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Germination of dormant onion bulbs in different growing media

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Abstract. The aim of the study was to examine the planting media as a stimulant for onion germination. This study used onion bulbs of the Batu ijo variety with one week after harvest sizes ranging from 20 to 25 g/tuber, bulbs lengths were from 4 cm to 5 cm. The research used a completely randomized design with three factors that repeated 10 replications. Onion bulbs were planted in pots with a volume of 2 L which were only filled with 80% of the pot volume. In each pot was planted one onion bulb that had been cut off the top 1/3 with a planting depth. The number of sample plant pots for each media were 15 pots so that the total were 45 pots. Watering was done as much as 1 L/pot/day so that the growing media was always wet. Every two days they were observed for variables number of sprouts, shoots, roots, and leaves. All variables were analysed by analysis of variance. The results showed that the onion bulbs sown for one month in growing media have not been able to stimulate germination, and cocopeat media produced 20% germination compared with more sawdust and husk media. On cocopeat media, dormant onion bulbs germinated in 14 days after planting (DAP), followed by sawdust and husk media in 16 DAP. Roots of dormant onion bulbs appeared between 7 to 14 DAP, and then shoots appeared in 14 to 16 DAP.

1. Introduction

The length of dormancy of onion (*Allium cepa* L.) bulbs in Indonesia was between 2 to 4 months after harvest [1]. To speed up the replanting of onion in the production centers to suit the season, various methods were needed so that dormant onion bulbs can be shortened. Freshly harvested onion bulbs have 3 stages, namely rest, dormancy, and sprout. According [2], during these stages there will be an increase in respiration, organic substrates, gibberellin activity, auxin, and cytokinin, carbohydrate remobilization, and inhibition by abscisic acid and an increase in ethylene concentration. The length of bulbs dormancy and germination that will occur was strongly influenced by weather conditions during the previous vegetative phase [3]. During dormancy, onion bulbs would change in water content, organic acids, carbohydrate content, phenolic compounds, and several compounds associated with endogenous growth of bulbs [4];[5]. Naturally breaking the dormancy of onion bulbs become sprouting was highly dependent on the variety, the nutrients present in the bulbs, and environmental factors. After a period of dormancy, the sucrose synthase activity and respiratory activity in the centre of the bulb increased, concomitant with initial sprout growth [6]. During the germination process of onion bulbs, physiological



changes occur, including increased levels of reducing sugars, respiration, water loss and changes in growth regulators [2].

Temperature of more than 30°C can reduce cytokinin activity and increase the concentration of ABA and ethylene so that budding was inhibited [2]. To speed up the sprouting of onion, it can be done by cutting the bulbs, and setting the photoperiodity and temperature [7]. The breaking of the dormancy of the onion bulbs was marked by the emergence of roots and then followed by the growth of shoots on the bulbs. Physical treatment of bulbs was able to shorten the dormancy period of bulbs. According to [8], efforts to cut bulbs between 50 and 75% on the length of the bulb by placing the bulb at temperature range of 15-20°C to accelerate the emergence of shoots. Environmental control effort to stimulate root release from bulbs was one way to break bulb dormancy. Planting media such as cocopeat and sawdust were good media for plants because their chemical and physical properties support plant growth [9]. Rice husks, sawdust and cocopeat have the ability to hold relatively large amounts of water and cause the growing media to hold relatively more amounts of water and cause the growing media keep water longer. The ability of long media to retain moisture from cocopeat and sawdust (1:1 v/v) can increase saving and nutrients, and maximizing yield for tomato [10]. For oil palm seedling growth media, it turns out that cocopeat or sawdust media produces more leaf number and dry weight, and root length compared to soil media [11]. The key to seed or bulb germination was very dependent on water which was always available in the media for the imbibition process so that it will stimulate the emergence of roots and shoots.

