GROWTH RESPONSE OF PALM OIL SEEDLINGS AFTER GIVING SHALLOT EXTRACT AND DIFFERENT SOAKING TIME

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ABSTRACT

The study was aimed to recognize the growth response of palm oil seedlings (Elaeis guineensis Jacq.) in the pre-nursery after giving shallot extracts (Allium cepa L.) and different soaking time. This study used an experimental method by a randomized block design with the factorial pattern. The first factor was the concentration of shallots extract which consisted of 4 levels: 0% (B0), 25% (B1), 50% (B2), 100% (B3). The second factor was the soaking time which consisted of 4 levels, namely 0 hours (P0), 5 hours (P1), 10 hours (P2), 20 hours (P3). The total of all treatments were 16 with 2 repetitions. The data were analyzed by using analysis of variance (ANOVA), followed by Duncan's Multiple Range Test (DMRT) at a significant of 5%. The results showed that administration of shallots extract and soaking time had no significant effect on the growth (stem diameter, leaf length, root length, wet weight, dry weight) of oil palm seedlings in pre-nursery at the age of 4 until 12 weeks after planting, except giving of soaking time toward the stem diameter growth at the age of 7 weeks after planting. The application of shallots extract and soaking time was able to increase the growth of oil palm seedlings in pre-nursery starting from the 4th until 12th weeks, in spite of having no significant effect. The best treatment of shallots extracts and soaking time resulted in a different growth response of palm oil seedlings in pre-nursery.

Keywords: palm oil seedlings, pre-nursery, shallot extract, soaking time.

INTRODUCTION

Palm oil (*Elaeis guineensis* Jacq.) is a dominant plantation crop in Indonesia, which is important in enhancing the country's foreign exchange, and also has a high economic value because it is one of the vegetable oil-producing crop (Sudarso *et al*., 2015). From year to year, oil palm production is rapidly increased following and pursuing soybean oil (Lubis, 2008). The development of palm oil plantations must be able to provide high production guarantee and optimal benefit for the company. Consequently, plant materials that are planted must have high quality and can be guaranteed from seed producer institutions (Pahan, 2013). The nursery process is very much noticed to obtain the result of high-quality palm oil seedlings. A nursery is an initial activity before planting in the field. The nursery in the pre-nursery stage, sprouts are planted in small polybags up to 3 months old (Lubis, 2008). The nursery is a foundation for every successful palm oil plantation which must produce healthy seedlings having the potential to maintain large oil yields for 25 years or more (Mutert *et al*., 1999). One of the factors which improve seed quality in the pre-nursery stage is the provision of growth regulators. Growth regulators are organic compounds not plant nutrients, active in low concentrations which stimulate, inhibit or change the growth and development of plants

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quantitatively and qualitatively (Lawalata, 2011). Growth regulators applied to the plants are both natural and synthetic (Arif *et al*., 2016).

Shallot extract (*Allium cepa* L.) can be used as a natural growth regulator. However, this shallot extract is generally applied and has a good effect on the growth of dicotyledonous plants such as on long pepper plant (Siswanto, 2010), and curly chili plants (Noviansyah and Chalimah, 2015). At low concentrations (1-1.5%), this extract has no significant effect on the growth of white jasmine's bud (Khair *et al*., 2013) but it can stimulate the growth of jasmine cuttings at high concentrations (100%) (Marfirani *et al*., 2014) and it can stimulate root growth on Jatropha stem cuttings (Siskawati *et al*., 2013), as well as it can stimulate the growth of *Rosa sp*. cuttings at the concentration of 70%. (Alimudin *et al*., 2017).

Allium cepa L. is a tropical spice plant which is not only being used as a seasoning and natural growth regulator, but also has the potential as antimicrobial (Eltaweel, 2013): antibacterial (Shinkafi and Dauda, 2013), anti-fungi (Mudyiwa *et al*., 2016), and anti-yeast (Tanackov *et al*., 2009), also antifertility (Thakare *et al*., 2009). *Allium cepa* leaves and extracts have good anti-inflammatory activity. Therefore, it is useful for various diseases (Anitha and Sakthivel, 2016). Unused shallots peels are usually wasted just like that, in fact, the concentration of chemical compounds contained are very useful if they are processed for the nutrition of other plants (Siswanto, 2010). Shallots extract contains total phenol/phenolics, flavonoids, ascorbic acid, and total sugar (Srivatsava *et al*., 2015), anthocyanins (Fredotovi'c *et al*., 2017), very high kaempferol and quercetin (Savova, 2011), high carbohydrate (88.56%) and low protein (0.88 %) (Ifesan, 2017), cyanogenic, oxalate, phytate and tannin glycosides are at low concentrations, and Ca2> Mg2> Mn2> K> P> Na> Fe2 in descending order (Edet *et al*., 2015).

