Long term performance of RRII 400 series clones in North Kerala

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Clone RRII 105 which is extensively cultivated in northern Kerala takes around 9 to 10 years for 70 per cent of the trees to reach tappable girth in majority of the small holdings. The slow early growth of RRII 105 in the region leading to delay in attainment of tappable girth, susceptibility to diseases and wind damage are some of the adverse traits associated with this clone. Of late the reporting of Corynespora leaf fall disease in clone RRII 105, which is highly susceptible to Corynespora (Manju *et al.*, 2010) in Karnataka region and in isolated tracts in the Malabar region pointed towards the adverse impact of monoclonal planting of rubber over large areas. Better performance of the RRII 400 series over that of RRII 105 in south and central Kerala prompted testing of these clones in north Kerala also so as to develop a set of multiple best performing clones suited to the region. With this in view a large scale clone evaluation trial incorporating 12 hybrid clones comprising nine indigenous clones (including five from the RRII 400 series) and three exotic clones were laid out in 1996 in the farm of Regional Research Station of RRII located at Padiyoor (11°58' N, 75° 36'E and 60m above MSL). Details of the field layout, data recording and overall performance of all these clones in the early years has been reported elsewhere (Meenakumari *et al.*, 2015). The long term performance of the five RRII 400 series clones from this trial over nine years of tapping and secondary traits are reported here. The seasonal yielding pattern of the RRII 400 series clones in response to the specific agroclimatic conditions prevailing in the region is discussed.

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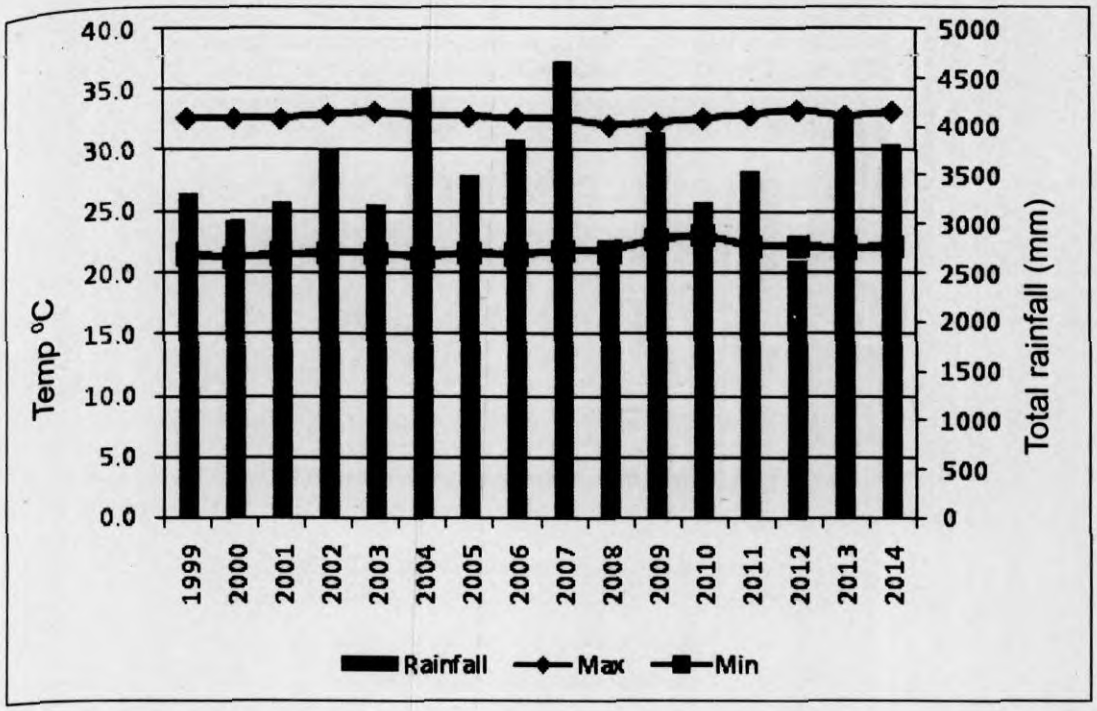

Fig 1. Weather during the study period (1996-2014)

Weather data of the station during the study period is given in Fig.1. The region receives an average annual rainfall of 3500 mm with optimum number of rainy days as ideally required (Rao and Vijayakumar 1992). However, rains are mostly concentrated during the months from June to August (Table 1). North East monsoon showers are limited and summers are relatively dry. The

Table 1. Monthly variation in temperature and rainfall distribution (1996-2014)

