

*Influence of Germination Media and Concentration of Sulfuric Acid (H_2SO_4) on Germination of Kepuh Seed (*Sterculia Foetida* Linn)*

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Abstract - Kepuh (*Sterculia foetida* Linn) is a species that can serve as the greening plants for soil conservation and hydrology. This study aims to determine the effect of media treatment and sulfuric acid concentration on germination of seed kepuh (*Sterculia foetida* Linn). The study was conducted from March to April 2017. Experiments were performed in a randomized block design with 2 factorials, 3 repetitions and 24 treatment combinations. The results showed, the combination of the media treatment and the concentration of sulfuric acid on the percentage of germination, the rate of germination, and the kepuh seed vigor index was in the A4B3 treatment. Where A4B3 treatment using cocopeat medium with seeds first soaked in 15% sulfuric acid solution for 15 minutes gives the best results.

Keywords – Germination; Seed Dormancy; *Sterculia Foetida* Linn; Sulfuric Acid; Media Treatment.

I. INTRODUCTION

Indonesia has the third largest tropical forest area in the world, has an important role as the lungs of the world and the life support system is also the driving force of the economy. High rates of forest degradation result in the function of forests as groundwater storage will also be disrupted, consequently disturbed ecosystems, extreme weather conditions, watershed water systems and the threat of floods, landslides and droughts, even the disruption of food security. The Government through forest and land rehabilitation programs has a very important purpose and objective to repair damaged, critical and non-productive land through forest and land rehabilitation and plantation development.

Kepuh (*Sterculia foetida* Linn) is a type of plant that can double function that is reforestation plant for land conservation and hydrology, besides the fruit also can be exploited for biodiesel. Kepuh is suitable for use as a type of plant for reforestation, because it is fast growing species and efficient in water use. Rooting is very deep and able to store

water in large quantities thus helping in the hydrological cycle [1].

Kepuh seeds are suspected of having physical dormancy (hard seed shell) which causes the seeds not to sprout even though the environment is optimum for the process of germination. One of the preliminary treatment techniques that can be applied to break the dormancy of seed skin is by immersion into a solution of sulfuric acid (H_2SO_4) [2]. The use of sulfuric acid (H_2SO_4) at suitable concentrations can soften the waxy coating on the hard and thick seed skins making it easier for the water absorption process into the seed. Water absorption by the embryo and endosperm causes enlargement of cells in the embryo and endoplasm so that the tender skin of the seeds is soft and provides space for the release of radical [3]. The results of Reference [4] shows that immersion using sulfuric acid solution (H_2SO_4) 20 N for 20 minutes of African wood seed (*Emission Maesopsi*) can increase the growth rate by 1.59% KN / etmal. Reference [5] explains that 20% sulfuric acid (H_2SO_4) solution gives the best effect on germination of saga seed (*Adenanthera sp*) is soaked in sulfuric acid concentration (H_2SO_4) for 30 minutes to increase 92, 00%.

Immersion of sulfuric acid (H₂SO₄) with some concentration level is expected to provide information in preliminary treatment of seed kepuh.

In addition, Kepuh tree is rare enough to be found, for it is necessary to apply silvicultural methods and appropriate seeding technology in support of cultivation. Media is one of the external factors that affect the seed germination for cultivation [6]. The use of appropriate seedling seed media is helpful for improving seed viability. Although there has been a lot of research about media selection for germination [4] [5], but the best sprout media information for seed kepuh until now not yet available. Based on the description above, this study aims to determine the effect of germination treatment and concentration of sulfuric acid on germination of seed kepuh (*Sterculia foetida* Linn).

II. METHODOLOGY

A. RESEARCH LOCATION

The research was conducted at Soil laboratory Faculty of Agriculture, Pattimura University - Ambon. The study was conducted from March to April 2017.

B. MATERIALS AND TOOLS

The tools used in the research are pipettes, measuring cups, tubs of sprouts, thermometers, sprayers, buckets, labels, and cup glasses. While the material used is seed kepuh (*Sterculia foetida* Linn), sand, soil, cocopeat, sawdust, and sulfuric acid solution (H₂SO₄) concentration 5%, 10%, 15%, 20%, 25%.

