Effect of Germination Media and Planting Depth on Viability and Vigor of Rubber Seed (Hevea brasiliensis Muel.Arg)

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ABSTRACT

This study aims to determine the effect of germination media and planting depth on viability and vigor of rubber seeds and whether or not the interaction between these two factors is significant. It was held in Gampong Kuta Padang, Johan Pahlawan District, West Aceh Regency, on February 14 to March 30, 2013. The seeds used in this study were local varieties of rubber seeds that had been selected as many as 675 seeds obtained from community gardens in East Seunagan District, Nagan Raya Regency. . This study used a completely randomized design (CRD) with 3x3 factorial pattern with 3 replications. There are 2 factors studied, namely germination media and planting depth. The germination media factor consisted of three levels, namely soil: sand, soil: compost, and soil: sawdust. The planting depth factor consists of three levels, namely 1, 2, and 3 cm. The observed variables included growth potential, germination capacity, growth speed, growth synchronously and germination vigor. The results showed that sprout media had a significant effect on growth potential, germination capacity, growth speed, sprout vigor and had no significant effect on growth simultaneously. The best viability and vigor of rubber seeds were found in soil germination media: compost. Planting depth had a significant effect on all observed variables. The best viability and vigor of rubber seeds were found at a planting depth of 2 cm. There was no significant interaction between germination media and planting depth on all variables of viability and vigor of rubber seeds observed.

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1. INTRODUCTION

Indonesia as an agrarian country has enormous potential for the development of the agricultural sector, in addition to its abundant natural resources, it also has a large area of land, especially outside Java, which has not been cultivated. This is certainly very useful to support a strong and stable national development.

The development of the agricultural sector plays an important role in supporting strong and stable national development. The agricultural sector such as plantations is a source of foreign exchange for the State which is still relevant to be pursued and developed. One commodity that has strategic value is rubber (Hevea brasiliensis Muel. Arg). Optimal land use, good cultivation techniques and the use of superior clones resulted in the average growth of Thai rubber plant production reaching 3% in 2009, while Indonesia only increased 2% (Anonymous, 2010)

Based on data released by the Directorate General of Plantations (2011) the area of Indonesian rubber plantations in 2011 reached 3,456 million ha and 86% of them belonged to the people, 8% were private plantations and 7% were large national plantations. The contribution of community rubber is 75%, while the national and private large plantations are 11% and 13%, respectively.

Productivity and low yield quality are fundamental problems in Indonesian rubber plantations, therefore it is necessary to develop agricultural cultivation. One of the efforts to increase production is to provide rubber seeds from superior clones for the scion in grafting rubber seedlings. Seeds used for seedlings, especially for the provision of rootstocks (onder stem, stock nursery) must be really good. Rubber plants can be propagated generatively (by seeds) and vegetatively (using clones). The supply of rubber seeds is known to have several clone seeds (clonal seeds). These seeds generally come from the parent seed garden.

To get good growth of rubber seedlings, many influencing factors include the germination medium because it is closely related to root development. The growth of plant roots will be better when added organic matter with a composition that is suitable for the planting medium. Organic material that is often used in nurseries is compost.

Compost fertilizer has the ability to change various factors in the soil, namely improving soil physical properties such as soil structure becoming more crumbly, improving humus conditions and increasing the population of microorganisms so as to increase the yield of good organic matter so that the soil will become more friable (Sarief, 1986).

According to Lakitan (1995), the germination media that is often used for plant nurseries in Indonesia is a mixture of sand, soil and manure. The use of sand has a positive impact on the physical properties of the soil, especially clay. Sand has a much larger size and has a small surface area compared to dust and clay particles, so its role in regulating the chemical properties of the soil is very small (Hakim et al., 1986). Sand is a light soil fraction that dries quickly and is easy to mix (Anonymous, 1997). The use of sand to improve soil physical properties such as soil structure is possible because sand can affect soil structure so that water and air management becomes better and roots penetrate the soil more easily.

