

# PERFORMANCE OF GRAFTED COCOA CLONES IN FRONTLINE DEMONSTRATION PLOTS AND FARMER'S PERCEPTIONS ON THE IMPACT OF SCIENTIFIC MANAGEMENT

S. Kalavathi<sup>1</sup> and S. Elain Apsara<sup>2</sup>

<sup>1</sup>Central Plantation Crops Research Institute, Regional Station, Kayamkulam, Aleppy, Kerala

<sup>2</sup>Central Plantation Crops Research Institute, Regional Station, Vittal, Karnataka

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## Introduction

Eventhough there is an expansion in the area and production of cocoa during recent times, the productivity remains low. The genetic inferiority of the existing plantations is one of the factors for low productivity (Balasubramanian, 2002). At the same time, there is a huge demand in Indian chocolate industries growing annually by 15%. To meet this demand, Directorate of Cashewnut and Cocoa Development, Kochi has been encouraging the farmers for large scale area expansion with high yielding cocoa clones along with adoption of input intensive cultivation practices including pruning and training technologies for improving and sustaining the yield.

CPCRI, Regional Station, Vittal has taken a lead role in implementing this programme by supplying high yielding varieties as soft wood grafts for planting in an area of around 240 acres and the farmers were trained on scientific cultivation practices including pruning, training and balanced application of manures and fertilizers. These plots serve as model demonstration plots for showcasing the technologies for large scale replication. With all these efforts and due to increasing demand and higher returns, several farmers are attracted towards cocoa cultivation in recent years. During 2009, around 600 hectares brought under cocoa in Tamil Nadu and 1,800 ha in Karnataka. When a technology is demonstrated for large scale replication, the performance of the technology in terms of its adaptability and appropriateness under field conditions should be documented for the benefit of the users. It is the right time to assess the perception of the cocoa growers who have already adopted these practices so that strategies can be worked out to popularize these technologies based on the opinion of the farmers (Venkattakumar and Bhat, 2003; Venkattakumar *et al.*, 2005). Hence the present study was conducted to assess the performance of the grafts under different field conditions and the perception of the cocoa growers on the impact of scientific management on the performance of these grafts.

## Materials and Methods

### (i) Recommended technologies

The technologies recommended include the following:

- a. Grafts of high yielding cocoa clones
- b. Pruning and training techniques
  - Primary Pruning : To obtain a supporting framework
  - Secondary Pruning : Umbrella shaped canopy with about 3.5 to 4.0 m spread and 2.7 m height (two storey architecture an optimum canopy area of 15-20 m<sup>2</sup>)
- c. Balanced application of manures and fertilizers
  - Dry Farm Yard Manure (5 kg) + 100 g N, 40 g P<sub>2</sub>O<sub>5</sub> and 140 g K<sub>2</sub>O per tree in two equal splits

## **(ii) Measurement of performance of cocoa grafts**

Growth parameters like height of the plant, girth, height at first branching (HAFB), canopy spread (EW and NS) and number of branches were studied and compared with different localities. Similarly, yield parameters like number of pods, pod weight, pod length, pod breadth, husk weight, beans weight, number of beans, ridge, furrow, single bean weight (SBW), shell percentage, recovery percentage, wet bean yield/plant and dry bean yield/plant were recorded for evaluation.

### **Sampling procedure**

The data on performance of cocoa grafts were collected from cocoa demonstration farmers who were selected by CPCRI, Regional Station, Vittal for the purpose of demonstrating improved recommended cocoa cultivation practices, under the project on “Research-cum-Demonstration plots” funded by DCCD, Kochi. Out of the total 96 demonstration gardens, observations on the growth and yield parameters were recorded from 12 gardens, two plots each from 5 taluks in Karnataka and one from Northern Kerala. Simple statistical techniques like mean, percentage and correlation were used for interpretation of data.

## **(iii) Measurement of perception towards pruning and fertilizer application practices**

### **(a) Standardization of data collection tool**

Two teacher made scales were developed in order to assess the perception of the farmers towards pruning and fertilizer application practices in cocoa cultivation. The scale developed for pruning originally had 18 statements (11 positive and 7 negative statements) and the scale developed for fertilizer management had 16 statements (11 positive and 5 negative) (Elain Apshara *et al.*, 2006). These two scales were standardized by rating the developed statements against a five-point continuum (most relevant, relevant, undecided, irrelevant, most irrelevant) by the expert opinions. After standardization of the scales, 10 positive statements about each technology were selected and given to the farmers for their perception. The opinion of the farmers was collected using a three-point continuum (agree, disagree, undecided). While administering this tool the scale was translated into Kannada language for better understanding.

