PERFORMANCE OF EIGHT POPULAR CLONES OF RUBBER *(HEVEA BRASILIENSIS)* FROM CERTAIN LARGE ESTATES

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Choice of the right planting materials is the most essential prerequisite for high production in any crop species. In a perennial plantation crop like *Hevea*, with a long economic life span of 30-35 years, this is of utmost significance. A large number of newer and better clones developed in different rubber producing countries, with wide variations in yield and secondary characteristics are being planted in our country. A knowledge of the performance of clones with respect to yield and important secondary characters in estates sector will enable a better assessment and subsequent selection of clones adapted to varying agroclimatic conditions. Earlier reports of such evaluation of clones available in India are based mainly on yield 2, 3, 8, 9. With a view to evaluate the general performance of eight popular clones, data on yield and secondary characters were collected from ten large estates representing the major rubber growing tract of Kerala. Three estates were chosen from Idukki Dist., two each from Trissur and Pathanamthitta and one each from Kottayam, Quilon and Kanyakumari Districts. The clones evaluated include RRII 105, PB 217, PB 235, PB 260, PB 311, PB 28/59, RRIM 600 and GT1.

Clones planted more or less in the same period were selected so as to facilitate a meaningful comparison among them. The selected fields were visited periodically during the past three years. Data on yield and secondary characters were collected during these visits either directly from the field or from the estates records. Secondary characters recorded were girth at opening, girth increment on tapping, incidence of *Phytophthora*, *Oidium*, Pink, occurance of brownbast (Tapping Panel Dryness), wind damage etc. Yield obtained without stimulation alone was utilized for the evaluation. Data on yield were available for a period of ten years in the case of clones PB 217, PB 28/59, RRIM 600 and GT1, for nine years in RRII 105 and for eight years in PB 235 and in PB 260. PB 260 and PB 311 being relatively recent plantings, the data for initial few years from a limited number of fields alone were available.

YIELD

The data were summarised on a per year and per hectare basis. Table 1 presents the average yield and range of eight clones, recommended by the Rubber Board. Mean yield based on less than five fields are not much reliable and must be taken with caution.

Over the first three years of tapping, clone RRII 105 exhibited relatively consistent yield trend and was the highest yielder too.

Over the fourth year PB 260 recorded the highest yield (mean yield in one estate only) and gave exceptionally good yield in the later years also. During the fourth year of tapping, clones RRII 105, PB 235, PB 260, PB 311 and PB 28/59 were high yielding and these clones continued to be high yielders in the fifth year also. Over nine years of tapping RRII 105 recorded the highest yield followed by PB 28/59. However, in the case of clones PB 217, PB 28/59 and GT1, the average yield for 10 years did not differ much. The yield of RRIM 600 and GT 1 was rather low during the first few years of tapping. But in the fifth year of tapping, it reaches 1680 kg ha^{-1} $year^{-1}$ and 1477 kg ha^{-1} $year^{-1}$ respectively, indicating the rising yield trend of these clones.

The average yield of the eight clones for first five years was 1358 kg ha^{-1} $year^{-1}$ ranging from 1151 kg ha^{-1} $year^{-1}$(GT 1) to 1618 kg ha^{-1} $year^{-1}$ (PB 260)(Table 2). Clones which showed above average yield per hectare include PB 260 (1618 kg), PB 311 (1451 kg), PB 28/59 (1406 kg) RRII 105 (1396 kg) and PB 235 (1369 kg)and those yielding below the average value were PB 217 (1266 kg), RRIM 600 (1214 kg) and GT 1 (1151 kg). However, yield of RRII 105 is considered to be more reliable than those from other clones because the number of fields involved in the study are more.

The average yield from fifth to tenth years of tapping was 1784 kg ha^{-1} $year^{-1}$ excluding clones PB 235, PB 260 and PB 311. In the case of PB 235 and PB 260 the data was available for 5-8 years only and for PB 311 it was nil. The yield data from fifth to tenth year ranged from 1673 kg ha^{-1} $year^{-1}$ (PB 28/59) to 1889 kg ha^{-1} $year^{-1}$ (GT 1). The yield pattern of GT 1 confirm its rising yield trend. Clones yielding above average included GT 1 (1889 kg), RRII 105 (1886 kg) and PB 217 (1786 kg) while clones yielding below average value were PB 28/59 (1673 kg) and RRIM 600 (1685 kg).

