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Full Length Research Paper

Assessment of selected *Hevea brasiliensis* (RRIM 2000 Series) seeds for rootstocks production

Noordin Wan Daud[1]*, Shafar Jefri Mokhatar[1] and Che Fauziah Ishak[2]

[1]Department of Crop Science, Faculty of Agriculture, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia.
[2]Department of Land Management, Faculty of Agriculture, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia.

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Rubber tree or *Hevea brasiliensis* is a tropical crop from the Amazon forest, South America. The name 'rubber' was been given to natural rubber by Priestly, in 1770. Today, rubber tree has been the main source of natural rubber for use worldwide. South East Asia is the main producer of natural rubber in the world. Seeds used for rootstocks production are very important to nursery and rubber industry. Rootstocks will be used for bud grafting in order to produce clone plant. This study which was divided into two stages, germination of seeds and seedlings growth performance, will provide some information about various seeds in terms of rootstock production. Germination test was carried out with 50 seeds from each clone. Six clones used in this study were PB 260, RRIM 901, RRIM 2001, RRIM 2005, RRIM 2006 and RRIM 2026. Seeds from clone PB 260 were used as control. Germination rate was determined after two weeks. After germination, seedlings were transplanted into polythene bags and growth performances were evaluated for three months. Experiments were carried out in randomized complete block design (RCBD) with four replications. Data obtained were analyzed using analysis of variance (ANOVA) and Duncan's multiple range test (DMRT) using statistical analysis system (SAS). The results showed that clone PB 260 had the highest germination rate with 72%, while seeds from clone RRIM 2005 and RRIM 2006 were the lowest. Although, germination rate was the second highest, seeds from clone RRIM 2001 had high growth performance as shown by seedlings height, girth and root dry weight. This study suggested seeds from clone RRIM 2001 were the most suitable seeds to use for rootstocks and seedlings production.

Key words: *Hevea brasiliensis*, RRIM 2000 series, nursery production, seedlings, rootstocks production.

INTRODUCTION

Hevea brasiliensis was introduced from Brazil to South East Asia in the year, 1876 when three British men, Farris, Cross and Henry Wickham took 70,000 rubber seeds out from the Amazon forest in Brazil. The seeds were brought to Kew Garden, England, Botanical Garden, Ceylon, and Singapore Botanical Garden. Only nine seeds were transported to Kuala Kangsar, Perak. These nine seeds were successfully raised and distributed in Malaya (Malaysia was known as Malaya before independence in 1957) (Malaysian Rubber Board, 2009, 2004; Noordin, 1993). Currently, there are more than 30 clones of rubber trees planted in Malaysia. Rubber seeds are required for two purposes, establishment of seedling plantings and for raising rootstock for bud grafting of clones (Leong, 1979; Ooi, 1978; Muzik, 1953). Rootstocks are very important which influence the performance of scion after bud grafting. Seedlings with good rooting systems will influence the efficiency of water and nutrient uptake from the soil (Bastiah et al., 1996, Soong, 1976). It will also influence the performance and yield of the budded plant (Ng, 1983, Ng et al., 1981). In Malaysia, the flowering seasons of rubber are in March and August. The peak seed falls follows approximately

*Corresponding author. E-mail: wnordin@agri.upm.edu.my. Tel: +603-89474840.

Figure 1. Seeds of PB 260.

six months later (Malaysian Rubber Board, 2009, 2004). Rubber seeds possess short viability, which declines dramatically after three days exposure to sunlight. Germination starts six to seven days after sowing (Malaysian Rubber Board, 2009; Silvio and Julio, 2005). Seeds sprouted each day should be picked and planted in nursery beds. Proper nursery establishment for rubber is important for raising rootstock. Planting rootstock in the polythene bags will give opportunity for selection of vigorous plants and decrease failures of seedling growth and budding (Ang, 1986; Khoo, 1979; Cho, 1978).

RRIM 2000 series clones were rubber plants produced through the breeding process with selection of several characteristics (Malaysian Rubber Board, 2009, 2007). The clones were produced to improve growth and yield of the rubber tree. Today, the yield is not only the latex, but the timber from the rubber tree which also has high demand in the furniture industry. Due to Malaysian Rubber Board (MRB) research, the performance of RRIM 2000 series has high growth rate and also can be tapped early to produce high latex yield in shorter period. Due to little and limited information about rubber seeds germination, this study was carried out in order to assess germination and seedlings growth performance of commonly used rubber seeds for rootstock and seedlings production in Malaysia. Results from this study also would give some new information about seedlings growth performance.