### **(b) Sampling procedure**

The data on perception towards pruning and package of practices were collected from cocoa demonstration farmers. Totally 96 farmers were contacted and from them a list of 50 demonstration farmers who have laid out the experiment and have more than five years of experience in cocoa cultivation were selected. The demonstration farmers were from eight taluks (Bantwal, Belthangady, Kodagu, Mangalore, Puttur, Sringeri, Sullia and Udupi) of Dakshina Kannada district of Karnataka state. The data were analysed using the statistical tools such as percentage values, mean and standard deviation.

## **Results and Discussion**

### **1. Performance of grafted cocoa clones**

#### **a. Performance in terms of growth parameters**

Grafted cocoa clones showed difference between various locations in various growth parameters like height, girth, height at first branching, spread of canopy (East-West and North-South) and number of branches.

Growth of the plants in terms of all the above parameters were highest in Bantwal Taluk, followed by Puttur, Sampaje and Kasaragod with slight variations in some of the parameters. Growth of the clones were poor only in Belthangady Taluk, might be due to poor soil conditions or insects like root grub, which needs further investigations.

**Table 1. Performance of grafted cocoa clones in terms of various growth parameters**

Taluk	Height (m)	Girth (cm)	HAFB (cm)	EW spread (m)	NS spread (m)	No. of branches
Bantwal	3.82	12.61	30.96	4.48	4.38	8.92
Puttur	3.06	11.2	27.38	3.66	3.68	5.56
Sullia	2.85	9.91	26.07	3.18	3.26	5.54
Sampaje	3.22	10.99	21.94	3.81	3.76	8.14
Belthangady	2.49	8.96	17.02	3.26	3.25	6.26
Kasaragod	3.24	8.26	24.84	3.13	3.35	6.04

**b. Performance in terms of yield parameters**

Observable difference was also noticed among various locations in yield characteristics like number of pods, pod weight, pod length, pod breadth, husk weight, beans weight, number of beans, ridge, furrow, single bean weight (SBW), shell percentage, recovery percentage, wet bean yield and dry bean yield of the grafted cocoa clones.

The dry bean yield varied from 289 g/ plant (Belthangady) to 821 g/ plant (Sampaje). But the wet bean yield and recovery percentages were higher in Bantwal (2.15 kg/plant and 89%), followed by Kasaragod (1.97 kg/plant and 89%). Single bean weight was higher in Sampaje and Puttur. Number of pods was found to be higher in Bantwal Taluk, while the weight of pods and beans as well as number of beans per pod were higher in Kasaragod and Bantwal. In general, the grafted clones performed well in areas like Sampaje, Bantwal and Kasaragod. In most of the areas, the bean quality as well as the recovery percentage were appreciable in case of the grafted clones.

**Table 2. Performance of grafted cocoa clones in terms of various yield parameters**

Taluk	No. of pods	Pod wt.	Beans wt. (g)	No. of beans (g)	Single bean wt. (g)	Shell %	Recovery %	Wet bean yield/ plant (kg)	Dry bean yield/ plant (g)	Dry bean yield /ha.(kg)
Bantwal	21.96	422.5	140.0	41.58	0.87	11.45	88.55	2.15	794.39	542
Puttur	16.24	387.5	110.0	39.50	0.91	13.95	86.06	1.25	583.75	398
Sullia	17.08	335.0	110.0	38.75	0.81	14.13	85.87	1.31	536.10	364
Sampaje	20.64	312.5	117.5	43.25	0.92	14.03	85.98	1.70	821.27	563
Belthangady	13.96	277.5	100.0	39.75	0.52	22.30	77.71	0.98	288.55	199
Kasaragod	19.78	437.5	142.5	45.75	0.86	10.57	89.43	1.97	778.24	535

### c. Correlation of growth parameters with yield

Spearman coefficient of correlation was worked out to find out the association of various growth parameters with yield under different field conditions.

**Table 3. Correlation of Growth Parameters with Yield**

Growth parameters	Correlation coefficient - Wet bean yield	Correlation coefficient - Dry bean yield
Height	0.772**	0.791**
Girth	0.560*	0.570*
Height at first branching	0.277	0.447
Canopy spread (EW)	0.526*	0.446
Canopy spread (NS)	0.561*	0.441
Number of branches	0.474*	0.454
Pod weight	0.717**	0.579*

Height, girth and pod weight were found to be significantly associated with both dry and wet bean yield, while the canopy spread and number of branches were significantly related to the wet bean yield.

## 2. Perception of cocoa demonstration farmers towards scientific management of grafted cocoa clones

### (a) Perception of demonstration farmers on pruning and training measures recommended for cocoa

Most of the farmers (88%) had moderate to high level of favorable perception on the recommended pruning and training measures (Table 4). Only 12 percent of them had less favorable perception towards pruning and training technologies.

