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DORMANCY BREAKING OF RED BEAN SEEDS (*Vigna angularis)* WITH HOT WATER, COLD WATER AND H_2SO_4 TREATMENT

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Abstract

This study aims at investigating the effect of dormancy breaking treatment on red bean seeds (*Vigna angularis)* by using cold water, hot water and H_2SO_4 treatment and knowing the materials which can break dormancy fast on red bean seeds. This study is done in quantitative research desain by using 15 pots and each pot is filled with humus, watered than labelled "cold water, hot water and H_2SO_4" with duration of red bean seeds soak for 5 minutes, 10 minutes and 30 minutes. The available red bean seeds are 30, each of the pots is filled with 2 soaked red bean seeds. Parameters which are used in this study are temperature, light and watering. Observed variable during this study is the speed of red bean seeds germination with the materials used for treatment, and the measured variable is average of germinatin height. The result of the fastest dormancy breaking is by soaking the seeds in hot water for 5 minutes, 10 minutes and then followed by H_2SO_4 50 % for 30 minutes, and cold water for 30 minutes. Germination growth in soaking seeds with H_2SO_4 10 % is slow at the first germination, but the growth of the plant's heigh is faster, proved by the growth of red bean seed plant on the tenth and twelveth day. Over all, the highest red bean after 15 days is the soaked seeds using hot water, H_2SO_4 10%, H_2SO_4 50% and cold water. While the soaked seeds using H_2SO_4 98% don't grow.

Keywords : Dormancy, Red Bean Seeds, Dormancy Breaking, Treatment Effectiveness

A. INTRODUCTION

Dormancy is a state experienced by living organisms or parts thereof in response to a state that does not support normal growth. Dormancy triggers can be mechanical , physical state of the environment, or chemical. While germination is an early stage of development of a plant, especially the seed plants . In this stage, the embryo in the seed which was originally located in a dormant condition experience a number of physiological changes that cause it to develop into young plants. This is known as a young plant sprouts.

Dormancy breaking in the seeds of plants, seeds requires media and influenced by several factors, one of which is water, which has an important function in dormancy breaking and germination of plant seeds, red beans are no exception. By different soaking treatments with water and certain chemicals, such as sulfuric acid with different concentrations will be able to produce a period of dormancy and germination of seeds of different , corresponding concentrations apply. Causes of dormancy is the low / no water imbibition process, the process of respiration depressed / inhibited, low food reserves mobilization process, low metabolic processes of food reserves .

The presence of water in the cell activates a number of enzymes early germination. Phytohormones abscisic acid levels decreased, while gibberellins increase. Increased hormone gibberellin stimulates of cell division in the active conduct of mitosis, as at the end of the radicle. As a result, the size of a large and growing radicle skin or

shell pressed from the seeds, which eventually burst. At this stage the necessary preconditions that shell beans are soft enough for the embryo to be broken.

Sulfuric acid (H2SO4) is a chemical substance that is able to increase the percentage of germination in seeds that have a hard seed coat dormancy . This is caused by H2SO4 facilitate the lignin content of the seed so that the seed cavities . This causes the water easily fit so the seeds easily germinate. Solution of concentrated sulfuric acid (H2SO4) causes damage to the seed coat and can be applied both to the legume and non- legume . The duration of treatment of acid solution must consider two things: the seed coat or pericarp can cracked to allow imbibition and the acid solution is not about the embryos . Soaking for 1-10 minutes is too fast to be able to dormancy break , while soaking for 60 minutes or more can cause damage (Schmidt , 2000 in Winarni, 2009).

According to Sutopo (2004) in https://id.wikipedia.org/wiki/Dormansi, said that the treatment with sulfuric acid can make the skin of the seed or seeds becomes easier to enter the water at imbibition process. Strong acid solution such as H2SO4 often used with varying concentrations until thick depending on the type of seed that is treated, so that the seeds skin becomes soft. Beside that also the chemical solution used can also kill fungi or bacteria that can make dormant seeds .

Research on the mindi seed shows that the fastest normally achieved after treated seed immersion in 12 N H2SO4 for 10 minutes (Soeherlin, 1996 in Silomba 2006). Research on African wood seed shows that the seeds soaked in a solution of H2SO4 with a concentration of 20 N and the soaking time 20 minutes can improve germination by 91.6 % compared with the control (no treatment) amounted to 57.7 % germination power (Kurniaty, 1987 in Silomba 2006).

