



Growth Performance of Clones Evolved by Ortet Selection of Rubber (*Hevea Brasiliensis*) in Dry Sub Humid Climate of Odisha

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Abstract

Need of more land for natural rubber (*Hevea brasiliensis*) cultivation expansion in India to non-traditional areas has entail the selection of clones suitable to warm dry climatic conditions of Odisha. The state is a nontraditional rubber growing region and the rubber tree undergo severe drought in the summer months. Prolonged high temperature, low erratic rainfall and soil moisture are the major environmental limitations affecting the performance of rubber in the region. The natural rubber early growth performance of 10 ortet clones namely O 1 to O 10 and 5 modern clones RRII 105, RRII 208, RRII 600, SCATC 93-14 and IRCA 111 were evaluated. The 10 ortet clones have been evolved from the elite tree selection among the polycross seedling populations established at the Regional Research Station of Rubber Research Institute of India in Dhenkanal, Odisha state. The 10 elite trees were cloned and such 10 clones evolved from ortet selection have evaluated for their early growth in terms of girth and other morphological traits. Girth at 5th year of planting of the ortet clones OR 8 and OR 4 were higher than that of the check modern clones RRII 105, RRII 208, RRII 600, SCATC 93-14 and IRCA 111. A good annual girth increment was also recorded in OR 8 and OR 5 and comparable to modern clones. Lower first branching height at 2.4 m and less number of branches 2.1 also recorded among ortet clones as compared to modern clones as desired for better clone selection and further tree improvement aspects. The present study at immature stage suggests scope of selection of promising local ortet clones from polycross seedlings suited to the sub optimal environment.



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Introduction

Rubber (*Hevea brasiliensis*) is traditionally cultivated in India in a narrow tract of land extending from latitude 8° to 12° N covering the states of Tamil Nadu, Kerala and Karnataka in India. Most of the area lies to the west of the Western Ghats. Due to limited scope for further expansion of the rubber cultivation area in this zone, increasing industrial demand and towards rubber cultivation expansion in dry and hot regions, cultivation of the crop was extended to less congenial areas.¹ One of the such regions identified was Odisha in Eastern India (20° N and 85° E). In this region, high temperature during the summer months, erratic low rainfall, low relative humidity and soil moisture in summer and heavy winds are the major limitations in growth and productivity of the rubber.^{1,2,3}

Selection of offspring following cross pollination is practiced in tree breeding programme for exploring chances of identifying the transmitted elite characters in the progeny under the native climatic condition. Polycross seeds developed under native climate is exposed to daily weather conflicts resulting in progeny with adaptive potential.⁴ Cross pollination is reported to be advantageous due to production of superior as well as locally adapted progeny.⁵ Such ortets which are the products of open pollination selected in a country would be important because they are locally adapted.⁶

In the early years of *Hevea* breeding in India, realizing the importance of indigenously developed planting materials, ortet selection was initiated in 1954,⁷ whereby a large population of trees raised from seeds were screened and high yielders identified. This led to the development of number of new primary clones. Ortet selection thus constitutes participatory plant breeding as practiced in rubber from the early days of crop improvement.⁴ Essentially ortet selection consists of identifying elite trees from a large population of genetically variable seedling trees, monitoring the selection for a period of time and finally cloning the best ortets to evaluate them in comparison with the best popular modern clones as checks.⁸

Stem girth of the *Hevea* trees is the one of the most important parameter based on which the status of maturity of the plantation is decided for tapping to

harvest latex, the product of commercial importance. Ideally a rubber plantation is considered mature and tappable when the trees have attained a girth of 50 cm at a height of 125 cm.^{9,10} Growth expressed in terms of stem girth increment is an important parameter in assessing genotypes for their adaptability in growth environments. Stem girth measurements and annual girth increment are extensively used in *Hevea* cultivation as parameters of growth during immaturity phase. These parameters are also generally used in assessing growth performance of new planting materials.¹¹ More adapted clones shows vigorous growth and reducing the initial phase before attaining tappable. The time to attain maturity by a plantation is quite important as it determines how long it will take to commence tapping to yield latex and to generate income. Morphological traits viz. first branching origin, number of primary branches are also important in point of view of canopy formation which plays an important role of clone successful survival against heavy winds.

The present study reports the early growth performance of ten ortet clones evolved from polycross seedling population and attempts to compare the performance with other modern popular clones under the sub optimal environmental conditions of Odisha.

