PERFORMANCE OF ELITE COCOA CLONES UNDER COCONUT CANOPY

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Introduction

Cocoa is a well known beverage crop of the world. The cultivation of cocoa on a large scale started in India in the early 1970's and grown as mixed crop in coconut and arecanut plantations for maximizing the income per unit area. The report on the evaluation of elite cocoa genotypes under coconut canopy in Karnataka is scanty. Hence research work was formulated to know the performance of cocoa genotypes under coconut canopy.

Materials and Methods

Nine elite genotypes namely, II-67 x NC-29/96 (VTLCH-3), ICS-6 x SCA-6 (VTLCH-2), I-14 x I-56 (VTLCP-8), NA-33 x ICS-89 (VTLCP-1), II-67 x NC-42/94 (VTLCH-4), II-56 x III-35 (VTLCP-9), Amelonado x Nanay-33 (VTLC-10), NC-45/53 (VTLCC-1) and I-56 x II-67 (VTLCH-1) were planted under canopy of West Coast Tall (WCT) variety of coconut during 2002. The trial was laid out in randomized block design with three replications and each treatment consisted of six plants (3 x 2) per plot per treatment per replication. The cocoa grafted seedlings were planted in double hedge system at Central Plantation Crops Research Institute, Research Centre, Kidu, Nettana (Altitude= 291m MSL, Rainfall = 3950 mm, Maximum temperature= 33^0C and Minimum temperature= 25^0C, Longitude= 12.30°E, Lattitude = 75. 20°N, Soil= Red and sandy laterite, pH= 6.6), Puttur Taluk, Dakshina Kannada Dist, Karnataka, India. The spacing for coconut trees was 7.5m x 7.5m which accommodated 175 trees/ hectare. While planting cocoa in double hedge system, plant to plant 2.5m x 2.5m spacing was adopted which had1600 trees/hectare. In order to exploit yield potential, the recommended package of practices for coconut and cocoa were followed. The grafted cocoa plants started yielding after two years of planting. Morphological data on plant height (m), number of cocoa pods/tree/year, cocoa pod weight (g), number of beans/pod, single dry bean weight (g), dry bean yield/tree/year (kg) and yield/ha (kg) were recorded. Pooled data for five crop seasons (2006-2010) were used and joint analysis of variance was carried out. Standard error and critical difference between two genotypes of the same season and standard error of a difference between two seasons mean genotypes of the same genotype was worked out using Indostat statistical programme (LeClerge *et al.*, 1965 and Gomez and Gomez, 1984).

Results and Discussion

The pooled values of mean performance of nine genotypes tested are presented in Table 1 and 2. The important yield components of cocoa were found maximum in hybrid VTLCH-2 for the traits, number of cocoa pods/tree/year (69.21), cocoa pod weight (516.00), number of beans/pod (42.14), single dry bean weight (1.16), dry bean yield/tree/year (1.95) and yield/ha (852.29). The hybrid VTLCP-8, VTLCH-3 and VTLCH-4 also recorded high yield/ha of 795.62 and 780.35 and 690.56 respectively. The lowest dry bean yield/tree/year was recorded in NC-45/53 (0.85) resulted in poor performance of dry bean yield/ha (405.21) under coconut canopy. The mean sum of squares due to genotypes, seasons and genotypes x seasons interaction were highly significant when joint analysis were carried out (Table 3). All hybrids and elite clones differ significantly for number of pods/tree, pod weight, number

of beans/pod, single dry bean weight, dry bean yield/tree/year and yield/ha. Except number of beans/ pod and single dry bean weight seasonal effect was highly significant for all other traits studied. The interaction [G x S] was found significant for all traits except single dry bean weight indicated genetic set up of the genotypes than that of seasonal effect (Patil and Ananda, 2010).

Genotype do not play major role and no significant difference was observed, but seasonal and cumulative effect due to interactions was significant for plant height. By pruning plant height is to be maintained upto 2.0-2.5 m which helps in inter cultural operations and produced more number of fan branches. Number of beans/pods fully depends on the number of ovules fertilized and cross compatibility. Hence beans per pod trait controlled genetically rather than seasonal effect. The yield potential of different Nigerian and Malaysian clones and hybrid involved with self incompatibility and desirable cross compatibility was elaborately explained (Elain Apshara and Rajan, 2009; Ananda and Patil, 2010). Less pods/tree/year in VTLCC-1 may be attributed due to cross compatibility, rotten and drying of opened flowers resulting in low fruit set. Stable nature and high yield potentiality helps to boost up dry yield. Hence yield consistency over seasonal effect and G x S interactions showed that, these four hybrids (VTLCH-2, VTLCP-8, VTLCH-3 and VTLCH-4) are suitable for commercial cultivation under coconut canopy. However study on stability parameter and adaptable performance of selected hybrids under multi location trial under varying environment is highly imperative.