The yield over 10 years of five clones were tabulated (RRII 105 for nine years). The mean yield per hectare per year in descending order were RRII 105 (1614 kg), PB 28/59 (1540 kg), PB 217 (1526 kg), GT 1 (1520 kg) and RRIM 600 (1449 kg). The average yield for the first ten years of tapping on virgin bark for five clones was 1530 kg ha^{-1} $year^{-1}$.

The yield over first five years was generally lower than that during the subsequent five years and the magnitude of increase in yield from five to ten years varied with the clones. In majority of the clones, highest yield was recorded during the second year of tapping in B panel (BO-2).

SECONDARY CHARACTERISTICS

The vigour at the time of opening varied among the clones in the selected estates. The girth at opening ranged from 45.75 cm in RRIM 600 to 53.25 cm in PB 235 at a height of 125 cm from the bud union with an immaturity period ranging from five to nine years. Such wide range obviously would be due to different factors like forms of planting materials used (Field budding, budded stumps and polybag planting), clonal difference in growth as well as soil and climatic factors. The percentage of tappable trees at opening ranged from 50 to 70.

In the present survey it was observed that though the year of opening for RRIM 600 ranged between six to nine years after planting, the majority of the fields were opened between six and seven years. Clones GT 1, PB 217 and PB 28/59

also showed similar difference. PB 235 and PB 260 being more vigorous, were opened earlier i.e. between five and six years after planting. Girth increment on tapping also varied among the clones.

The clones were scored for their relative susceptibility to *Phytophthora*, *Oidium* and Pink diseases. None of the clones were found to be completely resistant to these three common diseases, although variation existed in the degree of susceptibility.

In the case of resistance to wind damage formed by trunk snap and uprooting some differences were observed among the clones. Of the nine clones observed, the most susceptible was PB 311. Majority of the clones were rated as of average tolerance to wind damage.

Occurence of brown bast (tapping panel dryness) tends to increase with the years of tapping and intensity of tapping. On tapping in Panel A (BO-1) a relatively low average incidence of brown bast was noticed. From the overall assessment of the rating, RRII 105, PB 28/59 and PB 235 tends to have above average brown bast incidence especially in the later years.

OBSERVATIONS OF CLONES

RRII 105

This is a high yielding hybrid clone evolved by the Rubber Research Institute of India and is vey popular in the traditional rubber growing tract especially among the small holders. This clone has recorded high initial and subsequent yield in all the estates, indicating the suitability in different regions of the traditional tract. It also shows low yield depression during summer months. Average production from seven large estates over five years was 1396kg ha^{-1} $year^{-1}$ and over nine years was 1614 kg ha^{-1} $year^{-1}$.

Trunk is tall and straight, branching is good with strong union. Vigour before and after tapping average with dense canopy. Foliage dark green with glossy leaves which is characteristic of this clone. Overall, mean girth in different estates at the time of opening was 49.81 cm.. Girth increment on tapping was average. Mean girth at 17th year after planting recorded to be 68.92cm.

In gerneral, this clone showed a fair degree of tolerance to abnormal leaf fall under normal prophylactic measures and moderate resistance to *Oidium*. High susceptibility to Pink is also reported.

It has shown average panel dryness and tends to increase with the years of tapping and intensive system of tapping. During the fourth year of tapping average incidence of brown bast was reported to be 5.26% under 1/2 S d/3 system of tapping, whereas 10.0% brownbast was noted in 1/2 S d/2 system of tapping. In the tenth year of tapping about 26% brown bast was recorded under 1/2 S d/3 system of tapping. This observation agrees with the trial results in which RRII 105 was reported to have above average occurrence of brown bast.

There was some indication of an increase in wind damage incidence. On tapping Panel A (BO-1) the average tree loss due to wind damage was 2.2 trees ha^{-1} 13.3% wind damage was rated during the 10th year of tapping in an estate near Trichur. Low incidence of patch canker also was noticed in certain areas.

PB217

The first commercial planting was done by Cheruvally estate, Erumeli (Harrisons and Malayalam Ltd.,) in 1970. This clone was developed by the Prang Besar Station in

Malaysia.Average yield over five years and ten years from six estates were 1266 kg ha^{-1} $year^{-1}$ and 1526 kg ha^{-1} $year^{-1}$ respectively. Yield during summer months is high for this clone. Comparatively high yield in estates located at Pathanamthitta and Trichur Districts, indicating the suitability of this clone in relatively dry regions, where drought period is long extending over a period of four to five months. Its better adaptability to dry climate and high summer yield is also reported 1, 6.

