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Penggunaan Root Trainer sebagai Alternatif Pengganti Polybag untuk Meningkatkan Pertumbuhan Bibit Karet (Hevea brasilliensisMuell. Arg.)

*The Usage of Root Trainer for Alternative Change Polybag to Enhance Growth Rubber (Hevea brasilliensis*Muell. Arg.*)*

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ABSTRAK

The problem of the availability of rubber planting material for large planting areas has encouraged efforts to develop technology to provide rubber planting material that is easier, more effective and efficient. One technology that has developed especially in India is a root trainer. Root trainer technology is expected to be an alternative to polybag and it is expected that the planting material produced will have better growth and development in the field. The study was conducted using a root trainer with a diameter of 15 cm and a height of 30 cm, planting material used topsoil, cocopeat, Chicken dung and compost. The experiment was arranged in a factorial randomized design with one factor, the factor was type of planting media such as cocopeat, Chicken dung and compost with 4 levels, 100%: 75%: 50% and 25% (w / v).The results showed the use of a mixture of 50% cocopeat and 50% chicken dung significantly affected plant height and diameter of rubber seedlings at the age of 1 until 7 weeks after planting with an increase reaching 1-2 times compared to all treatments and controls (polybags). It is suspected that chicken dung contains macro nutrients N, P and K needed by plants at the beginning of its growth and Cocopeat makes the growing media have better aerase and drainage in supporting the development of plant roots.The cost of making seedlings in the root trainer is more expensive than the seeds in a poly bag, but it is not too significant, but the size of the rubber seeds in the root trainer is also smaller than the seeds in a polybag so it is easier and cheaper to transport seedlings in the field.

Keywords: Media, Root trainer, Rootstock, Rubber, and Seed

INTRODUCTION

Rubber is one of the plantation commodities that has high economic value. In Indonesia, rubber is one of the superior agricultural products, because it supports the country's economy, provides employment for the population and as a source of foreign exchange. one of the keys to success in rubber cultivation is the quality of the seeds used. Good quality rubber seedlings will display fast and good growth, especially if planted in an environment that is suitable for rubber plants and followed by good maintenance and fertilization. According to (Siagian, 2012) that in order to achieve high growth and productivity, planting material used is superior seeds from good selected seeds is an important step because the use of superior seeds will produce good plants and have sustainable production. Until now, the multiplication of rubber is still widely used grafting techniques. Grafting can be done on rootstocks planted in nurseries (ground nurseries) or those planted directly in polybags. Rootstock planted in the nursery will become a sleeping eye stum. Seedlings produced by SMT have shortcomings,

including poor root shape, longer seed preparation time, more difficult seed transportation and take up more space, and relatively higher price.In line with these conditions to meet the needs of planting materials which are much needed technology in the supply of rubber planting material that is more efficient and effective. One technology that has developed especially in India is a root trainer. Root trainer technology is expected to be an alternative.

MATERIALS AND METHODS

The study was conducted at the nursery of PT Hutan Ketapang Industri, Ketapang West Kalimantan . The study was conducted in November until December 2019.

Seeding Seeds

Seeding is done in seed beds with a size of 1 x 40 m, with sand planting media. Seeding by immersing the seeds evenly with the surface of the chest sand downward, then covered with reeds and watering is done in the morning and evening until the seeds germinate.

Media Preparation

The root trainer is filled with cocopeat, compost, manure at a ratio of 100%: 75%: 50% and 25% (w / v) with a weight of 300 grams / root trainer. before being added to the root trainer the media is added with water until it reaches 60-70% water content to keep the media from leaving the root trainer. Root trainers that have been filled with media are then arranged on a shelf that has been provided.

