



Original article

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The Effect of Various Types of Mulch on the Growth and Yield of Dayak Onions (*Eleutherine palmifolia* (L.) Merr)

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ABSTRACT

The research on the effect of various types of mulch on the growth and yield of *Dayak* onions (*Eleutherine palmifolia* (L.) Merr) has been carried out in the field at Al-Ikhwan complex, Banjarbaru City, South Kalimantan in March until July 2019. This research used a completely randomized design (CRD) single factor with 4 types of mulch treatment; m_0 = without mulch, m_1 = silver black plastic mulch, m_2 = rice straw mulch, m_3 = water hyacinth mulch, then repeated 3 times, thus 12 units of plot experiment. Each experimental unit contained 20 plants, with 6 sampling plant for observation. The parameters observed in this study were plant height, number of leaves, number of tillers, time of first flower appearance, number of bulb, and total fresh weight of bulb. The results showed that the treatment of various types of mulch could not affect the growth and yield of *Dayak* onions and there was not available the best type of mulch on the growth and yield of *Dayak* onions.

Keywords: endemic plants, ground cover, medicinal plants.

1. Introduction

Dayak onion (*Eleutherine palmifolia* (L.) Merr) has been used from generations to generations of the local Dayak tribe as a medicinal plant and it is a typical plant from Central Kalimantan which is can treat breast cancer, colon cancer, ulcers, diabetes mellitus, reducing hypertension, cholesterol, preventing strokes, and reducing stomach pain after childbirth. There are many phytochemical contents in Dayak onions which are the source of biopharmaceuticals, including flavonoids, alkaloids, steroids, glycosides, *phenolics*, and tannin substances. *Dayak* onions can be easily developed on a large scale so that the potential to be developed as a medicinal plant industry because these plants have a short harvest time of \pm 3-4 months and also can grow and adapt in almost all types of soil and climate (Galingging, 2009).

Today, modern medicines is very expensive. Lifestyle changes back to nature makes people tend to consume traditional medicines so that demand is getting higher in Indonesia till the world (Salim, 2017). Therefore the preparation of medicinal plant raw materials needs intensive efforts to be fulfilled, including efforts to increase the production of Dayak onions. Dayak onions are plants that grow wild and only a few people conserve them.

Shallots are similar with Dayak onions, the results of Dayak onions are bulb layers, thus cultivation is thought to have in common so that information in the cultivation of shallots can be used as a reference. According to A'yuningsih (2017), environmental factors such as soil and microclimate (humidity, temperature, light, and water) are among the factors that affect plant growth and development. Rahayu & Berlian (2004) states that shallots have short roots so they cannot stand drought. During the period of growth and development, shallots are not resistant to the places that are

too wet and excessive rainwater but require considerable water. It is suspected that Dayak onions also require sufficient groundwater content like onions, therefore cultivation technology is needed that can reduce evaporation and maintain soil moisture.

Plants can grow and develop well if the growth environmental conditions are appropriate, one way is to modify the growth environmental conditions using mulch. The use of mulch aims to maintain soil moisture, suppress weed growth, maintain soil temperature so that the temperature in the soil is relatively stable, and reduce evaporation (Sembiring, 2013 in Susiawan, et al., 2018). Lumbanraja & Malau (2013) also stated that mulch can reduce water loss due to evaporation and avoid direct surface damage from rain.

Most farmers use inorganic mulch in the form of plastic such as black plastic mulch or silver black plastic mulch. Plastic has properties that are difficult to decompose in nature, so the problem of plastic mulch waste becomes a case that must be anticipated. Open burning is a common way to reduce the amount of waste. The remnants of dirty plastic and fine grains of sand make it difficult for factories to recycle it again (Fahrurrozi, 2009). Therefore, one of the efforts to keep nature sustainable, to prevent it from environmental pollution and to be sustainable for the future is to use organic mulch.

Akbar et al. (2014), states that organic mulch has many advantages, including being able to improve groundwater reserves, soil fertility, soil structure, and the amount of organic material itself. Also, due to the availability of organic material and soil moisture that is maintained, organic mulch can attract soil fauna that is a source of food. This situation has an impact on the capacity of the soil to absorb water and aeration for the better. Hani et al. (2012), the use of organic mulch can increase plant growth rates because it also acts as a source of nutrients and can suppress weed growth.

Based on the explanation above, the author was interested in researching the application of mulch in Dayak onion cultivation.