Table 1. Performance of elite cocoa clones under coconut canopy

Treatments		Five years pooled data (2006 - 2010)		
		Plant height (m)	**Number of cocoa pods/tree/ year**	**Cocoa pod weight (g)**
T1	VTLCH-3	3.55±0.18 (5.33)	9.1±9.50 (19.33)	485.42±23.01 (4.74)
T2	VTLCH-2	3.56±0.83 (23.57)	69.21±5.41 (7.82)**	69.21±5.41 (7.82)**
T3	VTLCP-8	3.57±0.78 (22.10)	58.20±9.96 (17.12)**	511.29±2.80 (0.54)
T4	VTLCP-1	3.66±0.74 (20.21)	34.68±8.28 (23.87)	521.68±15.56 (2.98)
T5	VTLCH-4	3.63±0.59 (14.32)	43.36±8.44 (19.48)	556.55±48.40 (8.69)
T6	VTLCP-9	3.62±0.38 (10.69)	41.38±16.84 (38.70)	357.40±32.30 (9.09)
T7	VTLC-10	3.64±0.42 (11.70)	31.15±10.65 (34.19)	386.90±57.50 (14.86)
T8	VTLCC-1	3.61±0.44 (12.40)	33.49±9.11 (27.20)	343.60±23.43 (6.81)
T9	VTLCH-1	3.58±0.46 (13.08)**	51.68±12.30 (23.80)**	504.15±3.03 (0.60)
	X± σ n-1 (%)	3.60±0.038 (1.07)	45.81±12.56 (22.42)	464.77±79.61 (17.12)
Replications [R]		**2.083 (NS)**	**2.262 (NS)**	**0.771 (NS)**
Genotypes [G]		**1.152 (NS)**	**3.523 (6.97*)**	**2.896 (5.73*)**
Seasons [S]		**0.311 (0.62*)**	**2.586 (5.12*)**	**1.551 (3.07*)**
Interaction [GxS]		**1.865 (3.69*)**	**5.487 (10.86*)**	**9.310 (18.43*)**

Table 2. Yield performance of elite cocoa clones under coconut canopy

Treatments		Five years pooled data (2006 - 2010)			
		Number of beans/pod	Single dry bean weight (g)	Dry bean yield kg/tree/year	Yield/ha (kg)
T1	VTLCH-3	36.25±1.61 (4.44)	1.07±0.03 (2.80)**	1.60±0.28 (17.97)	780.35±92.35 (11.83)**
T2	VTLCH-2	69.21±5.41 (7.82)**	1.16±0.01 (0.97)**	1.95±0.44 (22.75)**	852.29±113.65 (13.33)**
T3	VTLCP-8	39.15±1.10 (2.80)	1.01±0.01 (1.65)	1.72±0.19 (11.43)**	795.62±102.91 (12.93)**
T4	VTLCP-1	31.68±0.96 (3.03)	0.88±0.03 (3.62)	1.31±0.17 (12.93)	520.76±81.22 (15.59)**
T5	VTLCH-4	37.11±1.81 (4.89)	1.00±0.01 (1.08)	1.63±0.35 (21.94)	690.56±100.66 (14.57)**
T6	VTLCP-9	35.54±2.94 (8.27)	0.97±0.06 (6.89)	1.56±0.26 (16.78)	439.95±94.13 (21.39)
T7	VTLC-10	37.34±4.25 (11.38)	1.05±0.02 (2.25)**	1.66±0.33 (19.81)	572.13±110.23 (19.26)
T8	VTLCC-1	27.21±0.99 (3.63)	0.97±0.03 (3.57)	0.85±0.32 (38.35)	405.21±129.93 (30.06)
T9	VTLCH-1	39.39±1.26 (3.20)	1.00±0.08 (8.00)	1.57±0.28 (18.11)**	653.64±90.96 (18.91)**
	X±σ n-1 (%)	36.20±4.44 (12.27)	1.01±0.07 (7.64)	1.53±0.30 (19.94)	634.50±160.24 (23.25)
Replications [R]		**1.513 (NS)**	**0.03 (NS)**	**0.230 (NS)**	**1.969 (NS)**
Genotypes [G]		**0.926 (1.83*)**	**0.051 (0.10*)**	**0.296 (0.58*)**	**3.888 (7.69*)**
Seasons [S]		**1.049 (NS)**	**0.057 (NS)**	**2.246 (0.48*)**	**2.050 (4.05*)**
Interaction [GxS]		**6.297(12.46*)**	**0.346 (NS)**	**1.476 (2.92*)**	**4.350 (8.61*)**

Table 3. Pooled analysis of variance for quantitative traits in cocoa

S.V.	*d.f*	Mean sum of squares						
		Plant ht.	No. of pods /tree/year	Cocoa pod wt.	No. of beans /pod	Single dry bean wt.	Dry bean yield/tree	Yield/ha
Replications [R]	2	9.54^{NS}	115.14^{NS}	38.39^{NS}	10.31^{NS}	0.03^{NS}	1.20^{NS}	21.15^{NS}
Genotypes [G]	8	11.16^{NS}	769.78**	507.29**	67.74 **	0.30 **	4.39 **	1069.08 **
Error (a)	16	9.97	93.09	62.94	6.44	0.02	0.658	113.38
Seasons [S]	4	30.69**	2738.96**	416.97**	74.95^{NS}	0.17^{NS}	31.32**	1076.38**
G x S	32	12.73**	566.06**	379.70**	203.45 **	0.09^{NS}	8.01 **	401.81 **
Pooled Error (b)	72	3.48	240.89**	86.69	39.66	0.12	2.18	151.39
Total	134	P = 0.05* ; P = 0.01**						

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