Red bean plants belonging to plant shrubs vines that require buffering when growing. Red bean plants have compound leaves and elliptic leaf litter of three. A height of about 3.5 m to 4.5 m. While fruit pods and elongated shape. In one pod there are generally 2 to 3 red beans. Red bean seed form has a size larger than the green beans or green beans with seed coat color dark red or red brick. If the skin is peeled seed, it will look white beans. Red bean plants can grow well in cold or wet temperate areas with altitudes between 1,400 m to 2,000 m above sea level. Temperature needed to grow red beans is about 16oC to 27o C with rainfall between 900 mm to 1,500 mm per year. But can also grow in rainfall between 500mm to 600 mm, but in the planting season. Red beans will grow well in soil that has a pH between 6.0 to 6.8 with a good drainage system.

In this study the authors wanted to investigate how differences in dormancy until red beans seed germination with using hot water, cold water and chemicals sulfuric acid concentration treatment and a different time

B. MATERIALS AND METHODS

Mini Research was conducted in the greenhouse State University of Medan, on 18 September 2015 - October 2015. Working procedures performed by selecting 30 red beans that are experiencing seed dormancy, providing hot water (100 ^{0}C) of 50 ml , providing cold water (room temperature) of 50 ml , providing H2SO4 10 % as much as 54 ml , providing 50 % H2SO4 as much as 59 ml , providing H2SO4 98 % 25 ml, soaked each of the 2 red bean seeds in hot water (100 °C) for 5 minutes, 10 minutes and 30 minutes, soaked each of the 2 red bean seeds in cold water (room temperature) for 5 minutes, 10 minutes and 30 minutes, soaked each 2 seeds red beans in H2SO4 10 %, for 5 minutes, 10 minutes and 30 minutes, soaked each 2 seeds red beans in H2SO4 50 %, for 5 minutes, 10 minutes and 30 minutes , soaked each 2 red bean seeds in H2SO4 98 %, for 5 minutes, 10 minutes and 30 minutes, beans poured every day, data collection is done for two weeks.

Analysis of the data used to process mini research data results are one-way analysis of variance technique. This research method to test the equality of two population mean that each independent distribution, normal distribution and has a homogeneous variance. The hypothesis of ANOVA (analysis of variance) : H0 : μ1 = μ2 = μ3 = ... = μn, There are no significant difference between dormancy breaking soaked red beans seed and old soaking beans with cold water, hot water, sulfuric acid 10 %, 50 % and 98 %. H_1 : $\mu_1 \neq \mu_2 \neq \mu_3 \neq ... \neq \mu_n$, There are significant differences between dormancy breaking soaked red beans seed and old soaking beans with cold water, hot water, sulfuric acid 10 %, 50 % and 98 %. The variables that were observed during the conduct of research is red bean seed germination speed with treatment material, obtained from :

$$\text{Height average} = \frac{N\,T + N\,T + \ldots\ldots\ldots + N\,T}{\text{The total number of seeds that germinated}}$$

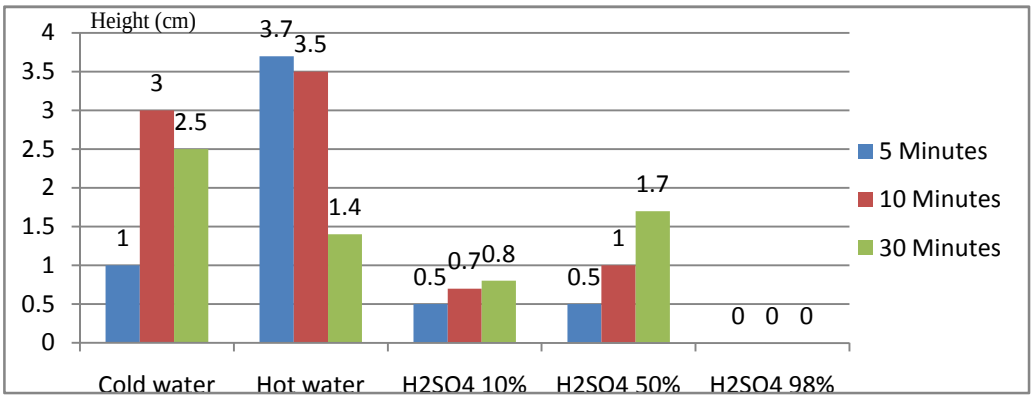
Where :