Month	T max (°C)	T max (°C)	Total rainfall (mm)	No. of rainy days
Jan	34.8	19.2	5.3	-
Feb	35.3	20.2	4.4	1
Mar	36.3	22.1	28.3	1
Apr	35.6	23.7	75.8	4
may	33.7	23.8	240.8	9
June	30.3	22.8	827.6	24
July	28.7	22.6	946.0	28
Aug	29.2	22.5	661.0	24
Sept	30.5	22.4	317.6	16
Oct	31.8	22.4	319.0	14
Nov	33.4	21.3	120.7	6
Dec	34.1	19.5	15.9	1

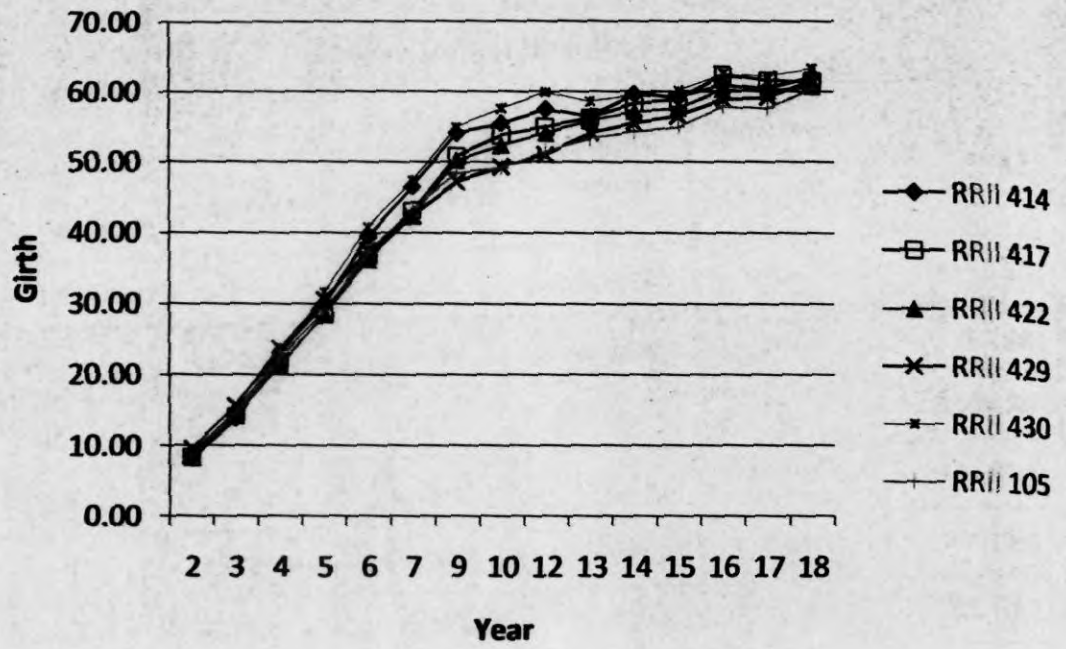

Fig 2. Growth trend of clones

uneven distribution of rainfall results in a longer dry spell of 4 to 5 months. Temperatures are also high with maximum temperatures ranging from 35 to 38°C during the summer months. Hence this part of Kerala is considered to be a seasonal drought affected area within the traditional belt. Growth of trees in the region was slow during the initial years and clonal variability was more pronounced 3-4 years after planting (Fig.2). All the five clones exhibited faster rate of growth than

Table 2. Growth attributes of clones

Clone	Tappability (%) (10th yr)	Girth at opening	Girth increment rate		Clear bole volume (m^3) 20th yr
			At immaturity	On tapping	
RRII 414	74.20	54.05abc	5.95ab	0.92d	0.11
RRII 417	63.49	50.80abcd	5.74abc	1.29bcd	0.10
RRII 422	62.92	50.19abcd	5.53abc	1.26bcd	0.10
RRII 429	53.33	47.22de	5.18bcd	1.50bc	0.07
RRII 430	76.07	54.93a	5.97ab	1.12cd	0.11
RRII 105	50.93	48.47bcde	4.98cd	1.53bc	0.08

RRII 105 during the immature phase which was reflected on the tappability percent also (Table 2). RRII 430 recorded the highest tappability of 76 % followed by RRII 414 (74 %). RRII 417 and RRII 422 also exhibited higher percentage of tappable trees (63 %) than the check clone RRII 105 (51%). Lakshmanan *et al.*, (2014) reported 53 per cent tappability for RRII 105 from this region. Girth at opening of RRII 430 was significantly superior to that of RRII 105.

The faster growth rate of the new clones has been observed in other experimental fields (Mydin *et al.*, 2011) and in commercial plantations and farmers holdings in Central and South Kerala (Mydin *et al.*, 2012; Gireesh *et al.*, 2013; Narayanan and Mydin 2015). After opening, the growth rate of RRII 400 series was not very vigorous and the girth increment rate was comparable to that of RRII 105. The observations by Deepthy *et al.*, (2010) corroborate these findings. Clear bole volume was estimated 20 years after planting. The new clones except RRII 429 recorded better bole volume (0.11 m^3) than RRII 105 (0.08 m^3). However, clonal variations were not significant presumably due to the poor and slow growth of trees in this region.