Materials and Methods

The present investigation was undertaken at the Regional Research Station of Rubber Research Institute of India at Dhenkanal (Lat: 20° 49' N, Long: 85° 30' E, Alt: 100m above MSL) in the dry sub humid climate of Odisha, Eastern India. Ten ortets were selected from polyclonal seedling plantation in the RRS farm, Dhenkanal. The original polyclonal seedling population were raised in RRS farm, Dhenkanal in 1989 from seeds collected from polyclonal seed gardens in kanyakumari district of South India. The experiment site soil is lateritic in nature with pH 5.5. The ten best selected ortets from the original base polyclonal population were cloned and established in source bush at RRS farm. Ten ortet clones (OR 1 to OR 10) along with five check modern clones, viz. RRII 105, RRII 2018, RRIM 600, SCATC 93-14 and IRCA 111 were planted employing a randomized block design with three replications and five trees per plot (Table 1).

Field planting was done at 2.5 x 2.5 m spacing using polybag plants of mentioned clones during the 2008.

Cultural operations as per the recommended package of practices for rubber were adopted.¹²

Table 1: Parentage of rubber clones evaluated in Odisha

Clone Of origin	Parentage	Country
Ortet clones OR 1 to OR 10	Clones evolved from ortet selection	
RRIM 600	Tjir 1 x PB 86	Malaysia
RRII 105	Tjir 1 x GI 1	India
RRII 208	Mil 3/2 x AVROS 255	India
IRCA 111	PB 5/51 x RRIM 605	Ivory Coast
SCATC 93-114	TR 31-45 x Heck 3-11	China

The Growth in terms of girth was recorded as the girth of the stem at 1.25 m above from the bud union at regular intervals. The observation recorded during the fourth and fifth year after planting (Y.A.P).

Observations on first branching height and number of primary branches were recorded during the fifth year of planting. The growth parameters were analyzed following standard statistical procedures.¹³

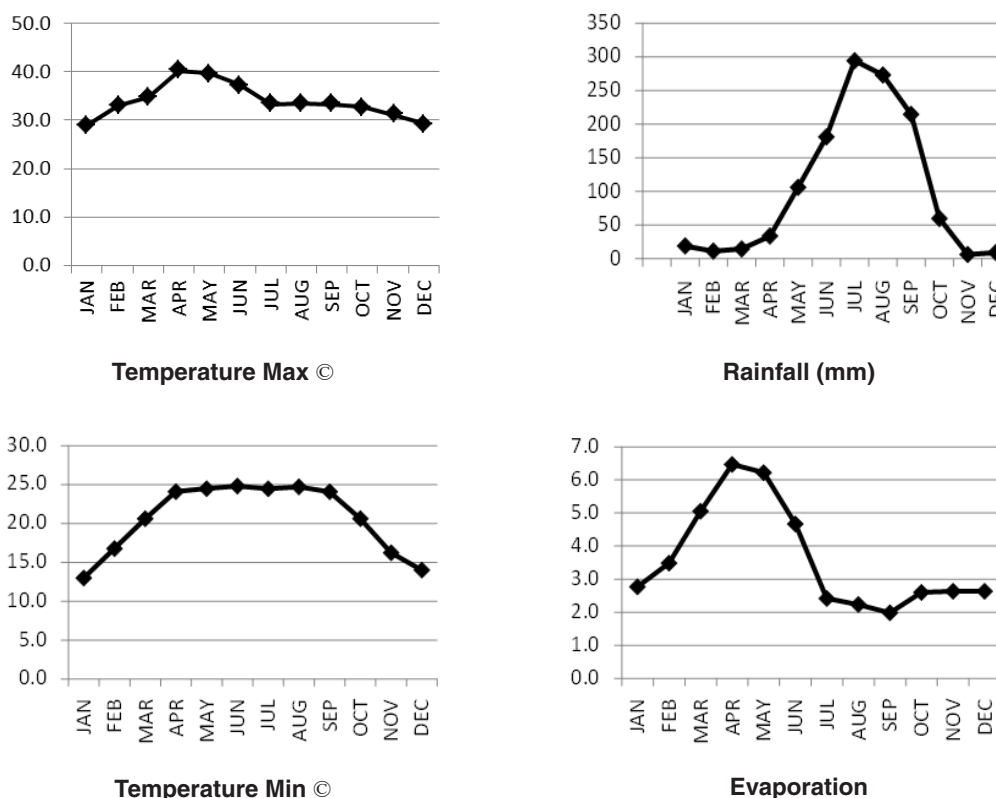


Fig. 1: Temperature Max & Min, Rainfall and Evaporation during study period

Results & Discussion

Dhenkanal is located in Odisha state in eastern India and experiences a hot, dry sub-humid climate and less congenial for rubber cultivation. The region received a mean annual rainfall of 1225 mm with only 67 rainy days, during the study period. The rainfall was almost confined to June to September with July recording the maximum rainfall. The dry period in general ranges from October to May during which experiences drought conditions. The summer months shows severe soil moisture stress conditions. The erratic and low rainfall are the major contributing factors for severe moisture stress during the major part of the year. The highest mean maximum temperature of 40.2 was recorded