N = Number of germinated at a certain time

T = Indicates the amount of time between the start of the test to the end of a certain interval of observation

C. RESULTS AND DISCUSSION

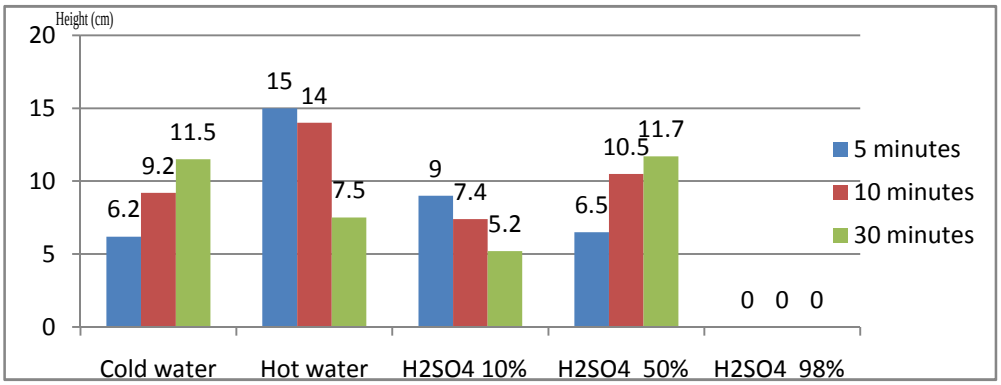
Analysis of the results of the experiment for 15 days can be seen in Table 1. Based on the table can be obtained data indicating that the most effective treatment in dormancy breaking of red beans. From the results of experiments that have been conducted, data showed that the process of dormancy breaking early fastest in the treatment given to the red bean is the soaking with hot water for 5 minutes treatment with a height of 3.7 cm sprouts taken from the height average sprouts planted in a pot on day 3 after planting , then soaking in hot water for 10 minutes with a high average sprouts 3.5 cm as in shown in chart 1.



Graph 1. Comparison average of germinatin height after dormancy breaking with the materials used for treatment after 3 days planting the seeds

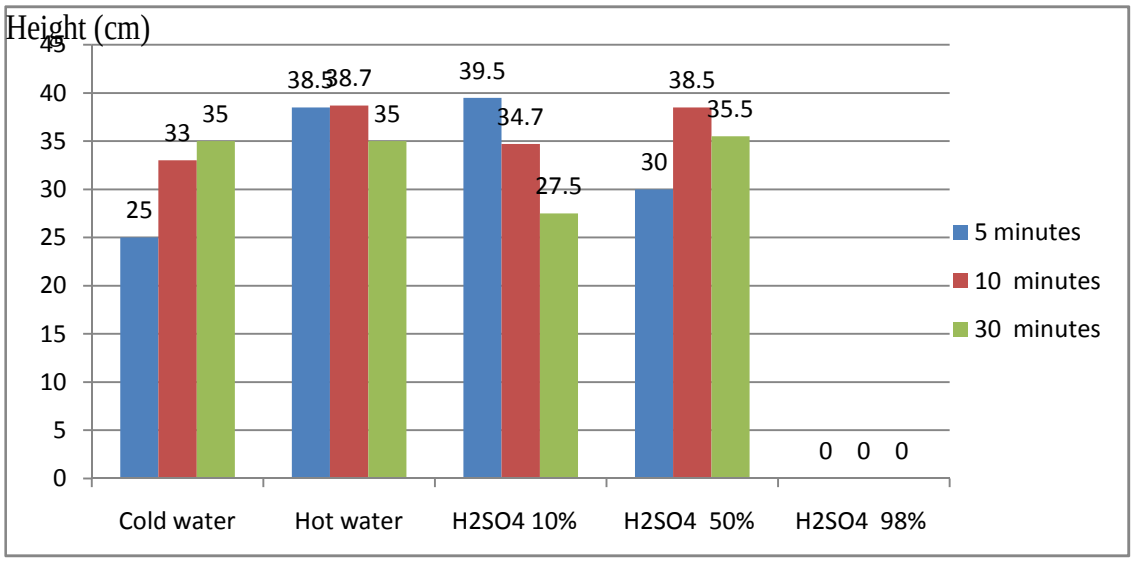
Note that the numbers on the graph is the height average of sprouts in a pot where in one pot contained two red beans. Sprouts high in a pot is different, perhaps because of differences in the thickness of the cell walls of seed or also maybe because the practitioner who grow beans were not at the location of the surface, maybe a seed that is located deeper and seeds others lie closer to the surface soil, thus allowing different sprouts high. Thus, the data retrieved shows with an average growth of sprouts in a pot.