MATERIALS AND METHODS

This study was conducted at *Hevea* Unit, University Agriculture Park, University Putra Malaysia, Serdang, Selangor. Six different rubber clones seeds used were RRIM 901, RRIM 2001, RRIM 2005, RRIM 2006, RRIM 2026 and the control PB260. Seeds were collected during the seeds falling season and stored in a dark, cold room for preservation and germination test were done immediately after enough seeds were collected due to short period of seeds viability. The identification of clones was based on the visual description of variations in morphological characteristics. The study was divided into two stages, germination at seeds bed and after the transfer of germinating seeds to the polythene bags. Sawdust was used as the medium for seeds germination. Fifty rubber seeds from each clone were spread over the germination beds in a single layer, the ventral part of the seeds were placed downward and press gently into the sawdust. The seeds were covered with a thin layer of sawdust to prevent loss of too much moisture. Germination rate study was assessed after two weeks of sowing. After germination, the seedlings were transferred to the polythene bags (0.15 × 0.33 m) which can fit up to 4.5 kg of soil. Soils used were the Typic Paleudult and Renggam series. Growth performance of seedlings was monitored for three months. The study consisted of six rubber clones seeds as treatments using Randomized Complete Block Design (RCBD) with four replications. Each replication contains five seedlings. Data were analyzed with Analysis of Variance (ANOVA) and Duncan's Multiple Range Test (DMRT) was employed for means comparison using Statistical Analysis System (SAS).

RESULTS AND DISCUSSION

The seeds were collected in the monoclonal plots at Malaysian Rubber Board (MRB) Sungai Buloh. The seeds were identified and verified according to specific criteria's. Seeds from PB 260 are small in size and rounded shape (Figure 1). Seeds from clone RRIM 901 are big in size and square in shape. It is smooth, shining and has a light brownish seed coat (Figure 2). For clone RRIM 2001, the seeds are large size, rounded shape; light brownish with smooth and shining seed coat. It had flat dorsal and its ventral is deep grooved, raised lateral cheeks (Figure 3). The seeds of RRIM 2005 are medium in size, square to slightly rectangular shape. It has dorsal with prominent ridge and dispersed brownish striations

Figure 2. Seeds of RRIM 901.

Figure 3. Seeds of RRIM 2001.

with its ventral slightly grooved. The lateral cheeks are raised and slightly depressed at posterior (Figure 4). RRIM 2006 seeds are medium in size, square shaped, dorsal with prominent ridge and dispersed brownish striations. These seeds are smooth, shining and has a light-brownish seed coat (Figure 5). Seeds from RRIM 2026 are medium and rounded in shape (Figure 6). It has smooth, shining and light brownish seed coat (Zain et al., 1997).

For the seed germination study, the germination percentage is illustrated in Figure 7. Figure 7 showed that T1 (PB 260) had the highest value with 72% germinated seeds and constitute the control. The good germinated seeds with germination more than 50% were T2, T3 and T6. These results indicate that T4 (RRIM 2005) and T5 (RRIM 2006) had low viability. Criteria inherited from parental plants influenced the viability and performance of seedlings when other factors such as dormancy

Figure 4. Seeds of RRIM 2005.

Figure 5. Seeds of RRIM 2006.

excluded (Thompson, 1979). In rubber seeds, there is not so much information about dormancy, because the rubber seeds possess high water content. Keleny and Van Haaren (1976) reported that there are no dormancy in rubber seeds except clones BR. 2 and Av. 163 ill which have some hardened seed coat. Thus, without dormancy characteristics, the rubber seeds would be easily damaged or destroyed at very low or very high temperature (Malaysian Rubber Board, 2009; Sakhibun, 1981). This damaged usually occurred when the rubber seeds are exposed to direct sunlight for a certain period. Rubber seeds viability are influenced a lot by humid tropical climate which have sunlight and rainfall throughout the year. Exposure of seeds to direct sunlight

Figure 6. Seeds of RRIM 2026.

