



## COCOA VARIETIES DEVELOPED AT CPCRI

S. Elaine Apshara

To increase the productivity per unit area and to meet the demand of chocolate industry, it is important to utilize multiple elite clones and hybrids in the area expansion programmes recommended by National Horticulture Mission (NHM). The Central Plantation Crops Research Institute (ICAR- CPCRI) initiated and involved in cocoa research at its Regional Station, Vittal in Karnataka state from 1960 onwards. From then on cocoa improvement programmes were intensified in a systematic manner with the following breeding strategies *viz.*, germplasm collection from primary and secondary centres of origin and distribution, conservation as field gene banks, characterization, evaluation and breeding for desirable traits. Apart from these comparative yield trials under different crop canopies and densities, multi location trials were effected to identify location specific clones (Elaine Apshara *et al.*, 2005). Methodologies followed in varietal improvement and details on varieties developed with high yield and specific characters (Table.1 and 2) are given here.

### 1) Breeding methods

**1.1). Selection:** An easy approach in cocoa improvement is selection breeding, which is possible with genetically variable populations (Vikraman Nair *et al.*, 2002). As a cross pollinated crop and with existence of self-incompatibility, the variability in cocoa is so high that in a seedling population, about 75% yield is obtained from 25% of the trees. CPCRI, Regional Station is conserving 405 germplasm collections which comprises of basic types of cocoa, the Criollo, Forastero, Trinitario and clones of different genetic groups and geographical origins. Evaluation trials are mainly focussed on assessing the cocoa genotypes for vegetative vigour, precocity in

bearing, adaptability in the introduced environment, cropping efficiency, stability in yield, potential in production, compatibility behaviour, quality attributes and their reaction to biotic and abiotic stress. In the mixed cropping system under arecanut and coconut, trees yielding an average of >50 pods/tree/year with medium canopy over six years after stabilisation, smooth pods with >350 g weight and >120 g wet bean weight/pod, having >35 beans with >1 g dry bean weight contributing to >1 kg dry bean yield/tree/year, processing value with 10-15% shelling, 85-90% nib recovery and >50% fat content are followed as selection criteria.

**1.2).Clonal selection:** In the beginning of this century, clonal selection programmes were initiated with pod index, bean size and disease resistance as criteria. Individual tree selections were made from seedling populations, utilised in hybrid development and further evaluated in clonal trials to fix the genetic potential (Eskes and Lanaud, 2001). Production of cultivars as clones is crucial in perennial crop breeding to reduce the period of breeding cycle, to get true to type plants, maximum yield from minimal canopy and to combine desirable traits. At CPCRI, cocoa germplasm collections were originally imported as seeds, evaluated under local conditions, individual performers were selected, clonally multiplied and further evaluated for performance as multiple clones. Later, imports were made as bud sticks, conserved as clones, evaluated and clonal selections were made from their performance over years.

**1.3).Hybridization:** Developing hybrids between two distant genotypes is another method



commonly adopted, which are based on heterosis and hybrid vigour and mainly for resistance breeding programs. Availability of self-incompatible but cross-compatible parents became advantageous in production of hybrids in cocoa. At CPCRI, five progeny trials involving 80 cross combinations with specific objectives were tried from 1980 onwards and best hybrids were developed as varieties. After effective testing of hybrid progenies as seedlings, clonal evaluation and further selections were made. It will boost mother trees for wider distribution instead of going for individual crosses of selective hybrid combination every time. Either parental clones will be supplied for establishment of bi clonal orchard for production of particular hybrid (Wood and Lass, 1985) or clones of hybrids will be supplied for planting as well as for mother blocks or scion banks.

These varieties are suitable for coconut and arecanut growing tracts in Western Ghats Hills and Plains of Karnataka and Kerala as well as the

coconut growing tracts of Tamil Nadu, Andhra Pradesh, Maharashtra and Goa under irrigated conditions. Optimal height and canopy area should be maintained with systematic annual pruning in the intercropping system. With recommended package of practices; 100:40:140 g NPK/ tree/ year in two splits and 20 litres of water/ day/ tree with drip irrigation during rainless periods will enhance the potential of the crop. Cost of cultivation with drip system will be around Rs.35,000/ ha with benefit cost (BC) ratio 1:3.

- In the future, varieties suitable for climate change scenario to be considered with location/ region specific clones and adaptive common clones for all cocoa growing zones.
- Varieties tolerant to major pests and diseases both existing and emerging are to be given priority with continuous evaluation and surveillance over seasons and cropping systems.
- Qualitative profiling of regional varieties to be done to get premium price.

Table 1. Hybrids

<p><b>VTLCH-1 (Vittal Cocoa Hybrid 1)</b>                      Vigorous, early, heavy bearer                      No. of pods/tree/year-50 (canopy 16m<sup>2</sup>)                      No. of beans/pod-40 to 42                      Single dry bean weight-1 to 1.11 g                      Shelling-13%, Nib recovery-87%, Fat-54%                      Dry bean yield-1.48 kg/tree/year, 1014 kg/ha</p>	
<p><b>VTLCHI-2</b>                      Hybrid, early, heavy bearer with medium canopy, tolerant to black pod rot                      No. of pods/tree/year-50 (canopy 15m<sup>2</sup>)                      No. of beans/pod-40                      Single dry bean weight-1 to 1.5 g                      Shelling-11%, Nib recovery-89%, Fat-54%,                      Dry bean yield-1.5 kg/tree/year, 1030 kg/ha.</p>	