According to Dwidjoseputro (1985), soil with good texture and structure is very supportive of the success of agricultural businesses, where the soil has good aeration and water absorption, so that plants can grow fertile. According to Lingga (1998), the soil structure desired by plants is a loose structure in which there are pore spaces that can be filled by balanced water and air for plant root growth, so that nutrient absorption can run well.

Another factor that affects the speed of seed germination is the depth of planting. The depth of planting according to Sadjad (1993) depends on the type of germination, water and oxygen content in the soil. The germination type of rubber seed is hypogeal because the embryo is not raised to the soil surface. Seeds with hypogeal germination type are generally planted deeper than seeds with epigeal germination type. The depth of planting seeds depends on the type of plant to be planted. For other crops, such as oil palm, sprouts are usually planted at a depth of 3 cm (Antoni, 2001).

Kamil (1986), added that sprouts planted too deep from the soil surface caused the coleoptiles to not reach the soil surface so that the coleoptiles became dry and caused the seedlings to die. On the other hand, if the sprouts are planted too shallowly, causing the risk of drought before they become seedlings, the seeds will easily fall or fall.

Seeding is defined as an effort to prepare plant material in the form of seeds, namely young plants through planting seeds (seeds) and vegetative parts of plants. Seedling techniques to produce quality seeds are important for the development of annual crops, including rubber plants. Perez (2005) stated that germination and seedling resistance are the ability of a plant to continue to live and are critical critical stages in the plant life cycle in dry ecosystems.

2. METHOD

2.1 Place and Time of Research

The research was conducted in Gampong Kuta Padang, Johan Pahlawan District, West Aceh Regency, on February 14 to March 30, 2013.

2.2 Materials and Tools

The materials used in this study were 850 local varieties of rubber seeds, sand, soil, sawdust, compost and water. Research Tools: Germination containers were used for germination of 27 seeds, measuring cups, label paper, gembor, ruler and other stationery.

2.3 Research Methods

This study used a completely randomized design (CRD) with 3x3 factorial pattern with 3 replications. The factors tested are:

Sprouts Media Factor (M) which consists of three levels, namely: M1 = Soil: Sand (2:1); M2 = Soil : Compost (2:1); M3 = Soil: Sawdust (2:1).

Planting Depth Factor (K) which consists of three levels, namely: K1 = 1 cm; K2 = 2 cm; K3 = 3 cm. Thus there are 9 treatment combinations with 3 replications, so in total there are 27 experimental units.

2.4 Analysis Method

The mathematical model of the design used in this study is as follows:

$$Yij = \mu + Mi + Kj + (MK)\ ij + \varepsilon ij \quad (1)$$

With:

Yij = Observation result of germination media factor (M) level i, planting depth factor (K) level j, in repetition k.

μ = General average

Mi = Effect of sprouting media (M) level i (i = 1,2,3)

Kj = Effect of planting depth factor (K) jth level (j = 1,2,3)

(MK) ij = Effect of interaction between germination media factor (M) level i and planting depth factor (K) level j

Ɛij = Experimental error of the i-level M factor and the j-level K factor.

If the results of the F test show a real effect, then a further test will be carried out with the BNJ test (Honest Significant Difference), at a probability level of 5%.

2.5 Research Implementation

Seed Preparation, Germination Media Preparation (Soil, Sand, Compost, Sawdust), Seedling and Maintenance.

2.6 Observation Parameter

Observation and measurement of data was carried out by analyzing the parameters: Growth Potential (%), Germination Power (%), Growth Speed (%/etmal), Growth Simultaneous (%) and Sprout Vigor (%).

