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Effect of Concentration and Length Time of Soaking Seed in Gibberellic Acid (GA3) on Germination and Growth of Christmas Palm (*Veitchia merilli* (Beec) H. F. Moors)

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Abstract: ***This research aimed to study effect of concentration and length time of soaking seed in Gibberellic Acid (GA_3) on Germination and Growth of Christmas Palm (Veitchia merillii (Beec) H. F. Moors. The research was conducted from May 2013 to August 2013 at Screen House of Sabrina Flora Company, Tangerang, Banten, on 30 m above sea level. Randomized Block Design (RBD) was used, consisting of two factors and three replications. The first factor was the concentration of Gibberellic Acid that consisted of 0 ppm, 50 ppm, 100 ppm, 150 ppm, and 200 ppm. The second factor was the lenght time of soaking that consisted of 12 hours , 24 hours, 48 hours, and 72 hours. The result of this research showed that there were no interaction effect on germination percentage, plant height, root length, fresh weight and dry weight of seedling. The best concentration and length time of soaking for chistmas palm were 200 ppm and 48 hours.***

Keywords: Veitchia merillii, seed, germination, growth, Gibberellic Acid (GA_3)

1. Introduction

Veitchia merilli, originally from Madagascar, is a tropical palm which is often planted by the road or as a landscape ornament. Veitchia merilli is a species of palm of which reproduction is occured through seeding. The seed must germinate quickly to get a new plan seed in a short period. Slow germination indicates an obstacle in the cultivation of palm, due to dormancy of the palm seeds. The seeds germinate within 3 to 4 weeks following its planting, this may come as a detriment to the cultivations [1]. Besides, the growth of palm seeds are also very slow, consequently it requires efforts to accelerate the germination and growth of veitchia merilli. It is related with the increasing of demands of palm trees and the existance of dormancy. It is necessary to make an attempt to resolve dormancy and accelerate the germination of seeds. Gibberellins (GA3, GA4, and GA7) have shown to break dormancy in numerous genera of seeds [2].

Gibberellin needed for germination and budding. Result of hydrolysis of food in the seed will be distributed to growing point and will produce germination, some spesific effect of GA3 to trigger seed germination among others, led to the growth of embrionis axis, develop cotyledon cells and trigger enzyme (amilase, protoase, lipase) activity primarily to convert fat into sugar.

Growth regulators have effect in growth and development [3]. The use of Gibberellin (GA3) 100ppm concentration can accelerate the germination a*rchonthophoenic alexandrae* and *ptychosspermaemarcharturii* palm [4]. The use of growth regulators Atonic 2mL/L can accelerate the germination of *roystonea elata palm* (Bart Harper). Gibberellins in seed soaking time can affect the actifity of Gibberellin in the seed, because the longer the seed will be more and more immersed into the seed that Gibberellin. According on these problems, it is necessary to study on the effect of concentration and soaking time of seed in Gibberellic acid on the growth of v*eitchia merilli* seed

2. Materials and Methods

The experiment was conducted in Sabrina Flora Desa Pangkalan Teluk Naga Tangerang, Banten Indonesia with a height of 30 metres above sea level. The experiment performed in the screen house and carried out from May to August 2013. The materials used are *Veitchia merilli* seeds taken from the ornamental plant cultivation garden Sabrina Flora, regulators body gibberellic acid, polybags plastic (15x20), compost media, distilled water, alcohol 75%. The instruments used in this study are black paranet (intencity 50%), measuring cups, stirres, plastic tubs, analitic scales, hygrometer, thermometer, high measuring tools, emrat, labels and stationery, as well as camera.

The experiment was conducted with Randomized Factorial Design consisting of two factors and three replicants. The first factor is the concentration which consist of : k_0 : 0 ppm, k_1: 50 ppm, k_2: 100 ppm, k_3: 150 ppm, and k_4: 200 ppm. The second factor is the length of soaking seeds in solution of GA3 (L), which consist of four levels, namely 1_1: 12 hours, 1_2: 24 hours, 1_3: 48 hours, dan 1_4: 72 hours. Data were analyzed by ANOVA (analysis of variations) and Duncan Multiple Range Test 5%.

