Chitosan And Composition Media For Improving The Growth Of Seed Sawo (Achras zapota L)

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Abstract. The optimal Sapodilla plant is cultivated as a garden plant to enjoy the fruit and the fruit tree is also long-lived. The duration of the brown seed germination (generative) is influenced by the hard nature of the seed coat so that it is difficult, to penetrate water and oxygen and cause dormancy to occur. The research aimed to determine the effect of immersion with chitosan as a growth regulator and planting media for the effectiveness of the growth sapodilla seeds. The experiment arranged factorially using Randomized Complete Design (RCD) and provided with 3 replication. The treatments consisted of 4 levels of planting media and 4 levels of chitosan concentration. The results revealed that germination of sapodilla were not influenced significantly by chitosan concentration and the media composition. Even though, there was a tendency that germination and the growth of treated seeds with 4 mL of fitosan were relatively better than control. In addition, the media composition (1;2;1) resulted the relative better of seed growth.

1. Introduction

Sawo is called also neesbery or Sapodillas in Indonesia, widely grown in the lowlands up to an altitude of 1200 m above sea level. Optimal sapodilla plants cultivated in the wetter areas to dry in Indonesia. Sawo generally cultivated as garden plants to enjoy its fruit and the fruit trees are also long-lived [1]. Tree and its fruit is known by several names such as sapodilla, anchor or anchor manila. A large and shandy trees can grow up to 30-40 m, lower branched, stem ruddy brown blackish-gray to dark brown. According [2] Plant sapodilla adaptable at various temperatures between 22-32 degrees Celsius, which is enough sunlight, other than that the plant is tolerant of shady circumstances (shade).

Sapodilla plant propagation can be done in generative and vegetative [3; 4]. The duration of the germination of seeds of sapodilla (generative) due to the nature of the hard seed coat so difficult penetrated by water and oxygen [3]. Sapodilla seed treatment requires breaking the skin hard to overcome the problem of seed dormancy in amber during the process of germination. Giving chitosan as PGR to brown plant is able to accelerate the growth of crops, higher crop yields and cropping becomes shorter lifespan.

According to [5] chitosan to prevent and treat the plants from diseases due to viruses, fungi and bacteria (vaccines and antibiotics). Chitosan is the utilization of shrimp shell waste is processed by gamma radiation and electron beam into oligochitosan. According to [6;14;30] Chitosan can control many pre- and postharvest diseases on different crops. [31]Chitosan also possesses several favorable biological properties such as biodegradability, biocompatibility, and non-allergenicity. In other words based [7], chitosan has been proven to stimulate plant growth, to protect the safety of edible products, and to induce abiotic and biotic stress tolerance in various horticultural commodities. This study is
focused to investigate the effect of immersion with chitosan as plant growth regulators and growing media composition on the germination and the growth of sapodillas.

2. Methods
The research was conducted at Greenhouse Faculty of Agriculture University of Sebelas Maret in March 2017 to June 2017. This study was arranged as a two-factor factorial experiment in a completely randomized design (CRD) with three replications. The first factor was the composition of the growing media (soil: compost: sand), which consists of 4 levels including soil: compost: sand (M1) 1: 0: 1 soil: compost: sand (M2) 1: 1: 1, ground: compost: sand (M3) 2: 1: 1 and soil: compost: sand (M4) 1: 2: 1 and the second factor was the concentration of chitosan which consists of four levels (k1= 0, k2 = 2, k3 = 4 and k4= 6 mL/L).

The observed responds were appear shoots, germination, plant height, leaf number, and leaf color. The data were analyzed using the F test and Duncan Multiple 5% level (Duncan's multiple range test) level of 5%.

3. Result and discussion
3.1. Germination
The amount of seed germination germinated in growth media at a predetermined time and is expressed as a percent. The average effect of concentration chitosan on the germination sawo shown on (Figure 1).