3. RESULTS AND DISCUSSION

3.1 Research result

3.1.1 Effect of Sprout Media

The results of the F test on the analysis of variance showed that the germination media had a significant effect on growth potential, germination capacity, growth speed, sprout vigor and had no significant effect on growth simultaneously. The average viability and vigor of rubber seeds on various germination media after being tested with BNJ0.05 can be seen in Table 1:

Tabel 1. Average Viability of Rubber Seed on Various Germination Media

Variable		Sprouts Media			BNJ 0,05
		M1 (Land : Sand)	M2 (Land : compost)	M3 (Land: Sawdust)	
PT	Arcsin $\sqrt{\%}$ (%)	53,00 b (63,56)	55,15 c (67,11)	50,03 a (58,67)	1,58
DB	Arcsin $\sqrt{\%}$ (%)	60,78 b (75,56)	63,17 c (79,11)	56,62 a (69,33)	2,02
KcT	Arcsin $\sqrt{\%}$ (%/etmal)	23,98 b (16,59)	25,36 c (18,45)	23,13 a (15,47)	0,69
KsT	Arcsin $\sqrt{\%}$ (%)	48,22 b (55,56)	49,76 c (58,22)	45,91 a (51,56)	1,24
VK	Arcsin % (%)	47,73 a (54,67)	51,61 b (61,33)	46,68 a (52,89)	1,59

Description:

- Numbers followed by the same letter in the same line was not significantly different in the BNJ0.05 . test

- () = Numbers before transformation
- PT = Growth Potential
- DB = Germination Power
- KcT = Growth Speed
- KsT = Simultaneous Growth
- VK = Vigor Sprouts

Table 1 shows that the best growth potential, germination rate, growth speed, simultaneous growth and germination vigor were found in soil: compost (M2) which was significantly different from soil: sand (M1) and soil: sawdust (M3).

The relationship between growth potential, germination rate, growth speed, growth synchronously and germination vigor of rubber seeds on various planting media can be seen in Figure 1:

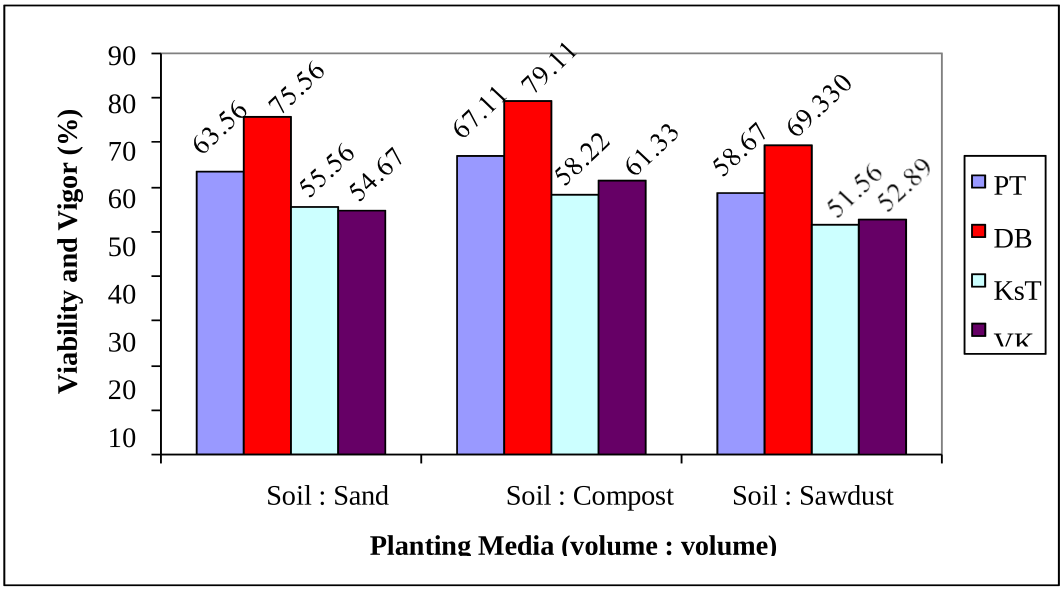

Figure 1. Growth Potential, Germination Power, Simultaneous Growth and Germination Vigor of Rubber Seeds on Various Sprout Media

The condition of the rubber seed germination media is soil: compost in germination is a medium that has loose properties. Some of the advantages of soil media: compost include the nature of the media that is friable and can bind water well. The addition of compost in the germination media can create physical, chemical and biological soil conditions that are suitable for rubber seed germination (Sunanto, 1992).