Directly, much benefits of shallots for human life, especially for the treatment of various diseases. But for plant life, shallots are still limited to use. There are still few studies reported that shallots extract can be beneficial in increasing vegetation growth or crop production, especially toward monocotyledonous plants. Mansi *et al*. (2017) reported that Cu-NP of shallots extract has significant potential to improve wheat growth but the expected effect depends on its concentration. Shallots also contain vitamins and starch, and phytohormones (auxin and gibberellin) (Khair *et al*., 2013). Auxin is often used for plant roots, but it is relatively expensive and difficult to obtain. Shallots can be used as a substitution for synthetic auxin. Auxin plays a role in influencing enlargement, elongation, and cell division as well as influencing nucleic acid metabolism and protein metabolism (Lawalata, 2011). Meanwhile, gibberellin functions to enhance plant growth, because it can stimulate cell division and growth leading to stem elongation and the leaf growth progresses more quickly, so that the rate of photosynthesis increases and improves overall growth, including roots (Arif *et al*., 2016).

Since shallots extract can stimulate growth by several types of plants and there is still no research that used it toward the growth of palm oil seedlings, this study is aimed to get the best growth response of palm oil seedlings (*Elaeis guineensis* Jacq.) in pre-nursery after giving shallots extract (*Allium cepa* L.) with different soaking time.

MATERIALS AND METHODS

This research was carried out from January to April 2018, in the community land of Bakaran Batu Village, Lubuk Pakam District, which is located about 7 m above sea level (BPS, 2017). The tools used were knive, hoe, meter, ruler, oven, analytic scale, 25 ml Erlenmeyer flask and container. The ingredients used were shallots extract, D x P Yangambi palm oil seedlings produced from PPKS Medan, polybags, topsoil soil, and compost. The method used was an

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experimental method with randomized block design (RBD) factorially with two repetitions, 16 treatments. The first factor was the concentration of shallots extract which consisted of 4 levels, namely 0% (B0), 25% (B1), 50% (B2), and 100% (B3). The second factor was the soaking time which consisted of 4 levels, namely without time (P0), 5 hours (P1), 10 hours (P2), and 20 hours (P3). The procedure in the research study: cleaning the area, making beds and shade, making shallots extract, making growing media, soaking palm oil seedlings according to treatment, maintenance, and observation toward the parameters of stem diameter, leaf length, root length, fresh weight, and dry weight of palm oil seedlings starting from the 4th until 12th weeks. The data were analyzed by analysis of variance (ANOVA), if it had a significant effect then continued with Duncan's Multiple Range Test (DMRT) at the level of 5% by using SAS 9.1.3 software.

RESULTS AND DISCUSSION

The results of analysis of variance (ANOVA) showed that the application of shallots extract and soaking time did not significantly influence toward the growth of palm oil seedlings in pre-nursery at the 4th week until 12th week after planting, except for stem diameter, different soaking time had significant effect toward the growth of the palm oil seedlings diameter in prenursery at the 7th week after planting. The best response from palm oil seedlings given different soaking time factors were palm oil seedlings without soaking time (P0) which had a stem diameter of about 2.39 cm. This treatment (P0) was not significantly different from the treatment of 10 hours soaking time (P2), but it was significantly different from 5 hours (P1) and 20 hours (P3) soaking time treatments (**Table 1**). In other words, to get a high stem diameter growth does not require soaking time (5-20 hours).

Table 1. Effect of soaking time toward the diameter of oil palm seedlings in pre-nursery at the age of 7 weeks.

