The effect of oyster mushroom baglog compost on the growth and production some local genotypes of purple sweet potato (Ipomoea batatas L.)

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Abstract. The use of compost is effective to improve the physical, biological and chemical structure of the soil, which makes plant growth and yield better. The purpose of study was to determine the effect of oyster mushroom baglog compost on the growth and production of several local purple sweet potato genotypes (accessions of Dolok Perdamean with purple tuber, accessions of Silimakuta with purple tuber, accessions of Sumbul with purple tuber, and accessions of Parbuluan with purple tuber) on the various doses of oyster mushroom baglog waste compost application (0, 10, 20, 30 ton/ha). This research was conducted at Jl. Idi Gang Eka Dewi, Medan Johor Subdistrict, from the end of December 2018 to June 2019. The results showed that the administration of oyster mushroom baglog compost gave a good influence on the growth and production of some local purple sweet potato genotypes. The accession of Sumbul with purple tuber had produces the highest growth plant stem length, while the Dolok Perdamean accession with purple tuber had produces the highest on B class tuber grading. The application of oyster mushroom baglog waste compost markedly improves on A class tuber grading. The best dose of oyster mushroom baglog waste compost was 30 tons/ha.

1. Introduction

Purple sweet potato is one of the carbohydrates producing plants which acts as an alternative food source besides rice and is widely used as an industrial raw material [1]. However, purple sweet potato production from 2012 to 2015 continued to decline in the amount of 2.4 million tons (2012) to 2.2 million tons (2015) [2]. Technical culture that can be done to increase production is the use of local genotypes, because it has high adaptability to diverse agroecosystems [3].

The application of nutrients in the form of oyster mushroom baglog waste compost so that the availability of micro and macro soil nutrient is maintained [4]. Compost application significantly affected tuber length, tuber weight, plant length and biomass weight [5].

Sweet potatoes need a lot of potassium nutrients in the process of growth and development. Nowadays, the use of oyster mushroom baglog waste compost as an alternative soil conditioner has developed as well as a provider of nutrients. Oyster mushroom baglog waste compost is rich in nutrients, especially high potassium hence it is very good for growth and tuber production [6].
The application of oyster mushroom baglog waste compost is useful for improving soil physical and chemical properties which is to loosen the soil, maintain air stability in the soil, bind ground water, increase pH and CEC (cation exchange capacity) in the soil, provide organic N, P, and K nutrients in the soil so that plant nutrient needs can be fulfilled [7].

This research aim was to determine the effect of oyster mushroom baglog waste compost on the growth and production of some local purple sweet potato genotypes (*Ipomoea batatas* L.) (Dolok Perdamean with purple tuber, Silimakuta with purple tuber, Sumbul with purple tuber, and Parbuluan with purple tuber) on several dose (0, 10, 20, 30 tons/ha) of oyster mushroom baglog waste compost application.

2. Material and method
The experiment was conducted in December 2018-June 2019 in Medan Johor Subdistrict. The study design used was a randomized block design with two factors, the first factor was local sweet potato genotyping (Dolok Perdamean with purple tuber, Silimakuta with purple tuber, Sumbul with purple tuber, and Parbuluan with purple tuber) and the second factor was doses of oyster mushroom baglog waste compost (0, 10, 20, 30 ton/ha). This experiment started from land preparation, making baglog oyster mushroom waste compost, compost application, planting sweet potato cuttings, cultivation, fertilizing, and analysis of morphological parameters which include plant stem length, tuber weight per plot, grading tuber class A, B and C.

Compost application was done 2 weeks before planting the cuttings by spreading the compost into the experimental plot and then covered again with soil until evenly distributed. Compost application adapted to the experimental design. For control treatment no compost is given.

The retrieval of morphological character data of the plant stem length was done when the plant was 6 WAP (weeks after planting) old. Observations of tuber weights per plot, grading tubers class A, B and C performed when the plant is aged 20 WAP.

The parameter test used was the F test if it was significantly different then continued with the Duncan Multiple Range Test (DMRT) level of α 5%.

3. Result and discussion
Data in Table 1 shows that some local genotypes produced different stem length growth. Sumbul genotype (purple tuber) produce the highest stem length compared to other genotypes. This was because the genetic adaptability of Sumbul is higher for the growth environment compared to other accessions. The difference growth, namely the length of the stem and the wet weight of plants from various genotypes, is a form of genetic adaptation to the environment. [8] stated that genotypic differences produce different stem length growth of sweet potato plant. This was supported by [9] which states that the use of several local clones resulted in the growth of different plant stem lengths.