3. Results and Discussion

3.1 Power of Seed Germination

Statistical analysis showed no effect of interaction occurs between the concentration and length of soaking seed in GA3 on *Veitchia Merilli* seed. Table 1 shows that the application

of GA3 can increased seed germination. Increased concentration of 50 ppm to 150 ppm did not increase seed germination, but the increasing of GA3 to be 200 ppm concentration, increased seed germination. Concentration of 200 ppm GA3 produce the highest seed germination.

Seed germination is regulated by several hormones that work in stage. Imhibition process causes water on the seed embryo produced gibberellin. Gibberellin activate hydrolytic enzyme involved in the digestion of food reserves in the seed. Gibberellin help accelerate amylase hydrolysis to sugars maltose and glucose. The more availability gibberellin, amylase hydrolysis process is also faster and simple sugars produced are also growing. The existence of high energy reserves that can stimulate cell division and elongation so that the growth of sprout increases, consequently the quality of the resulting sprouts become better. Gibberellin already in low concentrations can effect growth and development, but at high concentration will not take effect or cause a negative reaction to the plant [5].

According to Table 1, shows that the increase of soaking seed in GA3 can increase the germination of seed. The soaking time of 48 hours of germination of seeds higher than 12 hours, but an increasing time of 48 hours to 72 hours is not improve the germination of seeds, therefore, soaking time 48 hours is quite effective to produce higher germination compared to other treatment.

Table 1: The effect and length of soaking in Gibberellin acid on seed germination *Veitchia Merilli*

Treatments	Germination (%)
Gibberellin	
k_o (0 ppm)	28.28 a
k_1 (50 ppm)	51.67 b
k_2 (100 ppm)	53.00 b
k_3 (150 ppm)	54.00 b
k_4(200 ppm)	60.33 c
Soaking Time	
1_1 (12 hour)	45.41 a
1_2 (24 hour)	47.33 ab
1_3 (48 hour)	50.95 bc
1_4 (72 hour)	54.13 c

Description : values followed by the same letter in the same column are not significanty different at Duncan Multiple Range Test 5%.

Long soaking seed in GA3, determine the amount absorbed GA3 seed, the longer soaking, GA3 which absorbed the higher seed. Provision of Gibberellin acid as a growth regulator substances can stimulate cell division [6]. Embryo growth during germination depends on the preparation of foodstuff which are within endosperm. After the resting phase is over, then the metabolic activity increases accompanied by the enzyme activity and respiration. With the increasing number of GA3 is absorbed then the higher enzyme activity, reform of the higher food reserves that will ultimately improve the germination of seeds.

Baskin and Baskin [7] found positive effect for soaking in GA3 solution on early germination of Osmorhiza claytonii (apiaceae) seeds. It was reported that GA3 is effective in breaking of non-deep physiological dormancy, but it does not overcome the deep physio- logical dormancy [8]. Lack of GA 3 effectiveness in increasing final germination of Kelussia odoratissima might be seen as the possibility of Kelussia odoratissima seeds to have the deep physiological dormancy. But GA3 treated seeds germinated earlier.

Some studies have also shown that the results of exogenous application of GA3 on the breaking of seed dormancy and seed germination can differ widely among species and within species [9[. Other traits such as days to first germination and days to 50% germination were also affected by GA3 treatment. Rahman and Park [10] have found a significant number of *Koelreuteria paniculata* germinated seeds after treatment with GA3, but no significant differences in germination was observed among seeds treated with 100, 200 and 300 ppm GA3.