On 4 days after planting sprouts still the highest in the beans soaked in hot water for 5 minutes with a height of 15 cm, 14 cm hot water as shows on chart 2.



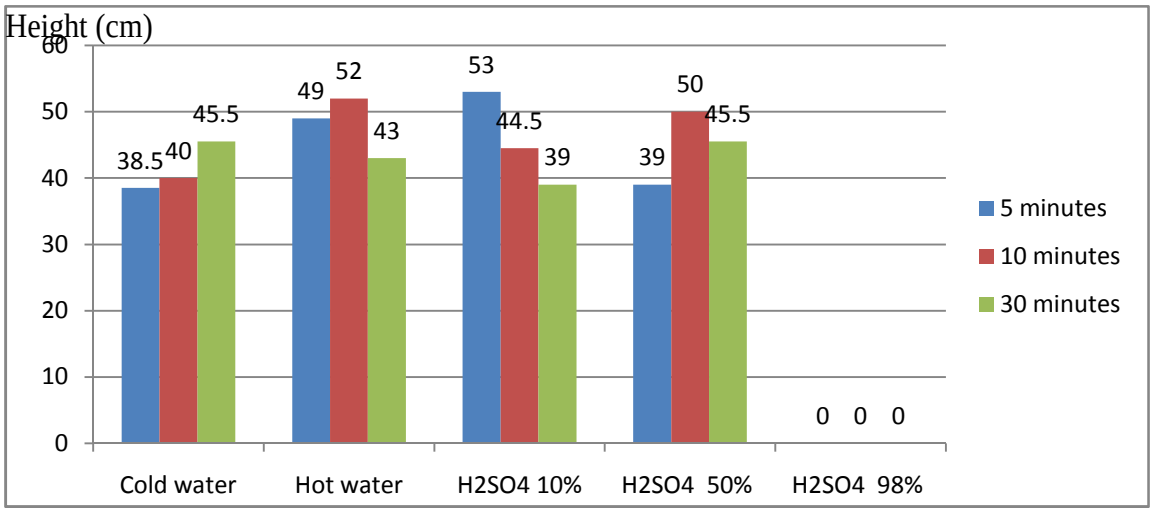
Graph 2. Comparison average of germinatin height after dormancy breaking with the materials used for treatment after 4 days planting the seeds

On 10 days after planting, the average height of sprouts not too differ significantly as which are shown in graph 3. Sprouts hight on soaking in hot water for 5 minutes, 10 minutes, H2SO4 10 % 5 minutes and 10 minutes H2SO4 50 % not much different, namely 38 cm, 38,5cm, 39.5 cm and 38.5 cm. This is may be caused by H2SO4 concentration is not high can accelerate the rate of metabolism in the seed, so as to accelerate the growth rate of sprouts. However H2SO4 concentration of 98 % (very high) can cause the death of the embryo seed , because it is too acidic, so it can kill the embryo in the seed. This can be seen in the chart, with red beans soaking in 98 % H2SO4 treatment given no seed germination.