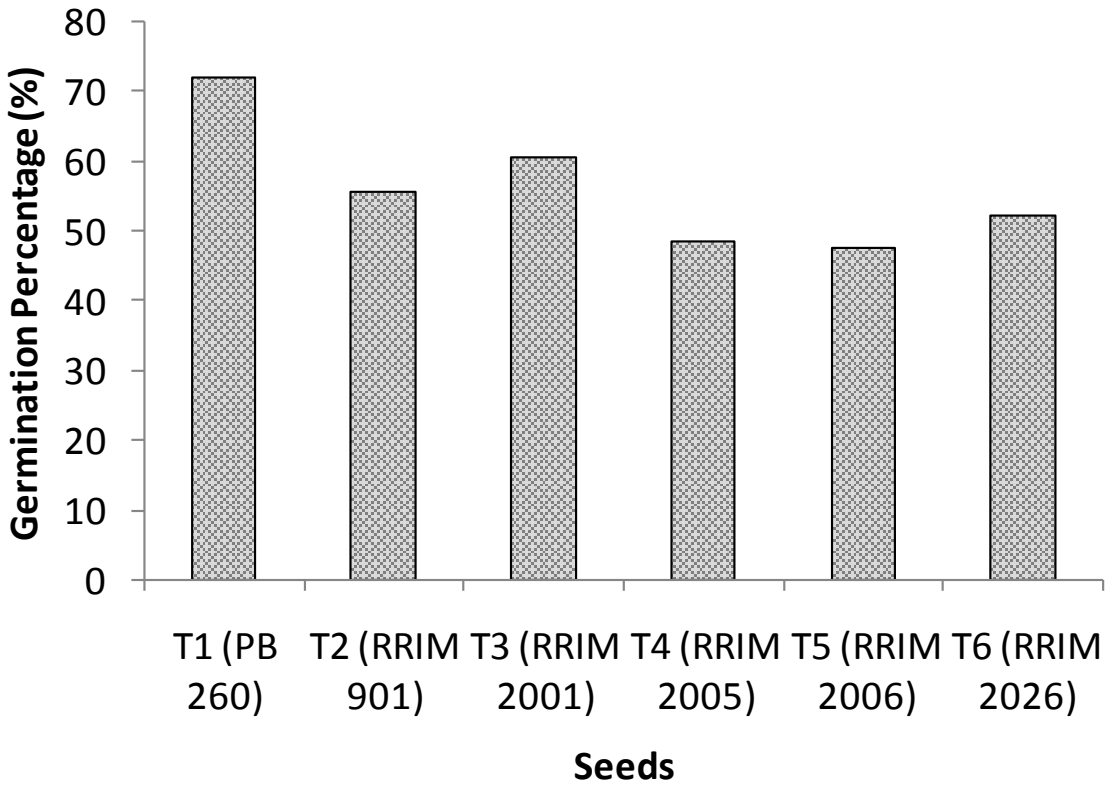

Figure 7. Germination percentage of several rubber seeds. Means with same letter are not significantly different at P<0.05.

will reduce the seeds moisture, consequently reduced the seeds viability (Sakhibun, 1981).

Figures 8 and 9 showed the seedling height and girth after three months transplanting from germination beds.

