

STATUS OF COCOA RESEARCH AND CLIENTS'S NEEDS IN THE STATE OF KERALA

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Cocoa (*Theobroma cacao* L.) is indigenous to tropical humid forests on the lower eastern equatorial slopes of the Andes in South America. It is an ancient crop having been cultivated, harvested and used by the indigenous people of Central and South America for thousands of years. Though cocoa was introduced into India in the early 20th century, its exploitation as a crop of significant economic value is just five decades old. It is recommended as an inter crop of coconut and arecanut in Kerala. Kerala is one of the leading cocoa producing states in India with 23.8 % area and 48.9% of production. After a severe set-back till 2001, the crop is regaining importance as a very viable intercrop during recent years due to remunerative returns and enrichment of soil nutrient status.

Cocoa Research in Kerala Agricultural University

As cocoa is an introduced crop, technology for successful cultivation had to be developed for conditions prevailing in India. With the objective of evolving cocoa varieties and develop production technologies relevant to our country, cocoa research was initiated in Kerala Agricultural University in 1979 under 'Kerala Agricultural Development Project. Cadbury-KAU Co-operative Cocoa Research Project was established in 1987 with the objectives of continuing ongoing research programmes and taking up problem oriented research. This was a land mark in the history of cocoa research in Kerala, which led to significant breakthrough in cocoa production technology and processing. A

very brief account of research findings is given below:

I. Crop improvement

1. Cocoa Germplasm

Germplasm of cocoa is being collected from farmers' field and by introduction from the University of Reading, UK. Germplasm collection at Kerala Agricultural University is the biggest in India with diverse types. The collection (vegetatively propagated clonal material - G VI) comprises of 565 genotypes (exotic Accessions (287) through import from University of Reading, UK and local collections (278) from farmers' fields and research stations).

2.. Selection for desirable characters and release of superior clones

Performance evaluation of the germplasm resulted in the identification of a total of 214 superior trees. These were multiplied clonally and evaluated in comparative yield trials. Studies of these clones over a period of twelve years resulted in the release of five clones M 16.9, M 13.12, G I 5.9, G II 19.5, GIV 18.5, GVI 55 (IMC 10) and GVI 56 (EET 272) as CCRP 1 to CCRP 7. The yield increase in these clones is almost double and these have desirable pod and bean characters.

3. Hybridization

The main objectives of breeding are evolving varieties with high yield, resistance to diseases (VSD and black pod), bold bean size and better processing qualities.

During the 26 year period from 1987 to 2013, 495 parents were used in hybridization programmes, 6031 crosses were made and 2344 crosses were obtained. The details of hybrids under evaluation are furnished below:

Term	No. of experiments	No. of hybrids produced	No. of hybrids under evaluation
1987-1996	9	25415	6431
1997-2002	2	45000	1207
2003-2007	5	7600	1566
2007-2012	4	6510	650

The top yielders over a period of twelve years were selected from Series I, Series II and Progeny Trial I and were released as CCRP 8, CCRP 9 and CCRP 10 during 2006 with very high yield, disease tolerance and desirable pod and bean traits.

Seven hybrid clones from hybrid populations with very high yield, bold beans and VSD resistance have been proposed for release as CCRP 11-17 respectively.

4. Inbreeding:

This programme, the first of its kind in the world on perennial crops, is intended to obtain high vigour and uniformity in the progenies when crossing is done between two genetically unrelated homozygous inbreds. The highly complex genetic nature of this crop makes production of inbreds a very difficult task and thus many of the breeding institutes dropped the programme after 2nd generation. However, the Kerala Agricultural University has succeeded in producing the first ever fifth generation inbred in the world of one genotype after 25 years of continuous effort. The KAU is proud of having the biggest assembly of inbred population of cocoa in the world with S5 generation of one genotype, S4 of two genotypes, S3 of 5 genotypes, S2 of 9 genotypes and S1 of 51 genotypes.