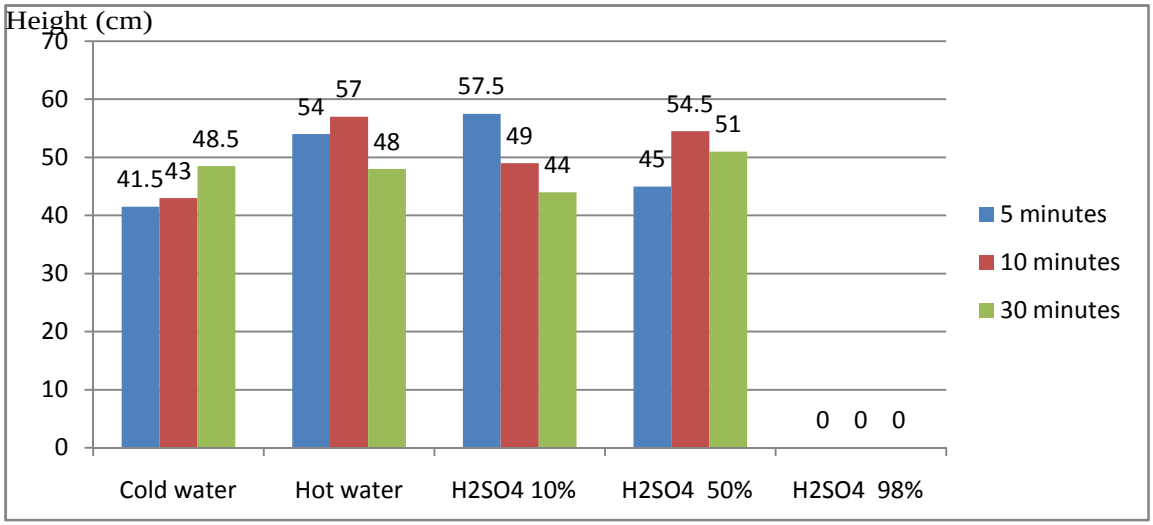
Graph 3. Comparison average of germination height after dormancy breaking with the materials used for treatment after 10 day planting the seeds

Chart 4 shows the average height data of red bean sprouts 12 days after planting seeds. Data show that sprouts highest are beans are soaked in H2SO4 10 % for 5 minutes at 53 cm, then the hot water for 10 minutes 52 cm, H2SO4 50 % for 10 minutes 50 cm and hot water 5 minutes 49 cm followed by data other (graph 4).



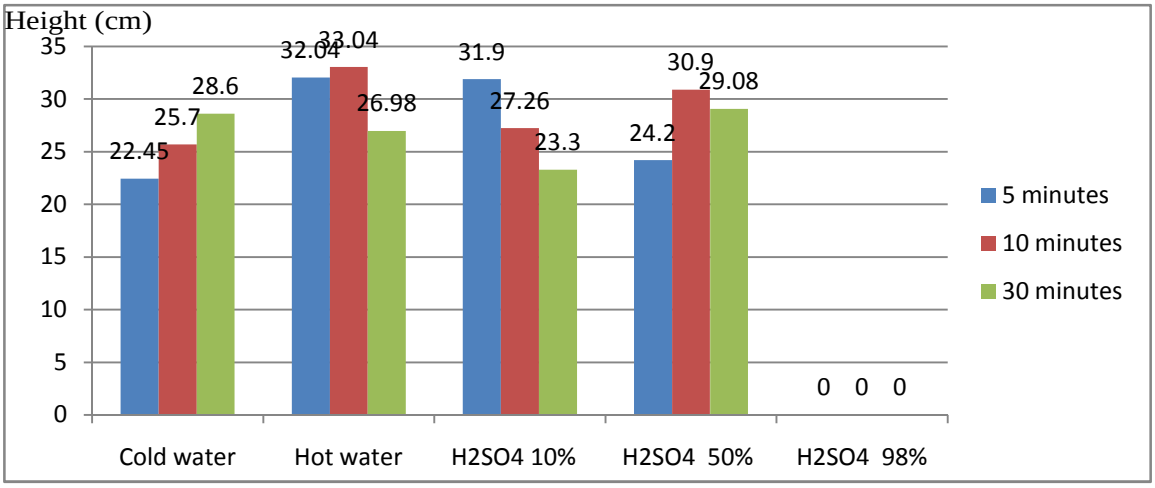
Graph 4. Comparison average of germinatin height after dormancy breaking with the materials used for treatment after 12 days planting the seeds

On 15 days after planting the seeds, all the sprouts look almost the height same, the height difference is not too significant, but still there is difference, as shown in chart 5. The highest nut stem seed is soaked in H2SO4 10 % for 5 minutes, then hot water 10 minutes .