Trunk is tall and straight, with uniform girthing. Canopy high with dense foliage and light branches. Average girth at opening from different estates was 51.87 cm (range 50.41 cm -53.90 cm) with good girth increment on tapping (3.85cm mean over five years).

Incidence of abnormal leaf fall due to *Phytophthora* is mild in Indian conditions; whereas it is reported to be very severe in Malaysia. Very high incidence of Pink during earlier stages is noticed. In several fields less *Oidium* was reported. But in an estate in Idukki district, *Oidium* infection was severe, possibly due to relative high elevation and humidity in that area. Occurrence of panel dryness was average and wind damage was low. Under 1/2 S d/2 system of tapping only 4.27% dryness was recorded in the A panel (BO-1). The percentage scrap on tapping is very low.

PB 235

This is a high yielding clone, developed by Prang Besar Station of Malaysia. In India commercial planting of this clone was initiated in 1970. This is one of the high yielding popular clones in Malaysia. Production potential of this clone is high in India, recording 1369 kg ha^{-1} $year^{-1}$ and 1591 kg ha^{-1} $year^{-1}$ over five and eight years respectively. But in recent years very severe stem bleeding and attack of bark feeding caterpillar on the trees is reported in many estates, where incidence of *Phytophthora* is severe.

This clone is vigorous and can be opened early. Trunk is very tall and straight with long light branches. Girth at opening was high (Mean of five estates 53.26 cm; range 51.72cm-58.31 cm). Average girth increment on tapping was 3.20 cm for the first five years. Owing to its soft bark, generally bark consumption on tapping is high.

In general this clone was showing more than 75% leaf retention during rainy months under normal prophylactic measures against *Phytophthora*. But in a few estates high susceptibility to *Phytophthora* was reported. *Oidium* infection was severe and was susceptible to panel dryness also. In one field, 5.7% dryness had recorded in the fourth year of tapping, which was on 1/2 S d/3 tapping system. 20-25% more scrap was recorded due to late dripping.

PB 260

This is a high yielding hybrid clone developed by the Prang Besar Station of Malaysia. In India, the clone is in the early years of tapping and the yield data was available from a few fields only. Mean yield over five years was 1618 kg ha^{-1} $year^{-1}$ (two estates) and that over eight years was 1951 kg ha^{-1} $year^{-1}$ (one estate). In Malaysia average commercial yield is reported to be 1584 kg ha^{-1} $year^{-1}$ and 2200 kg ha^{-1} $year^{-1}$ for five and ten years respectively.[4]

This clone possesses good branching habit and canopy. Trunk is tall and straight; branches spreading with light side branches and dense foliage. It has uniform early vigour

and comes to tapping very early. Among three large estates, planted with this clone, two were opened for tapping during the fifth year and the third, during the sixth year. In three estates, average girth at opening was 53.15 cm with the range value 50.00 cm-57.00 cm. Bark thickness is high. Though virgin bark is smooth, renewed bark is flaky and bulging.

In general this clone showed average tolerance to *Phytophthora*, *Oidium* and Pink. In Malaysia this is reported to be highly susceptible to tapping panel dryness.[4] In the present study in two estates, incidence of dryness was relatively lower in the A panel (BO-1). However, in the oldest plantation in Pathanamthitta District about 15% trees were affected by panel dryness during the third year of tapping in B panel (B0-2) under 1/2 S d/2 system of tapping. Incidence of wind damage has not so far been observed except a few branch snaps. PB 260 is at present, upgraded to class 1 of Rubber Research Institute of Malaysia because of its high yield performance and relatively wind fast characteristics.[6]

PB 311

In India tapping of this Malaysian clone commenced in 1989 at Kumbazha estate, Pathanamthitta and Mooply estate, Trissur (both are Harrisons & Malayalam Ltd., Plantations). Mean yield over first five years in India was 1451 kg ha^{-1} $year^{-1}$.

The clone is of average vigour. In most of the cases the main stem looses its prominence after 4-5 metre height and diffuses into many secondary branches with small leaves.

The mean girth at opening from five estates was 52.06 cm ranging from 48.33cm to 57.00 cm. Average girth increment on tapping was 4.80 cm over five years. Thickness of virgin bark at opening is below average (4.0- 5.0mm). Hence extreme care should be taken during tapping in order to avoid the injury of cambium.