![Figure 1. Effect of concentration on the germination of grown chitosan](image)

Figure 1 revealed that the germination was not influenced by the chitosan or same with control because of concentration chitosan that giving to seed no more than 4 mL/L. According to [7; 28; 29], germination was not influenced by the chitosan if giving 2 mL/L.

Treatment concentration chitosan 4 mL/L and 6 mL/L the highest yield in increasing germination of sawo with an average germination of 66.67% compared to 4 mL/L with an average of 58.33%. Sapodilla germination Gunung Kidul varieties used in this study is 66.67% lower (<80%) because it is influenced by genetic factors such as time of sapodilla seed dormancy, seed maturity level and size of the seed.

According to the explanation [8] states that the factors affecting the growth of seedlings genetic factors other than internal or external or environmental factors also grow. Imbibition process on the seed useful to increase the water content of the seeds and activates the enzyme, after it entered into the endosperm and overhauling food reserves. Reshuffle the compounds soluble in water and diffuses. According [9] chemical scarification can be done by soaking to soften endocarp and dispose inhibitors. Good results should be considered regarding the comparison of seed by soaking solution, temperature and soaking time.

Fitosan help improve the germination of sawo because of the supportive environment. This is in accordance [10] the effect of chitosan on seed germination properties are temperature and soil moisture around the seeds are treated. According to [11] chitosan has a fiberglass-forming properties are very good, so it is easy to form a semi-permeable layer on the surface of the seeds can retain
moisture absorbs seed and soil moisture, so as to increase seed germination. According to [12], treatment of chitosan improve seed germination and growth better.

3.2. Shoots appear
Shoots are part of new plants grow from sprouts or buds that are above the soil surface / media. The use of media concentration and composition chitosan not affect when shoots appear. The effect of concentration chitosan appear brown buds are on (Figure 2).

![Figure 2](image) Effect of concentration of chitosan on sapodilla shoots appear sapodilla

Currently the fastest shoots appear at a concentration of 4 mLL with value 32.33. When compared with controls (0 mLL) chitosan able to break dormancy and hasten germination. This is consistent with the results of research [13] chitosan application on chili seeds by soaking for 24 hours 50 ppm and 50 ppm spraying every 1-2 weeks improve germination. Potatoes and soybeans showed an increased yield and have a rapid germination. According to [14] chitosan on rice with 40 ppm able to improve germination and more production. The content of the hormone auxin, gibberellins and cytokinins in fitosan give each hormone effect against brown plant. Active auxin functions during the process of cell division and elongation will increase the activity of brown plants that encourage buds appear earlier. Giberelin able to push the microtubule orientation in the direction of the axis of cell growth and accumulation of cellulose and in the end only to the axis of the enlarged cell growth so that the shoots elongated [15].

3.3. Plant height
Plant height constitute crop growth indicators is done by measuring stem plants bordering the ground to the point of growing plants using a ruler. The chitosan concentration on plant height presented in (Figure 3).

![Figure 3](image) Effect of concentration on plant height chitosan
Figure 3 showed that the treatment concentration that could increase the growth at a concentration of 4 mLL with an average plant height of 4.14 cm. Chitosan was able to increase plant growth at appropriate concentrations. This is in accordance with the opinion [16] which states that the application of chitosan in the early stages of growth to increase the growth of plant height. Their fitohormon in fitosan affect plant growth. The hormone is auxin, gibberellin, and cytokines. This is in accordance with the opinion by [17] which states that the low molecular chitosan-containing plant hormones such as indole acetic acid (auxin), cytokinin (kinetin and zeatin) and gibberellin acid that promotes growth auxin plant. Hormone role is to stimulate the elongation of the growing point of influence rod, stimulates lateral root formation, and stimulate the differentiation process. According [18], a hormone IAA at certain concentrations in plants can stimulate the growth of long-stem plants and increases apical dominance, so the plants can grow taller. In addition to hormone IAA, chitosan also contains hormone gibberellins which can stimulate the growth of plant height, cell division and growth and stem elongation.