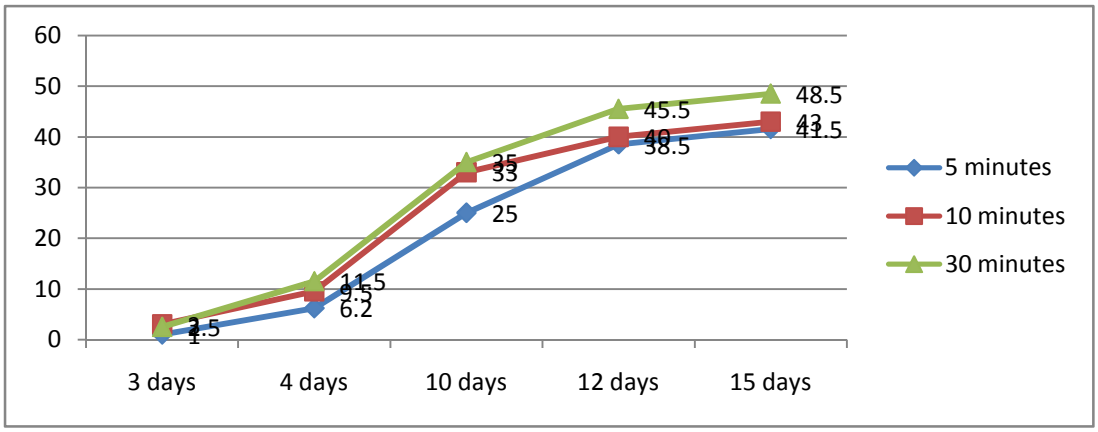


Graph 5. Comparison average of germinatin height after dormancy breaking with the materials used for treatment after 15 days planting the seeds

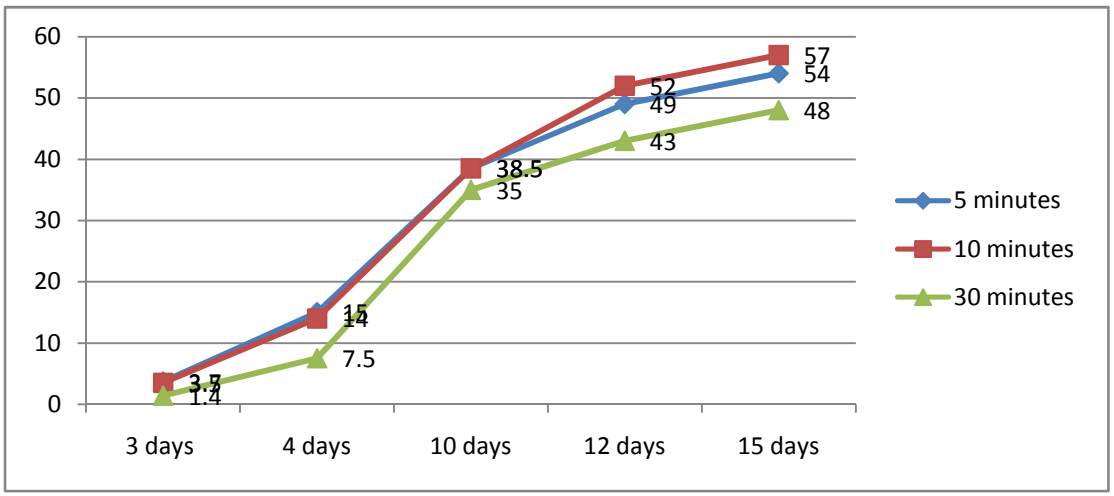
Graph 6 shows the higher average data stem red bean accumulated on days 3 to 15 days and then determined the average - higher growth rate stems from the graph below. Overall high average highest stem is in soaking the seeds in hot water for 10 minutes is 33.04 cm , then the hot water for 5 minutes 32.04 cm, H2SO4 10 % for 5 minutes 31.9 cm, H2SO4 50 % for 10 minutes 30.9 cm and 50 % H2SO4 for 30 minutes 29.08 cm in succession with other data on the graph 6. While the beans are soaked with H2SO4 98 % did not undergo germination .



