



AUGMENTING COCOA PRODUCTION IN INDIA

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Cocoa (*Theobroma cacao* L.) an essential component of chocolate, is popularly termed as 'Food of Gods'. Cocoa powder and chocolate are made from the dried seeds that are found in pods on the cocoa tree. It is known as a crop of humid tropics and is native to Amazon basin of South America. Cocoa plant is reported to be originated in Central America over 5000 years ago, its popularity and production has spread globally over time. The economic part of cocoa is bean, which is the source for chocolates, the world's favourite food and also widely used in confectioneries, beverages and other edible products. Major cocoa cultivation is under agro forestry systems in Latin American and African countries whereas, it is under palm based cropping systems in Asia-Pacific region. Cultivation of cocoa is primarily taken by small family farms of 2 to 5 hectares, while just 5% comes from large plantations.

Global scenario of production, consumption and trade

Cocoa is grown in 58 countries in around 10 million hectares with a production of four million tonnes. The average world productivity is 500kg/ha, wherein among major countries, Côte d'Ivoire has the highest productivity. The four West African countries *viz.*, Côte d'Ivoire, Ghana, Cameroon and Nigeria accounted for 63% of worldwide cocoa production, whereas Côte d'Ivoire alone contributed 33%. Adding the production of Indonesia to the output, the five countries reach a market share of 80%. Latin America, where the cocoa plant originated, presently accounts for only 13% of worldwide cocoa production. With the exception of Brazil, cocoa production is mainly concentrated in small-scale farms. While analyzing the last ten years

(2004-13), it was observed that world production has increased by 3.3% per annum. Africa's production expanded at an average annual rate of 3.7%. Cocoa output in the Americas grew at a lower average rate of 3.1%, with its share in global production stagnating at 14%, while production of cocoa beans in the Asia and Oceania region was the least dynamic of the three cocoa cultivating regions of the world, recording an average increase of only 1.9%. Over the past decade, weather-related conditions, namely *El Nino* and *La Nina* have also had a significant effect on countries such as Indonesia, Papua New Guinea, Ecuador and Peru, with *El Nino* events reducing global cocoa output by 2.4%, according to a study conducted by the International Cocoa Organization (ICCO).

Between 2004 and 2013, world cocoa consumption expanded by 24% with most of the increase coming from higher consumption in the traditional cocoa consuming countries of Europe (up by 17%) while consumption increased by 22% in the Americas over the same period. The most dynamic regions in terms of cocoa consumption were the Asian region (up by 50%) and the African region (up by 74%). In 2013, the leading consumers of cocoa were the United States, Germany, France, the United Kingdom, the Russian Federation and Brazil. The world per capital consumption of cocoa has increased from 0.60 kg in 2004 to 1.09 kg in 2013. Switzerland recorded the highest percapita consumption (5.9 kg/year) while the per capita consumption of India is a meager 0.04 kg. Information on net exports of cocoa beans shows that the African region, accounting for 70% of net world exports, is by far the largest supplier of cocoa to the world markets. The cocoa market remains highly

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concentrated, with the top five countries accounting for 87% of world net exports. Côte d'Ivoire is the world's leading exporter of cocoa beans, representing 28% of global net exports, followed by Nigeria (21%) and Ghana (19%). It is worthwhile to note that cocoa continues to be an important source of export earnings for many producing countries, in particular in Africa. Africa's heavy dependence on cocoa as well as on other primary commodities as a source of export earnings has been vulnerable to market developments, in particular price volatility, and weather conditions. The net imports of cocoa beans for the year 2013 shows that European countries accounted for major net imports of cocoa beans, followed by the USA (14%) and Malaysia (10%). It is worth noting that although the Netherlands imports a considerable amount of cocoa beans, most of these are used for the manufacture of cocoa products, which are subsequently re-exported.

