prospects. Durian fruit production in North Sumatra in 2023 will reach 137,353 tons, while demand from China is estimated to reach USD 8 billion. Durian consumption in Indonesia is also increasing, reaching 1,031 kg/capita/year in 2023. The increase in population and community income also encourages the need for quality durian every year (Gurning, 2022 ^[8]; K. Y. Harahap, 2016 ^[9]; Simbolon, 2019) ^[24].

However, most durian commodities in Indonesia are still cultivated in yards and moors, so the quality of the fruit tends to be low. (Ginting & others, 2023 ^[7]; Suteja, 2018) ^[25]. This low quality is caused by the lack of production technology inputs and the availability of a large number of superior seeds. The large market for superior durian demands the provision of high-quality durian seeds. (Bustomi *et al.*, 2022 ^[4]; Siahaan, 2016, 2016) ^[22].

One of the main problems in durian cultivation is low productivity, which is often caused by suboptimal maintenance methods. (Lestari, 2014 ^[14]; Silaban & Sugiharto, 2016) ^[23]. Many farmers maintain old durian plants with low productivity. Providing quality seeds is one of the key factors for the success of durian cultivation. Durian seedlings will grow optimally if the growing medium can bind air and nutrients, have good drainage and aeration, maintain moisture around the roots, and do not become a source of disease. (Anggara Nobriama *et al.*, 2019 ^[2]; R. H. Harahap *et al.*, 2021 ^[10]; Banana *et al.*, 2022).

In nurseries, nutritional needs are very important to consider. Nutrients can be fulfilled through the application of organic and inorganic fertilizers. Nitrogen is a macro element that plays an important role in accelerating plant

growth (Harita *et al.*, 2022 ^[12]; Nugroho *et al.*, 2018) ^[16]. Nitrogen deficiency will inhibit the process of photosynthesis, which is the main source of energy for plants. Nitrogen is indispensable during the vegetative phase to support plant productivity. In addition to nitrogen, plants also need other nutrients that can be obtained from oyster mushroom baglog waste, which is often simply thrown away (Ernanda *et al.*, 2022^[6]; R. H. Harahap *et al.*, 2021 ^[10]; Yuzairi U.S *et al.*, 2022) ^[27].

Oyster mushroom baglog waste, which is 90% composed of wood dust, contains high cellulose after the mushroom cultivation is completed. Mushroom baglog waste has a nutrient content in the form of nitrogen (0.7%), phosphorus (0.7%), potassium (0.3%), and organic carbon (49.00%). This content makes it a potential ingredient for improving soil fertility. Processing baglog waste into organic compost can provide various benefits, such as improving soil structure, increasing water absorption, and strengthening soil nutrient binding. In addition, baglog organic waste can be processed into organic fertilizer through the composting process. The composition of the baglog includes 90% sawdust, 7% rice bran, 1% lime, 2% tapioca, and 45-60% air volume.

Based on the potential use of urea fertilizer and oyster mushroom baglog waste compost in improving the quality of plant vegetative growth, this study was designed to test the influence of these two types of fertilizers on Montong durian seedlings. This study uses an experimental approach with a factorial Random Group Design (RAK), which consists of two main factors, namely the dose of urea fertilizer and the proportion of oyster mushroom baglog waste compost in the planting medium. The treatment included various doses of urea fertilizer (0 g, 10 g, 20 g, and 30 g per polybag) as well as various mixtures of baglog waste and topsoil (without baglog, 1:3, 1:1, and 3:1 ratios). With two iterations, this study is expected to provide valid data to determine the best combination of treatments that can support the optimal growth of Montong durian seedlings. The results of this study are expected to provide

scientific and applicative recommendations for farmers in choosing efficient and effective seedling methods to increase the productivity of Montong durian sustainably.

Research methods

This research was carried out in Amplas Village, Medan Amplas District, Medan City, North Sumatra. This location was chosen because it has favorable environmental conditions for Montong durian nurseries.

Tools and materials

The tools and materials used in this study include:

- **Tools:** hoe, 17x25 cm polybag, meter, scale, tarpaulin and padlock.
- **Ingredients:** Montong durian seeds, water, oyster mushroom baglog waste, urea fertilizer, EM4, and brown sugar.

