THE PRESENT SCENARIO OF COCONUT, ARECANUT AND COCOA IN INDIA

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Coconut and arecanut are traditional plantation crops grown in India for more than 3000 years and therefore are interwoven with social, cultural and religious customs of the people. Being small holder's crops, they provide livelihood for millions of people particularly in the peninsular region of the country. Cocoa was introduced as a profitable intercrop in coconut and arecanut gardens during the later half of the twentieth century. This article provides a bird's eye-view of the present scenario of coconut, arecanut and cocoa industry in the country.

COCONUT

Coconut, the *Kalpavriksha*, is a traditional crop known to exist in India from post vedic period. At present, the crop covers a total area of 1.91 million ha producing 14,925 million nuts. India ranks first in production among the 90 coconut producing countries in the world. The crop is mostly confined to the States of Kerala, Tamil Nadu, Andhra Pradesh and Karnataka accounting for 90 per cent of the area under coconut. It is also traditionally grown in Andaman and Nicobar and Lakshadweep Islands. Coconut cultivation is gaining momentum in non-traditional areas such as Maharashtra, West Bengal, Bihar and Madhya Pradesh and the north-eastern states. It is essentially a small holder's crop with more than 90 per cent of the holdings below one hectare with an average of 0.22 ha.

Coconut is cultivated in the country, as a source of food, drink, shelter and for a variety of raw materials for industrial exploitation. As much as 48 per cent of coconut production is used as raw nuts for edible and religious purposes, 10 per cent as tender coconut, 30 per cent for production of milling copra for oil extraction, 8 per cent for the production of edible copra and the remaining for preparation of various coconut products. The export earnings from coconut is mainly from coir and coir products, the value of which is around Rs.300/- crores per year.

Research Agencies

The Central Plantation Crops Research Institute (CPCRI) under Indian Council of Agricultural Research is given the mandate of research at national level. The Regional Station of CPCRI at Kayangulam is involved in research on pests, and diseases while the Regional Station at Lakshadweep is engaged in evaluation of suitable varieties and developing coconut based farming systems suitable for island conditions. The World Coconut Germplasm Centre at Andamans serves as an off-shore quarantine centre for coconut germplasm. The International Coconut Gene Bank (ICG) for South Asia was established at CPCRI, Seed Farm, Kidu (Karnataka) under the Coconut Genetic Resources Network (COGENT) of International Plant Genetic Resources Institute.

State Agricultural Universities of Kerala, Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, Orissa and Assam also have research programmes on coconut. Three research stations of Kerala Agricultural University at Kumarakom, Balaramapuram and Nileshwar have been the centres of coconut research for several decades.

The All India Co-ordinated Research Project (AICRP) on Palms has coconut as the most important mandate crop. It co-ordinates research in different centres in the country with CPCRI, Kasaragod as its headquarters. Out of the 16 centres under AICRP on Palms, the following 10 centres are conducting research on coconut; Veppankulam and Aliyarnagar (Tamil Nadu), Ambajipeta (Andhra Pradesh), Arsikere (Karnataka), Kasaragod (Kerala), Konarak (Orissa), Kahikuchi (Assam), Mandouri (West Bengal), Ratnagiri (Maharashtra) and Jagadalpur (Madhya Pradesh).

Research highlights

CPCRI has now the world's largest germplasm collection comprising of 265 accessions including 117 exotic and 148 indigenous accessions. Multilocational varietal evaluation trials resulted in the release of three cultivars for commercial cultivation viz., Laccadive Ordinary (Chandrakalpa), Philippines Ordinary (Chandra Tara) and Benawali Green Round (Pratap). Chowghat Orange Dwarf has been released as the best tendernut cultivar. The epoch making discovery of hybrid vigour in coconut by J.S. Patel in 1930s was further exploited by scientists from various research institutions resulting in the release of 12 hybrids with superior traits like early bearing and high yield. CPCRI has released three

hybrids for commercial cultivation viz., Chandrasankara (CODxWCT), Chandralaksha (LOxCOD) and Kerasankara (WCTxCOD). KAU recommended 5 hybrids for commercial cultivation in Kerala; Lakshaganga (LOxGB), Keraganga (WCTxGB), Anandaganga (AOxGB), Kerashree (WCTxMYD) and Kerasowbhagya (WCTxSSA). The hybrids released by TNAU are VHC-1 (ECTxDG), VHC-2 (ECTxMYD) and VHC-3 (ECTxMOD). APAU released Godavariganga (ECTxGB) for cultivation in Andhra Pradesh. Standardisation of embryo culture protocol has further facilitated germplasm collections from geographically distant countries. The drought tolerant nature of coconut hybrids such as WCTxGB, LOxCOD and WCTxCOD and talls like Laccadive Ordinary are of special significance since 80 per cent of the crop is under rainfed conditions.