2. Method

The research was carried out from June 2021 to July 2021, in the greenhouse of the Faculty of Agriculture, Sriwijaya University in Palembang city, Indonesia. The planting material used in this study was derived from onion bulbs of the Batu ijo variety planted in Pagar Alam City. The bulbs used were one week after harvest, the weight of the bulbs was 20 g to 25 g, and the length of the bulbs was between 4 cm to 5 cm. The planting media used consisted of 3 media, namely cocopeat, rice husk and sawdust which had been dried for one week. The pot used was a plastic buckets with a volume of 2 L which have 12 holes with a diameter of 5 mm. Each planting pot was filled with planting media as much as 80% of the total volume of the pot. Each planting media was prepared as many as 15 pots, and each pot was planted with one onion bulb. Before planting, the top of the onion bulbs were cut in 1/3 part and the bulbs were soaked with fungicide for 5 minutes, then the bulb were planted at a depth of 2 to 3 cm from surface of media. Watering was done every day with a volume of 1 L/pot/day so that the growing media was always wet. Observations off all variables were carried out data every 2 days. Parameter observed were the number of shoots, roots and leaves, plant height and root length.

3. Result and discussion

For one month, the dormant onion bulbs germinated in the cocopeat planting medium with as much as percentage of 20%, and for the other two of growing media the germination percentage were lower. For all dormant bulbs, for all dormant bulbs had about 2 days faster than sprouting. The number of shoots that emerged from dormant bulbs was relatively the same for husk and sawdust media, and lower than that of cocopeat media. The number of shoots that emerged from dormant bulbs was relatively the same for husk and sawdust media, and lower than that of cocopeat media. Cocopeat media was thought to have a lot of water retention due to its light weight and more micro pores [16] than other media. The availability of relatively large amount of water and a long time can support the emergence of shoots.

There was a similar trend between root length and plant height for all growing media, and the same trend between the number of shoots and the number of roots of onion (Table 1). Since dormancy of onion after harvest can vary between none and several week, and onion bulbs took long time to germinate, and during that time the bulbs were dormant [6]. As long as the concentration of ABA was still high in post-harvest bulbs, the germination process was difficult to occur naturally [12]. By cutting shoots and planting dormant bulbs of onion in various growing media, it was found that they have not be able to produce a lot of germination. Cocopeat was found to be able to stimulate cracking at 14 days after bulbs seeding with a relatively small percentage of germination, namely 6.67%. The low

germination was suspected as a result of the high abscisic acid (ABA) concentration and the suboptimal cytokinin concentration in the bulbs. The process of increasing the concentration of cytokinin was thought to occur on day 28 after planting. During the 14 days since the first sprouts appeared on the cocopeat media, it was assumed that water from the media imbibed into the onion bulbs and further reduced the concentration of ABA. Thus, the germination of dormant bulbs of onion on cocopeat media was higher than that of husk and sawdust media.

Table 1. Germination, rooting, and sprouting of dormant onion bulbs planted for one month on various growing media

Media	Germination (%)	Root emergency (DAP)	Sprouting (DAP)	Number of Root	Number Sprout	Root length (cm)	Number leaves (leaves)	Plant height (cm)
Cocopeat	20	12	14	8	3	20.5	7	7.7
Sawdust	6.7	14	14	8	2	19.7	4	6
Husk	6.7	14	16	7	2	18.1	2	5.3

Germination of onions from bulbs was the process of the emergence of shoots and roots on the bulbs. On cocopeat media dormant germination of onion bulbs occurred at 14 days after planting, and for sawdust and husk media at 16 days after planting. At the beginning of germination of onion bulbs from all planting media there was a germination of 6.7%, and there was a similarity of germination to 13.3% at 22 days after planting between sawdust and cocopeat media (Figure 1).

Dormancy bulb sprouts appeared 14 at to 16 days after planting from all tested growing media. The rate of formation of two sprouts at 22 days after planting for cocopeat and sawdust was higher than that of husk media. The rate of sprout formation of onions will be different from the three types of growing media at 28 days after planting (Figure 2).