Planting Testing in the root trainer

The root trainer which contains media is watered then the seeds are planted in the root trainer that has been prepared by planting the seeds in the hole made in the middle of the root trainer, rubber seeds used are GT1 clones. The experiment was arranged in a factorial randomized design with one factor, the factor was type of planting media such as cocopeat, chicken dung and compost with 4 levels, 100%: 75%: 50% and 25% (w / v). The experiment was repeated three times (400 seedlings / replications) so that a total of 18,000 root trainers contained 300 grams of media. Testing of growing media on rubber plants with the root trainer system is as follows:

1 100% of the soil (Polybag) is the control
2 100% Cocopeat
3 75% Cocopeat + 25% Chicken dung
4 75% Cocopeat + 25% Compost
5 50% Cocopeat + 50% Chicken dung
6 50% Cocopeat + 50% Compost
7 25%Cocopeat+25% Chicken dung+50% Compost
8 25% Cocopeat + 25% Compost + 50% Organic I
9 100% Chicken dung
10 75% Chicken dung + 25% Compost
11 75% Chicken dung+ 25% Cocopeat
12 50% Chicken dung + 50% Compost
13 25% Chicken dung+25%Compost+50% Cocopeat
14 100% Compost
15 75% Compost + 25% Chicken dung
16 75% Compost + 25% Cocopeat

Data analysis

The data of this study were analyzed by analysis of variance, and results of the study were analyzed by F test, while the difference between treatments was tested by Duncan's Multiple Range Test at 5 % level using SAS software version 9.4 (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Seeding rubber seeds in beds with a size of 1 m x 40 m using sand media (Figure 1) and covered with reeds to keep conditions moist.According to the Sembawa Rubber Research Institute (2009) rubber seeds that are sown with sand soil and nursery media that are well maintained will cause seeds to

germinate on the fifth day, so it can be said the germination process of the three clones is proceeding normally. This is in accordance with the opinion of Muhammad (2010), that a mixture of soil and sand is often used as a planting medium for plant growth. Comparison of soil with suitable sand can be used as a medium for seeding. Seed transfer is carried out at the age of 5-7 days after nursery, the rubber sprouts Stadia to the root trainer is when the root grows (Radicle) reaches ± 1-2 cm and the flumula at that time has appeared popped (still bent) above the surface (Figure 2). According to Qomara (2003), the speed of growth of rubber seeds is strongly influenced by factors of food availability contained in the seeds and sufficient so that it can encourage the growth of sprouts. Carefully transfer the rubber seeds to the root trainer, before transferring the seeds of the root trainer has made a planting hole to make it easier to plant. Root trainer rack that is using a steel frame and for watering is done by using a sprinkle with watering intensity done in the morning and evening for 10 minutes (Figure 3).

Figure 1. Germination beds

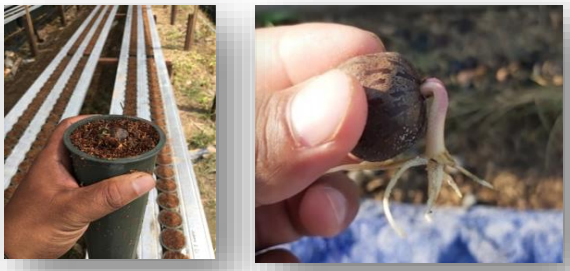

Figure 2. Criteria of seeds planted in root trainer

Figure 3. Planted in root trainer *Plant Height (cm)*

The treatment of the media influences the height of the rubber plant. Table 1 shows that the combination of cocopeat and chicken manure in the first week increased plant growth 1-2 times of all treatments and controls. This is in line with research at the Sembawa Research Center on the effect of several root trainer planting media on the growth of rubber seedlings aged 10 weeks showing that soaked cocopeat produced the best growth.

Based on the results of variance showed that the combination of 50% cocopeat media and 50% chicken manure significantly affected the height of rubber seedlings at the age of 2 and 4 weeks after planting with a height increase of 7.25 cm compared to the polybags that only reached. It is suspected that chicken manure contains macro nutrients N, P and K needed by plants at the beginning of its growth.