2. Methods

The research was carried out from March to July 2019 in the experimental land of Al-Ikhwan, Banjarbaru, South Kalimantan. The ingredients are *Dayak* onion bulbs, silver black plastic mulch, rice straw, water hyacinth, manure, and water. The tools are mulch holes, machetes, scales, hoes, bamboo pegs, scissors, meters, plastic cups, and cameras.

The design in this study was Completely Randomized Design (CRD) of one factor with 4 (four) treatment levels; m0 = without mulch, m1 = silver black plastic mulch, m2 = rice straw mulch, m3 = water hyacinth mulch and 3 replications (3 three) times, so we get 12 experimental units. In each experimental unit, there were 20 plants so that 240 plants were obtained.

The implementation of this research consisted of tillage, mulch preparation, mulch administration, seed preparation and planting, maintenance, and harvesting. The parameters observed were plant height, number of leaves, number of tillers, time of appearance of flowers, number of tubers per clump, total fresh weight of tubers.

Data obtained from the results of the study that were tested for homogeneity using the Bartlett test. Analysis of variance (ANOVA) is continued if the data has been homogeneous. If the data are not homogeneous, then the data is transformed until the data becomes homogeneous. After homogeneous data, it is continued with an analysis of variance (ANOVA). The results of a variety of analyzes that show a real or very real effect on the treatment, then carried out further tests with the Least Significant Difference Test (LSD) at the 5% test level so that it knows which treatment is best for plant growth and yield. Data analysis using Minitab16 software.

3. Results and Discussion

Result

A The results observation of the height *Dayak* onions on the administration of various types of mulch during its growth period can be seen in Figure 1

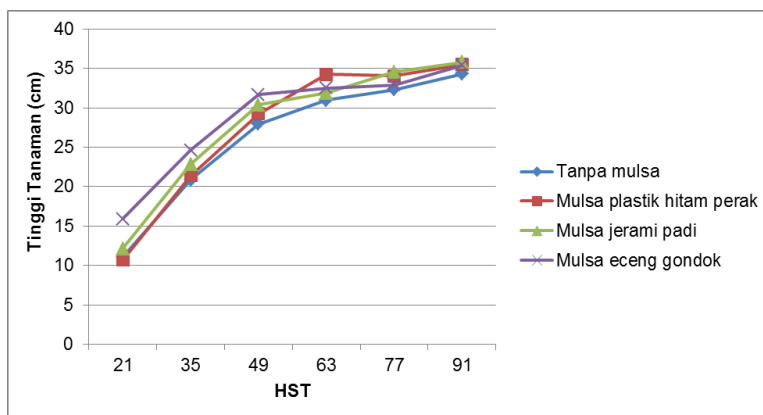


Figure 1. Graph of average plant height (cm) on the administration of various types of mulch

The data above shows that plant height during its growing period towards all treatments given no significant effect, namely at 21 HST ranging from 10.7 - 15.9 cm, 35 HST ranging from 20.9 - 24.6 cm, 49 HST ranging from 28.0 - 31.7 cm, 63 HST ranging from 31.0 - 34.2 cm, 77 HST ranging from 32.3 - 34.5 cm, and 91 HST ranging from 34.3 - 35.8 cm.

The results of observations of the number of *Dayak* leaves on the administration of various types of mulch during their growing period can be seen in Figure 2.

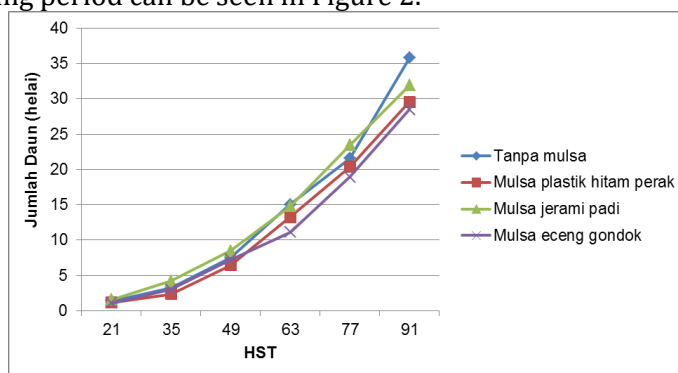


Figure 2. Graph of the average number of leaves (strands) in the administration of various types of mulch

The data above shows that the number of leaves during the growing period of all treatments given an effect that is not significantly different; at 21 HST ranges from 1.1 to 1.6 strands, 35 HST ranges from 2.3 to 4.2 strands, 49 HST in the range of 7.2 - 8.5 strands, 63 HST ranges from 11.1 - 15.0 strands, 77 HST ranges from 18.9 - 23.4 strands and 91 HST ranges from 28.4 - 35.8 strands.