Indian cocoa production scenario

Cocoa is a shade loving crop and showed imminent capacity to share the inter spaces of coconut, arecanut and oil palm and adapted to the microclimatic conditions available in such perennial gardens. Cocoa got its entry into India way back in 1798 and tropical diversified congenial climate available in India especially in the Madras, Malabar and Mysore states of South India provided immense scope for its cultivation. Though cocoa was conferred with plantation status like coffee, tea and rubber, commercial cultivation of cocoa started only in 1970's. Majority of the processed cocoa products are consumed within India. Nearly 21.13 lakhs ha of coconut, 4.53 lakhs ha of arecanut and 2.00 lakh ha of oil palm gardens are available in India of which 35% is under irrigation and can be utilized for cocoa plantings. Availability of such areas in the states like Kerala, Karnataka, Maharashtra, Pondicherry, Tamil Nadu, Andhra Pradesh, Orissa, Assam and West Bengal will therefore

offer very good scope for its cultivation.

The first plantings of cocoa was done in Courtallam in Tirunelveli district of Madras state followed by plantings in 1873 at Burliar fruit station in the Nilgiris at 450 m and 800 m elevations. During 1930-1935, Criollo, the red and traditional type of cocoa was planted at Kallar and Burliar stations followed by Forastero, the green cultivated adaptive type and in 1955, an attempt on research was initiated by Indian Council of Agricultural Research (ICAR). In 1960's wide cultivation was taken up in the Western ghats region, which got rains from both monsoons and with short dry season (Wood, 1964). In Cardamom hills and Shevroys, cocoa was planted at high altitudes. In 1962, ICAR decided to have Criollos in South India and Forasteros in North East states comprising Orissa, Tripura and Assam. Amelonado cocoa from Malaysia was planted in 1963. In Assam, Cachar and Lushai Hills were found to be suitable with alluvial soils in valley bottoms. In Andaman islands, few plantings were made. In 1964, CPCRI initiated arecanut + cocoa and coconut + cocoa mixed cropping trials at its Vittal, Peechi, Palode and Kahikuchi centres and proved it as profitable and compatible cropping systems for cocoa cultivation. In 1965, Cadbury established a research cum demonstration unit in Wayanad region. In 1968, onwards systematic cocoa improvement programs are being conducted at CPCRI with germplasm introductions. In 1979, Kerala Agriculture University (KAU) initiated cocoa programs and in 1987 cocoa research was intensified. From 2008 onwards, Tamil Nadu Agricultural University (TNAU) is involving in cocoa research. Cocoa research by different institutes resulted in high yielding varieties, resistant clones, quality planting materials, scientific production technologies, integrated nutrient, pest and disease management systems, region specific cultivation practices and small scale processing methodologies for sustainable cocoa cultivation in India.



With the success of research efforts, promotion of cocoa achieved a significant reach up to the year of 1980 with the developmental activities mainly concentrating in the states like Kerala, Karnataka, Tamilnadu and Andhra Pradesh. Kerala was leading state in promoting cocoa cultivation. Attractive price for pods and beans coupled with large-scale distribution of planting materials, area coverage was enhanced. Because of the monopolistic exploitation of the available industrial unit, cocoa price fell down in 1981-83 and growers started cutting the crop. As per the instruction of Ministry of Agriculture, to safe guard the interest of farmers, the Central Arecanut Marketing and Processing Co-operative (CAMPCO), Mangalore entered into marketing scenario from 1990's. The CAMPCO exported cocoa beans worth Rs. 40 million to European countries in the initial phase of operations. With a view to creating a permanent demand and a steady market, CAMPCO established a 'Chocolate Manufacturing Factory' at Kemminje village in Puttur Taluk, Dakshina Kannada District of Karnataka in the year 1986 and now it has a licensing capacity to produce 9200 tonnes. It has been producing a variety of products, semi-finished items like cocoa mass, cocoa butter and cocoa powder and finished products in moulded line, count line, chocolate drink etc. From 1997-98 onwards, the non-traditional tracts of Karnataka and other states like Andhra Pradesh and Tamil Nadu started developing cocoa in their coconut plantations, since there is a steady procurement facilities through contract farming. At present more than 10 industrial entrepreneurs and companies existing in the field demanding nearly 40,000 MT of cocoa beans of which the present production is hardly 33%. In 1996-97 Cadbury had 62% of the Indian chocolate market, Nestle 25%, Lotus 9% and Amul 4% and later Cadbury increased its market share to 70%. It is suggested that multinational companies must be under tripartite agreement or to have