The fertilizer dose for adult bearing palm has been recommended as 500 g N, 320 g P_2O_5 and 1200 g K_2O/palm/year in two split doses. A spacing of 7.5 x 7.5 m to accommodate 175 palms/ha was found to be optimum. Drip irrigation with 32 l of water/palm/day during summer months was found to be sufficient for adult palms. A low cost technology for the large scale production of vermicompost from coconut wastes has been standardised. A number of economically viable cropping models with compatible crop combinations have been developed to harness the natural resources and to fetch higher income from a unit holding.

There has been significant progress in the development of integrated pest management strategies for combating the pests of coconut palm viz., rhinoceros beetle, red palm weevil, leaf eating caterpillar, white grubs and minor pests. Trials are on to identify suitable pesticides and biocontrol agents for eriophyid mite which has emerged as a serious pest to coconut production. Control measures have also been developed for the burrowing nematode, *Radopholus similis.*

The etiological agent causing century old root (wilt) disease has been identified as phytoplasma and the insect vectors involved in the transmission are lace bug, *Stephanitis typica* and plant hopper, *Proutista moesta.* Intensive efforts are on to evolve resistant/tolerant coconut varieties against root (wilt) disease. Field screening of the hybrid involving disease free Chowghat Green Dwarf palms as female and West Coast Tall as male gave encouraging results. A management strategy has been developed to obtain satisfactory yield from

diseased palms. Control measures have also been developed for other diseases such as leaf rot, stem bleeding and bud rot.

Development of multipurpose dryers of various capacities using farm wastes as fuel is a significant achievement. An electronic copra moisture meter has been designed and calibrated to determinine moisture level in the range of 5 to 40 per cent. A process for making snow ball tendernut has been developed using eight months old coconut. Sweet and crispy coconut chips have been prepared from mature and fresh coconut kernel by osmotic dehydration and drying.

Developmental agencies

The Indian Central Coconut Committee constituted in 1945 was the first Government agency vested with the responsibility of coconut research and development in the country. The Committee was abolished in 1966 and the programmes on coconut development was entrusted with the Directorate of Coconut Development. The Directorate functioned till the formation of Coconut Development Board in 1981.

The Coconut Development Board (CDB) with its headquarters at Kochi is the apex agency involved in coconut development in the country. With the objective of increasing production and productivity of coconut, CDB is implementing various programmes such as production and distribution of quality planting materials, establishment of seed gardens and demonstration farms, area expansion, promotion of integrated farming in coconut holding, rejuvination of root (wilt) affected gardens, biological control of pests, establishment of a technology development centre and extension and publicity through various mass media and publications. The Board is also concentrating on promotion of coconut industry by initiating the development of appropriate technologies for product diversification and improving marketing of coconut and coconut products as well as providing financial and technical assistance for cultivation and processing of coconut.

The State Agriculture and Horticulture Departments and Agricultural Universities with their state wide network of extension units are implementing multipronged programmes for the development of the crop. They form the vital channels for the transfer of technologies to the farming community.

The impact of development programmes is visible from the improvement in area, production and productivity. The area under coconut recorded an impressive increase from 0.64 million ha in 1955-96 to 1.91 million ha in 1998-99. In production front also, India achieved fairly better growth and emerged as the largest coconut producing country in the world with a production of 14,925 million nuts in 1998-99 compared to the base level of 4224 in 1955-96. The contribution of Kerala to the total production is 45 per cent followed by 21, 15 and 10 per cent by Tamil Nadu, Andhra Pradesh and Karnataka, respectively. But in terms of productivity, Andhra Pradesh and Tamil Nadu have impressive figures of 19573 and 11620 nuts/ha while Kerala and Karnataka are way behind with low figures of 6188 and 5195 nuts, respectively.

Constraints

The root (wilt) disease prevalent in a contiguous manner in eight southern districts and in isolated pockets in the northern districts of Kerala and in certain districts of Tamil Nadu is a serious threat to coconut cultivation. As the disease has no curative measures and is debilitating in nature, it has significantly affected coconut production in the premier coconut growing state of the country. The eriophyid mite, *Aceria guerreronis* K. has reached epidemic proportions in recent times affecting the production and productivity of coconut in many districts of Kerala, Tamil Nadu and Karnataka. Large scale sudden occurrence of the pest and the problems encountered in spraying the bunches right on the crown has made the control operations very cumbersome.