The bole volume reported from other locations ranged from 0.1 to 0.2 m^3 (Mydin *et al.*, 2011, Meenakumari *et al.*,(2013).

Mean annual dry rubber yield over nine years of tapping is given in Tabel 3. Yield of RRII 430 was significantly superior in the BO-1 panel (60.25 g t^{-1} t^{-1}). The trend in yield was the same in the BO-2 panel also and for the entire period of nine years (60.33g t^{-1} t^{-1}). RRII 105 recorded a mean yield of 49.8 g t^{-1} t^{-1} in the BO- 1 panel, 52.13 g t^{-1} t^{-1} in the BO-2 panel and 50.63 g t^{-1} t^{-1} over nine years of tapping.

The yield of RRII 414, RRII 417 and RRII 422 was comparable to that of RRII 105. Year wise yield of the clones in comparison with RRII 105 is depicted in Fig. 3. RRII 430 showed significantly superior yield from the first year of tapping onwards. The

Table 3. Mean yield ($gt^{-1}t^{-1}$) of clones over 7 years of tapping

Clone	Annual yield ($gt^{-1}t^{-1}$)		
	BO -1 panel	BO -2 panel (over 3 yrs.)	Mean over 9 yrs.
RRII 414	49.59bcd	47 bc	48.73 bc
RRII 417	53.83b	50 b	52.41 b
RRII 422	51.68b	54.88 ab	52.75 b
RRII 429	45.14cde	46.5 bc	45.6 cd
RRII 430	60.25a	60.5 a	60.33 a
RRII 105	49.88bc	52.13 ab	50.63 bc

Note : Means followed by the same letters are not significantly different

consistent behaviour of RRII 430 has been noticed across locations (Mydin *et al.*, 2011, Meenakumari *et al.*, 2011). Clonal differences in yield performance were more conspicous during wet months than in the dry months. Monthly variation in yield of the high yielding clones is given in Fig 4. Minimum