Memorandum of Understanding (MoU) with State Govt. departments, central agency and farming communities for guaranteed procurement and remunerative price for the produce.

Table 1 Area and production of cocoa in India (2015-16)

State	Area (Ha)	Production (MT)	Productivity (Kg/Ha)
Kerala	14,650	6500	725
Karnataka	13565	2200	440
Tamil Nadu	28209	1500	300
Andhra Pradesh	24156	7000	590
Total	81274	17200	550

In India, cocoa is cultivated mainly in the states of Kerala and Karnataka and its cultivation is gaining popularity in the states of Tamil Nadu and Andhra Pradesh. At present, demand for cocoa beans far outstrips the local production, necessitating large scale imports to meet the national requirements. India produces 17200 tonnes of cocoa from an area of 81274 hectares (Table.1). Tamil Nadu has the highest area under cocoa (34%) while in the case of cocoa production, Kerala has the major share (42%). The compound annual growth rate of area and production among major cocoa growing states were worked out for two periods (2000-07 & 2007-14). The All India growth rate in area of cocoa in the recent period was an impressive 14.2%. The growth rate in area was impressive invariably among all states except Andhra Pradesh, which has recorded 20% reduction in growthrate in comparison with the earlier period. In contrast to this overall growth rate in all India, cocoa production has come down to 5% in period II from 8% recorded in period I. Except Tamil Nadu, all other states recorded lower growth rate in period II, and in the case of Karnataka, it was negative.

Domestic Import-Export scenario: A glance: The import (value) of cocoa and cocoa products increased at a compound growth rate of 31%

during the ten years period (2002-11), which shows a surging domestic demand of cocoa and cocoa products as well as surplus processing capacity existing in the country. On the other hand, the export growth was almost stagnant which accounts for only around 9% of total value of exports during the period under consideration. Cocoa beans and chocolate products together constitute around 70% value of cocoa imports to India. The projected demand of cocoa by 2050 is 212 thousand tonnes against the estimated supply of 121 thousand tonnes (Fig.1). With the projected supply, there would be a demand-supply gap of 90 thousand tonnes of cocoa beans in 2050. To achieve this target, the cocoa production in the country should increase at an annual growth rate of 7.68 per cent considering the market growth at 20 % and the cocoa sector has a great potential to develop in future years.

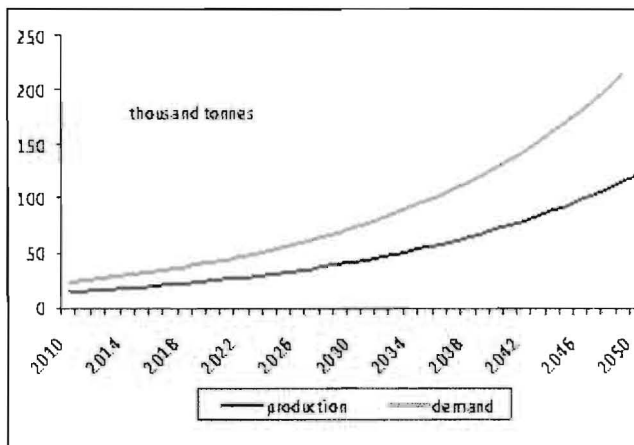


Fig. 1. Projected demand and production of cocoa

Research efforts in India

Cocoa genetic resource management and development of varieties with desirable traits are the major concern. ICAR-Central Plantation Crop Research Institute is recognized as the national active germplasm site and diversified clones from both primary and secondary centers of origin have been collected and conserved in field gene banks. The CPCRI and KAU through three to four decades of research have developed high yielding