The most immediate problem faced by the farming community is the fall in price of coconut and the difficulties encountered in marketing. This has been the result of globalisation which permit free trade and the low prices prevailing in the international market.

Though India has achieved impressive growth in production, the per palm yield is lower than 40 nuts annually compared to more than 100 nuts obtained in experimental palms under rainfed conditions. Majority of coconut cultivation in the country is still under rainfed conditions. Vigorous transfer of technology programmes and adoption of recommended agrotechniques by farming community can therefore be effective to enhance the productivity especially since the adoption level is presently only 10-15%. It is heartening to note that the

productivity is very high in states like Tamil Nadu and Andhra Pradesh where majority of farmers follow the recommended package of practices including irrigation.

Future strategies

The coconut industry poses a very bright future in spite of the constraints and problems beset with the industry. The research efforts needs to be further strengthened to achieve higher productivity to sustain coconut cultivation as a profitable enterprise. Among the research programmes, development of coconut varieties tolerant to the debilitating root (wilt) disease needs top priority. Development of drought tolerant varieties should also form an important area of research due to the fact that major share of coconut cultivation in the country is still under rainfed conditions. Organic farming technologies including recycling of wastes, vermicomposting, exploitation of N_2 fixing legumes and biofertilizers deserve more emphasis to reduce the dependence on chemical fertilizers and to prevent environmental degradation. The strategy on plant protection front should focuss on ecofriendly measures through biological control and use of botanical pesticides and organic amendments to achieve the suppression of pests and diseases below the economic injury level. The scarcity of labour for field operations necessitates fabrication of labour saving implements.

Raising compatible subsidiary crops and integrating with livestock are vital for the effective utilization of natural resources such as water, soil, sunlight and nutrients and to realise additional net returns from a unit area to sustain coconut cultivation as a profitable enterprise. Value addition and by-product utilization are also important to reduce dependence of coconut price on the price of coconut oil. In view of the competition from cheaper vegetable oils it is necessary for the crop to move away from the oil sector to the extent possible. Enormous possibilities exist to put coconut into other alternate uses like tendernut, edible copra, desiccated coconut, coconut cream, nata-de-coco etc. Popularisation of new products along with product diversification can go a long way to achieve healthy growth of coconut industry.

ARECANUT

The arecanut palm (*Areca catechu* L.) is a commercial crop cultivated as a source of masticatory nut popularly known as arecanut or betelnut or supari. Though its primary use is masticatory, it also finds use in human and veterinary medicines and in certain religious and social functions. Recorded history of the palm dates back to BC 1300. The palm is now cultivated in an area of 2.69 lakh ha and the annual production is 3.34 lakh tonnes. More than six million people in different parts of the country are dependent on the arecanut industry directly or indirectly for their livelihood. India is the largest producer and consumer of arecanut in the world. The palm is also grown on a limited scale in Sri Lanka, Bangladesh, Malaysia, Indonesia and Philippines.

Karnataka is the major arecanut growing state with an area of 88,000 ha and production of 1.28 lakh tonnes accounting for 38% of the country's production. Kerala ranks second with an area of 76,000 ha and production of 0.94 lakh tonnes contributing 28% to the total production. Assam ranks third with a production of 0.64 lakh tonnes from an area of 74,000 ha and contributes 20% of the total production. It is grown in a limited extent in Tamil Nadu, Meghalaya, West Bengal, Maharashtra and Goa.

The area under arecanut increased rapidly during the last four decades from 0.98 lakh ha in 1956-57 to 2.69 lakh ha in 1997-98. During the same period, production increased from 0.77 lakh tonnes to 3.34 lakh tonnes and the productivity increased from 788 kg per ha to 1243 kg. The increase in production has been due to both increase in area and productivity. India achieved self-sufficiency in its requirement of arecanut in early seventies. The research and developmental activities of the Central Plantation Crops Research Institute, Regional Station, Vittal, by way of evolving high yielding varieties, development of sustainable crop production and crop protection technologies and the efforts of the Directorate of Arecanut & Spices Development have contributed a great deal to this achievement..