C. PROCEDURES

Experiments were performed in a randomized block design with 2 factorials, 3 repetitions and 24 treatment combinations. The seeds used in the study are ripe seeds that are characterized by the color of reddish fruits with dark or dark brown leather. After the seed is selected, then air dried in room temperature for 3-6 days.

The container used for the media is a sprout tub of size P x L x T (40 x 30 x 15 cm). Sprout media is inserted into the container up to half the height of the sprout tub. Before planting the seeds of kepuh first soaked in sulfuric acid (H₂SO₄) with different concentrations for 15 minutes. Each treatment was performed with 3 replications. After

immersion, the seeds are then washed with aquades and ready to be planted on the media.

The seeds are planted into each container of 50 seeds per container. To maintain the media moisture, the initial stages of the study were given the water of each container of 1000 ml. Furthermore, during the study, daily spraying using sprayer as much as ± 250 ml of water in each container.

Observation of germination is done daily by noting the number of normal germinated seeds. Then calculated the number of normal sprouts that grow further calculated the percentage of germination, rate of germination, and seed virgor index. The factorial experiment was conducted by using factorial randomized block design consisting of 2 factors, namely germination medium (A) with 4 levels, namely Soil (A1), Sand (A2), Sawdust (A3), Cocopeat (A4) and sulfuric acid concentration (B) with 6 levels ie Control (B0), 5% (B1), 10% (B2), 15% (B3), 20% (B4), 25% (B5).

III. RESULT

A. EFFECT OF SPROUTS MEDIA, CONCENTRATION OF SULFURIC ACID SOLUTION AND INTERACTION (SPROUTS MEDIA AND CONCENTRATION OF SULFURIC ACID SOLUTION) TO PERCENTAGE OF SEED GERMINATION OF KEPUH (STERCULIA FOETIDA LINN).

The result of the research on percentage of seed germination (*Sterculia foetida* Linn) can be seen in Figure 1. The picture shows that there is significant difference between single treatment and interaction with highest percentage is 97,33% found in cocopeat media treatment and 15% H₂SO₄ concentration (A4B3). The lowest germination percentage of 2% that is in all media with soaking of seed at concentration 25% (B5).

At concentrations 5 - 15% showed increased percentage germination. However, at a concentration level of H₂SO₄ greater than 15% indicates a decrease in the percentage of germination. This suggests that the immersion treatment that can be used to solve the dormancy of kepuh seed is at a solution concentration of from 5 to 15%. At that concentration level, the H₂SO₄ solution can make the seed shell softened so as to allow water into the enter the seeds to begin the initial process of germination.