**Table 4. Distribution of respondents according to their favorable perception towards recommended pruning and training measures in cocoa (n=50)**

Category of favorableness	Score category	Frequency	Percentage
Low	<72.51	6	12
Moderate	72.51 to 91.96	40	80
High	>91.96	4	8
Total		50	100
Mean: 82.23		SD: 9.72	

The data revealed that the demonstration farmers were convinced of the advantages of adopting the recommended pruning and training measures *viz.*, formation pruning, structural pruning, sanitary pruning in their plots in improving the growth and yield of the grafted cocoa clones.

### (b) Statement-wise perception of the respondents towards pruning and training measures

A detailed perception analysis revealed that the farmers very well understood the need for adopting pruning and training for the grafted cocoa plants. Table 5 clearly shows the perception of the farmers on the benefits of adopting pruning and training.

**Table 5. Statement-wise perception of the respondents towards pruning and training measures**

Statements	% of respondents
Proper and systematic pruning is essential and removal of infected branches in mature tree is necessary	100
Pruning regulates the canopy size, shape, health and vigour of the plant by allowing more sunlight	90
Technologies on pruning and training as easily understandable and considerable quantity of pods were observed on the trees with these recommended practices	90
Grafted cocoa plants should be adopted with these pruning and training techniques	100

In general, the respondents had favorable opinion towards the recommended pruning and training technologies and felt the positive effect on performance of the trees especially under the mixed cropping system.

**(c). Perception of the respondents towards the recommended fertilizer application practices**

Majority of the demonstration farmers in general perceived the need for applying fertilizers for obtaining better yield and growth of grafted cocoa.

**Table 6. Distribution of respondents according to their favorable perception towards recommended fertilizer regimes (n=50)**

Category of favorableness	Score category	Frequency	Percentage
Low	<72.37	9	18
Moderate	72.37 to 92.11	31	62
High	>92.11	10	20
Total		50	100
Mean 82.24		SD: 9.87	

Table 6, revealed that most of the respondents (82%) had moderate to highly favorable perception on recommended fertilizer practices. A highly favorable perception coupled with subsidy from DCCD, Kochi might have contributed to high level of adoption. This also confirmed the impact of participatory research and demonstration concept of technologies.

**4. Statement-wise perception of the respondents towards fertilizer regimes**

A detailed perception analysis revealed that the farmers very well understood the effect of application of fertilizers on the growth and yield of the grafted cocoa plants. Table 7 clearly shows the perception of the farmers on the benefits of adopting recommended fertilizer regimes for the cocoa grafts.

**Table 7. Statement-wise perception on recommended fertilizer regimes**

Statements	% of respondents
Recommended fertilizer application along with proper irrigation would increase the pod yield	100
Recommended fertilizer dosage of both organic and inorganic manures, with sufficient field sanitation have a definite impact on the plant performance	95
Fertilizer schedule is easily understandable to adopt and with affordable cost factor	90

Cent percent of the respondents opined that fertilizer application along with proper irrigation would increase the pod yield. Ninety five percent of them agreed that recommended fertilizer dosage of both organic and inorganic manures, with sufficient field sanitation have a definite impact on the plant performance. Statement wise perception analysis of the respondents revealed that 90 percent of the respondents convinced that fertilizer schedule is easily understandable to adopt and with affordable cost factor. The farmers, in general agreed with the positive effect of manuring schedule recommended for cocoa cultivation.

### Conclusion

The frontline demonstration on the performance of grafted cocoa clones served as an effective tool for convincing the farmers on the quality of the grafts as well as the need for pruning and application of fertilizers in improving the growth and yield. The grafted clones performed well in most of the localities with higher performance in Sampaje, Bantwal and Kasaragod. Eventhough the yield levels were not very high in other taluks, the bean quality and recovery percentage were excellent. The results revealed the need for more training to educate the farmers on the need for timely adoption of management practices for improving the uniform performance of the grafted materials. Eventhough these techniques were demonstrated, some of the operations were skipped or delayed by the farmers due to some socio-economic constraints. Hence, to make the farmers more receptive in adoption of important practices, programmes like annual farmers' meet or field days are needed for sharing the experiences and constraints. Most of the respondents had moderate to high level of favorable perception towards the recommended pruning technologies and fertilizer regimes. Most of the respondents have adopted the practices of structural and sanitary pruning measures in their plantation of mixed crops. All the demonstration farmers agreed with the importance of pruning technologies in the early years of plant growth especially in the grafted cocoa. At the same time more education is needed for following the season of pruning and smearing Bordeaux paste at the cut ends of the branches to avoid any secondary infections. Most of the farmers adopted the combination of organic and inorganic manures and split doses of fertilizers at different stages of plant growth along with irrigation. Training must be imparted for application of balanced nutrients, as some farmers tend to apply more fertilizers than required. More emphasis should be given on these technologies and concerted efforts are to be taken to educate the farmers in cocoa plantation management.

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