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Table 1. Pertambahan tinggi tanaman didalam root trainer dengan perlakuan media

Treatment	Plant height (cm)													
	1st week		2nd week		3rd week		4th week		5th week		6th week		7th week	
Polybag (control)	4.3	ab	1.2	ab	2.3	b	3.5	bc						
100% Cocopeat	5.6	ab	1.3	ab	4.7	ab	4.9	abc	3.7	ab	1.9	ab	13.6	ab
75% Cocopeat + 25% Chicken dung	4.2	ab	1.5	ab	5.9	ab	2.9	cd	3.9	ab	1	b	30.2	a
75% Cocopeat + 25% Compost	5.1	ab	1.7	ab	4.7	ab	3.7	bc	4	ab	2.1	ab	14.2	ab
50% Cocopeat + 50% Chicken dung	5.5	ab	2.6	a	6.9	a	7.2	a	4.9	a	3.8	a	28.5	a
50% Cocopeat + 50% Compost	8.2	a	2.4	a	4.6	ab	3.8	bc	4.9	a	1.2	b	19.7	ab
25% Cocopeat + 25% Chicken dung + 50% Compost	4.3	ab	2.3	a	2.7	b	5.1	abc	4.8	a	2.1	ab	28.1	a
25% Cocopeat + 25% Compost + 50% Chicken dung	4.2	c	1.3	ab	2.3	b	4	bc	5	a	1.9	ab	23.6	ab
100% Chicken dung	5.2	ab	1.6	ab	3	ab	5.5	abc	3.4	ab	1.5	ab	13.9	ab
75% Chicken dung + 25% Compost	7.6	ab	1.4	ab	1.7	b	2.3	cd	3.4	ab	3.4	ab	18.1	ab
75% Chicken dung + 25% Cocopeat	3.7	c	1.2	ab	4.8	ab	5.8	abc	3.3	ab	1.8	ab	12.6	ab
50% Chicken dung + 50% Compost	3.8	c	2.2	a	2.9	ab	6.9	ab	3.2	ab	3	ab	23.7	ab
25% Chicken dung + 25% Compost + 50% Cocopeat	5.5	ab	1.5	ab	4	ab	3.4	bc	3.7	ab	3.1	ab	24.6	a
100% Compost	6.9	ab	2	a	4.7	ab	3.5	bc	3.5	ab	3.2	ab	20.3	ab
75% Compost + 25% Chicken dung	5.4	ab	1.3	ab	2.9	ab	6.9	ab	3.1	ab	1.4	ab	14.7	ab
75% Compost + 25% Cocopeat	7.4	ab	1	ab	2.2	b	4.9	abc	3	ab	3.1	ab	31.8	a

Remarks: Mean values within a column followed by the same letters are not significantly different at $p<0.05$ according to Duncan's Multiple Range Test

Table 1. shows that media treatment significantly affected plant height. The use of a mixture of 50% cocopeat (v / w) and 50% chicken dung causes plant height to increase significantly up to 1-2 times when compared without treatment (soil media) until the age of 7 weeks after planting. The treatment using the combination of cocopeat gives a significant effect on plant height with a dose of 25%, 50% and 75% but the treatment without the combination with a dose of 100% cocopeat has no significant effect because it has a very low nutrient content so it doesn't have an effect on plant height. The higher the percentage of cocopeat use in growing media, the worse the results obtained at high variables. This is thought to be caused by the presence of tannins in cocopeat which causes seedling growth to be slow. Sukarman et al (2012) stated that cocopeat media contained tannins which are mechanical barrier compounds in nutrient absorption. Tannin compounds are inhibitors of the activity of the hormone gibberellins and disrupt the transpotation process of nutrients P and K. If the P and K elements are available in limited quantities and are not able to meet the needs of plant growth, plants will experience growth barriers of roots, stems and leaves (Marisa, 1990) .

In addition to tannins, a factor that is suspected to be the cause of slow growth of sea sengon seedlings is the high C / N in cocopeat media, high C / N indicates that nutrients are available in low amounts

because organic matter has not decomposed (Pandebesie and Rayuanti, 2012).