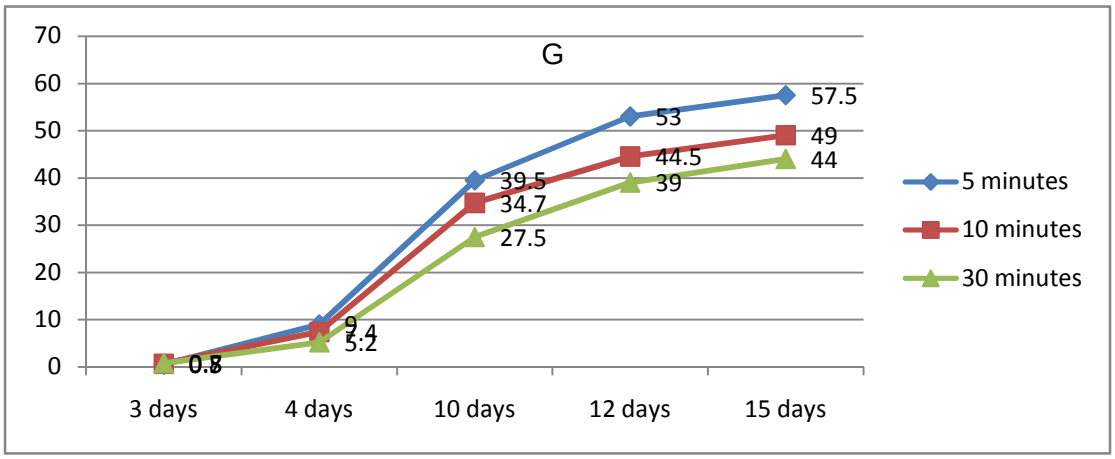
Graph 6. Comparison average of germinatin height after dormancy breaking with the materials used for treatment after 3 days up to 15 days planting the seeds



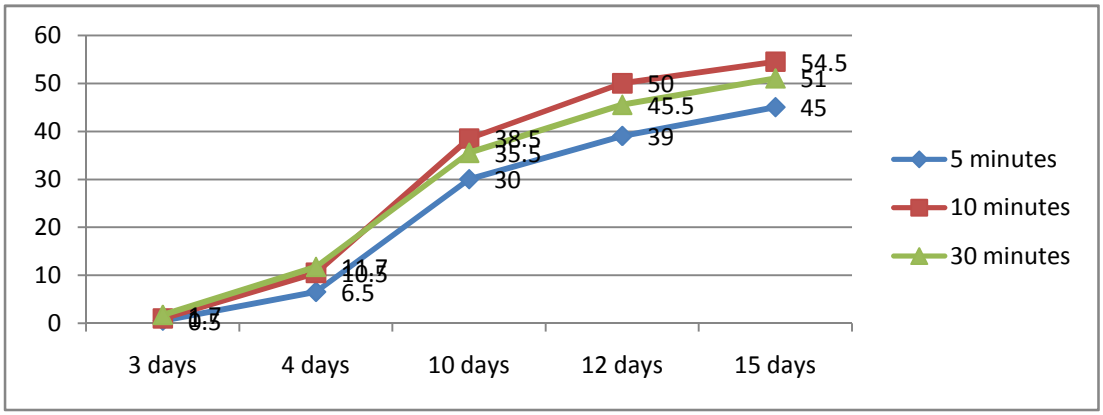
Graph 7. Increase average high in red beans seed stem soaked in cold water



Graph 8. Increase average high in red beans seed stem soaked in hot water



Graph 9. Increase average high in red beans seed stem soaked in H2SO4 10%



Graph 10. Increase average high in red beans seed stem soaked in H2SO4 50%

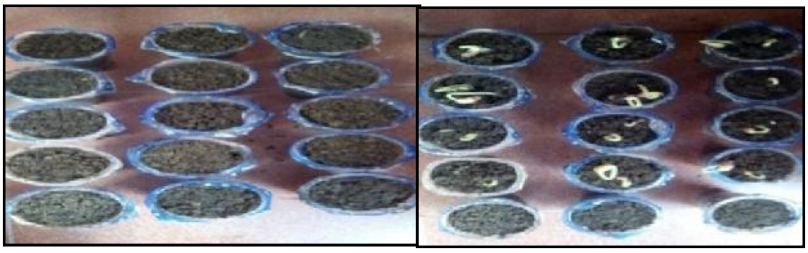


Figure 1. The seeds that have been planted in pots, each containing two red beans that have been done soaking with the material treatment and germination on 3 days.