Research preparation

- **Baglog waste composting:** Oyster mushroom baglog waste is fermented with EM4 and brown sugar for 1 month before use. The composting process is carried out in the shade using a tarp to maintain moisture and optimize fermentation.
- **Planting medium:** The medium used is a mixture of topsoil and baglog waste compost with various ratios, adjusted to the treatment.

Research design

This study uses a factorial Group Random Design (RAK), with two main factors, namely:

1. **Factor 1:** Urea fertilizer application:
 - U0: Without the application of urea fertilizer.
 - U1: Urea fertilizer as much as 10 g/polybag.
 - U2: Urea fertilizer as much as 20 g/polybag.

- U3: Urea fertilizer of 30 g/polybag.
2. **Factor 2:** Composting oyster mushroom baglog waste:
 - B0: No composting of oyster mushroom baglog waste.
 - B1: Oyster mushroom baglog waste compost of 750 g + top soil 2,250 g (1:3).
 - B2: Oyster mushroom baglog waste compost of 1,500 g + top soil 1,500 g (1:1).
 - B3: Oyster mushroom baglog waste compost of 2,250 g + top soil 750 g (3:1).

Each combination of treatments was repeated 2 times, so that there were 32 experimental units.

Observed parameters

The vegetative growth parameters of Montong durian seedlings are observed every week after planting (MST) and include:

1. **Plant height (cm):** Measured weekly to see the development of the plant's vertical growth.
2. **Number of leaves:** Observed weekly to find out the number of leaves formed in each treatment.
3. **Rod diameter (mm):** Measured using a caliper to know the growth of the rod.
4. **Leaf area (cm²):** Measured to find out the surface area of the leaves formed during the study.
5. **Fresh weight and dry weight of plants (g):** Weighed after harvest to determine the vegetative biomass.

Results and discussion

Plant height

The results of the analysis of the height of mounting durian seedlings from the age of 4 -11 MST are presented in Table 1.

Table 1: Summary of Fingerprint Analysis of Height Observation Variety of Montong durian plants after being given urea fertilizer and Oyster Mushroom Baglog Waste Compost.

SK	F. Calculate plant height at 4 MST-11 MST								F.05	F.01
	4 MST	5 MST	6 MST	7 MST	8 MST	9 MST	10 MST	11 MST		
U	0,16 in	0,06 in	0,11 in	0,03 in	0,06 in	0,22 in	0,05 in	0,02 in	3,29	5,42
B	0,48 in	0,33 in	0,32 in	0,38 in	0,43 in	0,70 in	0,29 in	0,21 in	3,29	5,42
UB	0,84 in	0,61 in	0,58 in	0,63 in	0,65 in	0,35 in	0,56 in	0,60 in	2,59	3,89
KK %	26,37 %	26,61 %	26,20 %	23,93 %	22,99 %	23,02 %	23,61 %	21,58 %		

Based on Table 1, the results of the variegated fingerprint analysis showed that the application of urea fertilizer and oyster mushroom baglog waste compost did not have a real effect on the high growth of Montong durian plants at the age of 4–11 MST. This is suspected to be caused by an inappropriate dose of urea fertilizer. This opinion is in line with (Azwin, 2016) [3], Which states that the application of urea in the right dosage in nurseries can increase plant growth optimally.

In addition, the use of oyster mushroom baglog waste compost also does not have a real effect on plant height. This is likely due to the high value of the C/N ratio in oyster mushroom baglog compost, which is 69.81, with a nitrogen

content of only 0.33% and a P₂O₅ of 0.61%. A high C/N ratio can inhibit plant growth because active decomposer microbes need time to complete the decomposition process. Microbes in the process of overhauling organic matter require nutrients for their activities, so there is competition between microbes.

Number of leaves

For the parameters of the number of leaves, the results of the variety fingerprint and the results of the average difference test on the growth of the number of leaves aged 4 - 11 MST with the application of urea fertilizer and oyster mushroom baglog waste compost are presented in table 2.