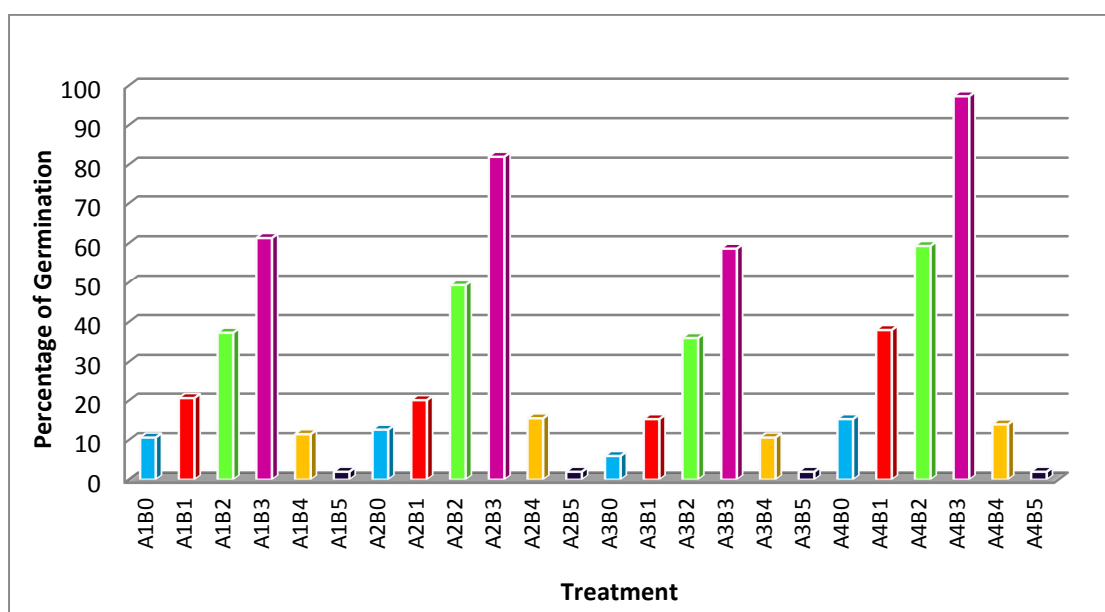


Figure 1. Percentage of Seed Germination Kepuh (*Sterculia Foetida* Linn) With Germination Media Treatment and Immersion Concentration of H₂SO₄ Solution.

Treatments with concentrations above 15% ie 20 - 25% showed a decreasing percentage of germination. This suggests that at these concentrations may cause damage to embryonic cells and endosperm of seeds that have not germinated or the occurrence of abnormalities in germinated embryos. Reference [7] suggested that H₂SO₄ solution if used in excess will penetrate the seed shell and damage the embryo so it can slow the process of germination.

This result also shows that the treatment of cocopeat (A4) media can increase the percentage of seed germination of seed from 15.33 to 97.33%. The use of cocopeat media strongly supports the seed germination process, which has the ability to store water, adequate air space for gas and water exchange, thus creating ideal conditions for seeds to develop. Research using media cocopeat and some other media for germination of Ramin seeds showed that the use of cocopeat media is superior because Ramin seeds grown on cocopeat media germinate earlier than other media [8].

B. EFFECT OF SPROUT MEDIA, CONCENTRATION OF SULFURIC ACID SOLUTION AND INTERACTION (SPROUT MEDIUM AND CONCENTRATION OF SULFURIC ACID SOLUTION) TO GERMINATION RATE OF SEED OF KEPUH (*STERCULIA FOETIDA* LINN)

Result of analysis of variance to viability of seed kepuh showed that germination medium and concentration of solution have real effect only at each treatment singly, whereas interaction between them is not real to rate of

germination. To know the media and how the concentration of sulfuric acid that affect the rate of germination, then tested using Duncan's Multiple Range Test.

TABLE 1. RESULTS OF DIFFERENT TEST DUNCAN SPROUTS MEDIA INFLUENCE ON THE RATE OF SEED GERMINATION KEPUH

Treatment	Rate of Germination (Day)
A1	16.21a
A2	15.88ab
A3	15.08b
A4	13.74c

DMRT 0.05 = 0.6285, 0.6610, 0.6823

Description: The numbers followed by the same letter are not significantly different based on Duncan's different test at the 5%.

Different test results show that the treatment of cocopeat sprouts (A4) media is significantly different from other media. Treatment with cocopeat medium can accelerate the germination rate of seeds of kepuh up to an average of 13.74 days. This shows that cocopeat media treatment can provide environment that can support faster germination (Table 1). The availability of water in the media, absolutely necessary for the initial process of germination [9]. The advantage of using cocopeat media is because it has high water retention and low light weight [10].

TABLE 2. DIFFERENT DUNCAN TEST RESULTS INFLUENCE THE CONCENTRATION OF H₂SO₄ SOLUTION TO THE RATE OF GERMINATION OF THE SEED KEPUH.

Treatment	Rate of Germination (Day)
B0	14.75cb
B1	15.13b
B2	14.76bc
B3	13.9c
B4	15.93ab
B5	16.96a

DMRT 0.05 = 0.7698, 0.8096, 0.8357, 0.8545, 0.8690

Description: The numbers followed by the same letter are not significantly different based on Duncan's different test at the 5%.

Different test results in Table 2 show that the concentration of 15% (B3) solution gives the smallest value, meaning that the average days required for shorter germination. Treatment B3 is the treatment with the most optimal concentration to accelerate germination. Soaking with 15% H₂SO₄ concentration will soften the skin of the seeds to ease the process of water imbibition and the entry of oxygen into the seeds, and increase cell metabolism to start the germination process [11]. While the concentration treatment of 25% (B5) was the slowest treatment for germination. Reference [12] states that the type of strong acid given is only effective at a certain concentration.

Excessively high concentrations will damage the injured part, excessive callus division, or tissue dying, while too low concentrations become ineffective.

