

TRINITARIO TYPE OF COCOA AND THEIR PERFORMANCE IN INDIA

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Introduction

Trinitario type of cocoa, which is a natural hybrid between Criollo and Forastero types (Wood and Lass, 1955) is said to be originated from Trinidad. They are known to have mixed characteristics and highly adaptive to the introduced environment. Around 95% of the world's cocoa population comprised of Forasteros and Trinitarios (Eskes and Lanaud, 2001). Trinidad Selected Hybrids (TSH) which have low pod index, large beans and good disease resistance with optimal management (Kamaldeo Maharaj 2009, 2012) are the main component of cocoa economy of Trinidad and Tobago. In Ivory Coast, the first crosses between Upper Amazon and Trinitario clones were very popular due to their vigour, precocity, productivity and bean quality (Tahi *et al.*, 2012). Most of the cultivable types of Asian continent are Trinitarios, especially in Malaysia and Indonesia which are the major cocoa producers in the region. They are also found to be rich in flavour components with mixture of white beaned types (Freddy *et al.*, 2009; Indah and Agung, 2013). Considering the above advantages, an effort was made to evaluate Trinitario type of cocoa conserved at CPCRI, Regional Station, Vittal, Karnataka for their cropping efficiency in India.

Materials and Methods

Thirteen true Trinitarios obtained from Trinidad were planted during 1995 at a spacing of 2.7 m x 5.4 m under 2.7 m x 2.7 m spaced arecanut in field gene banks of CPCRI, RS, Vittal. They were assessed for their growth and yield performance and stable economic traits over years. Five trees per clone were observed for their height (m), girth (cm), no. of branches and canopy area (m²) at the age of nineteen years and the pod yield of individual trees was compiled for six years from fourteenth year of bearing. Pod and

bean characteristics also recorded as per standard procedures. Data were analysed using MSTAT program.

Results and Discussion

Among the Trinitarios, significant difference observed for the growth characters studied. Plant height ranged from 3.21 to 4.58 m and vigour ranged from 34.2 to 53 cm in nineteen year old trees. In nine clones, high vigour contributed to high pod yield in this trial. With 6.2 to 12.4 branches, canopy of the trees spread to an area of 15.0 to 22.5 m² among the clones (Table 1). To some extent the number of branches and canopy area were maintained at optimal level with systematic annual pruning to make cocoa compatible and manageable in the intercropping system under arecanut. In general, the pod yield is expressed with respect to the canopy area and age of the tree.

Table 1. Growth of Trinitario type cocoa clones

Clones Name	Total height(m)	Girth (cm)	Branches (no.)	Canopy area (m ²)
Trinitario 1	3.21	41.8	7.6	15.0
Trinitario 2	4.21	53.0	8.8	21.4
Trinitario 3	3.84	47.0	8.0	16.4
Trinitario 4	3.83	34.2	6.0	15.1
Trinitario 5	3.92	45.6	7.0	19.6
Trinitario 6	4.57	44.8	8.4	21.8
Trinitario 7	3.41	39.4	10.2	22.5
Trinitario 8	4.57	50.8	8.2	21.8
Trinitario 9	4.26	51.2	9.0	20.4
Trinitario 10	4.20	44.6	10.8	22.1
Trinitario 11	4.08	48.4	6.2	19.1
Trinitario 12	4.28	44.2	8.8	21.3
Trinitario 13	4.58	43.4	12.4	22.4
CV%	15.29	26.01	37.55	29.5
SD	0.62	11.97	3.22	5.87
CD (5%)	1.72	33.28	8.95	16.3

The average pod yield of main season, May- July (healthy pods of 6 harvests/ year) was compiled from fourteen to nineteen year old tress and observed for stable and high yielders. Annual pod yield showed significant difference among Trinitarios (Table 2.) throughout the growth period. In the fourteenth year of bearing the yield

ranged from a lowest of 17.4 to a highest of 53 pods, whereas at the age of nineteen years it ranged from 37.4 to 72.6 pods/ tree/ year. The mean pod yield over six years ranged from a lowest of 34.7 to a highest of 63.3 per tree. Among the clones Trinitario 7, 1, 13 and 6 were identified as potential yielders.