Know that the water play an important role in the process of seed germination and plant life. Water on seed germination function is to soften the seed coat. Imbibisi incoming water will soften the seeds and lead to the development of embryo and endosperm. Water will provide the ease of entry of oxygen into the grain.

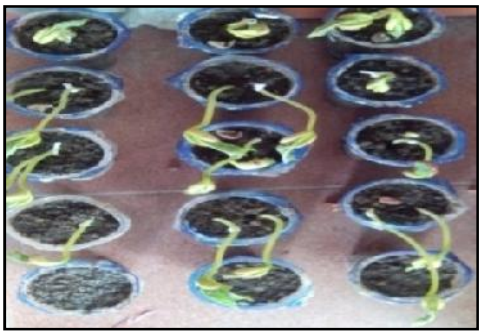


Figure 2. The emergence of sprouts

Figure 4. The red beans growing the beginning of the red bean seeds

For soaking treatment with 98% sulfuric acid, allegedly died due to the use of acidic substances much so that it has a fairly high acidity. Allegedly also at 98% H2SO4 soaking treatment, the acid in H2SO4 that is still attached to the grains can interfere with the germination process. Results of previous studies (Harbani 2004 in writing Puspaningrum 2013), seed soaking purchase with 50% H2SO4 immersion for 20 minutes, 20 seeds were planted only 8 seeds that can germinate, while others decay due to fungus. Soaking treatment with H2SO4 not affect the length of hypocotyl, radicle length and seedling dry weight because the seeds are able to germinate after H2SO4 treatment only affected the skin softening seeds and not up to the embryos so that the embryo can grow normally. But if treatment H2SO4 until the seed embryo, the embryo will not experience growth so as not to happen germination (Suyatmi, et al, 2006, in writing Puspaningrum 2013). H2SO4 in principle is to remove the layer of lignin in the seed coat is hard and thick so the seeds lose permeable layer against gas and water so that the metabolism can run well. But the higher levels of H2SO4 that is given, it can cause death to the embryo seeds, because a very high acid sfat basically can destroy the cell walls of plants and also embryo.

Seeds dormancy breaking by soaking the seeds using hot water can also accelerate the seed dormancy period. Seen from the data obtained from the experiment, that the seeds of the fastest germinating seed is soaked with hot water for 5 minutes and 10 minutes, but not for 30 minutes. It is possible if it is too long soaking the layers of the embryo can be broken, but still able to grow. While only steeped for 5 minutes, the seeds are very effective and fast to germinate, although in its growth after experiencing faster growth germinating of the seeds soaked by using H2SO4 10% for 5 minutes. This may H2SO4 10% is ideal for the growth of bean sprouts, which can speed up the rate of

metabolism and physiological activity of the seed. High temperatures while if it is too acidic, the plant embryos can die. This is consistent with the theory that the effects of acid rain that can damage the plant. Thus it can be said that there is a significant difference between seeds dormancy breaking of red beans are soaked and long soaking beans with cold water, hot water, sulfuric acid 10%, 50% and 98% according to the hypothesis, and also there is a difference in growth rate high rods with different treatment.

D. CONCLUSION

From the description above, it can be concluded that the seed dormancy breaking can be done by chemical treatment involving chemical compounds such as H2SO4, hot water and cold water. Seed dormancy does not mean the seed is dead, but the circumstances in which the seeds undergo complete rest so that even in a state of optimum seed growing media, seeds did not show life signatures.

Seed dormancy breaking the fastest of the results of this research mini is by soaking the seeds in hot water for 5 minutes, 10 minutes and then followed by H_2SO_4 50 % for 30 minutes, and cold water for 30 minutes. Germination growth in soaking seeds with H_2SO_4 10 % is slow at the first germination, but the growth of the plant's heigh is faster, proved by the growth of red bean seed plant on the tenth and twelveth day. Over all, the highest red bean after 15 days is the soaked seeds using hot water, H_2SO_4 10%, H_2SO_4 50% and cold water. While the soaked seeds using H_2SO_4 98% don't grow.

Nonetheless, it is still necessary to re-research studies to support the data from this mini research and is still need for deepening of this seed dormancy.

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