

## Identification of high-yielding trees in cacao (*Theobroma cacao*)

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Since cacao (*Theobroma cacao* L.) is gaining considerable importance in the national economy, an identification of high-yielding trees to achieve increased productivity is essential. A few Malaysian cacao accessions along with arecanut (*Areca catechu* L.) were planted at Vittal to study the spacing and manurial requirement. As some of these introduced materials showed high-yield potential at this regional station, an attempt was made to identify high-yielding trees, which can be either directly utilized for clonal multiplication and planting or as parents in the breeding programmes.

At Vittal, an experiment on areca-cacao mixed crop involving 6 spacings and 2 manurial doses replicated 4 times is in progress since 1970. For cacao crop tree-wise yield data on number and weight of pods for 10 years (1975-1984) were utilized for the present study. There were 456 trees. The analysis of the experimental data revealed that there were significant difference between spacings but not between manurial doses (Shama Bhat 1983). Further leaving aside the closest spacing S<sub>1</sub> (areca 2.7 m × 2.7 m and cacao 2.7 m × 2.7 m) and the widest spacing S<sub>3</sub> (areca 2.7 m × 2.7 m

and cacao 5.4 m × 5.4 m), the remaining 4 spacings, viz S<sub>2</sub> (areca 2.7 m × 2.7 m and cacao 2.7 m × 5.4 m), S<sub>4</sub> (areca and cacao in 3.9 m × 3.9 m quincunx), S<sub>5</sub> (areca and cacao in 3.3 m × 3.3 m quincunx) and S<sub>6</sub> (areca 2.7 m × 2.7 m and cacao 3.6 m × 5.4 m), were at par.

To identify elite ones, trees receiving both the manurial doses and planted in spacings S<sub>2</sub>, S<sub>4</sub>, S<sub>5</sub> and S<sub>6</sub> were considered, because the effects of these treatments were at par. For this curtailed population, mean and coefficient of variations were worked out for number and weight of pods/tree/year.

The following selection criterion was adopted to identify the elite trees due to importance of each of the yield attributes.

*Step 1.* Fix up norms of high mean and low coefficient of variation separately for number and weight of pods based on their distribution pattern.

*Step 2.* Select 2 groups of elite trees, one based on pods/tree and another based on podweight/tree, using the norms arrived at step 1.

*Step 3.* Pool these 2 groups and rank these trees separately for each of the 10 years based on estimated dry-bean yield and final ranking is done using 'ranksum' technique.

There was a wide variation in mean values and CV even for the curtailed population. The mean yield/tree for pods was 10-159 pods and for weight of pods 3.11-45.36 kg. The CV was 16.53-109.1%. The frequency distribution of trees for varying tree yields shows that 33% of trees yield have less than 45 pods or 15 kg wet weight

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Table 1 Yield attributes, rank-sum and coefficient of variation for yield of cacao

Tree No.	Yield attributes/tree/year			Dry-bean yield	
	Pods	Wet weight (kg)	Estimated dry bean (kg)	Rank-sum of 10 years	CV (%) of 10 years
29/1	159	48.4	6.69	29	31.7
18/1	126	35.6	5.10	60	29.4
56/1	111	36.3	4.94	65	38.1
30/1	127	32.0	4.84	65	35.6
11/3	111	36.3	4.60	72	35.2
16/1	128	33.4	4.43	80	33.0
5/1	96	30.8	4.15	85	18.5
67/2	94	45.9	4.14	90	23.6
5/3	91	35.1	4.32	91	37.9
101/3	112	47.4	3.98	91	28.4
48/3	121	32.4	4.23	93	33.3
18/2	83	38.2	4.01	100	30.8
89/1	108	36.4	3.77	100	28.1
13/3	93	32.1	3.80	109	35.9
11/2	81	38.1	3.20	122	33.3
21/1	99	34.5	2.97	135	37.5
12/1	105	33.5	2.84	143	32.6

of pods and 6% of trees yield have more than 105 pods or 35 kg wet weight. This reveals the common trend of majority of low-yielders and a minority of high-yielders. This pattern is similar to other perennial crops such as arecanut or coconut (*Cocos nucifera* L.) (Bhagavan 1985). Majority of trees had 30–70% CV. Only one-fourth of trees had CV less than 40%.

Of the 288 trees, 11 were selected. These trees yielded on an average 96 pods and above and coupled with CV less than 40%. Similarly 14 selected trees yielding on an average 32 kg and above showed CV less than 40%. Pooling these 2 groups of selected trees resulted in a net total of 17 elite trees, since 8 trees were common to both the groups. Among the selected trees, 4 trees (29/1, 16/1, 89/1, 21/1) belonged to 'Amelanado' × 'Na 33'; 5 trees (67/2, 18/1, 11/3, 18/2, 11/2) to 'Landas 364'; 3 trees (30/1, 101/3, 48/3) to 'Amelanado' × 'Na 32'; 3 trees (56/1, 13/3, 12/1) to 'PA 7' × 'Na 32'; and 2 trees (5/1, 5/3) to 'Red Axil'.

Mean yield/tree/year for number of

pods, weight of pods and estimated dry-bean yield along with rank-sum and CV for dry-bean yield are presented in Table 1. The trees listed were arranged based on rank-sum. Tree No. 29/1 with low rank-sum showed highest yield for all the yield attributes. The other trees which rank high were 18/1, 56/1 and 30/1.

Single (dry) bean weight characteristic for these 17 trees highlighted the importance of trees 21/1, 11/2, 18/2, 67/2, 5/3 and 101/3, because these had beans weighing more than 1 g.

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