

Cotton Research and Extension in Madras State

by N. KESAVA IYENGAR &
V. SANTHANAM,
Cotton Breeding Station,
Coimbatore

Before it is proposed to tackle the problem of the present paper of "Cotton Research and Extension in Madras State", it is necessary to give a brief account of what is already achieved in Cotton Research and Extension in the Madras State". In the symposium held last year a review of recent advances in Cotton Breeding Research in the Madras State was presented by Kalyanaraman and Santhanam and the progress in Cotton Extension Work was reviewed upto 1952 by Balasubramaniam in the symposium on cotton extension held in the Fifth Conference of Cotton-growing Problems in India by the Indian Central Cotton Committee, Bombay.

Cotton, an important commercial crop of Madras, is grown at present over an area of 87 lakhs of acres, with a production of about 2.7 lakh bales, both as an irrigated and unirrigated crop. The American cotton, familiarly known as "Cambodia" in trade, was first introduced into Madras in 1906 and it is now grown at present over an area of about 3.4 lakhs acres, of which about 1.5 lakh acres are grown under irrigation and the balance of 1.9 acres is raised as unirrigated crop. The *deshi* cotton known in trade as 'Tinnevellis' and "Karunganni" occupies an area of about 4.7 lakh acres. A small area is also grown to other varieties classed under 'Salems' over an area of about 65 000 acres. These constitute "Uppam" and "Nadam" which are being replaced by Cambodia or Karunganni cottons. Unlike the other States of the Indian Union, Cambodia cotton is grown in Madras both as winter and summer-season crops. Since it is well known that in summer, the cotton crop gives not only a higher yield but shows superior fibre qualities, a great impetus is now given to grow cotton in summer as an off-season crop, wherever irrigation facilities are available. This off-seasonal cropping does not in any way affect the food position of the tract but enriches the cultivators by means of a cash crop. It may be stated with confidence that in the map of India, the Madras cottons viz. Cambodia and Karunganni will in future occupy a very prominent place. In yield of *kapas* the irrigated Cambodia ranks foremost and is capable of producing about a bale of lint per acre. Quality cottons like Madras Cambodia Uganda 1 and Madras Cambodia Uganda 2 are placed outside the purview

of price control by the Government of India, along with two other varieties of Bombay, viz. B. C. 134 and B. C. 170.

The development of cotton industry in the Madras State is influenced by two factors viz. development of mills and cotton research. The former sprung up in large numbers in centres like Coimbatore, with the functioning of the Pykara Hydro-Electric Scheme and shortage of cloth created during World War No. II. Of the 80 mills working in the Madras State, about 38 are located in Coimbatore district alone and the annual requirement of raw cotton to feed the mills of the State is estimated to be about seven lakh bales. In general the cultivators of Coimbatore, Salem, Tiruchi, Ramanathapuram, Madurai and Tirunelveli are highly cotton-minded and many progressive cultivators pay great attention to the cultivation of this cash crop. Yields as high as 2,000 lb. of seed cotton are recorded in the irrigated Cambodia grown in garden-lands under wells. On the agricultural side, both plant breeding and agronomic research have played a vital role in the improvement of yield and quality of the several varieties of cotton grown in the State. The progress of Cambodia cotton kept pace with the improvements of breeding technique, designed to bring higher yield, better ginning per cent, superior fibre qualities like length, fineness and higher warp counts. With the introduction of Cambodia 2 by pure line selection, the Cambodia bulk with a staple of less than 13/16" and spinning 26 counts was upgraded to 13/16" in staple length and spinning 33 counts. This strain was found to be highly adaptable to varying types of soil and suited many irrigated and unirrigated tracts of this State. As a result of intensive research and hybridization work, Madras Cambodia Uganda 1, which comes to maturity a fortnight earlier than Cambodia 2, gained popularity as a summer crop in the districts of Ramanathapuram, Tirunelveli, Madurai, and South Arcot and is now recommended to be grown as a cold-weather crop in Coimbatore, Salem, Tiruchirapalli and Madurai districts also. This cotton is superior to Cambodia-2 in ginning per cent (37), fibre length (1.00" inches) and spinning performance (44 counts) and on account of its superior length is placed outside price control. As a result of further breeding research involving multiple crosses, another new strain, Madras Cambodia Uganda 2, was evolved in 1953 and this is now gaining popularity in the *Masipattam* area, replacing the former strain, Madras Cambodia Uganda 1, rapidly. This new variety is not only earlier than Madras Cambodia Uganda 1 by a fortnight but it is capable of yielding 18 per cent more of *kapas* per acre, with finer and longer lint, capable of spinning 50 counts or more. Similarly, in the winter area, strain 9030, from a multiple cross, is promising in ginning per cent, fibre length, fineness, higher spinning capacity and resistance to *jassids* and is expected to replace Madras Cambodia Uganda 1 very soon. Breeding researches in the summer cotton at Srivilliputhur

has shown that great possibilities exist to produce quality cottons comparable to the imported East African styles with a staple length of 1-3/16". The reduction of duration of the improved varieties had a tremendous effect on the successful introduction of cotton in the summer areas as a rotation with paddy crop. Recent efforts made by the Agricultural Department on extending cotton cultivation in the deltaic areas of Tanjore met with success by the introduction of a still shorter duration variety like P 216 F, which could complete its harvest in five months yielding 1,000 lb. *kapas* per acre. This quality cotton is capable of spinning 40 counts and shows great adeptability over a wide range of conditions. Breeding researches are under way at the Agricultural Research Station, Aduthurai to evolve a still shorter duration, quality cotton capable of finishing in 4½ months.