Giving compost into the media can improve the structure of the media so that it becomes loose and has good aeration so that the need for seeds for water is well maintained, this is due to the role of compost in improving soil physical properties, including increasing the capacity of the soil to hold water, stimulating aggregate granulation and stabilize it, reduce plasticity, and other bad properties of clay (Murbandono, 1996). The addition of compost into the sprouting media can also improve soil biological properties such as increasing the number and metabolic activity of soil organisms and the activities of micro-organisms in helping the decomposition process of organic matter.

Soil containing sand and supplemented with organic matter is a good medium for germination. The physical condition of the soil is very important for the life of sprouts to become mature plants. Seed germination will be hampered in dense soil, because the seeds are trying hard to penetrate the soil surface (Sutopo, 2002).

It is not suitable for rubber seed germination.

The results also showed that the decrease in viability of rubber seeds on soil: sawdust (M3) was presumably because the soil: sawdust had not been able to provide good environmental conditions so that the air needed for rubber seed germination was not available properly. Sutopo (2002) stated that soil media has good water binding capacity so that if the germination media is too moist it will cause rotten seeds caused by fungi and soil bacteria.

Furthermore, Sutedjo and Kartasapoetra (1988) added that poor soil structure can inhibit the flow of water, air and micro-organism activity so that it will disrupt seed germination.

3.1.2 Effect of Cultivation Depth

The results of the F test on analysis of variance showed that planting depth had a significant effect on growth potential, germination capacity, growth speed, growth synchronously and germination vigor. The average viability and vigor of rubber seeds at various planting depths after being tested with BNJ0.05 can be seen in Table 2:

Table 2. Average Viability and Vigor of Rubber Seeds at Various Depths of Planting

Variable		Planting Depth (cm)			$BNJ_{0,05}$
		K_1 (1)	K_2 (2)	K_3 (3)	
PT	Arcsin $\sqrt{\%}$ (%)	54,05 b (65,33)	54,91 b (66,67)	49,22 a (57,33)	1,58
DB	Arcsin $\sqrt{\%}$ (%)	62,15 b (77,78)	62,80 b (78,22)	55,62 a (68,00)	2,02
KcT	Arcsin $\sqrt{\%}$ (%/etmal)	24,72 b (17,53)	25,18 b (18,23)	22,58 a (14,75)	0,69
KsT	Arcsin $\sqrt{\%}$ (%)	47,70 b (54,67)	50,54 c (59,56)	45,64 a (51,11)	1,24
VK	Arcsin $\sqrt{\%}$ (%)	49,78 b (58,22)	50,84 b (60,00)	45,38 a (50,67)	1,59

Note: Numbers followed by the same letter in the same row are not significantly different in the BNJ0.05 . test

Table 2 shows that the best growth potential, germination capacity, growth speed and germination vigor were found at a planting depth of 2 cm (K2) which was significantly different from a planting depth of 3 cm (K3) but not significantly different from a planting depth of 1 cm (K1). While the best growth uniformity was found at a planting depth of 2 cm (K2) which was significantly different from a planting depth of 3 cm (K3) and a depth of 1 cm (K1).