Soaking Time (P)	Mean
P0 (0 Hour)	2.39 a
P1 (5 hours)	1.94 b
P2 (10 Hours)	2.23 ab
P3 (20 Hours)	2.00 b

Description: Numbers followed by the same notation indicate that they were not significantly different at the level of 5%.

Although statistically tested, the result had no significant effect on the growth of palm oil seedlings in pre-nursery, but when it is viewed from the average result of overall vegetation growth parameters showed that the application of shallots extract and different soaking time was able to increase the growth of palm oil seedlings in pre-nursery stage starting from the 4th week until the 12th week after planting. Based on the result of the averages, the best treatment for stem diameter growth of palm oil seedlings was the application of 100% shallots extract without soaking time (B3P0) which was able to reach the highest average compared to the other treatments. This treatment also increased the leaf length approximately 11.62 cm, higher than the other controls and treatments starting from the 4th week until the 12th week. Meanwhile, the best treatment for root length growth was the B2P1 application which produced root length approximately 29.37 cm, B2P0 application gave the highest wet weight approximately 4.79 g and B0P2 application gave the highest dry weight approximately 3.28 g of palm oil seedlings in pre-nursery at the 12th week. This treatment gave higher result than the control (root length 23.25 cm, fresh weight of 3.36 cm, and dry weight 1.67 g) and the other treatments, can be seen in **Table 2**.

One of the limiting factors for plant growth is external factors including natural ingredients (in this study is onion extract) which contains hormones and soaking time. The concentration of hormones applied to plants can stimulate growth but can also inhibit plant growth, as well as soaking time. According to Pamungkas *et al*. (2009) the immersion long time factor has an effect on increasing the root length to plant growth. The slow growth of long roots can slow the growth of plant seeds, including the length of the leaves, diameters of the stem, fresh weight, and dry weight of the plant. In addition to the soaking time, the concentration of onion extract may also affect the hormone, nutrient and other compounds contained in the onion, which is needed by the growth of oil palm seedlings in the pre-nursery. According to Davies (1995) growth regulators are only needed in small amounts to determine physiological processes, differentiation, growth, and development. Hormones are only effective in a certain amount (Gana, 2010).

Table 2. The average red onion extract and soaking time on the growth parameters of oil palm seedlings in the pre-nursery 12th week.

Treatment	Mean				
	Root Length (cm)	Fresh weight (g)	Dry weight (g)	Leaf Length (cm)	Stem Diameter (cm)
B0P0	23.25	3.36	1.67	8.09	2.97
B0P1	17.75	2.90	1.46	7.49	2.29
B0P2	25.00	5.30	3.28	11.22	3.10
B0P3	24.37	3.52	1.78	9.9	3.14
B1P0	23.37	2.99	1.47	9.47	3.12
B1P1	19.37	3.60	2.22	8.8	2.94
B1P2	20.75	2.61	1.73	8.5	2.62
B1P3	25.25	2.67	1.42	8.17	3.12
B2P0	25.37	4.79	3.02	11.02	3.31
B2P1	29.37	4.25	2.44	10.17	3.21
B2P2	18.87	3.14	1.88	9.95	3.07
B2P3	15.87	1.44	0.62	7.6	2.65
B3P0	28.50	4.65	2.23	11.62	3.67
B3P1	19.00	1.57	0.58	6.75	2.67
B3P2	20.00	2.48	1.00	9.22	3.12
B3P3	21.75	2.31	0.92	8.89	3.10

According to Khair *et al*. (2013) phytohormones in red onions are auxin and gibberellin. Red onion juice contains hormones that have a role similar to indole acetic acid (IAA) (Alimudin *et al*., 2017). Auxin plays a role in cell elongation followed by cell enlargement and increased wet weight (Siregar *et al*., 2015). Metabolism and transportation of auxin are very important for plant development. This process is integrated to ensure cellular auxin levels are determined or even gradients in tissues or organs (Rosquete *et al*., 2012). In cell development, auxin can increase osmotic pressure, increase cell permeability to water, cause a reduction in pressure on the cell wall, increase protein synthesis, increase plasticity and cell wall development (Abidin, 2010). Enlargement of the cell wall begins with the relaxation of wall stress, which allows cells to take water and grow physically. Xyloglucan endotransglucosylase cuts and joins xyloglucans. Endo- (1,4) β-d-glucanases plants may

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digest noncrystalline regions of cellulose microfibrils and release trapped xyloglucans, thereby increasing wall expansion and cell growth (Cosgrove, 2005).