Physiological dormancy in seeds of some plants depends on the ratio of levels of growth inhibitor (abscisic acid) and growth promoter (gibberellic acid). This has been tested in species such as *albizia grandibracteata*, where three concentrations of gibberellic acid promoted germination with respect to the control [9]. In the metabolic activity, Gibberellic acid has an important role. This growth hormone produced by the embryo then distralokasi to eleuron layer so as to produce the enzyme amylase. The next process is the enzyme into the endosperm. As a result of the inclusion of the enzyme into the endosperm, then there was a change that is changing starch into sugars and produce useful energy for amylase activity is acid. Treatment soaking time associated with the beginning germination phase characterized by water absorber (imhibition then going on softening the seed coat so that dehydrates protoplasm. Therefore, it takes a certain soaking time to allow water into the seed.

3.2 Plant Height

High palm seeding aged 2 week after germination (WAG) to 12 WAG is not influenced by the interaction between concentration and soaking time gibberellin. From aged 2 to 12 WAG gibberellin applications from 50 ppm to 200 ppm increase *veitchia merilli* seedlings compared to those without gibberellin. At the age of 2 to 6 WAG gibberellin concentration of 200 ppm generate high palm seedlings higher than other treatments, but at 8 to 12 WAG gibberellin increase concentration of 50 ppm to 200 ppm does not increasing seeding height. This is in line with the result of Nuraini[1] research which state that the king of palm seed soaking with a solution 100 ppm gibberellin can increase the height or length plumula seeds that will growth into leaves.
According Weaver [11] gibberellic acid stimulates cells elongation, due to amylase hydrolysis process which is activated by gibberellic acid. As a result of this process, the sugar concentration increases resulting osmotic pressure within the cell rises so there is a growing tendency of these cells. With the cell elongation will cause increased plant height. Gibberellin is a hormone that can be found in nearly all plant life cycle. These hormones affect seed germination stem extention, leaf expansion, flower induction, the development of seed and pericarp growth[2].

3.3 Root Lengh

Veitchia Merilli palm seedling root length was not influenced by the interaction between the concentration and length of soaking the seeds in gibberellins. Root length was not affected by the concentration of gibberellins but influence by soaking time (Table 3). Seeds are soaked in gibberelin for 72 hours resulted in root length longer than those soaked for 48 hours but no different from those soaked for 12 and 24 hours. Most of endogenous hormones in plants located in the meristem tissue that is actively growing tissues such as shoot tips/ crown and root. Hormone gibberellic acid did not affect the length of the roots of plants because roots also synthesise gibberellic acid, gibberellic acid but cause little effect on root growth, and will inhibit root growth. Wounding in the root system will lead to concentration of gibberellic acid on the canopy decreased sharply, it shows that most of the supply of gibberellic acid on the canopy comes from the roots through the xylem. Roots are harmed repeatedly can not supply water and mineral nutrients in sufficient quantities to maintain the ability to synthesize editorial gibberellic acid alone[3].

Table 2: Effect of the concentration and length of soaking in gibberellic acid to the height of veitchia merilli seedlings aged 2 to 12 WAG.

Treatments	Plant Height (cm)					
	2 WAG	4 WAG	6 WAG	8 WAG	10 WAG	12 WAG
Gibberellin						
k_o (0 ppm)	0,93 a	3,42 a	13,08 a	22,16 a	28,54 a	30,97 a
k_1 (50 ppm)	1,36 a	4,12 b	14,66 b	24,65 b	31,62 b	34,49 b
k_2 (100 ppm)	1,56 b	4,27 b	15,12 b	25,40 b	32,53 b	35,54 b
k_3 (150 ppm)	1,89 c	4,50 b	15,23 b	25,54 b	32,56 b	35,65 b
k_4(200 ppm)	2,18 c	5,11 c	16,73 c	26,70 b	33,98 b	37,02 b
Soaking Time						
1_1 (12 hour)	1,22 a	3,77 a	13,40 a	23,11 a	29,93 a	32,80 a
1_2 (42 hour)	1,50 b	4,20 ab	14,79 b	24,59 ab	31,65 ab	34,49 ab
1_3 (48 hour)	1,69 bc	4,41 bc	15,32 bc	25,35 b	32,20 ab	35,03 ab
1_4(72 hour)	1,92 c	4,76 c	16,35 c	26,50 b	33,62 b	36,62 b

Description : values followed by the same letter in the same column are not significanty different at Duncan Multiple Range Test 5%.