elite clones and hybrids, with yield range of 1 to 3 kg dry bean yield/tree and with varying processing qualities. Availability of large quantity of cocoa ESTs in public domain has helped in identification of genes related to *Phytophthora* pod rot resistance and moisture stress tolerance related genes. Cocoa in its native zone is grown as an under storey crop either under permanent shade or under temporary shades. In the Asian continent, cocoa cultivation is widely undertaken in palm-based cropping systems. Spacing under arecanut, single and double hedge systems of planting under coconut, triangle system of planting under oil palm have been developed for successful cocoa cultivation with canopy modifications. Formation pruning and training in young plants, structural and sanitary pruning in matured trees, canopy architectural engineering in both grafted and seedling plants were developed.

Phytophthora related diseases in the traditional high rainfall zones in seedlings, trees and pods, manifested through seedling dieback, stem canker and black pod rot and vascular streak dieback are major threats. Sowing before the onset of monsoon, soil solarization, biopriming measures, and adequate drainage facilities will reduce the incidence and spread of disease in the nursery. Shade regulation, timely harvest of pods, removal and destruction of infected pods, systematic annual pruning, smearing with Bordeaux paste on cut ends, spraying with copper fungicides are the remedial measures. Clones resistant to black pod rot and vascular streak die back has been identified. Mealy bugs and tea mosquito bugs are the major pests affecting cocoa, primarily during the summer season. It is observed that unscrupulous cutting of trees has aggravated the pest problems in the recent years. Screening of cocoa germplasm has identified clones tolerant to tea mosquito bug based on grades of damage levels in flushes, cherelles and fruits. Cocoa is considered as a functional food because of its



richness in terms of polyphenols and antioxidant properties. Genotypes, growing conditions, seasons, pre and post harvest handling etc. decide the quality of beans. Bean size with respect to bean indices, moisture content, shelling percentage, nib recovery and fat contents add value to the marketable bean. Elite clones and hybrids are developed with rich bean qualities. Clones rich in polyphenols, procyanidins, fat, antioxidant properties etc. have been identified.

Developmental efforts through Horticulture Mission

A Central Sector Scheme providing training to farmers and laying out field demonstrations on scientific methods of cultivation and on farm processing of cocoa beans was implemented in the 5th Plan and the same was continued in the 6th & 7th Plan periods. During the 8th Five Year Plan, steps were taken to generate good quality planting materials through clonal gardens, to rejuvenate unproductive trees and to support irrigation and marketing network besides measures for transfer of technology through demonstration and farmers training programmes. Infrastructure for generation of planting materials has been supported only to Research Institutes initially, and it was extended to establishment of Regional Nurseries/ Model clonal gardens in different states. Clonal multiplication of varieties has a potential productivity of 3 kg of cocoa per tree and so the establishment of regional nurseries became the foremost approach in the 9th Five Year Plan. Directorate of Cashewnut and Cocoa Development (DCCD)- CPCRI established 17 regional nurseries in 6 states. In 2001, Government of India's intervention and positive approach again revitalized the promotion of cocoa in India. Research findings, commercial adoption and developmental activities has amply proved cocoa as a best companion with coconut, arecanut and oil palm gardens, which provided additional income per unit area, enhances productivity of

soil as well as the main crops. It is also observed to be beneficial for small holders in providing sustainable employment and contribute to better share in the national GDP.