The concentration of auxin in the cell depends on the part of the plant, the type of plant and the age of the plant used (Lawalata, 2011). According to Abidin (2010) the effect of a relatively high concentration of auxin on root growth will cause inhibition of root extension but increase the number of roots. Gibberellin also plays a role in supporting cell extension, cambium activity, xylem development and supporting the formation of new RNA and protein synthesis. The use of gibberellin will support the formation of a proteolytic enzyme that will release tryptophan as the origin of the form of auxin. This means that the presence of gibberellin will increase the auxin content. Likewise in this study, the concentration of red onion extracts containing auxin and gibberellin hormones is likely to cause high concentrations of hormones, especially auxin in oil palm seedlings, resulting in a lack of growth in root length, stem diameter, fresh weight, and dry weight of oil palm seedlings, so the growth of oil palm seedlings in pre-nursery becomes slow. The less effective administration of red onion extract to the growth of oil palm seedlings in prenursery may also be due to increased abscisic acid content in the seedling tissue. According to El-Ghit (2016) the application of onion extract causes higher abscisic acid content from plant seeds and lower auxin content. Likewise, the immersion time factor of oil palm seedlings with shallot extract significantly affected the growth of stem diameter in pre-nursery at the age of 7 weeks after planting. Treatment without soaking time (P0) actually gives a higher stem diameter growth compared to other treatments. This is likely to be related to the stage of development of oil palm seedlings (when soaking, the seeds are in the germination stage). The cells that make up the plant tissue in the germination stage have a high sensitivity. Plant tissue cells are meristematic so they are very sensitive to environmental changes. Meristem is an area of rapid cell division in plants; this is where the initial cells (or stem cells) are retained and organogenesis begins, such as root and shoot meristems (Cosgrove, 2005). According to Weyers and Paterson (2001) hormones play a role in controlling the physiological processes of plants. Control can be on the network that responds through changes in sensitivity, or as a combined control, where the response is determined by sensitivity and concentration. Plants appear to have homologous intracellular signaling systems. It is postulated that the mechanism of action of synthesis may be only one of several possible ways that phytohormones can control physiological processes. Cells or tissues or plant types have specific responses to signals received from outside (Talukder *et al.*, 2015). Fosket (1994) also argues that the meristematic region of embryogenesis produces the body of the plant by producing cells that become leaves, stems, and roots. Meristematic activity is governed by physiological and environmental signals, so meristems are inactive when conditions are not favorable to growth, but save potential for growth. The pattern of cell division in the meristem will determine the placement of leaves and tissue organization in plant organs. Likewise, oil palm seeds which are soaked with red onion extract will absorb minerals and hormones contained in the onion extract to affect the activity of the inner cell metabolism in sprout tissue of oil palm seedlings. Accordingly, in the pre-nursery phase, endogenous and exogenous hormones possibly interact based on cell sensitivity which structures the organ of oil palm seedlings leading to the growth of oil palm seedlings. Because of the possible concentration of red onion extract concentration and soaking time which was given to oil palm seedlings did not provide any advantage on the cell division process in cell extension and enlargement, it occured potential storage for the growth of treatment oil palm seedlings. Thus, onion extract and different soaking time application for oil palm seedlings did not have any effect on the vegetation growth, but those treatments could increase the growth of oil palm seedlings in pre-nursery phase.

CONCLUSION

The application of red onion extract (*Allium cepa* L.) with different concentration and soaking time did not significantly influence the growth of leaf length, root length, fresh weight, dry weight, and stem diameter of oil palm seedlings in the pre-nursery phase at 4th - 12th weeks, except to the stem diameter at the 7th weeks. The application of soaking time significantly affected the stem diameter of oil palm seedlings in the 7th weeks old after planting, which reaches the highest size of 2,39 cm on the seedlings without soaking time. Even though red onion extract and soaking time application do not significantly effect but it can increase oil palm seedlings growth in pre-nursery phase which commences from the 4th weeks to 12th weeks. The best treatment of red onion extract and soaking time produce a different response for oil palm seedlings growth in pre-nursery phase.

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