Table 2: Results of Fingerprint Analysis of Various Parameters of the Number of Montong Durian Leaves after the application of urea fertilizer and Oyster Mushroom Baglog Waste Compost

SK	F. Count the number of leaves at 4 MST-11 MST								F.05	F.01
	4 MST	5 MST	6 MST	7 MST	8 MST	9 MST	10 MST	11 MST		
U	0,35 in	0,09 in	0,18 in	0,19 in	0,13 in	1,43 in	0,46 in	0,36 in	3,29	5,42

B	0,09 in	0,25 in	0,20 in	0,26 in	0,11 in	0,81 in	0,14 in	0,11 in	3,29	5,42
UB	0,57 in	0,52 in	0,46 in	0,59 in	0,64 in	1,74 in	1,16 in	1,12 in	2,59	3,89
KK %	30,95	27,02	24,60	20,54	16,57	12,65	11,78	11,32		

Remarks: tn = unreal, * = real at 95%, ** = very real at 99%. MST = weeks after planting

Based on Table 2, the results of the variegated fingerprint analysis showed that the application of urea fertilizer and oyster mushroom baglog waste compost did not have a real effect on the number of leaves of Montong durian seedlings at the age of 4–11 MST. Although there was no real effect, it was seen that the application of urea fertilizer (0.36) produced a higher number of leaves compared to the application of oyster mushroom baglog waste compost (0.11). This shows that nitrogen (N) in urea fertilizer is more effective than nitrogen in compost. Another possibility is that the nitrogen dose from the given compost is too low. This opinion is in line with (Dwidjoseputro, 1984) [5], Which states that nitrogen is an essential component in the formation of compounds such as amino acids and chlorophyll, which play an important role in the growth of vegetative parts of plants, including stems, leaves, and roots. (Azwin, 2016) [3] also explained that urea fertilizer contains high nitrogen levels (46%), which plays a significant role in various plant physiological processes. However, if the nitrogen dose is given too little or too much, plant growth can be stunted.

Meanwhile, the composting of oyster mushroom baglog waste did not show any real effect, which was likely due to the low total level of P₂O₅ in the compost, which was only 0.61%, both available and unavailable. This low P content can affect the formation of plant tissues, such as the number of leaves. (Satria *et al.*, 2015) [21] Stated that phosphorus (P) is very important in stimulating root growth so that roots can absorb more nutrients to support the formation of new tissues, including leaves. In addition, according to (Jumin, 2017) [13], Young plant stems are growth accumulation areas supported by essential nutrients such as nitrogen, which play a role in the formation of chlorophyll in the leaves, thereby increasing the rate of photosynthesis and encouraging plant vegetative growth.

Rod diameter

The results of the analysis of various fingerprint parameters of the stem diameter of mounting durian seedlings aged 4 MST to 11 MST with the application of urea fertilizer and oyster mushroom baglog waste compost are presented in Table 3.

Tabel 3: Hasil Analisis Sidik Ragam Diameter Batang bibit durian Montong setelah Aplikasi pupuk urea dan Kompos Limbah Baglog Jamur Tiram

SK	F. Calculate the stem diameter at 4 MST-11 MST								F.05	F.01
	4 MST	5 MST	6 MST	7 MST	8 MST	9 MST	10 MST	11 MST		
U	1,37 in	1,41 in	1,48 in	1,34 in	1,69 in	1,76 in	1,70 in	1,66 in	3,29	5,42
B	2,42 in	1,26 in	0,86 in	1,38 in	1,77 in	1,46 in	1,45 in	1,34 in	3,29	5,42
UB	1,75 in	0,75 in	0,66 in	0,81 in	0,87 in	0,92 in	0,87 in	0,90 in	2,59	3,89
KK %	21,61	21,05	18,59	16,47	39,38	13,02	12,08	11,25		

Remarks: tn = unreal, * = real at 95%, ** = very real at 99%. MST = weeks after planting

Based on Table 3, the results of the variegated fingerprint analysis showed that the application of urea fertilizer and oyster mushroom baglog waste compost did not have a real effect on the stem diameter of Montong durian seedlings at the age of 4–11 MST. The application of urea fertilizer also did not have a significant effect on the growth of stem diameter. This is suspected to be caused by a dose of urea that is too high so it inhibits the growth of plant stems. The dose of 10 g/polybag used in this study is still relatively high for the nursery phase. This opinion is in line with (Prastowo, 2006) [18], Which states that the application of high doses of fertilizer to fruit plant nurseries can inhibit stem growth. The recommended dosage for seedlings is 1–2 g per plant.

phosphorus content in the soil is only 29.63 ppm, while the total phosphorus content in baglog waste compost is only 0.6%, including available and unavailable. Phosphorus deficiency can cause plant growth to be stunted and plant stems to look smaller or dwarfed. This is in line with the opinion (Satria *et al.*, 2015) [21], Which states that phosphorus is an important element in plant metabolism and plays a significant role in supporting stem growth. Phosphorus contributes to root growth and the formation of root hairs, which helps to better support plant stems.