The Ministry of Agriculture, further given special thrust status to cocoa under Mission for Integrated Development of Horticulture (MIDH) and initiated many innovative programmes. With the commencement of National Horticulture Mission (NHM) in 2005-06 the development programmes of cocoa are being implemented by the states under State Horticulture Mission (SHM). Directorate of Cashewnut and Cocoa Development (DCCD), Cochin has been authorized to monitor the status of execution of these programmes. In addition to this, Front Line Technology Demonstrations (FLD) in farmer's plots, research institutes, publicity measures on cocoa promotion and pest and disease management have also been implemented under the direct control of DCCD. Area expansion is the major component implemented in 2005-2006 in the states of Kerala, Karnataka, and Andhra Pradesh and in 2007-08 provision was given to Tamil Nadu. For this, DCCD in association with various stake holders like CPCRI, Agri/ Horti Universities, state departments, AICRP- Palms centres, KVKs and NGOs taken up intense publicity measures. So far, 213 demonstration plots were established in potential states. Farmer's trainings, exposure visits, field days, seminars, workshops etc. are other technology transfer activities conducted by the Directorate. Apart from increasing productivity in traditional belts, expanding area in non- traditional areas is given importance as well, by way of supplying quality planting materials from recognized nurseries. As per the guidance of National Horticulture Board (NHB) nursery accreditation and recognition is provided by DCCD for cocoa, which assures incessant supply of certified material from different regions.

Developmental and policy aspects

Taking into consideration the past growth trends, the demand for cocoa beans in India by the year 2050 would be about 220 thousand tonnes and the projected supply is be only 120 thousand tones, thereby forming a huge supply deficit of around 100 thousand tonnes of cocoa beans. We need to chalk out a logical and pragmatic strategy to achieve the desirable projected demand-supply equation. Increasing per capita consumption of cocoa in India is the motivating factor behind the projection of an optimistic supply-demand scenario. About 26 lakh ha area is available in India under coconut, arecanut and oil palm plantations for cultivation of cocoa plants (new area expansion) and around 35% of this land is under irrigation. Thereby, the total potential area

for cocoa planting comes to around eight lakhs ha. Availability of such areas in the states of Kerala, Karnataka, Tamil Nadu, Andhra Pradesh and Orissa will therefore offer ample scope for newer area expansion of cocoa. At present, the area of cocoa is around 81 thousand ha and we can have a realistic target of introducing an additional 40 thousand ha into cocoa plantation by the year 2020. Meanwhile the productivity should be increased to 700 kg/ha, and we assume that 60% of the newly introduced area will give full potential yield and thereby produce 46 thousand tonnes of cocoa beans by the year 2020. The scheme for progressive increase in production for years 2020 to 2050 is schematically illustrated in Fig.2. Through the projected schedule we might attain a production surplus of 20 thousand tonnes by the year 2050.

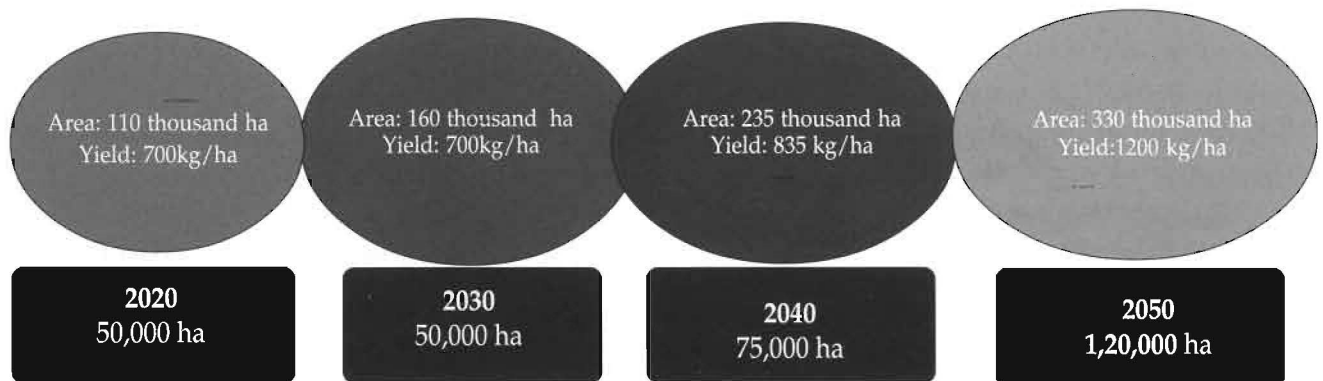


Fig.2. Scheme for becoming a cocoa bean surplus nation by 2050 (Source: Vision 2050, CPCRI)