Table 2. Pod yield of Trinitario type cocoa clones over years

Clones	Years (Age from 14- 19 years)						
	2009	2010	2011	2012	2013	2014	Mean
Trinitario 1	41.6	56.4	38.4	84.0	65.4	55.4	56.9
Trinitario 2	30.4	31.0	32.0	32.4	45.2	37.4	34.7
Trinitario 3	32.4	32.2	35.2	50.4	55.2	63.4	44.8
Trinitario 4	29.4	32.2	37.2	48.0	47.4	43.4	39.6
Trinitario 5	30.4	28.2	27.2	52.4	64.2	51.4	42.3
Trinitario 6	25.8	30.2	45.2	66.2	63.4	69.6	50.1
Trinitario 7	41.4	56.4	66.0	76.0	67.4	72.6	63.3
Trinitario 8	37.4	42.0	38.0	48.0	56.6	43.0	44.2
Trinitario 9	53.0	36.8	34.4	41.8	53.0	43.0	43.7
Trinitario 10	18.0	19.8	25.4	51.4	50.8	46.0	35.2
Trinitario 11	22.0	27.8	35.4	63.4	62.8	54.0	44.2
Trinitario 12	17.4	15.0	29.6	70.0	57.6	62.4	42.0
Trinitario 13	36.0	36.8	38.0	71.2	76.2	62.0	53.4
CV%	16.21	18.27	17.96	11.89	14.47	14.10	
SD	5.18	6.25	6.66	6.91	8.52	7.63	
CD (5%)	14.40	17.38	18.51	19.21	23.69	21.21	

The economic pod and bean traits are tabulated here (Table 3.), specifically the bean no. per pod which ranged from 30.2 to 52.8 and processed bean weight 0.90 to 1.20 gram. Dry bean yield here was compiled with the pod no., bean no. and single dry bean weight which showed a range of 1.23 to 3.06 kg/tree. Processing value

regard to shelling percentage, nib recovery and fat contents also assessed among the Trinitarios. The shelling percentage ranged from 13.1 to 18.5% and nib recovery ranged from a minimum of 81 to a maximum of 86%. Beans of six clones are rich in fat contents.

Table 3. Bean traits of Trinitario type cocoa clones

Clones	Beans no.	SBW (g)	DBY (kg)	Shell %	Nib recovery %	Fat %
Trinitario 1	44.2	1.20	3.00	13.1	86	53.2
Trinitario 2	40.4	0.92	1.27	16.7	83	50.3
Trinitario 3	43.8	0.94	1.86	18.2	82	48.4
Trinitario 4	52.8	0.99	1.90	14.3	85	49.6
Trinitario 5	42.2	0.94	1.68	15.5	84	47.6
Trinitario 6	42.2	1.00	2.13	13.7	86	50.1
Trinitario 7	42.6	1.13	3.06	15.3	84	51.2
Trinitario 8	30.2	0.93	1.23	16.4	83	48.6
Trinitario 9	43.6	0.98	1.77	16.1	84	49.5
Trinitario 10	39.2	0.90	1.25	18.5	81	48.2
Trinitario 11	32.8	0.97	1.40	17.1	82	50.2
Trinitario 12	44.2	0.90	1.58	17.5	83	47.8
Trinitario 13	42.6	1.02	2.30	15.6	84	50.6
SBW- single dry bean weight			DBY- dry bean yield			

Conclusion

From the overall performance of Trinitarios, it was concluded that Trinitario 7, 1, 13 and 6 exhibited optimal canopy and vigour in the intercropping system with high yields of 63.3, 56.9, 53.4 and 50.1 pods/ tree/ year and 3.1, 3, 2.3 and 2.13 kg dry bean yield/ tree respectively. All these clones showed favourable pod index (no. of pods required to produce 1 kg dry beans) and

bean indices (no. of beans/ 100 g). With single bean weight of more than 1 gram, 10-15% shelling, 85-90% nib recovery and >50% they are found to be suitable for chocolate industry. These clones can be multiplied and recommended for cultivation in small and medium sized farms to get an additional remuneration and for sustainable and profitable cocoa farming. Further evaluation of their performance under coconut canopy and in multi locations is required.

Best performing Trinitarios

	Vigour (cm)	Canopy area (m ²)	Pod index	Beans no.	Bean index	Dry bean yield (kg)	Shell %	Nib recovery %	Fat %
Trinitario 7	39.4	22.49	20.7	42.6	113	3.06	15.3	85	51.2
Trinitario 1	41.8	15.02	19.0	44.2	120	3.00	13.1	87	53.2
Trinitario 13	43.4	22.42	23.2	42.6	102	2.30	15.6	84	50.6
Trinitario 6	44.8	21.84	23.5	42.2	100	2.13	13.7	86	50.1

Trinitario 1



Trinitario 6



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