In addition, the small diameter of the stem is also suspected to be caused by the low phosphorus (P) content in the compost of oyster mushroom baglog waste and soil. The

Leaf area

The results of the analysis of the wide variety of leaves of montong durian seedlings aged 4 - 11 MST with the application of urea fertilizer and oyster mushroom baglog waste compost are presented in Table 4

Table 4. Results of Fingerprint Analysis of Wide Variety of Leaves of Montong Durian Seedlings after Applying Urea and Waste Compost of Oyster Mushroom Baglog

SK	F. Hitung luas daun pada 4 MST-11 MST								F.05	F.01
	4 MST	5 MST	6 MST	7 MST	8 MST	9 MST	10 MST	11 MST		
U	1,70 in	0,31 in	0,22 in	0,56 in	0,47 in	1,15 in	0,63 in	0,73 in	3,29	5,42
B	0,16 in	0,04 in	0,09 in	0,06 in	0,59 in	0,15 in	0,25 in	0,27 in	3,29	5,42
UB	1,04in	0,98in	1,01in	1,24in	1,19in	1,78in	1,21in	1,38in	2,59	3,89
KK %	26,17	23,25	26,21	18,48	21,49	16,82	15,82	15,87		

Remarks: tn = unreal, * = real at 95%, ** = very real at 99%. MST = weeks after planting

Based on Table 4, the results of the variegated fingerprint analysis showed that the application of urea fertilizer and oyster mushroom baglog waste compost did not have a real effect on the leaf area of Montong durian seedlings at the age of 4–11 MST. The application of urea fertilizer is not able to significantly increase the leaf area, which is suspected because the applied urea fertilizer has not been able to optimally provide nutrients for plants. This is due to the characteristics of nitrogen in urea fertilizers that are highly easily washed by rainwater, evaporated, or utilized by decomposer microorganisms. This opinion is in line with (Satria *et al.*, 2015) ^[21], Which states that nitrogen is easily lost from the soil due to washing by rainwater, so its availability for plants is limited. Nitrogen elements are absorbed by plants in the form of nitrate ions (NO₃⁻) contained in soil solutions and directly play a role in the formation of proteins, plant growth spurts, and the formation of chlorophyll, amino acids, fats, enzymes, and other compounds. In addition, the element potassium (K) also acts as an activator of important enzymes for photosynthesis and respiration, although it is not a structural component in organic compounds.

Meanwhile, oyster mushroom baglog waste compost also did not have a real effect on the leaf area. This is likely due to the difficulty with which the wood dust in baglog waste decomposes completely during the composting process. The nutrients contained in baglog waste have mostly been used by oyster mushrooms during the process of reshuffling cellulose as an energy source. (Wahono & others, 2019) ^[26] Explains that wood waste in baglog waste takes a long time to decompose and can supply nutrients to the soil. (Pratiwi & Purnamasari, 2019) ^[19] Also confirms that optimal sawdust composting takes about two months with the addition of EM4 by 20% to increase the nitrogen content. However, in this study, composting was carried out for only one month, so the nitrogen content and other nutrients were not yet available enough to support optimal plant growth.

Conclusion

The application of urea fertilizer and oyster mushroom baglog waste compost did not have a real effect on the vegetative growth of Montong durian seedlings, including plant height, number of leaves, stem diameter, and leaf area at the age of 4–11 MST. This ineffectiveness is thought to be caused by too high doses of urea fertilizer, which inhibits growth, as well as low nutrient content, especially nitrogen and phosphorus, in oyster mushroom baglog waste compost. In addition, the high C/N ratio in compost and short composting time result in limited nutrient availability for plants. Nitrogen in urea fertilizer is also easily washed and evaporated, so it is not optimally absorbed by plants. Therefore, this study shows the importance of adjusting the dosage of urea fertilizer and improving the quality of compost through a more optimal composting process to support the growth of Montong durian seedlings effectively.

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