Pink disease has not been a problem and was relatively more tolerant to *Oidium* than *Phytophthora*. But one of the three fields in Pathanamthitta District was severely affected by *Oidium*. This clone is reported to be highly susceptible to wind damage in Malaysia[7]. Wind damage was relatively higher in the present study too. In the oldest plantation about 22.0% trees were badly affected by wind till the fifth year of tapping. In an estate near Mundakkayam about 4.1% of the trees were damaged by wind over the third year of tapping. Hence care should be taken not to plant this clone in wind prone areas.

Late dripping is a major problem, resulting in very high scrap percentage. In certain cases second collection of latex in the afternoon is also practised due to the high level of late dripping.

Among the clones, PB 311 reported lowest DRC (about 25%) especially during the early years of tapping.

PB 28/59

This Prang Besar primary clone was planted as early as in 1966 at Cheruvally estate, Erumeli (Harrisons and Malayalm Ltd.)

The response of agro-climatic condition is highly pronounced in this clone. First five years yield ranged from 744 kg ha^{-1} $year^{-1}$ (Idukki District) to 1548 kg ha^{-1} $year^{-1}$ (Pathanamthitta District). Generally its growth and yield are very high in Kanykumari region, with an average yield of 1806 kg ha^{-1} $year^{-1}$ over eight years. Higher yield possibly due to relatively low incidence of *Phytophthora* and *Oidium* in those regions. In the

present investigation average commercial yield over five and ten years were 1406 kg ha^{-1} $year^{-1}$ and 1540 kg ha^{-1} $year^{-1}$ respectively.

Trunk is fluted and crooked. Trunk bending is common in this clone. Canopy has moderate to heavy branches. Average girth at opening was 50.50 cm. Girth increment on tapping was below average.

This clone is highly suceptible to *Phytophthora* especially in *Phytophthora* endemic areas. The incidence of *Oidium* and panel dryness was also high. But wind damage was low. Incidence of brown bast was very high affecting 6.61% trees after five years of tapping. Number of trees that dried due to this malady was above 30% after 15 years of tapping.

RRIM 600

This is a popular high yielding clone developed by Rubber Research Institute of Malaya in 1932. In general this clone showed a steady rising yield trend. In present case, over five and ten years yield was reported to be 1214 kg ha^{-1} $year^{-1}$ and 1449 kg ha^{-1} $year^{-1}$ respectively. This clone perform well especially in Kanyakumari region, where yield over ten years of tapping was 1637 kg ha^{-1} $year^{-1}$. Relatively good growth performance has been reported in non-traditional tract also.[5]

Stem tall and straight with moderate heavy branches. During immaturity the main stem is typically tall and slender. Trees have a high level first fork. Hence induction of branching is desirable in this clone. Crown narrow and broom shaped; foliage sparse with small yellowish green leaves. Though girth at opening was low (Mean value 45.75 cm), girth increment on tapping was high.

Because of its high susceptibility to *Phytophthora* abnormal leaf fall disease, severe crop loss is experienced in *Phytophthora* endemic areas unless timely prophylactic measues are adopted. Average resistance to *Oidium* and pink is reported. Incidence of wind damage and brown bast is mild. But in a few estates, occurrence of above average brown bast was recorded. In a study on the long term performance of RRIM 600, it was recorded about 25% panel dryness in the later years of tapping.[1]

GT 1

Commercial planting of this early Indonesian clone was done by Cheruvally estate, Erumely in 1968. Studies revealed that the yield of GT 1 is rather low during the first few years of tapping. Average commercial yield over five and ten years of tapping is 1151 kg ha^{-1} $year^{-1}$ and 1520 kg ha^{-1} $year^{-1}$ respectively. In general, summer yield during the months from February to May, is high. This clone is also better adapted to dry regions.

Trunk upright and slightly kinked. Its branching habit is variable. Canopy narrow, open and globular with dense dark green leaves. Girth at opening in different estates was average (Mean 50.40 cm; range 47.90-52.19 cm). But girth increment on tapping was high. Over the three years of tapping average girth increment was 4.11 cm.

In general this clone has above average resistance to *Phytophthora* and Pink; whereas *Oidium* infection was observed from average to above average. Incidence of wind damage and panel dryness was relatively very low.