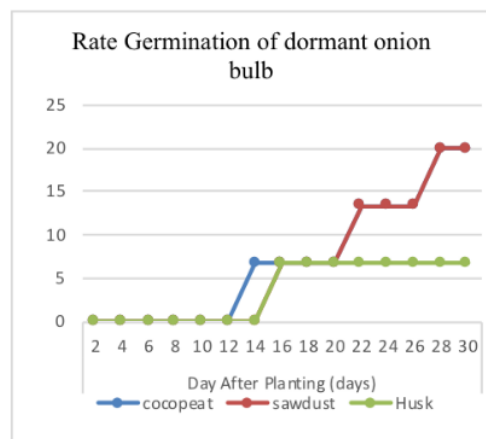


Figure 1. Rate of germination from dormant onion bulb on various growing media

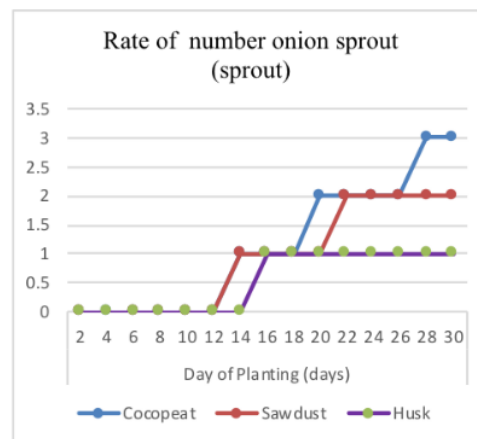


Figure 2. Rate of number sprout from dormant onion bulb on various growing media

Roots from dormant onion bulbs appeared between 12 to 14 days after planting with one root per bulb for all growing media. The number of onion bulbs continued to increase until 28 days after sowing for all planting media, and the highest number of roots occurred in cocopeat growing media (Figure 3). The roots of dormant onion bulbs appeared 12 to 14 days after planting, and could be an indicator that the germination process was starting to occur in the bulbs. The process of root formation was a process of cell differentiation triggered by auxin in onion bulbs [13]. At the beginning of germination of dormant

onion bulbs, very few roots appeared with a short size. Over time, more and more roots appeared with different length between cocopeat, husk, and sawdust media between 18 days to 26 days after planting. The rapid increase in the number and length of roots in this phase was predicted to be a result of the photosynthesis process of the existing leeks. The presence of leeks formed by bulb would stimulate the formation of auxin so that the root growth process would run quickly on bulbs that have grown.

Onion roots appeared on day 14 in all growing media with variations in length between 1 to 1.5 cm, and on day 16 the root lengths were increasingly different between the three media. Onion roots grown in cocopeat media were longer than husk and sawdust media from the beginning of the emergence of roots up to 30 days after sowing. On day of 30 it turned out that the onion roots from the cocopeat medium were longer than the sawdust and husk media (Figure 4).