The results of observations of the number of *Dayak* onions in the administration of various types of mulch at harvest can be seen in table 1.

Table 1. The average number of tillers in the administration of various types of mulch

Treatment	Number of tillers (tillers)
Without mulch	9,2
Black silver plastic mulch	8,6
Rice straw mulch	8,3
Water hyacinth mulch	8,8

The data above shows that the number of tillers for all treatments given had no significant difference; at most 9.2 tillers and at least 8.3 tillers.

The results of observations of the appearance of *Dayak* flowers on the administration of various types of mulch can be seen in table 2.

Table 2. The average time of emergence of flowers (HST) in the administration of various types of mulch

Treatment	When flowers appear (HST)
Without mulch	54,0
Black silver plastic mulch	54,2
Rice straw mulch	56,2
Water hyacinth mulch	57,3

The data above shows that the time when interest appeared on all treatments given an effect that was not significantly different, namely the fastest 54 HST and the slowest 57.3 HST.

The results observations of the number of tubers per family of onions on various types of mulch can be seen in table 3.

Table 3. The average number of tubers per clump (cloves) in the administration of various types of mulch

Treatment	Number of tubers per clump (siung)
Without mulch	4,6
Black silver plastic mulch	5,1
Rice straw mulch	4,9
Water hyacinth mulch	6,0

The data above shows that the number of tubers per family of all treatments given an effect that is not significantly different, at most 6 cloves and at least as much as 4.6 cloves.

The results of observing the total fresh weight of the *Dayak* onion tubers in the administration of various types of mulch can be seen in table 4.

Table 4. Average total fresh weight of tubers (g) for the administration of various types of mulch

Treatment	The total weight of fresh tubers (g)
Without mulch	18,0
Black silver plastic mulch	21,3
Rice straw mulch	20,1
Water hyacinth mulch	18,5

The data above shows that the total fresh weight of the tubers for all treatments given was not significantly different; the heaviest weight of 21.3 g and the lightest 18 g.

Discussion

Plant height is a parameter that shows the vegetative growth activity of plants. With cell division, the plant will experience increased plant height. Plant height growth is influenced by several factors, such as the environment, physiology, and genetics of plants (Syifa, 2016). The results of the analysis of variance showed that the height of the *Dayak* onions for all treatments given no significant effect during growth. But it is different in the research of Wisudawati et al. (2016), by applying rice straw mulch to onion cultivation, the plant height was higher than silver plastic mulch, black plastic mulch, and without mulch. Likewise in Putri's research (2017), the provision of rice straw mulch in onion cultivation resulted in a higher plant height compared to silver black plastic mulch, transparent plastic mulch, and without mulch.

The results of this study indicate that the height of *Dayak* onions is higher, reaching 34.3 - 35.8 cm when compared to the Sepoel study (2018) which in his research with the treatment of solid organic fertilizer on peat soil only reached 20.92-23, 45 cm. However, in the study of Sitepu et al. (2015) with the treatment of giving husk charcoal plant height can reach 52.83 - 55.35 cm.

Based on Figure 1, the growth of plant height is faster at the age of 21 - 49 HST, after 49 HST the rate of plant height starts to decrease due to entering the generative phase. Nendissa (2008), the growth rate of plant height decreases because in the generative phase photosynthate is more directed at tuber formation so that plants begin to be active in forming tubers. In addition to declining, plant height growth also fluctuates due to some leaves or dead clumps of plants, while others grow new puppies.

The results of the analysis of variance showed that the number of *Dayak* leaves on all treatments produced an effect that was not significantly different during growth. But in the research of Fauzi et al. (2016), using silver black plastic mulch in onion cultivation produced more leaves than mulch and without mulch. Fatmawaty et al. (2015) said that the vegetative growth activity of plants can be indicated by the parameter number of plant leaves. Leaf formation itself is influenced by the genetic traits of plants but can be accelerated by a good growing environment.

The results of this study showed that the number of *Dayak* leaves was relatively the same as other studies, ranging from 28.4 to 35.8 strands, as in the research of Siregar et al. (2014) with tuber cleavage treatment and comparison of planting media results of his study showed the number of leaves 23.69 - 38.03 strands. But when compared with the research Sitepu et al. (2015) with the treatment of rice husk charcoal, the number of leaves can reach 72.41 - 84.61 strands.

