EFFECT OF GENETIC DIVERSITY ON FRUIT SET IN HEVEA BRASILIENSIS.

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Abstract: Fruit set was evaluated in six crosses of *Hevea brasisliensis* clones in Rubber Research Institute of Nigeria, Iyanomo, Benin City with the objective to evaluate variation for fruit set among the crosses. Hand pollination was carried out in 2008 and 2009 using diallel crossing technique with three replications. Analysis of variance using randomized complete block design and mean separation were the statistical tools applied. There was significant variation for crosses in 2008, 2009 and combined analysis. Interaction between crosses and year was significant. The implications of these results are discussed.
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1. Introduction

Controlled hybridization is one of the regular exercises in Plant Breeding Division of Rubber Research Institute of Nigeria (RRIN) to generate new *Hevea* clones with potential for high latex yield. This process which allows plant breeders to manipulate and control the genetic composition of new genotypes has led to the development of new *Hevea* clones with higher latex yield in RRIN. The improvement was from between 300 and 400Kg/ha/yr for the original Wickham germplasm pool to 900 and 1600Kg//ha/yr and thereafter to 2000 and 3500kg/ha/yr (Omokhafe and Nasiru, 2005).

However, development of new *Hevea* germplasm is dependent on the number of fruit sets that are obtainable from the crosses. Generally, fruit sets in *Hevea brasiliensis* is reportedly very low ranging between 0 to 5% and rarely exceeding 10% (Priyadarshan and Clement- Demange, 2004; Hamzah et al, 2002). This low fruit set has limited the number of germplasm developed at any hybridization exercise and selection process. The higher the fruit set, the higher the chances of generating new germplasm from which evaluation and selection can be practiced.

Diversity of parents in crosses also plays an important role in improvement programmes. For example, Olapade and Omokhafe (1990) reported a significant clonal variation for fruit sets in *Hevea brasiliensis*, suggesting that genetic factors influence the incidence of fruit set. Previously at RRIN, exotic rubber clones of Malaysia origin have been used extensively in hybridization programmes to generate new *Hevea* hybrids for evaluation and selection. Recently, the focus is on the generation of hybrids using parents from different genetic bases. This may have the combined effect of improving the latex yield (economic value) of the crop and improving fruit sets in *Hevea*. This study was carried out to investigate the effect of genetic diversity on fruit set in *Hevea brasiliensis*.

2. Materials and methods

Four clones, i.e. three RRIN developed (NIG 801, NIG 804 and NIG 805) and one of Malaysia origin (RRIM 600), were selected based on their high latex yield. These were used in a diallel mating design in three replications to generate single cross hybrids and their reciprocals in March to April of each of 2008 and 2009, respectively. Hybridization was successful in six (6) out of the planned twelve crosses and fruit sets were recorded in May/June of each year. These were calculated in percentages and used in analysis of variance applying the randomized complete block design (RCBD) model for the individual year as well as the combined years as outlined by Steel and Torie (1960). This is because the diallel analysis model had no advantage over the RCBD. The mean performance for each cross was separated using least significant Difference at 5% probability level.

3. Results and Discussion

The results of the pollination exercises for the two years are presented in Table 1. Analyses of variance for the individual year (Table 2), combined years (Table 3) and Mean performance for each cross (Table 4) are also presented. The analysis of variance for the individual years and the two years combined showed that highly significant differences for fruit set among the crosses in *Hevea* exist. These differences suggested the existence of considerable genetic variability among the parents used for the crosses and could be exploited to maximize higher fruit set in rubber. Consistently higher fruit sets were recorded among the crosses between Nigeria clones (RRIN

developed clones) and the one of Malaysian origin than those involving only Nigerian clones (RRIN developed clones). The ones involving clones of Nigeria origin were also consistently very low in fruit sets in both years. This means that clones from different genetic base in crosses set more fruits in *Hevea* than those from one locality.

In this study, more fruit set was recorded in 2009 than in 2008 for any particular cross suggesting that records of fruits sets must be evaluated for more than one year before inferences could be drawn on how many years are required to make an assertion on the role of genetic diversity in improving fruit sets in *Hevea*. This is also corroborated by the significant Year x Cross interaction effect obtained which could have meant that the relative performance of the parents in crosses for this character were not consistent from year to year. However, the second year evaluation of the crosses did not produce any change in the performance ranking of the crosses, i.e. the crosses that performed best in 2008 in fruit sets were also the best in 2009 in the same order. This showed that factors other than genetic may have influenced higher fruit set in 2009 than 2008. Therefore, in Hevea, one year evaluation is sufficient to draw valid conclusion that genetic diversity of parents in crosses is an important factor in improving fruit sets. Generally, fruit sets in Hevea brasiliensis is low, about 5% and rarely exceeding 10% (Priyadarshan and Clement- Demange, 2004; Hamzah et al, 2002). However, a cross, NIG 801 x RRIM 600 in 2009 recorded about 13.40% fruit sets while in 2008 crosses, it also recorded the highest value of 6.68%. Therefore, the parents (NIG 801and RRIM 600) used in the cross have great potentials for high fruit set among the set of Hevea clones used in this study.

Table I: Fruit set results for 2008 and 2009 Hand pollination exercise in RRIN

		Flowers pollinated		Fruit set total		% Fruit set	
S/N	Crosses	2008	2009	2008	2009	2008	2009
1	NIG805 x RRIM600	2064	2551	10	48	0.48	1.88
2	NIG805 x NIG804	2198	2446	5	5	0.23	0.20
3	NIG805 x NIG801	2553	2499	5	16	0.20	0.64
4	NIG804 x NIG801	2109	2412	24	23	1.14	0.94
5	NIG804 x RRIN600	2160	2343	26	78	1.20	3.33
6	NIG801 x RRIM600	2276	2604	152	349	6.68	13.40
	Total	13360	14855	222	519	1.66	3.49

Table 2: Mean squares for the analyses of variance for % fruit set in 2008 and 2009 respectively

		Means squares	
Sources of variation	Df	2008	2009
Replication	2	0.10	0.04
Crosses	5	10.36**	8.43**
Error	10	0.04	0.04

** = significant at 1% probability level.

Table 3: Means squares for the combine analysis of variance for percentage fruit set in 2008 and 2009

Sources of variation	Df	Mean square
Year	1	1.65**
Rep/year	4	0.04
Crosses	5	9.37*
Cross x year	5	1.13**
Error	20	0.04

*, ** = significant at 5% and 1% level of probability, respectively.

Table 4: Mean separation for fruits sets in the crosses in 2008, 2009 and combined years.

S/N	Crosses	Means		Combined
		2008	2009	
1	NIG805 x RRIM600	0.33	0.63	1.44
2	NIG805 x NIG804	0.23	0.07	0.45
3	NIG805 x NIG801	0.20	0.21	0.62
4	NIG804 x NIG801	0.54	0.32	1.29
5	NIG804 x RRIM600	0.56	1.11	2.50
6	NIG801 x RRIM600	2.37	4.47	10.27
	LSD %	0.36	0.36	0.34

It is also reasonable to suggest that further hybridization exercise in RRIN Rubber Improvement Programme should include only parent materials from wide genetic base to improve fruit sets. This will increase the breeders' chances of having more genotypes for evaluation and selection for the desired characters.

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