Soaking time effect on root length due to the water while soaking imbibis process that can soften the seed coat .Selainitu , with the longer soaking seed in GA3 will increase the activity of enzymes-hydrolase enzymes that convert starch into simple sugars that will be used for root growth. This is supported by research results Nurshanti [12] which mentions the king palm seed soaking with 100 ppm may increase the length of root seed when compared to treatment without gibberellins.

Salisbury and Ross[3] states that giberelin not only spur the stem extension but also the growth of the whole plant, including the leaves and roots. One effect of gibberellin on seed is encouraging cell elongation aradikulasehingg can penetrate the skin endosperm of seeds or fruit skins that limit growth. Gibberellins stimulates the synthesis of auxin that is needed for root growth .Radikula are candidates for root that is used to absorb nutrients and minerals from the tanah.Oleh therefore radicle growth rate can affect plant growth stage next princess palm, because the roots are longer will be able to absorb nutrients and minerals more than roots more short.
Fresh weight and dry weight of seedlings was not affected by the concentration of gibberellins but is affected by long soaking seed in GA3 (Table 3). Salisbury and Ross[3] and Sitompul and Guritno [13] stated that the weight of the wet plants can indicate metabolic activity of plants and plant fresh weight value is influenced by the water content, nutrients and products of metabolism. The higher the water content and the metabolism are contained within the plant tissue, the higher the weight of the fresh, as well as on the nutrients available to plants. Production plants are usually more accurately expressed by the size of the dry weight than the weight of the wet, because the wet weight is influenced by moisture [13].

Giving some gibberellic acid concentration gives the same effect relative to the dry weight of palm seeds, palm seeds for the growth of the gibberellic acid were focused on cell elongation and cell enlargement less trigger, so that despite the different seedling height but gives equal weight. In addition to the performance of gibberellic acid which can accelerate the hydrolysis of starch, fructan, and glucose to glucose and fructose molecules will indirectly accelerate the process of respiration so that the accumulation of starch is reduced, and the dry weight would be reduced. This is in accordance with the opinion of Gardner [14], which states that the results of the dry weight of the plant is a balance between taking CO_2 (photosynthesis) and release CO_2 (respiration).

Table 3: Effect of Concentration and Old Seed Soaking in gibberellic acid to the length of roots of seedlings *Veitchia merilli*

Treatments	Root Length (cm)	Fresh Weight (g)	Dry weight (g)
Gibberellin			
k_o (0 ppm)	24,28 a	1,20 a	3,52 a
k_1 (50 ppm)	25,55 a	1,27 a	3,55 a
k_2 (100 ppm)	26,57 a	1,22 a	3,53 a
k_3 (150 ppm)	25,38 a	1,24 a	3,65 a
k_4 (200 ppm)	25,82 a	1,29 a	3,64 a
Soaking Time			
1_1 (12 hour)	24,74 ab	1,19 a	3,44 a
1_2 (42 hour)	26,05 ab	1,20a	3,48 ab
1_3 (48 hour)	24,29 a	1,30 b	3,65 ab
1_4 (72 hour)	27,01 b	1,30 b	3,76 b

Description : Values followed by the same letters in the same column are not significantly different with Duncan's Multiple Range Test 5 %

4. Conclusions

There is an interaction between the concentration and length of soaking the seeds in gibberellic acid (GA3) on seed germination and seedling growth of palm princess. Concentration of 200 ppm and duration GA3 soaking seeds in GA3 for 48 hours is the best treatment to improve germination and seedling growth of palm princess. Concentration of 200 ppm and duration GA3 soaking seeds in GA3 for 48 hours can use to improve germination and seedling growth of palm princess.

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