Lowest plant height at a concentration of 2 mLL, This is because the plant contains very little hormone that uninterrupted growth. Giving low concentrations, auxin can act as inhibitors for the enzyme can not catch the concentration that tends to hamper growth. This is in accordance with [19] that phytohormones play an important role in controlling plant growth and development at very low concentrations, at high concentrations of these compounds would be toxic. The average yield of the effect of media composition on the plant height is presented in (Figure 6).

![Figure 4](image_url)

**Figure 4.** Influence of media composition on the plant height

Figure 4 showed that the treatment composition of different media can improve the growth of plant height. The highest of plant height (1.66 cm) at age 6 WAP was resulted by the media with composition (M4). According [20], the addition of compost (organic material) has a good influence on the physical properties of the soil, add humus very positive effect on the physical properties of the soil, maintain soil structure, and filled with enough oxygen and improve water absorption. The soils will be able to hold a lot of water to form ground water that is useful, to support plant roots in absorbing the nutrients for plant growth. The composition of the media treatment of M1 increased plant height better than M2, M3, M4 at age 7 to 12 MST. According to research [21] which resulted in the availability of water is not optimal. Less water availability will affect plant height growth. Although maximal availability of water in the growing media plant sapodilla still able to tolerate drought and to maintain the rate of photosynthesis in water stress conditions [22].

### 3.4. Number of leaves

The number of leaves determines the result of photosynthesis in plants. The process of photosynthesis is influenced by environmental factors one of them light. The effect of concentration and soaking time fitosan on the number of leaves are presented Figure 5.
Figure 5 indicated that application chitosan of 4 mL resulted the highest number of leaves, the highest was 2.75 strands at a concentration treatment chitosan 4 mL. Treatment concentrations of 2 mL has an average number of the lowest leaves are an average of 2.42 leaves. According to [23] plants treated with chitosan have larger leaves and more. Application of chitosan also shorten the vegetative phase and accelerate flowering plants. The number of leaves K1 control plants (0 mL) is 2.58 strands. When compared with control plants, chitosan have the effect of increasing the number of leaves. This is because the growth and division of normal cells. In the opinion of [24;27], the application of chitosan can act as fertilizer to strengthen the growth of plants. In addition, chitosan is also able to increase the effectiveness of photosynthetic chlorophyll content so as to be increased. Plants treated with chitosan have larger leaves and more.

3.5. Leaves color
The leaves are an important part for the plants because the place of photosynthesis process occurs. The observed of leaf color to determine the content of the pigment contained in the leaves brown are shown in Figure 6.

This occurs because function of nitrogen that is to be part of the chlorophyll molecule that controls the ability of plants to perform photosynthesis. Nitrogen acts as a constituent of chlorophyll. According [25] high nitrogen content makes the foliage greener and last longer. Nitrogen deficient plants color the leaves become pale yellow to dark green.

The method used to take the automation notation in the manual color process book is to match the leaf sample to the book by attaching the leaf to a dry condition. The leaf color notation obtained at the time of observation is 30% Y 75 50 which means brown leaves have a cyan overall color at 30% with a yellow color at level 75 and a darkness value of 50. Light plays an important role in the formation of chlorophyll, but in research this light has not been able to be optimized, so it becomes one of the
limiting factors in the formation of chlorophyll. In the opinion of [26] if the environment is supportive, water is available and temperatures are appropriate then sunlight is a limiting factor for growth. Light absorbed by the leaves is used for the synthesis of chlorophyll which is then converted into chemical energy in photosynthesis. Chlorophyll is the main pigment in plants. Chlorophyll has the main function in photosynthesis which is utilizing solar energy, triggering CO$_2$ fixation to produce carbohydrates and providing energy.

4. Conclusion

The interaction between chitosan concentration and media composition gave a non significant effect on all observed responds. The administration of chitosan concentration of 4 mL resulted good for germination, number of leaves, and leaf height, while the best buds appear was obtained by the application of chitosan concentration of 6 mL.

This finding shows that on Figure 2.

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