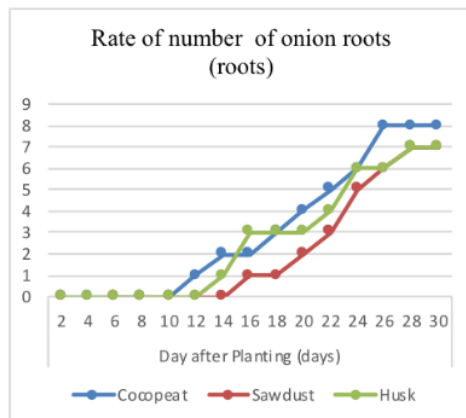


Figure 3. Rate of number of roots from onion bulb on various growing media

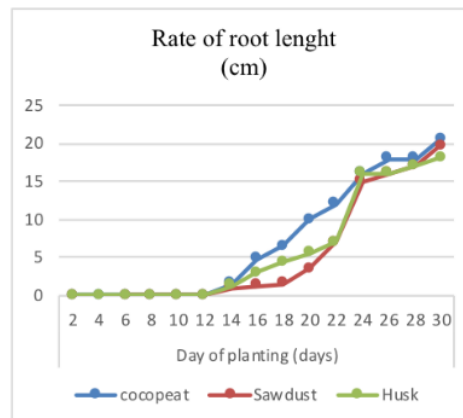


Figure 4. Rate of roots length from dormant onion bulb on various growing media

Onion bulbs at 14 days after planting began to produce shoots in cocopeat and sawdust media, and the next two days onion shoots appeared for all planting media. Furthermore, the shoots will break into leaves on day 22 after planting for all planting media. From day 24 to day 30, it was clearly seen the difference in the number of leaves from the three growing media, and the highest number of leaves was produced from onions grown on cocopeat media (Figure 5). The formation of dormant onion bulb sprouts occurred 14 until 16 days after planting for all growing media. The phenomenon of emergence of shoots occurs later than the release of roots from bulbs. However, the length of root and sprouting was closely related which was controlled by auxin, gibberellin acid and ethylene [14]; [15]; [4]. Of course, in line with the greater number of roots of bulbs planted on cocopeat media would trigger the number and length of shoots so that it was greater than bulb planted on husk and saw dust media. The number of sprouts from onion bulbs grown from the three media looked relatively the same. This was thought to be more influenced by bulbs genetic factors.

Onion plant height showed variations on the 24th day, at which time the leaves were already formed. Onion height on cocopeat media was longer than the other two growing media. The difference in plant height from the start was differences for the next day (Figure 6).

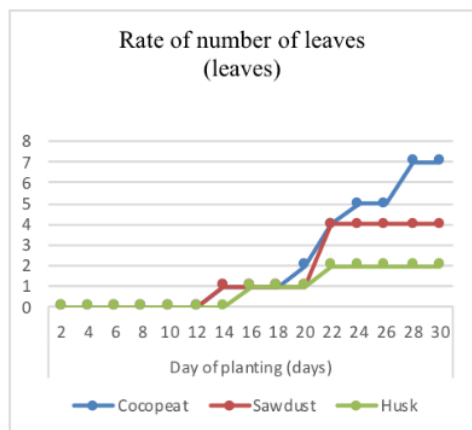


Figure 5. Rate of number from leaves on dormant onion bulb on various growing media

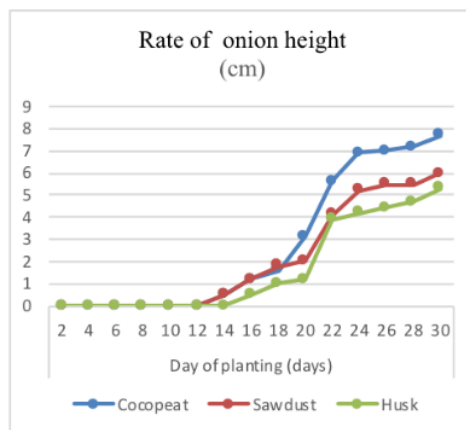


Figure 6. Rate of onion height from dormant onion bulb on various growing media

The number of leaves on the onion bulb was thought to be correlated with the height of the onion plant. The bulbs planted on cocopeat media had a large number of leaves and the long leaves were longer than the husk and sawdust media. This condition occurred as a result of the ongoing process of nutrient absorption from the media and also photosynthesis that occurred in the leaves. The longer the lateral root of the existing onion would increase the amount of nutrients absorbed by the leaves so that the formation of organic compounds would be more and more to be used in increasing the volume of the leaf blade.

4. Conclusions

The conclusions of this research were germination of dormant onion bulbs using organic material based planting media was not optimal to stimulate germination rate, root growth and shoots emerged from onion, the difference of planting media could affect the number of leaves and plant height of onions from dormant bulbs and growing media of cocopeat produced a better germination performance of onion than husk and sawdust media.

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