C. EFFECT OF GERMINATION MEDIA, CONCENTRATION OF SULFURIC ACID SOLUTION AND INTERACTION (GERMINATION MEDIA AND CONCENTRATION OF SULFURIC ACID SOLUTION) TO GERMINATION RATE OF SEED OF KEPUH (STERCULIA FOETIDA LINN)

The result of the analysis showed that the germination media treatment and the concentration of sulfuric acid solution and the interaction both had a very significant effect on the vigor index. The percentage and rate of seed germination are closely related to the vigor. Seeds with high vigor will result in a high percentage and fastest germination rate resulting in good seedling quality.

Figure 2 shows the highest vigor index present in A4B3 treatment (medium cocopeat and 15% solution concentration) ie 3.96. While the lowest vigor index that is on treatment A1B5 and A3B5 is 0.06. The vigor index or growing rate is an indication of the time it takes for the seed to grow simultaneously during the germination process. The faster the time it takes, the ability of the seed to grow into better mature plants so it can be predicted the potential to be obtained is also high.

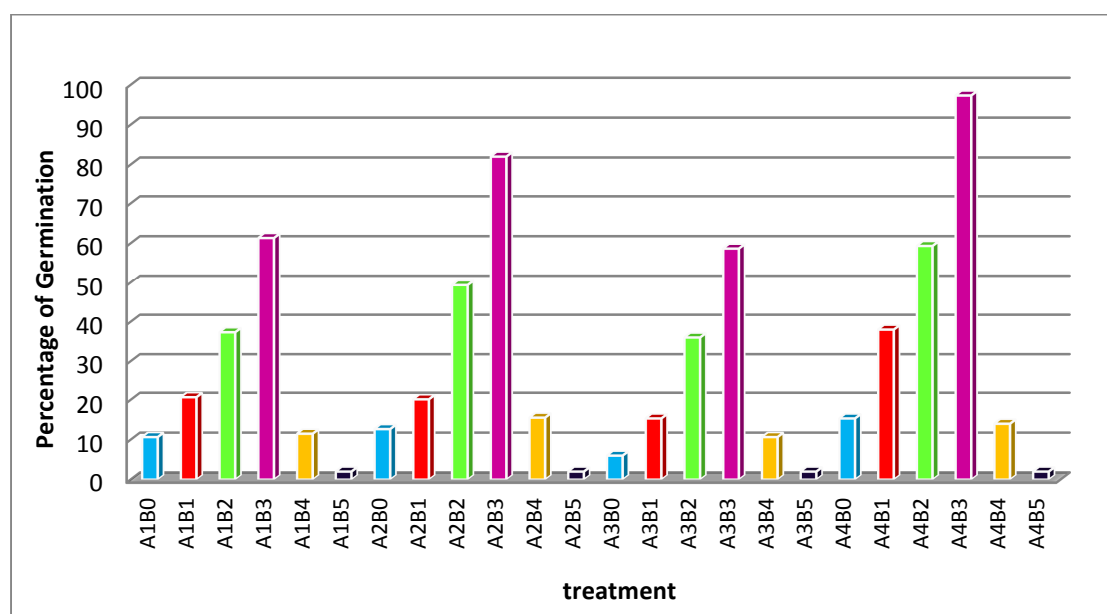


Figure 2. Vigor Index of Kepuh Seed (*Sterculia Foetida* Linn) With Germination Media Treatment And Immersion Concentration Of H₂SO₄ Solution.

Treatment with sand media also showed good results in the value of seed vigor index. Reference [13] states that sand media can absorb nutrients, water, and oxygen and support plant roots. Soil media treatment showed a low vigor index value; this is expected because the soil media during the research process becomes solid. The physical condition of the soil is very important for the ongoing germination process; the seeds will be hampered germination on dense soil because the seeds are trying hard to penetrate the soil surface. The clumped soil structure also results in the decrease in the volume of soil due to watering.

Sawdust media produces the lowest value of the vigor index. In this medium also found the growth of fungus. Sawdust is an organic material in which contained many organic compounds, one of which is lignin [13]. Excessive levels of lignin can make the sprouts die, so that perfect sterilization on sawdust media should be noted. Reference [14] explains that sawdust media contains hemicellulose, cellulose, lignin, and extractives such as tannins, resins, turpentine which, if not through a good combustion process, can be toxic to plant growth.