**Table 1.** The effects of several oyster mushroom baglog waste compost dosage and local sweet potato genotypes on plant stem length (cm) at 6 WAP (weeks after planting)

| Genotypes                      | Baglog Compost Dosage (ton/ha) |   |   |   | Average |
|--------------------------------|--------------------------------|---|---|---|---------|
| Dolok Perdamean Accession (purple tuber) | 54.25 55.03 48.07 88.88 61.55 b |   |   |   |         |
| Silimakuta Accession (purple tuber)         | 81.91 51.66 101.00 63.86 74.61 ab   |   |   |   |         |
| Sumbul Accession (purple tuber)             | 100.00 116.71 92.29 97.64 101.66 a |   |   |   |         |
| Parbuluan Accession (purple tuber)          | 64.08 53.81 24.83 56.80 49.88 b    |   |   |   |         |
| Average                                      | 75.06 69.30 66.55 76.79             |   |   |   |         |

Note: In Duncan's Multiple Range Test at α = 5% of the same letters in the numbers shows insignificant differences.
Plant stem length showed no significant effect in each treatment of oyster mushroom baglog waste compost dosage (Table 1). However, the application of 30 tons/ha dosage increased the plant stem length compared to other treatments. This was because the nutrients contained in the oyster mushroom baglog waste compost had begun to be available in the soil as a support to the growth of stem length. [10] reported that compost acts as a source of nutrition and also creates rooting areas that are conducive to vegetative growth of plants.

The observations of tuber weights per plot in several sweet potato genotypes not significantly different (Table 2). The heaviest tuber weight per plot was obtained in the purple tuber Dolok Perdamean (883.45 g) when compared to the purple tuber Silimakuta (530.58 g), purple tuber Sumbul (610.08 g) and purple tuber Parbuluan (472.08 g). This was because of the temperature factor. All local clones cultivated in this research originally came from the highlands (1600 meters above sea level) namely Dolok Perdamean, Silimakuta, Sumbul and Parbuluan which is included in the low-temperature category (22-23 °C) hence when planted in the lowlands (34 meters above sea level) namely in Medan Johor which is included in the high-temperature category (30-31 °C) resulted in plant stress. The high temperature in Medan Johor caused the Gibberellin Acid (GA) hormone to rise sharply in sweet potato plants which resulted in an expansion of stem length better than tuber formation, hence the tuber weight decreased dramatically, as a result, the tuber weight per plot becomes not significantly different. This was also supported by [11] which stated that high temperatures will trigger the oxidation of IAA (Indol Acetic Acid) hormone which results in the process of inhibiting tuber formation.

### Table 2. The effects of several oyster mushroom baglog waste compost dosage and local sweet potato genotype on the tuber weight per plot (g)

| Genotypes                        | Baglog Compost Dosage (ton/ha) | Average |
|----------------------------------|--------------------------------|---------|
| Dolok Perdamean Accession (purple tuber) | 409.17 776.67 848.97 499.00 | 883.45  |
| Silimakuta Accession (purple tuber) | 566.00 495.33 438.67 622.33 | 530.58  |
| Sumbul Accession (purple tuber)   | 286.67 899.33 710.00 544.33 | 610.08  |
| Parbuluan Accession (purple tuber) | 405.33 517.67 269.33 696.00 | 472.08  |
| Average                          | 416.79 672.25 566.74 840.42  |

### Table 3. The effects of several oyster mushroom baglog waste compost dosage and local sweet potato genotype on a-class tuber grading (tuber/plot)

| Genotypes                        | Baglog Compost Dosage (ton/ha) | Average |
|----------------------------------|--------------------------------|---------|
| Dolok Perdamean Accession (purple tuber) | 0.00 0.67 0.00 1.00 | 0.42   |
| Silimakuta Accession (purple tuber) | 0.33 0.33 0.33 0.33 | 0.33   |
| Sumbul Accession (purple tuber)   | 0.00 0.33 0.33 0.67 | 0.33   |
| Parbuluan Accession (purple tuber) | 0.00 0.00 0.33 1.67 | 0.50   |
| Average                          | 0.08b 0.33b 0.25b 0.92a   |

Note: In Duncan's Multiple Range Test at α = 5% of the same letters in the numbers shows insignificant differences.