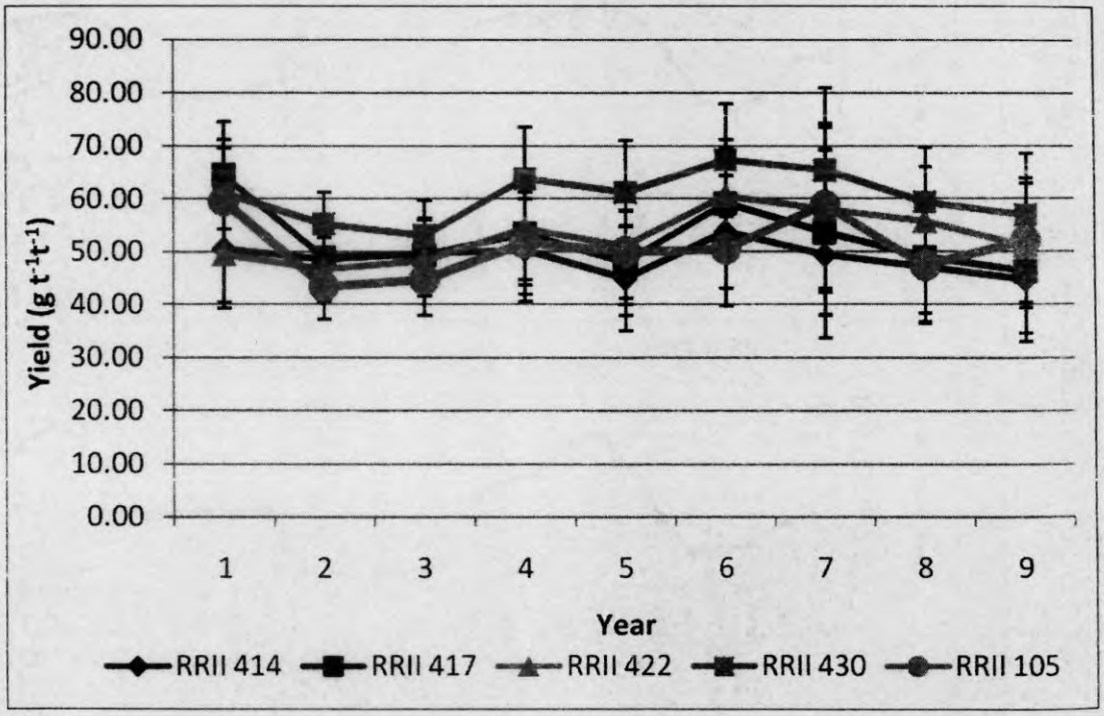

Fig 3. Yearwise yield of clones

performance was noticed during the drought prevailing months (Feb-May) for all the clones. A progressive increase in yield was seen from June onwards, with clonal variation in the proportion of increase. A striking feature was the shift in seasonality of yield in North Kerala compared to rest of the traditional belt. Peak yield observed in the present study was during the months of August-September. Lakshmanan *et al.* (2014) also reported the same pattern from the region in a set of exotic clones. In South and Central Kerala experiencing both monsoons, a dual peak could be observed during July and November (Mydin *et al.*, 2007; Rajagopal *et al.*, 2003). In the present study, eventhough a second peak was observed in November, yield was relatively lower, presumably

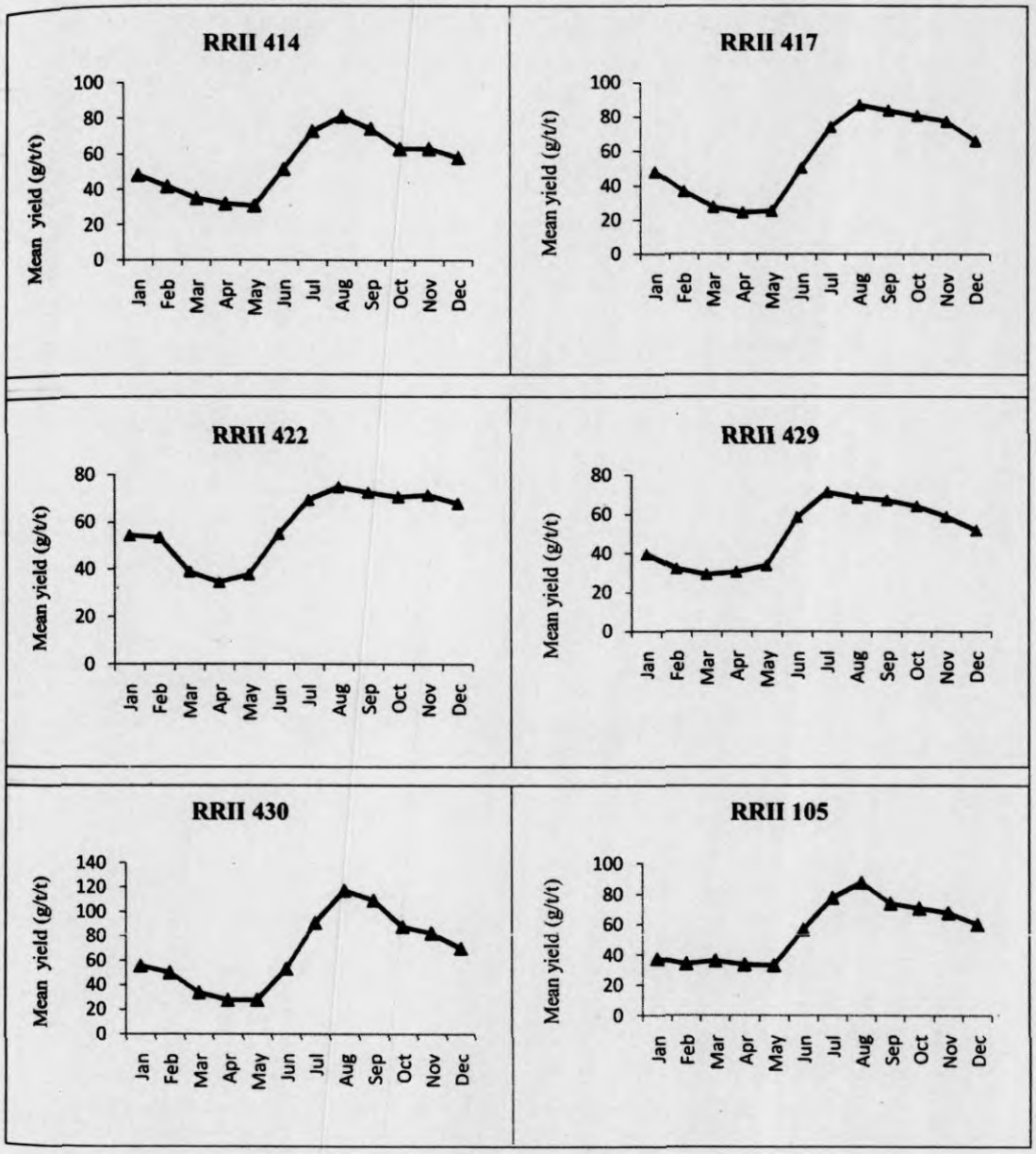

Fig 4. Monthly variation in yield of selected clones