Research highlights

Screening of germplasm accessions and varietal evaluation trials resulted in the release of six high yielding varieties for commercial cultivation in the country. Mangala

(3.00 kg chali/palm/year), Srimangala (3.18 kg chali/palm/year), Sumangala (3.2 kg chali/palm/year), Mohitnagar (3.67 kg chali/palm/year), Samrudhi (4.3 kg chali/palm/year) and SAS-1 (4.6 kg chali/palm/year) are the superior varieties released for cultivation to suit different agro-climatic regions.

About 85-90 per cent of the total area under arecanut is still occupied by the local varieties such as South Kanara (2.00 kg chali/palm/yr), Hirehalli (3.20 kg), Thirthahalli (2.00 kg), Mettupalayam (2.00 kg) and Srivardhana (2.00 kg). Replacement of the less productive local varieties with high yielding varieties will result in significant increase in productivity. Some promising hybrid combinations of the naturally available dwarf mutant, Hirehalli dwarf with high yielding varieties of Mangala, Sumangala, Sreemangala and Mohitnagar are under field evaluation. The dwarf hybrids will be useful to overcome the problems encountered with the tall stature of the high yielding varieties.

Scientific management techniques have been standardised to realise optimum yield from arecanut plantations. A spacing of 2.7 x 2.7 m is recommended to obtain maximum yield from a unit area. Based on the results of manurial trials, annual application of 100 g N, 40 g P_2O_5 and 140 g K_2O in the form of fertilizers and 12 kg each of green manure and compost per bearing palm is recommended. Adoption of drip irrigation result in saving of 44% of water. Fruit rot (koleroga/mahali), foot rot (anabe roga), inflorescence die back and yellow leaf disease cause damage to the arecanut palm. A simple technology of covering arecanut bunches with polythene covers have been developed for the effective management of fruit rot. Covering the bunches with disease guards made up of arecanut leaf sheath is an eco-friendly method in place of polythene bag to achieve the same results. The four pests which cause considerable economic loss to the crop are mites, spindle bug, inflorescence caterpillar and root grubs. Plant protection measures have been developed for the pests and diseases.

Development of cropping involving both annuals and perennials constituted an important milestone in the progress of arecanut research. This has helped to mitigate the problems associated with monocropping such as long pre-bearing period of 5-8 years, high investment and low returns in the initial period, fluctuation in market prices and unexpected losses due to pests and diseases. Cropping system approach enhances natural resource use efficiency as 70 per cent of the land and 50 per cent of the sunlight are unutilised in the

monocropping system. The profitable intercrops during the initial stages of arecanut are banana, ginger, chilli, colocasia, paddy, turmeric, elephant foot yam and dioscorea. The compatible mixed crops which provide significant economic returns in adult plantations are cocoa, pepper, banana, acid lime and betel vine.

Development of high density multispecies cropping models provided further dimensions to cropping system in terms of economic viability and sustainability. The model involving arecanut + banana + cocoa + pepper was found to be one of the ideal combinations. In this system, the fertilizer requirement could be scaled down to 66 per cent of the recommended dose in addition to other benefits such as higher net profit of 85-98 per cent than monocropping and generation of additional employment by 80 per cent than monocropping. This model gave a net income of Rs.2,69,000/ha in coastal Karnataka region. Cropping models have also been developed for different agroclimatic regions in the country. The tendency to plant arecanut in coconut gardens without giving a wider spacing is not advisable.

Organic farming practices find application in arecanut plantations to develop eco-friendly and sustainable production systems. About 5-6 tonnes of areca wastes are available from a hectare of arecanut plantation annually in the form of fallen leaves, bunch waste and husk. Suitable technologies such as *Oyster* mushroom cultivation and vermicompost production have been developed for profitable utilization of these wastes and to enhance economic returns from the areca populations. Recycling of areca wastes utilizing the earthworm, *Eudrilus eugieniae* resulted in the production of vermicompost to meet 50% N, 32.5% P and 26% K requirement of one hectare of garden besides providing organic matter and micronutrients.

Alternate uses

The constituents of the nut can be used profitably in various ways. Tannins, a by-product from the processing of immature nuts find use in dyeing clothes, tanning leather, as a food colour, as mordant in producing variety of shades with metallic salts etc. Fat which constitutes 8-12 per cent of the nut can be extracted and used for confectionary purposes. Arecanut husk finds use in preparations of hard boards, pulping and paper boards, cushions

and non-woven fabrics besides being a good source of furfural. Arecanut leaf sheath could be used for preparation of throw-away cups, plates, plyboards, tea chest, packing cases and suitcases.