The application of various oyster mushroom baglog waste compost dosage increased significantly in the A-class tuber grading parameters (Table 3). The treatment of oyster mushroom baglog waste compost dosage as much as 30 tons/ha increased A-class tuber grade compared to other treatments. This is because with oyster mushroom baglog waste compost as much as 30 tons/ha had been able to meet the nutritional needs of plants, causing the nutrient absorption to be better which results in a more optimal plant vegetative growth hence more and more photosynthates that are produced to be
transplanted into the tuber, which have an impact on the enlargement of the tuber and produce a lot of tuber weights in A-class grade. Fresh tuber grading according to SNI (Indonesian National Standard) number 01-4493-1998 with criteria (A-class: tuber weight > 200 g/tuber, B-class: tuber weight > 100 - 200 g/tuber, and C-class: tuber weight 75 - 100 g/tuber). Correlation between A-class fresh tuber grading (tuber weight > 200 g/tuber) on oyster mushroom baglog waste compost application with different dosages presented in Fig 1. was a positive linear curve with the highest grade was 0.92 g obtained in 30 ton/ha treatment and the lowest grade was 0.08 g in 0 ton/ha treatment. It has been reported by [12] that the application of oyster mushroom baglog waste compost can improve soil physical properties hence tuber growth is better.

Correlation of A-class fresh tuber grading on various doses of oyster mushroom baglog waste compost application can be seen in Figure 1.

![Figure 1. Correlation of A-class fresh tuber grading on oyster mushroom baglog waste compost application with different dosages](image)

Table 4. The effects of several oyster mushroom baglog waste compost dosages and local sweet potato genotype on B-class tuber grading (tuber/plot)

| Genotypes                        | Baglog Compost Dosage (ton/ha) | Average |
|----------------------------------|--------------------------------|---------|
|                                  | 0     | 10    | 20  | 30  |         |
| Dolok Perdamean Accession (purple tuber) | 1.00  | 1.67  | 3.00| 3.33| 2.25 a |
| Silimakuta Accession (purple tuber)   | 0.33  | 1.00  | 0.33| 1.00| 0.67 b |
| Sumbul Accession (purple tuber)     | 0.33  | 2.33  | 1.33| 1.00| 1.25 b |
| Parbuluan Accession (purple tuber)  | 1.33  | 1.00  | 0.00| 1.00| 0.83 b |
| **Average**                        | 0.75  | 1.50  | 1.17| 1.58|         |

Note: In Duncan's Multiple Range Test at $\alpha = 5\%$ of the same letters in the numbers shows insignificant differences.

Genotypes produced different B-class fresh tuber grading (Table 4). Dolok Perdamean (purple tuber) produce the grading of B-class tubers more than any other genotype. This was because genetic factors play a major role in producing tubers in B-class tuber and this accession was thought to be able to adapt well in the Medan Johor area hence it was still able to provide optimal tuber yields even if it was planted in a different environment from the origin area. [13] reported that certain genotypes would grow well in certain environments but not in all different environments. The results of the research of
[14] and [15] also prove that genetic differences in various genotypes greatly influenced the growth and production of sweet potatoes.

Sweet potato genotype does not significantly affect the result of C-class fresh tuber grading can be seen in Table 5. This was thought because of the differences in agroecosystem factors, one of which is temperature. At first, the local clones used came from low-temperature (cold) environments and were in the highlands hence when planted in Medan Johor region which was included in the lowland and high-temperature (hot) categories caused the genetic potential of tuber growth carried by each clone not optimal, hence the ability of local clones to produce C-class tuber does not look significantly different between local clones. [16] reported that tuber weights and number of tubers were strongly influenced by ambient temperature.

Table 5. The effects of several oyster mushroom baglog waste compost dosages and local sweet potato genotypes on C-class tuber grading (tuber/plot)

| Genotypes               | Baglog Compost Dosage (ton/ha) | Average |
|-------------------------|-------------------------------|---------|
|                         | 0    | 10   | 20   | 30   |         |
| Dolok Perdamean Accession (purple tuber) | 0.33 | 0.67 | 2.00 | 2.00 | 1.25   |
| Silimakuta Accession (purple tuber) | 1.00 | 0.67 | 1.00 | 2.33 | 1.25   |
| Sumbul Accession (purple tuber) | 0.00 | 1.00 | 1.00 | 0.67 | 0.67   |
| Parbuluan Accession (purple tuber) | 0.67 | 0.67 | 0.33 | 0.33 | 0.50   |
| Average                 | 0.50 | 0.75 | 1.08 | 1.33 |         |

4. Conclusion

The effect of oyster mushroom baglog waste compost was seen significantly on the growth and production of some local purple sweet potato genotypes. The highest plant stem length is produced by the Sumbul genotype. Dolok Perdamean with purple tuber was the local genotype with the most B class tuber grading. Fresh grading of A-class tubers is most significantly influenced by the application of oyster mushroom baglog waste compost. The best dose of oyster mushroom baglog waste compost application was 30 tons/ha.

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