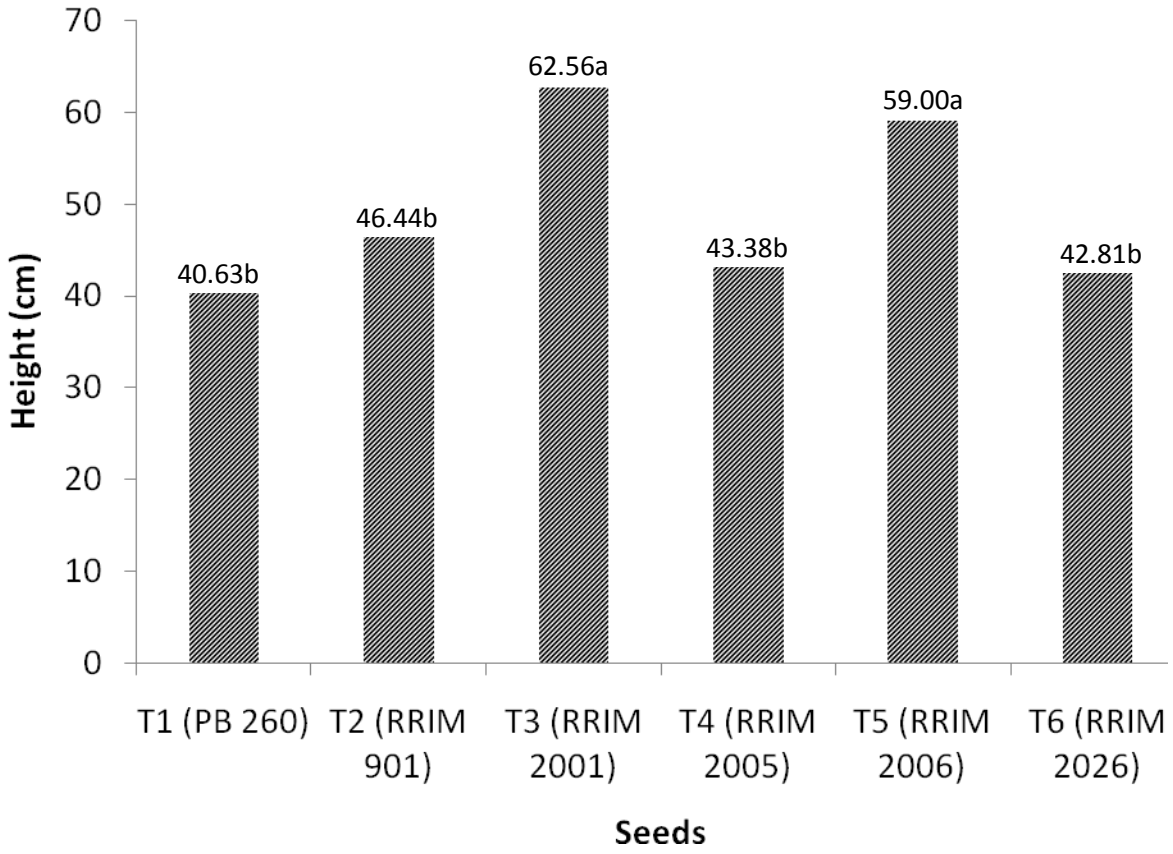

Figure 8. Height of seedlings after three months. Means with same letter are not significantly different at P<0.05.

Results showed there are significant differences between the treatments. For height parameter, seedlings from RRIM 2001 (T3) and RRIM 2006 (T5) were in same group according to Duncan's grouping and significantly higher from other treatments at P<0.05. For girth, T3 (RRIM 2001) was significantly higher than T1, T2 and T4 but it is not significantly different from T5 and T6. These seedlings showed higher performance and vigour from other seedlings in terms of plant height and girth. Height and girth can play important role in representing growth performance in rubber plant (Haridas, 1978; Narayanan, 1968). Girth was very important because it will determine whether the matured rubber plant can be tapped, or in seedlings, the rootstocks can be used for bud grafting. Normally, the matured plant can be tapped at the age of four and half year or reach 45 cm in girth. For rootstocks, bud grafting was done when the plant reach the age of three months or the stem started to hardened (Malaysian Rubber Board, 2009, 2004).

Table 1 showed leaf, stem, root and total dry weight of seedlings after three months. In terms of stem dry weight, seedling from clone RRIM 2006 (T5) had the highest value (10.92 g), and significantly different from other seedlings (1.60 to 7.71). Seedlings from T3 (RRIM 2001) gave the highest value which mean most vigor in terms of root production, although, it is not significantly different from T5 (RRIM 2006). Roots are important for rootstock in uptake of water and nutrients uptake from the soil, which will influence the success and vigor of the scion after being budded (Bastiah et al., 1996). Other studies showed that in rootstocks selection characteristics, feeder root development played an important role in the performance of rubber clone and yield (Ng, 1983; Ng et al., 1981; Soong, 1976). Sakhibun (1981) and Petch (1911) have found that the secondary roots will grow more rapidly than the primary root in rubber seeds germination. This feature was observed in T3 (RRIM 2001) which has more root development compared others.