Development scenario

The Indian Central Arecanut Committee (ICAC) was constituted in 1949 to assist the Government in the improvement, development and marketing of arecanut and arecanut products. The research and developmental efforts supported by ICAC resulted in increasing the overall production beyond the targets set in the third five year plan. The Indian Central Arecanut Committee was dissolved in 1965 and the Government of India constituted the Directorate of Arecanut and Spices Development in 1966. The emphasis from IVth Five Year Plan was on the intensive cultivation of the existing area and discouraging area expansion under arecanut since India had achieved self sufficiency. The major task was to increase and sustain productivity rather than total production. Continuous application of chemical fertilizers and pesticides has deteriorated soil health and resulted in the emergence of new pest and disease complexes. Adoption of organic farming technologies is a right step to mitigate these problems and to achieve sustainable productivity without any harmful effects on environment and human health.

Better marketing of the produce is essential for the healthy growth of arecanut industry. The raw nuts are sold in all primary markets in the producing regions. The Central Arecanut and Cocoa Marketing and Processing Co-operative Ltd. (CAMPCO), Mangalore since its inception in 1973 is an important agency involved in procuring and selling arecanut.

Constraints

Although arecanut was the most profitable plantation crop grown in the country till recently, decline in the prices is a major problem faced by the farmers now. The traditional farmers are constrained by the higher cost of production resulting from the increasing cost of inputs particularly labour. The factors causing concern to arecanut industry are surplus production, expansion of area at the rate of 3 to 4 per cent per year, fear of banning gutka and pan masala as well as limited export potential.

Yellow leaf disease is a serious malady affecting arecanut production in most parts of Kerala and some parts of Karnataka, Tamil Nadu and Maharashtra. As the disease is caused by phytoplasmas, there is no definite plant protection measure to control the disease. The disease is transmitted by the insect, *Proutista moesta.* The management trials and disease resistance breeding programmes are underway to tackle the problem. Emphasis need to be given to the new biotechnological tools like genetic engineering, somaclonal variation and tissue culture to achieve lasting solution to the serious malady affecting the arecanut cultivation.

Future strategies

The future strategy for the healthy growth of arecanut industry should focus on maximising productivity of arecanut plantations, finding solution to the important maladies affecting the crop, developing economically viable alternate uses and ensuring market stability for commodity. The wrong notions on the health hazards of arecanut should be removed. The future of arecanut industry would depend on adoption of high density multispecies cropping in arecanut plantations to safeguard the crop against price crash and a change in the status of the crop from a `chew and spit' item to a multidimensional plantation crop with a variety of uses.

COCOA

Cocoa (*Theobroma cacao* L.), a beverage crop native to Amazon region of South America, has been introduced in India as a profitable mixed crop in coconut and arecanut plantations about three decades ago. The crop is now cultivated in an area of 14,618 ha with an annual production of 7837 tonnes and productivity of 535 kg/ha. Global production of cocoa is 2.7 million tonnes, of which nearly 90% comes from small holdings of two hectares or less. Ivory Coast leads in cocoa production in the world with a contribution of 40% followed by Ghana, Indonesia, Malaysia and Brazil. Two geographic population forms viz., Criollo and Forastero are identified. Forastero is the commercially cultivated one in major cocoa growing countries.

Kerala accounts for 71 per cent of the area and 80 per cent of the production in India. Karnataka and Andhra Pradesh are the other cocoa growing states. The country earned foreign exchange worth Rs. 9 crores in 1995-96 and Rs. 6 crores in 1996-97 through export of cocoa products.

Research highlights

The Central Plantation Crops Research Institute, Regional Station, Vittal and Kerala Agricultural University, Vellanikara, Thrissur are the centres of cocoa research in the country. A large number of germplasm collections are maintained at both the centres. The current holding of cocoa germplasm at Vittal and CPCRI, Research Centre, Kannara comprises of 128 accessions collected from Nigeria, Malaysia, Ghana and England. Crop Improvement programmes at CPCRI led to the selection of seven high yielding varieties from Malaysian and Nigerian collections. Vegetative propagation with an average 70-80 per cent success has been standardised by soft wood wedge grafting and patch budding of three month old cocoa seedling. Clonal seed gardens have been established at CPCRI, KAU and Central State Farm, Aralam to produce superior planting material.