**VTLCH-3**

Hybrid, heavy bearer, suitable for water limited conditions

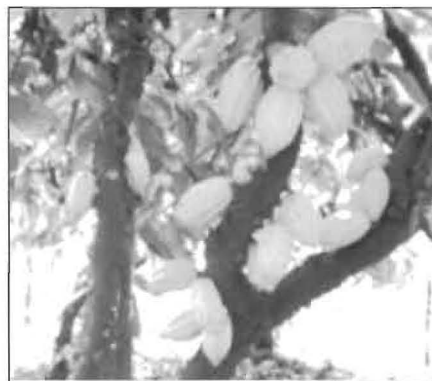
No. of pods/tree/year-41 (canopy 18m<sup>2</sup>)

No. of beans/pod-41

Single dry bean weight-1 to 1.05 g

Shelling-15%, Nib recovery-87%, Fat-51%

Dry bean yield-1.7 kg/tree/year, 1150 kg/ha



**VTLCH-4**

Hybrid, heavy bearer, suitable for water limited conditions

No. of pods/tree/year-40 (canopy 18m<sup>2</sup>)

No. of beans/pod-40

Single dry bean weight-1 to 1.07 g

Shelling-15%, Nib recovery-87%, Fat-51%,

Dry bean yield-1.6 kg/tree/year, 1090 kg/ha.



**VTLCH-5- Netra Centura**

Hybrid, heavy bearer both under arecanut and coconut canopy, suitable for high density planting

No. of pods/tree/year-66 (canopy 16-17m<sup>2</sup>)

No. of beans/pod-43

Single dry bean weight-1 to 1.11 g,

Shelling-11%, Nib recovery-88%, Fat-52%,

Dry bean yield-2.5 to 3 kg/tree/year, 1500-1800 kg/ha.

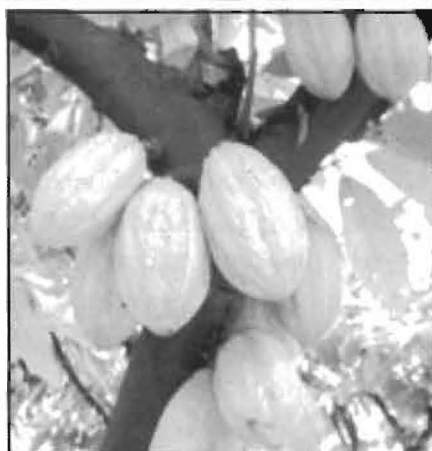


TABLE.2. CLONES

**VTLCC-1 (Vittal Cocoa Clone 1)**

Clonal selection, heavy bearer, self and cross compatible, suitable for North East region





No. of pods/tree/year-55 (canopy 12m<sup>2</sup>)

No. of beans/pod-35

Single dry bean weight-0.9 to 1.05 g

Shelling-12%, Nib recovery-88%, Fat-50%, Dry bean yield/tree/year-1.3 kg, 890 kg/ha.



<p><b>VTLCS-1</b> (Vittal Cocoa Selection 1)                  Selection, stable, high yielder both under arecanut and coconut, withstands biotic and abiotic stress                  No. of pods/tree/year-55 (canopy 12m<sup>2</sup>)                  No. of beans/pod-42 Single dry bean weight-1.13 g                  Shelling-11%, Nib recovery-89%, Fat-52%, Dry bean yield/tree/year-2.52 kg, 1700 kg/ha.</p>	
<p><b>VTLCS-2</b> (Vittal Cocoa Selection 2)                  Selection, stable, high yielder both under arecanut and coconut, bold and bigger beans, less incidence of pests and diseases                  No. of pods/tree/year-55 (canopy 15m<sup>2</sup>)                  No. of beans/pod-41 Single dry bean weight-1.21 g                  Shelling-15%, Nib recovery-85%, Fat-53%, Dry bean yield/tree/year-2.7 kg, 1840 kg/ha.</p>	
<p><b>VTLCS-3</b> (Vittal Cocoa Selection 3) Selection, stable, high yielder both under arecanut and coconut, suitable for water limited conditions                  No. of pods/tree/year-58 (canopy 15.6m<sup>2</sup>)                  No. of beans/pod-43 Single dry bean weight-1 to 1.11 g                  Shelling-11%, Nib recovery-88%, Fat-55%, Dry bean yield/tree/year-2.4-2.5 kg, 1440-1500 kg/ha.</p>	
<p><b>VTLCS-4</b> (Vittal Cocoa Selection 4) Selection, stable, high yielder both under arecanut and coconut, suitable for water limited conditions                  No. of pods/tree/year-58 (canopy 19m<sup>2</sup>)                  No. of beans/pod-44 Single dry bean weight-1 to 1.11 g                  Shelling-13%, Nib recovery-87%, Fat-54%, Dry bean yield/tree/year-2.5-2.8 kg, 1500-1680 kg/ha.</p>	

**References**

1. Elain Apshara, S., Ananda, K.S. and Balasimha, D. 2005. Cocoa breeding at CPCRI, India. INGENIC Newsletter 10: 34-37.
2. Eskes, A.B. and Lanaud, C. 2001. Cocoa. In: Tropical Plant Breeding. (Eds). Andre Charrier, Michel Jacquot, Serge Hamon and Dominique Nicolas. Science Publishers Inc., USA and CIRAD, France, pp. 78-105.
3. Vikraman Nair, R., Mallika, V.K. and Prasannakumari Amma, S. 2002. Breeding and Genetics. In: Cocoa Ed. Balasimha, D, CPCRI, Kasaragod 671 124, pp. 18-47.
4. Wood, G.A.R. and Lass, R.A. 1985. Cocoa IV Edition. Longman Group Limited, Longman House, Burnt Mill, Harlow, Essex CM20 2JE, England. 620 p.