Conclusion

From the results, it can be concluded that seeds from clone PB 260 (T1) had the highest germination rate and seeds from clone RRIM 2005 (T4) and RRIM 2006 (T5) were the lowest. For the growth performance of seedlings, RRIM 2001 (T3) and RRIM 2006 (T5) showed good performance. In plant height, girth increment and root dry weight, RRIM 2001 (T3) was better than others and about the same as RRIM 2006 (T5). Considering the germination rate and overall growth performance, this

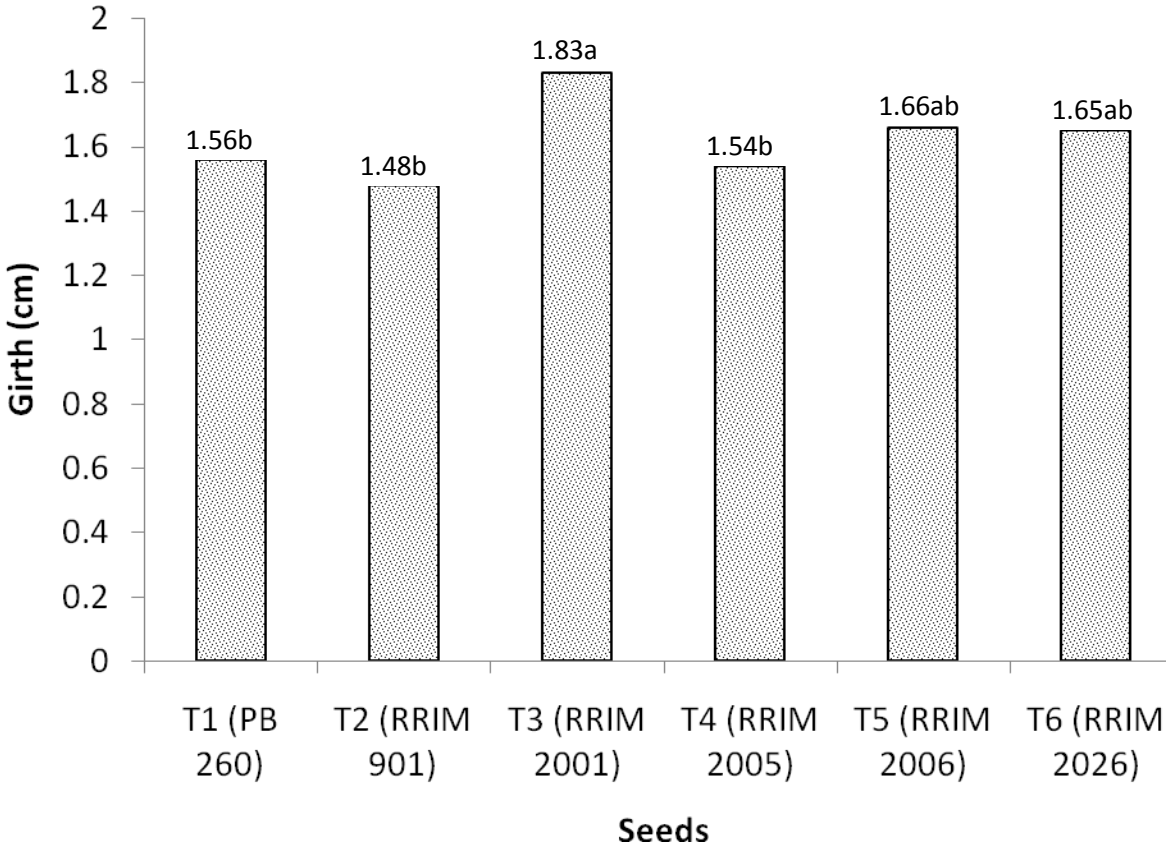

Figure 9. Girth of seedlings after three months. Mean with same letter are not significantly different at P<0.05.

Table 1. Biomass production of several seedlings after three months.

Treatments	Dry weight (g)			Total
	Leaf	Stem	Root	
T1 (PB 260)	4.58^{a}	4.26^{cd}	2.86^{de}	11.70^{c}
T2 (RRIM 901)	6.75^{a}	1.60^{d}	2.28^{e}	10.63^{c}
T3 (RRIM 2001)	1.88^{a}	4.04^{cd}	9.03^{a}	14.94^{bc}
T4 (RRIM 2005)	2.66^{a}	6.02^{bc}	5.89^{bc}	14.56^{bc}
T5 (RRIM 2006)	4.58^{a}	10.92^{a}	8.14^{a}	23.63^{a}
T6 (RRIM 2026)	5.60^{a}	7.71^{b}	6.98^{bc}	20.29^{ab}

Means followed by the same letters in each column are not significantly different at P<0.05 level.

study recommended seeds from clone RRIM 2001 as the most suitable seeds to be used for raising seedlings for rootstocks production.

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