International Cocoa Organization (ICCO) and Indian cocoa production: The International Cocoa Organization (ICCO) is a global organization, composed of both cocoa producing and cocoa consuming member countries. Located in London, ICCO was established in 1973 to put into effect the first International Cocoa Agreement which was negotiated in Geneva at United Nations International Cocoa Conference. Since then, there have been seven Agreements. The Seventh International Cocoa Agreement, negotiated in 2010 in Geneva, came into force provisionally on October 2012. It should be taken as a challenge to become a member of ICCO, which is of utmost importance in order to realize the vision of India

to become one of the major players in cocoa production and trade in the world. It will be the first step towards making the presence of India in the world cocoa map in all the four spheres namely cocoa production, trade, processing and consumption. In order to become a member of ICCO, we need to become a signatory of the next International Cocoa Agreement (ICA). The next ICA is tentatively scheduled to be held in the year 2020. We need to have realistic goals to raise our area, production and trade aspects with respect to cocoa and cocoa products in a phased manner. The modalities to become a member of the ICCO should be closely followed after becoming a



signatory of the ICA.

The econometric studies ensure the presence of spatial price integration among the regional cocoa markets in India and also its integration with world cocoa markets. The presence of co-integration between the pairs of cocoa price series of both regional and world market confirms that there is a co-movement of prices and thus they are integrated markets in nature. This gives an important insight that the price fluctuations in the world market will be transmitted to the domestic market and can affect the domestic price since they are integrated. Following liberalization of cocoa marketing systems in the nineties, farm gate prices in most cocoa producing countries are now largely determined by international prices. As a result, farm gate prices have shown greater fluctuations in most cocoa producing countries. Studies also indicate that the trend in cocoa production remains strongly linked to the financial capability of cocoa farmers to invest in yield improvement. This may result in supply shocks because major share of cocoa is produced by West African countries and a surplus/deficit in production in these regions will be reflected straight away in the international prices. Above all cocoa beans are heavily traded in two world exchanges: London (NYSE LIFFE) and New York (ICE) and cocoa futures contracts are the benchmark global price quote for cocoa.

Future strategies needing focus

The main strategies for enhancement of cocoa production are based on increasing productivity and expansion of area. Concerted research efforts are required to generate cost effective cocoa production system. There is a need to prioritize the action outlining the research, development and extension, to make this commodity one of the drivers in rural and regional economic development. Demand for high value produce of cocoa is growing both in domestic and overseas market at the same time, competition is also increasing. Production, demand and supply of commodities, economics and trade, sensitive stages and process during crop development, diversity and dynamics of major insects, microbes and pathogens, intensification of studies on pest and

weather relationships etc is needed. Therefore, sustainability will depend upon improving competitiveness, reducing impact on environment, quality assurance and food safety and capability of communities engaged in this sector to manage change.