Table 2. Average increase in plant diameter in the root trainer

Treatment	Diameter (cm)							
	1st week		2nd week		3rd week		4th week	
Polybag (control)	0.051	ab	0.023	ab	0.024	ab	0.194	ab
100% Cocopeat	0.046	ab	0.019	ab	0.009	b	0.021	ab
75% Cocopeat + 25% Chicken dung	0.056	ab	0.035	ab	0.027	ab	0.027	a
75% Cocopeat + 25% Compost	0.054	ab	0.015	b	0.024	ab	0.011	ab
50% Cocopeat + 50% Chicken dung	0.072	a	0.043	a	0.039	a	0.027	a
50% Cocopeat + 50% Compost	0.041	ab	0.045	a	0.026	ab	0.024	ab
25% Cocopeat + 25% Chicken dung + 50% Compost	0.080	a	0.010	b	0.012	ab	0.017	ab
25% Cocopeat + 25% Compost + 50% Chicken dung	0.064	ab	0.027	ab	0.010	b	0.022	ab
100% Chicken dung	0.052	ab	0.012	b	0.025	ab	0.018	ab
75% Chicken dung + 25% Compost	0.028	b	0.037	ab	0.018	ab	0.012	ab
75% Chicken dung + 25% Cocopeat	0.040	ab	0.031	ab	0.011	ab	0.011	ab
50% Chicken dung + 50% Compost	0.039	ab	0.024	ab	0.017	ab	0.019	ab
25% Chicken dung + 25% Compost + 50% Cocopeat	0.056	ab	0.024	ab	0.039	a	0.013	ab
100% Compost	0.039	ab	0.043	a	0.015	ab	0.014	ab
75% Compost + 25% Chicken dung	0.050	ab	0.033	ab	0.012	ab	0.010	ab
75% Compost + 25% Cocopeat	0.057	ab	0.031	ab	0.038	ab	0.013	ab

Remarks: Mean values within a column followed by the same letters are not significantly different at $p<0.05$ according to Duncan's Multiple Range Test

Table 2. shows that the highest stem diameter of seedlings 1 and 4 weeks after planting was found in the combination treatment of 50% Cocopeat and 50% Chicken dung while the lowest was found in the treatment of 75% Chicken dung and 25% Compost, this was due to chicken having particles that are so fine that aerase becomes ugly and growth is somewhat inhibited. According to Indriyanto (1999), states that the classification of seedling media that is good for root growth is a growing medium that has good drainage and aerase, can maintain moisture around the seedling roots and does not become a source of disease for seedling roots. Similar to the effect on plant height, the best diameter of plants at the age of 1 to 4 weeks after planting using cocopeat as a combination of media that is at a dose of 25%, 50% and 75%. However, it has an unfavorable growth response using 100% cocopeat as a growing medium. this is because cocopeat basically has the ability to bind and store water that is very strong, cocopeat is a medium that has a high enough water holding capacity. Cocopeat media has a micro pore that is able to absorb greater water movement causing higher water availability (Istomo and Valentino, 2012). At certain times, these conditions cause gas exchange in the media to experience obstacles because the media is saturated with water. This happens because the macro pore space that is supposed to be filled with water is filled with water so the roots experience breathing difficulties. Therefore, the water in the media will be reduced so that it can inhibit plant growth (Utami et al, 2006).

The results of variance showed that the planting media had an effect on the diameter of the rubber seedling stem at the age of 5 to 7 weeks after planting (MST). The average diameter of rubber seedling stems at the age of 5 to 7 weeks after planting (MST) due to planting media treatment can be seen in Table 3.

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Table 3. Average increase in plant diameter in the root trainer

Treatment	Diameter (cm)					
	5th week		6th week		7th week	
Polybag (control)	0.022	ab	0.021	b	0.025	ab
100% Cocopeat	0.021	ab	0.022	b	0.047	a
75% Cocopeat + 25% Chicken dung	0.026	a	0.015	b	0.022	ab
75% Cocopeat + 25% Compost	0.017	ab	0.050	a	0.021	ab
50% Cocopeat + 50% Chicken dung	0.026	a	0.050	a	0.047	a
50% Cocopeat + 50% Compost	0.012	ab	0.010	b	0.028	ab
25% Cocopeat + 25% Chicken dung + 50% Compost	0.013	ab	0.026	b	0.031	ab
25% Cocopeat + 25% Compost + 50% Chicken dung	0.017	ab	0.011	b	0.040	ab
100% Chicken dung	0.018	ab	0.012	b	0.013	b
75% Chicken dung + 25% Compost	0.015	ab	0.021	b	0.020	ab
75% Chicken dung + 25% Cocopeat	0.009	b	0.014	b	0.042	ab
50% Chicken dung + 50% Compost	0.023	ab	0.010	b	0.014	ab
25% Chicken dung + 25% Compost + 50% Cocopeat	0.010	b	0.013	b	0.015	ab
100% Compost	0.011	b	0.027	b	0.019	ab
75% Compost + 25% Chicken dung	0.013	ab	0.010	b	0.014	ab
75% Compost + 25% Cocopeat	0.016	ab	0.019	b	0.033	ab