IV. CONCLUSION

Thus, the most appropriate treatment combination for the seeds of the kepuh is to use cocopeat medium with the seeds first soaked in 15% sulfuric acid solution for 15 minutes. With this combination of treatments has been shown to increase the percentage of germination, rate of germination, and vigor index of seed kepuh (*Sterculia foetida* Linn).

REFERENCES

- [1] I. M. Naâ, "ANALISIS POTENSI PRODUKSI BENIH, PENANGANAN DAN KARAKTERISTIK PERTUMBUHAN BIBIT KEPUH (*Sterculia foetida* Linn.) SEBAGAI SALAH SATU SUMBER BIOFUEL," [Yogyakarta]: Universitas Gadjah Mada, 2012.
- [2] Y. R. Wang, J. Hanson, and Y. W. Mariam, "Effect of sulfuric acid pretreatment on breaking hard seed dormancy in diverse accessions of five wild *Vigna* species," *Seed Sci. Technol.*, vol. 35, no. 3, pp. 550–559, Oct. 2007.
- [3] J. Kamil, *Teknik Benih*. Padang: Angkasa Raya Universitas Andalas, 1979.
- [4] T. B. Winarni, "Pengaruh perlakuan pendahuluan dan berat benih terhadap perkecambahan benih kayu afrika (*Maesopsis eminii* Engl.)," Institut Pertanian Bogor, 2009.
- [5] F. Rozi, "Pengaruh Perlakuan Pendahuluan Dengan Peretakan, Perendaman Air (H₂O), Asam Sulfat (H₂SO₄), Dan Hormon Giberillin (Ga,) Terhadap Viabilitas Benih Ka Yu Afrika (*Maesopsis Eminii* Engi.)," 2003.
- [6] J. R. Peralta *et al.*, "Uptake and effects of five heavy metals on seed germination and plant growth in alfalfa (*Medicago sativa* L.)," *Bull. Environ. Contam. Toxicol.*, vol. 66, no. 6, pp. 727–734, 2001.
- [7] L. Sutopo, *Teknologi Benih*. Jakarta: Raja Grafindo Persada, 2004.
- [8] N. W. UTAMI, W. WITJAKSONO, and D. S. H. HOESEN, "Seed germination and seedling growth of ramin (*Gonystylus bancanus* Miq.) on various growing media," *Biodiversitas J. Biol. Divers.*, vol. 7, no. 3, 2006.
- [9] L. O. Copeland and M. F. McDonald, *Principles of seed science and technology*. Springer Science & Business Media, 2012.
- [10] A. Ameri, A. Tehranifar, M. Shoor, and G. H. Davarynejad, "Effect of substrate and cultivar on growth characteristic of strawberry in soilless culture system," *Afr. J. Biotechnol.*, vol. 11, no. 56, pp. 11960–11966, 2012.
- [11] M. Saberi, A. Shahriari, F. Tarnian, and S. Noori, "Comparison the effect of different treatments for breaking seed dormancy of *Citrullus colocynthis*," *J. Agric. Sci.*, vol. 3, no. 4, p. 62, 2011.
- [12] K. R. Indriana, "PENGARUH WAKTU PENYIMPANAN BENIH DAN KONSENTRASI LARUTAN ASAM SULFAT TERHADAP VIABILITAS DAN VIGOR BENIH JARAK (*Jatropha curcas* Linn) DI PERSEMAIAN," *Paspalum J. Ilm. Pertan.*, vol. 4, no. 2, pp. 23–30, 2017.
- [13] Z. Zuyasna, Z. Zaitun, and S. Alfina, "Pertumbuhan dan Hasil Tiga Varietas Mentimun (*Cucumis sativus* L.) Pada Medium Hidroponik Tertentu," *J. Agrista*, vol. 13, no. 3, pp. 104–112, 2009.
- [14] J. Hadrawi, "Kandungan Lignin, Selulosa, dan Hemiselulosa Limbah Baglog Jamur Tiram Putih (*Pleurotus ostreatus*) dengan Masa Inkubasi yang Berbeda sebagai Bahan Pakan Ternak," *Skripsi Fak. Peternak. Univ. Hasanudin Makasar*, 2014.