The data in the present survey reveals that the clones differ widely with respect to yield potential as well as secondary characters. A knowledge of the performance of both indegenous and exotic

Table 1. Yield (kg ha^{-1}) of various popular clones form certain large estates in India

Clones		Year of Tapping									
		1	2	3	4	5	6	7	8	9	10
RRII 105	a	926	1262	1531	1646	1614	1848	2158	1965	1573	
	b	604-1420 (18)	825-1986 (18)	1088-2301 (18)	1180-2578 (17)	1312-2249 (13)	1325-3192 (11)	1596-3894 (8)	1481-2815 (4)	1488-1736 (3)	
PB 217	a	709	1103	1414	1454	1652	1637	1720	1327	1809	2437
	b	454-1530 (8)	834-1519 (8)	973-1839 (8)	906-2194 (8)	988-2233 (7)	1217-2050 (3)	1531-2010 (3)	1042-1617 (3)	1359-2289 (2)	(1)
PB 235	a	670	1093	1598	1816	1668	1581	2752	1552		
	b	246-1088 (7)	833-1497 (7)	1242-2085 (7)	1516-2193 (7)	1304-2232 (7)	1255-2123 (3)	(1)	(1)		
PB 260	a	639	1439	1524	1665	2826	2413	2826	2280		
	b	494-723 (3)	1136-1741 (2)	1188-1859 (2)	(1)	(1)	(1)	(1)	(1)		
PB 311	a	880	1086	1504	1953	1833					
	b	525-1086 (6)	697-1344 (5)	1225-2185 (5)	1558-2708 (4)	1534-2017 (3)					
PB 28/59	a	645	1257	1472	1753	1904	1681	1540	2034	1925	1187
	b	335-963 (10)	723-1655 (10)	790-2029 (10)	964-2099 (10)	925-2480 (10)	910-2473 (10)	1067-2246 (8)	1305-3215 (8)	1365-3265 (4)	(1)
RRIM 600	a	580	785	1457	1569	1680	1490	1867	1887	1384	1795
	b	414-702 (5)	698-886 (5)	953-2368 (5)	1128-2357 (5)	966-2781 (5)	1114-2403 (5)	1523-2633 (5)	1228-2617 (5)	963-2197 (5)	1033-2440 (5)
GT 1	a	623	997	1228	1431	1477	1627	2044	1971	1763	2039
	b	328-1100 (9)	552-1390 (9)	947-1270 (9)	931-1858 (9)	1113-1916 (8)	1134-2094 (6)	1887-2355 (5)	1430-3195 (4)	1608-1917 (2)	1974-2104 (2)

a. Mean yield (kg ha^{-1} year^{-1}) b. Range (kg ha^{-1} year^{-1})

Values given in parentheses relate to number of fields recorded. Data from a minimum of five fields are more reliable.

clones in estates sector is beneficial for the appropriate choice of planting materials, to a considerable extent.

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Table 2. Yield (kg ha^{-1} $year^{-1}$) of various popular clones from certain large estates in India.

Clones	Mean yield over first five years of tapping	Mean yield over five to ten years of tapping	Mean yield over ten years of tapping
RRII 105	1396	1886#	1614*
PB 217	1266	1786	1526
PB 235	1369	1962+	1591@
PB 260	1618	2506+	1951@
PB 311	1451	–	1451x
PB 28/59	1406	1673	1540
RRIM 600	1214	1685	1449
GT 1	1151	1889	1520
Mean	1358	1784	1530

 # Data from four years of tapping
+ Data from three years of tapping
** Data from nine years of tapping*
@ Data from eight years of tapping
x Data from five years of tapping

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Sunlight Improves Quality of Rubber

Contrary to the popularly held belief that the drying of sheet rubber in direct sunlight causes defects, it has been found that drying in sunlight results in good quality rubber produced in a shorter time.

Dr. LMK Tillekeratne, director of the Rubber Institute of Sri Lanka (RRISL) said it was traditional to protect both sheets and crepe laces from sunlight, even going to the extent of painting factory windows black to prevent the entry of sunlight.

However, Dr. Tillekeratne said that according to the research of the RRISL, sheet rubber can be dried in hot sunlight in four to five days. He recommends the use of smoking for one day to produce the requisite honey brown colour and prevent mould contamination. In the case of unfractioned, unbleached crepe rubber, he says, it has been possible to completely dry them in two days by exposing to direct sunlight from 10 am to 4 pm continuously.

Dr. Tillekeratne says if sunlight is not available on the first day, a drying tower of smoke house should be used.

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