

PLANTATION CROPS RESEARCH - STATE OF ART

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Kerala is blessed with unique ecological conditions suitable for cultivation of many high value commercial crops. Of the total geographical area of 3,88,497 ha in Kerala, plantation crops occupy 46.21 per cent. Coconut, Rubber, Cashew, Coffee, Arecanut, Teav Spice Crops besides Teak and Eucalyptus are the major plantations of the State. Besides Kerala, plantation crops are cultivated in appreciable extent in Tamil Nadu, Karnataka, Andhra Pradesh, Orissa, Tripura and Assam. Though plantation crops occupy only 3.2 million hectares in the country, they have generated considerable income of around Rs. 15,000 million during the year 1996-97 which is 70 per cent of the total export earnings of the agri-horticultural crops in the country.

India is the leading producer of coconut, cashew, tea and arecanut, second in cardamom and ninth in coffee. Plantation crops are confined to traditional belts and are committed to the land for longer periods. They have restricted geographical distribution and hence the possibility of area expansion is limited in traditional growing areas. Coffee, tea, rubber and to a limited extent oil palm are cultivated in an organised manner. Crops like coconut, arecanut, spices and cashew are grown by individual farmers and **the** production technologies advocated are not followed fully due to many socio-economic reasons thereby affecting their productivity.

In addition to the above, a large number of medicinal and aromatic plants are native to Indian forests and have been brought into cultivation to meet the Ayurved, Unani and Sidha school of medicines in the country. The

primary products of these crops are of great economic value, a portion of which is consumed in the country and a major portion finds its way in the export channels. The by-products of these crops support a number of industries and generate considerable employment potential to millions of farm families. The products of these crops are a part of daily life of the population, such as "Tea, the cup that cheers", their future requirements are high. This necessitates increase in production and productivity through technological advances in crop improvement, crop production and plant protection aspects to meet the country's demand and earn valuable foreign exchange.

The national average yield of plantations is low compared to the yields obtained in plantations of the organised sector, throwing open vast challenges to fully utilize the technological advances in different disciplines in the research institutions. This can be achieved by managing the vast acreage of the existing plantation crops through agrotechniques to improve fertilizer use efficiency, water management and plant protection. The other aspect of productivity increase is through replacement of senile plantations by high yielding varieties obtained through breeding strategies and bio-technological advances.

The Indian Council of Agricultural Research through its persistent efforts has built up a vast infrastructure over the decades to achieve the goals of increased production and productivity in plantation crops.

The Central Plantation Crops Research Institute, Indian Institute of Spices Research, All India Co-ordinated Research Project on Palms, Cashew, Spices, Medicinal and Aromatic plants, National Research Centre on Cashew, National Research Centre on Oil palm and National Research Centre for Medicinal and Aromatic Plants are primal research organisations in plantation crops. The Central Agricultural Research Institute in Andaman and Nicobar Islands, ICAR Research Complex in Goa, and ICAR Research Complex for North East Hill Region also carry out research on plantation crops. Besides the above Institutions, Agricultural Universities in Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Assam and West Bengal also carry out research specific to their regions. Coffee, rubber and spices to a certain extent are handled by commodity boards. Coffee research is carried out by the Central Coffee Research Institute, Balehonnur under the Coffee Board.

UPASI Tea Research Institute at Valparai and Tea Research Association, Toklai caters to the research needs of tea in respective regions. Rubber Research Institute of India at Kottayam handles R&D under Rubber Board. The research on small and large cardamom is handled by Indian Cardamom Research Institute, Myladumpara under Spices Board. Besides research on crop improvement in general, these Institutes also work on certain aspects of harvest and post harvest technology of plantation crops. CSIR institutes like Central Institute for Medicinal and Aromatic Plants (CIMAP) and the Regional Research Laboratories at Jorhat, Bhubaneswar and Thruvananthapuram also do research on plantation crops particularly medicinal and aromatic plants.

Significant Achievements

Coconut

Coconut is now grown mainly in 13 States in the country. There has been an unprecedented increase in area, production and productivity during the last 45 years. The area under coconut has increased from 0.626 million ha in 1950-51 to 1.795 million ha in 1995-96 and production from, 3281 million nuts to 13967 million nuts. Mathematically this accounts for 186.6 per cent increase in area and 325.6 per cent increase in production. Currently India has been adjudged as the largest producer of coconut in the world. During the decade from 1985-86 to 1995-96, the growth rate achieved in production was 7.56 per cent. The increase in productivity during the last decade was about 54 per cent.