In arecanut gardens established with a spacing of 7.5 x 7.5 m, cocoa can be introduced at a spacing of 2.7 x 5.4 m or 5.4 x 5.4 m. Either single or double hedge system of cocoa planting is possible between two rows of coconut spaced at 7.5 x 7.5 m. Under single hedge system, cocoa is planted at 3.5 m apart in between two rows of coconut trees whereas under double hedge system the spacing between plants within the rows is 3.5 m and between rows is 3.0 m. The optimum dose of fertilisers for cocoa was found to be 100 g N, 40 g P_2O_5 and 140 g K_2O) per tree per year. Drip irrigation with 20 l of water per tree per day was sufficient for the sustenance of the crop in summer months. Pruning of cocoa trees can enhance the yield by 15 to 30 per cent.

Effective measures to control rat and squirrel damage have been worked out. Management strategies are also available for sap sucking insects like mealy bugs, mirids and aphids. Crop protection measures are available for the control of diseases such as black pod disease, canker, pink disease and cherelle wilt.

A simple heap/basket fermentation technique for processing of cocoa beans suitable to different farm sizes have been standardised. As an ideal mixed crop, cocoa cultivation has been found beneficial to enrich nutrient status of soil, retains soil moisture and arrest the weed growth through constant leaf fall.

Development scenario

In India, the cultivation of cocoa on a commercial scale started in the early 1970s. The area under cocoa increased substantially during seventies and reached a peak of 29,000 ha in early eighties due to the attractive prices and aggressive promotional strategies adopted by State Agriculture Department of Kerala. The Cadbury India Ltd. also played a significant role in promoting cocoa cultivation. The area under cocoa came down to 22,500 ha in 1982-83, further declined to 16,862 ha in 1989-90 and 12,400 ha in 1997-98. The set back in cocoa cultivation in the first half of 1980 was largely due to the poor demand, fall in prices and increased loss due to the pests and diseases. The formation of CAMPCO in 1982 and its involvement in marketing and processing sector were significant to regain the interest of the farmers in this crop to some extent. The present production of around 6900 tonnes leaves a gap of 7000 tonnes between demand and supply of dry beans. The cocoa processing units projected a demand of 30,000 tonnes by 2000 AD. A three fold increase in production will have to be registered to meet the demands of the domestic cocoa processing units.

Challenges

Production of cocoa-based beverages and chocolate industry have shown tremendous growth not only in Europe and North America but also in India, China and other developing countries. This has resulted in increased demand for dry cocoa beans in both international and domestic markets. The interest being shown by multinationals in the sector as a result of globalisation further enhanced the demand for the crop. Nearly 50 per cent of the requirement of the industry is now met by imports causing a big drain on foreign exchange. India can emerge as a top producer of cocoa with good export potential if we take proper steps to encourage cocoa cultivation and provide marketing facilities and remunerative price to the farmers.

Future strategies

A vital step needed to enhance the production is the expansion of cocoa to non-traditional areas in the states of Karnataka, Tamil Nadu, Maharashtra, Andhra Pradesh, Goa and Pondicherry and North-eastern states where large areas under coconut are available. Narrowing down the gap between the yield obtained in farmers' fields (500 kg/ha) and the yield realised in experimental farms (2000 kg/ha) can also result in significant improvement in production. Measures such as supply of superior planting materials, replacing seedlings by grafts and transfer of proven technologies through field demonstration will go a long way to enhance the productivity. As there is enormous export potential, it is necessary to identify and propagate varieties which produce quality standard beans for export market. Development of eco-friendly organic farming technologies for producing organic chocolates is another option to promote export due to the concerns raised by enrivonmentalists on the increased use of agrochemicals in cocoa. Evolving resistant/tolerant strains of cocoa against diseases like black pod and canker would help to reduce yield loses due to these diseases.

By-product utilization is another measure to enhance the net income of the farmers. Every tonne of cocoa beans produced will yield 8 to 9 tonnes of pod husk which can be converted to cattle feed, manure and even for the production of biogas. The mucilage or pulp can be used in the preparations of jams, jellies and vinegar. The sweatings collected during the fermentation of beans can be profitably used for production of acetic acid. Establishment of common facilities on co-operative basis for fermenting cocoa beans and procurement through agencies like CAMPCO or Cadbury are also important for promotion of cocoa industry in India.

It could therefore be seen that while challenges exist in the development of coconut, arecanut and cocoa, these are not unsurmountable and adequate timely steps if taken can ensure a bright future for these crops in the country.

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