Inbred crosses aimed at producing highly vigorous and uniform progeny using early generations of genetically distant genotypes were taken up in 1993, 2007, 2008, 2009, 2010, 2011 and 2012. Assessment of performance of the progenies is in progress.

5. Seed Gardens:

In order to produce quality hybrid pods for distribution to the farmers, five poly clonal seed gardens and one biclonal seed garden have been established with parents tested for combining ability. The parents have been selected based on cross compatibility and better combining ability. Pods from these seed gardens are being/ will be distributed over entire South India under the Development programme of M/s Cadbury India Ltd.

6. Scion orchards:

Four scion orchards were established. This is intended to supply bud wood to produce about 5 lakh budded plants of improved clones per year.

II. Agrotechniques

Studies were conducted to develop agrotechniques for successful cultivation of the crop in the country. The results of these studies led to the standardization of different practices and these formed the basis for package of practices of cocoa.

III. Post harvest handling and farm level value addition

Studies on primary processing using small quantities varying from 2 kg to 50kg wet beans was carried out and the methods to obtain good quality cocoa was standardized. The methods for drying and storage are also standardized.

Studies on secondary processing indicated lot of scope for farm level value addition. A number of cocoa products of acceptable quality could be produced and marketed. A small chocolate unit is functioning from 2000 in Kerala Agricultural University.

IV. Plant Protection

Detailed survey was conducted in different cocoa growing regions of the state, the diseases infecting the crop were studied. The symptomatology, etiology, spread and control of different diseases were studied and recommendations to effectively check the diseases were given.

The major diseases identified during the survey were Vascular streak die back (VSD), Phytophthora pod rot, Canker, Seedling blight, Colletotrichum pod rot, Lasiodiplodia pod rot, Colletotrichum leaf spot, Chupon blight and die back, Phytophthora twig /leaf blight, Petiole rot and White thread blight

Kerala Agricultural University and clients needs

The cocoa research in Kerala Agricultural University is rated as one of the best in the world. The effective link with extension staff especially executives of Cadbury India Ltd and farmers helped the field problems to be tackled immediately. The important problems of the farmers and action taken to solve the issues are furnished below:

1. Majority of the cocoa plantations in Kerala, are in the small holder sector. This adversely affects level of adoption of improved production technologies and subsequent realization of higher returns from cocoa. Use of good quality planting materials with better management practices standardized by the Kerala Agricultural University can help in doubling the yield.
2. Fluctuation in price is another factor. Cocoa prices vary from region to region and season to season. This can be mainly attributed to the difference in quality of beans produced in these areas and many open markets have been established in Kerala to ensure fair price to the growers.
3. Incidence of black pod disease reduces yield by 35% in Kerala. Attempts to breed resistant varieties have been initiated since 2005 in Kerala Agricultural University and resistant varieties can be expected to reach the farmer by 2017.
4. Incidence of Vascular Streak die back causes die back of branches of grown up trees and death of small plants upto the age of 2 years. The KAU has evolved varieties resistant to this disease. Distribution of clonal seeds with high level of resistance is taken up by the University and management strategies to reduce loss due to the disease have been advocated.
5. Small bean size is a problem in areas with erratic rainfall and long spells of summer with high temperature. Hybridization to evolve varieties with bold beans is taken up in 2007 and varieties with bean size above 2g can be expected by 2017.
6. Incidence of mealy bug and tea mosquito causing severe yield reduction has been reported from certain parts of Kerala. Effective remedial measures have been recommended.
7. The damage of pods by rats and squirrels is high in neglected gardens. But the damage could be minimised with systematic poison baiting and trapping.
8. In areas of uneven distribution of rainfall, cocoa can be grown as intercrop, only if irrigation facilities are available. Soils of Kerala are poor in moisture retention capacity and fertility. This can be compensated by manuring and fertiliser application. Cocoa cannot tolerate high salinity and alkalinity as tolerated by coconut. So, such areas are to with extreme agroclimatic conditions are to be avoided.