CPCRI has the largest assemblage of germplasm, consisting of 46 indigenous and 86 exotic types from 22 countries. Exploiting the hybrid vigour, nine hybrids involving tall and dwarfs as parents and three high yielding varieties have been released for commercial cultivation. These have received attention and acceptance by farmers of Kerala Tamil Nadu, Andhra Pradesh, Karnataka and Goa. These varieties and hybrids are capable of yielding 1.62 to 2.99 tonnes of oil/ha annually. CPCRI has developed many cropping systems involving annuals and perennials grown in different tiers by exploiting soil and air space more efficiently. Coconut and arecanut based inter-mixed, multistoried-multispecies cropping systems developed at CPCRI is a major significant achievement. Coconut-cocoa and pepper cropping system provided a maximum return of Rs. 2,32,000/- per ha per year. The high density multispecies cropping system now being demonstrated in the

Institute has continued to yield very profitable returns and in the 14th year. An annual net return of Rs.1,32,800 per ha with a gross return of Rs. 93,300/ - ha has been realised. Due to favourable conditions like organic matter addition, internal nutrient cycling and microclimatic conditions, these systems can be maintained at suboptimal levels of external nutrient addition. These systems demonstrate the vast potential that can be profitably exploited.

About 50,300 ha has been identified as potential area for growing coconut in the semi and non-traditional areas in the country. The non-traditional areas include Bihar, Tripura, Nagaland, Manipur, Arunachal Pradesh and Rajasthan.

Drought is a common problem in many parts of Kerala especially in the northern districts. To circumvent this problem, CPCRI has screened 23 germplasm accessions for this trait. Recent studies have indicated that West Coast Tall x West Coast Tall, Java Giant, Andaman Giant, Federated Malay States, Laccadive Ordinary x Chowghat Orange Dwarf as drought tolerant. The reduction in yield during drought years can be as high as 75.8% in drought affected COD x WCT hybrids, whereas it is only 15% and 44% respectively in LO x COD and LO x Gangabondam which have been identified as drought tolerant lines.

Root wilt disease is a serious problem leading to annual loss of 968 million nuts in eight districts of Kerala. Subjecting the carefully selected disease free palms to serological and physiological tests and by further selection and breeding work, Chowghat Green Dwarf x West Coast Tall (CGD x WCT) has been identified to show tolerance/resistance to the disease. These field planted palms are under observation. Biotechnological investigation for fingerprinting diversity using biochemical and molecular markers, embryo culture technique for germplasm collection and somatic embryogenesis are being carried out. Presently the plantations in Kerala and Tamil Nadu are threatened by an Eriophid mite infesting nuts which causes huge loss. The CPCRI, KAU and TNAU are researching in this.

Arecanut

Arecanut research has helped in increasing the production and productivity and achieving self sufficiency in the country. So far, five high

yielding varieties viz. Sumangala, Sreemangala, Mohitnagar and Calicut-17 were released which can yield 8.8 to 15 kg ripe nuts/tree/year. The natural dwarf identified from Hirehalli is being exploited to produce high yielding varieties by hybridisation between dwarf and released varieties. This will to a large extent is expected to ease the problem of harvesting in arecanut in the near future. Addressing to the multivarious research needs of arecanut over the past 45 years has lead to increase in arecanut production from 76000 tonnes during 1956-57 to 3.12 lakh tonnes during 1996-97.

Oil palm

Oil palm has been recognised as one of the highest edible oil yielding crop which can yield 4-6 tonnes of oil/ha/year from 3-25 years of economic life span. In India 7.96 lakh hectares has been identified as potential area for cultivation under assured irrigation. So far 39,413 ha have been planted. Andhra Pradesh (19,500 ha), Karnataka, (7,11 ha), Tamil Nadu (5,000 ha) and Kerala (3,805 ha) are principal oil palm growing states in the country. Gujarat, Goa, Maharashtra, Orissa, Assam, Tripura and West Bengal have also been identified to grow oil palm in future on a larger scale.

Two high yielding oil palm hybrids viz. Palode-I and Palode-II were released after their evaluation since 1976. These hybrids are capable of yielding 4.4 tonnes of palm-oil/ha/year under rainfed conditions of southern Kerala. The CPCRI has enough parental palms for commercial production of hybrid seeds to meet the country's requirements.

Palm oil has been receiving good consumer acceptance and India has imported 1.469 million tonnes of palm oil during 1997-98 to satisfy the edible oil deficit to meet the consumer demand.

Spices

India ranks first in terms of area and production of black pepper, large cardamom, ginger and turmeric. An all time high of Rs. 1180 crores was earned by the country with spices export during the year 1996-97. Panniyur selections are the famous black pepper cultivars released. Contribution of Indian Cardamom Research Institute in identifying superior small cardamom clones is worth mentioning. India has clear monopoly in large cardamom. Through concerted research efforts, 10 high yielding varieties/hybrids in black pepper,

7 in cardamom, 2 in cinnamon, 5 in ginger and 16 in turmeric were identified for release.

To overcome the problem of undetected male plants in nutmeg seedlings at the time of planting, a chemical compound has been identified which can be detected to delete accidental planting of male seedlings.

India is a global leader in development of value added products in spices and export. Besides processed whole spices, oils, oleoresins, curcuminoids find global markets.

The targetted production of planting material during Eighth Plan was 80.15 million cuttings of black pepper, 2250 tonnes of seed rhizomes of each ginger and turmeric and 2,40,000 seedlings of tree spices. Plant propagation methods have been standardised for production of true to type quality planting material.

Seed spices are mainly grown in Rajasthan and Gujarat. Madhya Pradesh, Haryana, Punjab, Uttar Pradesh, Andhra Pradesh and Bihar also cultivate seed spices to a notable extent. Twelve varieties of coriander, 5 varieties each in cumin, fennel and fenugreek have been released for cultivation.