Remarks: Mean values within a column followed by the same letters are not significantly different at $p<0.05$ according to Duncan's Multiple Range Tes

The duncan test results showed that the treatment combination of 50% cocopeat and 50% chicken dung was significantly different 1-2 times with the treatment of other planting media and control. It is suspected that the cocopeat media treatment mixed with chicken dung can accelerate the growth of plant diameter. Increasing the stem diameter of a plant is very dependent on the genetic factors of a plant and the availability of nutrients absorbed by plants during their lifetime. In accordance with the opinion of Hakim, et al., (1986) that the growth of a plant is very dependent on the lack of availability of nutrients in the soil, it is very disturbing physiological activities which will adversely affect overall growth.Suriatna (1988) said that the phosphorus nutrients function to accelerate root development, increase resistance to pests and diseases, respiration processes, cell division processes and plant metabolism so as to encourage the rate of plant growth including stem circumference. Potassium nutrients function to accelerate the growth of meristematic tissue, especially on plant stems, strengthen the stems so that they do not easily fall, it is very important in the process of photosynthate where increasing photosynthate in plants will increase the size of the plant girth.

According to Jumin (2002), the stem is an area of plant growth accumulation, especially in younger plants so that the presence of nutrients can encourage vegetative growth of plants including the formation of chlorophyll in the leaves so that it will spur the rate of photosynthesis. The more photosynthesis rate, the resulting photosynthate will provide a large size increase in stem diameter.

Cost analysis of rubber seeds in root trainer and polybag

Growing media for rubber seedlings in the root trainer and in polybags differ in terms of type, weight, and volume of the media. The root trainer pot is filled with cocopeat growing media mixed with manure and compost with a weight of

about 0.3 kg. The weight and volume of the planting media is much lower than the media for polybags with top soil that reaches 5 kg.this case in the root trainer is cheaper than seedlings in polybags in terms of the cost of planting media filling, seed sorting, and transportation. However, seedlings in a root trainer are more expensive than seedlings in a polybag in terms of the cost of making a root trainer, planting media, and materials as well as shelf power. In total, the cost of making seedlings in a root trainer is more expensive than seedlings in a polybag as shown in Table.

Table 4. Cost analysis of rubber seeds in root trainer and polybag

Uraian	Cost (Rp)	
	Polybag	Root Trainer
Labor	**2.438**	**1.433**
of planting media	750	300
Planting Seeds	50	50
Seed Selection	10	-
Shade making	-	65
Fertilization	10.86	10.86
Spraying	6.8	6.8
Weeding manual	26	-
Weeding Chemical	1.1	-
Sprinkling	150	-
Making the Root Trainer Rack	-	100
Polybag Land Preparation	183	-
Grafting	900	900
Rocking	350	-
Materials and Tools	**1.085**	**2.364**
Seeds	50	50
Polybag	750	-
Root trainer	-	800
Media	-	600
Fertilizer	120	60
Fungiside	5	5
Paranet	-	36
Steel frame	-	265
Paranet Pole Wood	-	313
Sumisanswi / PVC	125	100
Grafting Plastic	10	10
Bud eyes	25	25
Total	**3.523**	**3.696**

Conclusion

1. Rubber seedlings from root trainers use a combination of 50% cocopeat and 50% chicken dung significantly 1-2 times higher than seedlings in polybags and other media combinations in indicators of plant height and diameter.
2. The cost of making seedlings in the root trainer is more expensive than the seeds in a poly bag, but it is not too significant, but the size of the rubber seeds in the root trainer is also smaller than the seeds in a polybag so it is easier and cheaper to transport seedlings in the field.

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