The relationship between growth potential, germination rate, growth speed, growth synchronously and germination vigor of rubber seeds at various planting depths can be seen in Figure 2:

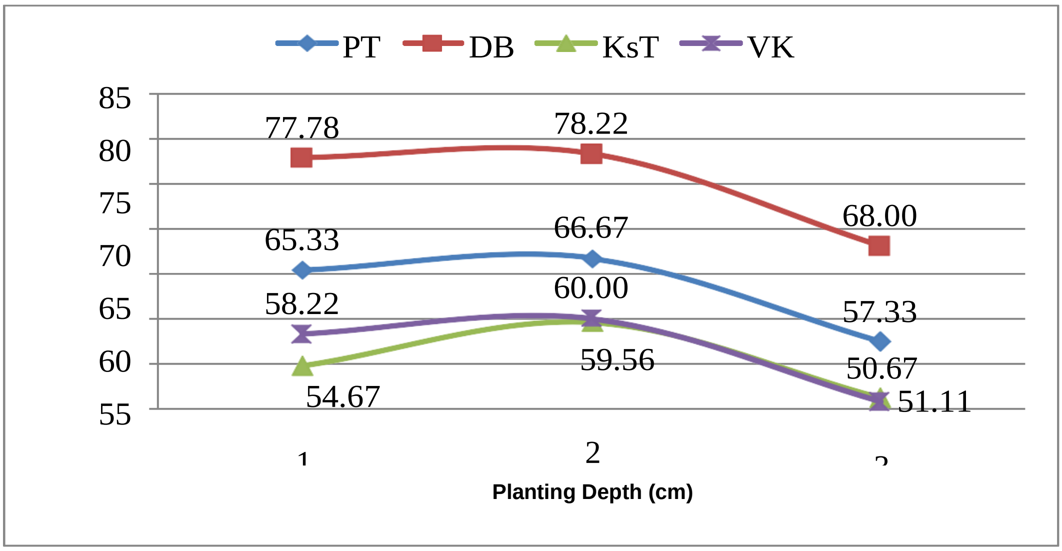

Figure 2. Growth Potential, Germination, Simultaneous Growth and Germination Vigor of Rubber Seeds at Various Planting Depths

The results showed that the planting depth of 2 cm was the right depth for rubber seeds because it was able to provide the highest values of growth potential, germination, growth speed, growth uniformity and germination vigor compared to planting depths of 1 and 3 cm.

Proper planting depth of seeds can make it easier for plumules to emerge to the soil surface, while planting too deep causes the coleoptiles to not reach the soil surface, these coleoptiles then dry in the soil and the sprouts will die. This causes insufficient food reserves in the seeds and the sprouts will run out of energy before the plumules emerge to the soil surface.

3.2 Discussion

Planting that is too shallow causes the seeds to dry quickly and the sprouts that grow easily fall because the roots are not strong. This is in accordance with the opinion of Sutopo (2002) which states that the level of planting depth of sprouts greatly affects the growth of sprouts. Planting too deep causes the sprouts to run out of energy before the plumules appear on the soil surface, on the other hand, if planted too shallowly, there is a risk of drying out before the seeds sprout.

The depth of planting depends on the diameter of the seed, the type of germination, the water and oxygen content in the soil. Seeds that split in two emerge above the soil surface, usually requiring shallower planting than single seeds in soil plants. Planting on relatively dry soil requires a deeper planting hole (Harjadi, 1984).

The results of the F test in the analysis of variance (appendixes with even numbers 2, 4, 6, 8 and 10) showed that there was an insignificant interaction between the germination media and planting depth on all variables of viability and vigor of rubber seeds observed. This means that the difference in viability of rubber seeds due to differences in germination media does not depend on the depth of planting or vice versa.

4 CONCLUSION

From the results of the research that has been done, the following conclusions can be drawn: Sprout media had a significant effect on growth potential, germination rate, growth speed, sprout vigor and had no significant effect on growth uniformity. The best viability and vigor of rubber seeds were found in soil germination media: compost; Planting depth had a significant effect on all observed variables. The best viability and vigor of rubber seeds were found at a planting depth of 2 cm; There was no significant interaction between germination media and planting depth on all variables of viability and vigor of rubber seeds observed.

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