Cocoa

Cocoa cultivation at present is mainly as a profitable mixed crop in arecanut gardens, where it enhances unit area income considerably. Present area under cocoa is estimated to be about 16500 ha with an annual production of 6000 tonnes of dry beans. The beans weighing more than one gram with low acidity high fat content and high shelling percentage are preferred internationally. CPCRI Regional Station, Vittal has 128 accessions. Eleven promising lines yielding more than 2 kg of dry beans/tree/year have been identified for distribution to growers.

India has the largest acreage of 4,18,331 ha of tea in the World, of which 81.9 per cent is in north India and 18.1 per cent is grown in southern India. Tea production has reached a record level of 780 million kg in 1996 and the industry is poised to achieve 1000 million kg in the middle of next decade.

Noticably field productivity in south India with 2300 kg/ha is considered to be the highest in the World. The domestic consumption of tea which was a meagre 75 million kg during 1950 has gone upto 595 million kg during 1995. India exports about 163 million kg made tea contributing to 1 6.3 per cent of global market.

Tea

India is leading producer as well as exporter of tea in the world with a production of 74.38 lakh tonnes of tea during 1995-96.

In tea, a total of 56 clones, 7 biclonal and polyclonal seed stocks were compared to national average of 1752 kg/ha. Some of the clones are capable of yielding 7500 kg/ha. Increased productivity and reduction in production costs are required to make India a competitive exporter. The Tea Research Institute at Tocklai and UPASI Tea Research Institute at Valparai (Tamil Nadu) are the active centres of research while AAU, Jorhat and CSIR laboratory at Palampur are also engaged research on tea.

Coffee

Coffee is traditionally cultivated in Karnataka, Kerala and Tamil Nadu and to a limited extent in eastern hill regions covering Andhra Pradesh, Orissa, West Bengal, Maharashtra and N.E. States. Arabica and Robusta contribute 50 per cent each under total area of 2.93 lakh hectares. India exports about 60 per cent of the total annual production of two lakh tonnes of coffee. During 1995-96, 1.71 lakh tonnes of coffee was exported earning a foreign exchange of Rs. 1526 crores.

The average productivity of coffee in India is 860 kg/ha which compares well with that of world average estimated productivity of 505 kg/ha. Research efforts have led to evolving 12 elite arabica and three superior robusta selections/hybrids which occupy about 80 per cent of area under coffee in the country. The identification of 'Cauvery" variety of Arabica type which has shown resistance to leaf rust has revolutionized high density planting for increased productivity per unit area. Coffee cultivation can be introduced in lower elevations like that of tea. Research must be directed towards developing suitable varieties for such non-traditional areas.

Cashew

Cashew is one of the important export earning crops, the potential of which was realised in India way back in 1900 itself. From 1.10 lakh ha in 1995-96 the area under the crop has increased to 6.35 lakh ha. The production has increased from 0.79 lakh tonnes to 4.18 lakh tonnes during the same period. However, the productivity has remained stagnant and has shown a marginal increase to 725 kg/ha from 700 kg/ha during 1955-56. The country has earned an export earning of 1232 crores in 1995-96 from cashew. The development of soft wood grafting has revolutionised the production of elite planting materials. Millions of planting materials are being produced at Konkan Krishi Vidyapeeth, Vengrta and NRC (Cashew), Puttur. The tea mosquito continues to be a menacing pest. Even though control measures have been developed, we are far from developing tolerant lines for tea mosquito and stem borer.

Conclusions and Future Thrusts

The present status and some of the problems requiring immediate attention of different plantation crops have been given in a nut shell in the foregoing pages. We have only touched the tip of the iceberg. The crops and the individual problems would need much more space. Many authorities on the subject have attempted to cover these in this Compendium. There are other publications brought out by the Indian Council of Agricultural Research such as "Vision 2020" of Central Plantation Crops Research Institute, Indian Institute of Spices Research, National Research Centres on Cashew, Oil Palm and Medicinal Plants which dwell in detail the various aspects on plantation crops. The areas of science which would be used in the years to come to solve the problems including socio-economic aspects are mentioned below:

1. Conservation of biological diversity and protection from being exploited by external agencies and preserving them in gene banks or by *in situ* conservation. These aspects are to be considered in the light of Intellectual Property Rights.
2. Application of modern biotechnological tools such as molecular markers, development of tissue culture techniques for mass multiplication, *in vitro* conservation and use of bio-processing techniques for production of secondary metabolites for medicinal and related use.

3. In view of the depleting water resources, developing drought tolerant lines as well as methods of effective moisture utilisation have to be developed.
4. Safe and effective organic farming methods and utilisation of resources are important aspects to be researched upon, so that commercialization of plantation crops do not cause an ecological imbalance.
5. Development of State/district level information system based on conventional and remote sensing approaches in GIS environment.
6. Technology for plantation crops for the small farmers must keep in mind the socio-economic aspects including the gender issues as women form a major work and managing force in States like Kerala.