The new initiatives to be taken to strengthen the research activities are as follows:

- i) Evolve varieties with durable resistance to pests; heat, drought with high level of bioactive compounds, having high nutrient and water use efficiency. Biotechnological tools must be used in conjunction with conventional breeding to tag genes of interest for marker assisted selection. Utilize the tools of bio-informatics and nanotechnology for enhancing the output.
- ii) Region specific technology generation based on maximum productivity of available natural resources needs emphasis. Develop production system for productive use of water and nutrients. Canopy management system for efficient utilization of nutrients, air, water and sunlight to optimize production with resources. Integrated management of emerging pests and development of cost effective, eco-friendly approaches.
- iii) Develop production and post-harvest technologies to improve product quality and minimize environmental impacts. Increasing the value of production by reducing variability in yield, quality, reducing crop losses and increasing marketability. Mechanization of operation and use of non-conventional energies. Technological innovations value chain management for reduction of losses and enhancement of quality. Inter institutional mechanisms to network and review the ongoing program of biotechnology, cost effective production technologies, post harvest technology, farm mechanization, transfer of technology and organic farming for optimization.
- iv) In the evolving liberalization regime, the market integration is becoming an inevitable

event. There is an urgent need to come up with a clear market intelligent mechanism which could provide price signaling in advance. Cocoa is an important commodity traded in the international stock exchanges. In the domestic level, we may formulate a producer consortium to facilitate the future trading and stock investment of cocoa beans, and there by combat the speculative price movements to a large extent. Risk aversion mechanisms should be adequately taken while advising the area expansion programmes on cocoa wherein we should discourage the monocropping of cocoa.

- v) Domestic supply chain of cocoa in India is still in rudimentary stages. CAMPCO and Cadbury India Ltd (now Mondelez India) are the major procuring agencies in India, who are directly procuring the cocoa beans from farmers. The value share of the producer/farmer is a meager 32% because most of the farmers sell the produce as wet beans, even without doing minimal processing. Drying yards, primary processing facilities, and storage facilities are lacking in the case of most of the cocoa farmers. Since the stringent food safety standards and trace back systems are evolving in international arena, it is a real challenge to establish robust procuring system in the upstream end of the cocoa value chain in the country.
- vi) Focus is needed to establish village level primary processing units and capacity building for fermentation and drying of cocoa beans with the formation of strong farmer aggregates, women SHG's and rural youths. Development of exclusive market yards and assembling places for cocoa beans along with the adoption of high quality food safety standards would be a pro-active step for better realization of bean prices. Assured buy-back systems developed in the frame of contract farming under the stake of government (tripartite arrangement) can help the growth of the sector. State machinery should go for Memorandum of Understanding with the leading chocolate manufacturers for appropriate marketing arrangements and supply chain development. On a pilot basis, we may explore this opportunity by

popularizing the organic cocoa and may endeavour for organic/sustainable certification.

- vii) In order to make cocoa farming more profitable, farmers need to produce high quality cocoa. Average productivity will increase, when entrepreneurial farmers are trained to use inputs such as fertilizer judiciously and adopt cultivation of high yielding cocoa varieties. Corporate investments in training and distribution networks for fertilizer and seedlings will play a crucial role in helping farmers become more prosperous. To attain the projected bean surplus, it is essential to focus on partnership building and reinforced capacities across the cocoa sector. Meaningful partnerships should be evolved between all stakeholders, namely governments, cocoa farmers, and the cocoa industry to boost productivity and strengthen the cocoa community development

Conclusion

Plantation crops (coconut, cashew, cocoa and arecanut) are emerging as important sector of horticultural crops. These crops including cocoa being high value and low in volume have provided opportunities to farmers in utilizing marginal land and have added value to environment through diversification. The technologies developed based on new research strategies would help in enhancing the productivity of cocoa resulting in increased production and lesser dependence on import with self reliance on indigenous production required for processing. We have succeeded in developing new cultivars, production system and also large number of products which require be adopting, and researching together in network mode. There is need to develop and disseminate technologies to help cocoa farmers in terms of realization of higher returns. Further, large tracts of potential area need to be brought under cocoa cultivation even in non-traditional areas. Increasing productivity and expansion of area through developmental agencies will have strong impact on cocoa development, in general, and increased production of cocoa in the country, in particular. Intensification of research will definitely add value for optimization and effective utilization of this crop. ●