during the month of April, while the lowest mean minimum temperature was recorded in January. November to February is the winter and the summer is from February to June (Fig 1). Adverse weather conditions limited the growth of the rubber plants.^{2,3,14} Growth performance assessment and possible adaptability in future among locally evolved clones from ortet selection has been taken in consideration under such dry sub humid climate.

Tree growth is an important factor for early good yield.¹⁵ Further, the early growth is crucial for *Hevea* especially with respect to the attainment of tappable girth.^{9,10}

Table 2 :Growth performance of ortet and modern clones

Ortet clones/ Modern clones	Girth (cm)		Annual Girth Increment (cm)
	4 th Y.A.P.	5 th Y.A.P.	
OR 1	20.5	27.0	6.5
OR 2	19.8	26.0	6.2
OR 3	21.5	27.2	5.7
OR 4	23.8	29.6	5.8
OR 5	20.7	28.3	7.6
OR 6	21.7	28.1	6.4
OR 7	22.1	28.3	6.2
OR 8	23.0	30.1	7.1
OR 9	19.6	24.9	5.3
OR 10	21.1	28.4	7.3
RRIM 600	19.2	26.9	7.7
RRII 105	20.8	26.7	5.9
RRII 208	19.4	27.4	8.0
IRCA 111	17.7	24.9	7.1
SCATC 93-14	20.5	30.0	9.5
C.D.	NA	NA	-
SEm	1.76	2.03	-
C.V.	14.73	12.75	-

The growth of trees in term of girth and mean annual girth increment from fourth and fifth years of planting is depicted in Table 2. The clones evolved from ortet selection showed good girth as comparative to modern clones. The ortet clones OR 8 and OR 4 have attained highest girth 30.1 cm after the fifth year of planting. The higher mean annual girth

increment in ortet clone OR 8 was also comparable to girth increment among modern clones. Clones that are more adaptable shows vigorous growth, thus reducing the initial phase before attaining tapability. Good girthing is an important character in sustaining high yield in superior clones and and also reducing wind damage losses through trunk snap.¹⁶

Stem annual girth increment is widely used as a parameter of growth in natural rubber, particularly during the immaturity period. Growth in terms of girth increment is an important parameter in assessing genotypes for their adaptability in new growth environments.¹¹

The present study has showed inter clonal variations in first branching and number of primary branches (Table 3). Lower first branching height at 2.4 m

recorded in ortet clone OR 5 and few other ortets clones. Lesser number of primary branches 2.1 have been observed among ortet clones as compared to modern clones. Less number of primary branches and low first branching height are desirable characters for ideal clone selection. The primary branches contributes a significant role in the formation of the canopy. Balanced canopy plays an important role in wind resistance among natural rubber plantation.¹⁷

Table 3: Branch characteristics of ortets and modern clones

Ortet clones/ Modern clones	First Branching Height (m)	Number of Primary Branches
OR 1	2.8	2.6
OR 2	2.9	2.2
OR 3	3.0	2.1
OR 4	2.9	2.6
OR 5	2.4	2.1
OR 6	2.8	2.4
OR 7	2.7	3
OR 8	3.0	2.6
OR 9	2.8	2.4
OR 10	2.6	2.5
RRIM 600	2.9	2.3
RRII 105	2.8	2.5
RRII 208	3.1	2.6
IRCA 111	3.1	2.7
SCATC 93-14	2.9	3.7
C.D.	NA	NA
SEm	0.24	0.23
C.V.	14.91	15.97

In the present study clones evolved from ortet selection showed at par growth in desired traits as compared to modern clones under the dry sub humid climatic condition. The ortet clones OR 8, OR 4 and OR 3 showed comparative good growth, morphological characters and adaptability in the region, which indicated that the clones evolved from ortet selection could be comparatively better adapted in local dry sub humid climatic conditions. The good growth performance of ortet clones in the region suggests the scope of selection of local clones for stressful dry sub humid conditions of the Odisha state.

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Conflict of Interest

The authors do not have any conflict of interest.

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