The results of the analysis of variance showed that the number of tillers on all treatments produced no significant effect. But in the research of Fauzi et al. (2016), using silver black plastic mulch in onion cultivation produced the highest number of tillers compared to rice straw mulch and without mulch.

This study gives relatively the same number of tillers which is 8.3 - 9.2 tillers when compared with other studies such as Joseph's research (2009), which is 8.43 - 12.61 tillers with shade treatment and soil texture. However, in the study of Sitepu et al. (2015) with the treatment of rice husk charcoal, the number of tillers was 19.33 - 23.07.

The results of the analysis of variance showed that the time of appearance of the *Dayak* flower on all treatments resulted in an effect that was not significantly different. The time of emergence of interest in this study was 54 - 57.3 HST which was relatively similar when compared to the research of Sitepu et al. (2015) with the treatment of rice husk charcoal, which is 54.88 - 56.33 HST. But in the study of Raga et al. (2012) with the treatment of plant spacing and tuber cutting, the time of flower emergence was slower is 75.46 - 77.77 HST.

The results of the analysis of variance showed that the number of tubers per *Dayak* clump on all treatments produced an effect that was not significantly different. But it is different in Marliah (2012) research, by using water hyacinth mulch in onion cultivation produces more tubers than straw mulch and roasted husk.

The number of tubers is related to the growth of the number of tillers. Tillers that reach the generative phase will begin to form tubers. The more tillers that reach the generative phase, the more tubers are formed. The results of the number of tubers per clump in this study were 4.6 - 6 cloves when compared to other studies such as Ekawati (2018) which were relatively the same, 2.3 - 5.7 cloves with the treatment of leaf fertilizer. However, in the research of Siregar et al. (2014) with tuber cleavage treatment and comparison of planting media can produce 7.50 - 12.00 cloves. Likewise in the research of Sitepu et al. (2015) with the treatment of rice husk charcoal can reach 11.76 - 13.20 cloves.

The results of the analysis of variance showed that the total fresh weight of the *Dayak* onion tubers on all treatments produced no significant effect. However, in Putri's study (2017), in the cultivation of shallots with rice straw mulch yielding a fresh total weight of tubers is better than without mulch, transparent plastic mulch, and silver black plastic mulch.

A large number of tubers can produce large tuber weights as well, but the tubers from the results of this study are diverse namely large and small. According to Setiyowati et al. (2010), the metabolic process is ineffective when the number of leaves is increasing, because if vegetative growth is still ongoing but has entered the generative phase resulting in the competition of assimilating translocation to flowers or tubers, so that eventually the cells remain small due to reduced energy in vacuole cells.

The total fresh weight of *Dayak* onion tubers in this study was heavier namely 18-21.3 g when compared to the Ekawati study (2018) with the treatment of leaf fertilizer, 9.9-13.2 g. However, the results of the total fresh weight of these tubers are still not maximum, because in the study of Raga et al. (2012) by treatment of plant spacing and tuber cutting, can produce fresh tuber weight per clump 34.59 - 53.94 g. Whereas in the study of Sitepu et al. (2015) with the treatment of rice husk charcoal can reach 74.53 - 84.54 g.

The results of the study of the use of mulch on all observed parameters showed no significant effect. According to Sembiring (2013) in Susiawan, et al. (2018) the use of mulch aims to suppress weed growth, maintain soil moisture, and reduce evaporation. Lumbanraja & Malau (2013) also stated that mulch can reduce water loss due to evaporation and avoid direct surface damage from rain. According to Thomas, et al. (1993) in Widodo, et al. (2014) stated that the function of mulch straw is to prevent water evaporation, maintain soil aggregates from rainwater, protect the soil from sun exposure, suppress weed growth, minimize soil erosion, improve soil physical properties, especially soil structure, and be able to control pests and disease in plants. However, in this study, it was suspected that without mulching or applying rice straw mulch, silver black plastic mulch, and water hyacinth mulch had provided a suitable growing environment (reducing soil surface erosion, maintaining soil moisture, soil temperature, and evaporation) for growth and development. Plants, so there is no effect of all these treatments.

4. Conclusions

1. The treatment of giving various types of mulch cannot affect the growth and yield of *Dayak* onions.

2. There was not available the best type of mulch on the growth and yield of *Dayak* onions

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