Breeding work in Karunganni cotton has resulted in the evolution of Karunganni 2 and Karunganni 5 cottons by hybridization. These *Arboreum* strains are capable of spinning 30's counts as against 18-20 counts of local Tinnies and have now replaced the former strain Karunganni 1, evolved by straight selection methods. As a result of extensive hybridization work taken up recently, three long-linted cultures viz. 6186-9, 6874 and 6188 with a staple length of nearly one inch, and yielding more than Karunganni 2 or Karunganni 5 in the respective tracts have been isolated. One of these quality cottons, capable of spinning 40 to 42 counts will soon be released for the entire Karuganni and Tirunelveli zone of the State, covering about 4.5 lakhs of acres.

Research is under progress to acclimatise and successfully introduce Sea Island cotton in the West Coast of the State. Varieties like Montserrat and Andrews have indicated possibilities and with judicious transplanting and manuring, yields as high as 850 lb. of *kapas* could be realised on the poor *modan* soils of Malabar tract. The cotton grown in such areas is capable of spinning 100 counts, with a mean fibre length of 1.45 inches.

In addition to plant breeding research, agronomic studies on time of sowing and spacing, have furnished very valuable results in upgrading the yields of cotton. Early sowing and close spacing was in general found beneficial. In the case of Karunganni the harmful effects of *Irungu cholam* which precedes the cotton crop were got over by recommending indigo as a mixture with the cholam crop. In the case of manuring, application of ammonium sulphate as top dressing at 40 lb. nitrogen level in two split doses was found to be beneficial to the irrigated Cambodia crop and in the case of unirrigated cottons one dose at 20 lb. nitrogen at the time of sowing was in general beneficial. In the attempts to find out varieties resistant to stem weevil of Cambodia, a perennial

Brazilian variety named 'Moco' was found to be highly resistant and this cotton is recommended for growing in the backyards, of houses, waste lands, to meet the needs of extra-factory consumption. This perennial cotton with a staple length of one inch is capable spinning upto 50 counts and yields even upto 4 lb. *kapas* per plant under favourable conditions. Indents are being received every day for the supply of seeds of this variety from the various parts of India. Under mixed cropping, cotton-groundnut mixture, ragi-cotton mixture and chilli-cotton mixture were popularised and this practice served as an extra source of income to the cultivator.

With the above background it is now proposed to deal with the question of "What next in cotton research and extension in Madras State". This is indeed a difficult problem and needs considerable information regarding the potentialities of development, facilities available for expansion, demand, marketing, export and other factors. The future plans will have to be done with reference to the cultivation, trade and consumption by mills in a cash crop like cotton. According to the Second Five-Year Plan, the target of cotton production for the Indian Union is fixed at 55 lakh bales by the end of 1960-'61 and the share of Madras is 4 lakh bales. To achieve this production of quality cottons, which are much needed by the Indian Union to reduce imports and save foreign exchange, long-range research and short-term cotton extension schemes are aligned. The following are some of the points for consideration.

(1) In order to encourage the production of extra long-staple cottons the Indian Central Cotton Committee have agreed to fully finance such schemes for a period of 15 years and a scheme has been approved for Madras for the summer zone with the object of evolving extra long-staple American cottons with a staple length of 1-3/16" and more. In the Winter area similar attempts have to be made to breed extra long-staple cottons in alignment with the progress of the summer cotton and the gap in quality between the cotton grown in two different seasons of the year in the State should be narrowed down as far as possible to avoid the chances of malpractices like mixing etc., that may arise.

(2) The production of extra long-staple cotton is at present attempted in this State, by hybridization of cultivated Americans, both inter-specific and intra-species and sometimes involving complicated crossing programmes. Since inter-specific hybridization between Asiatic and American cottons which differ in chromosome numbers have yielded successful results by back-crossing techniques in Bombay State in the release of strains like BC. 134 \times Co. 2 and BC. 170 \times Co. 2 which are superior long-staple cottons, serious attempts are to be made in the breeding programme of this State also, by hybridizing select lines of

Karunganni with various promising lines of acclimatised *Hirsutum* cottons, to yield early-maturing, high-yielding and long-linted types, resistant to pests, diseases and drought. It may be mentioned that some of the Surat Asiatic - American hybrid derivatives, 2196 (discovered by the senior author), BC. 125 x Co. 2 etc. were found to be highly resistant to *Blackarm* and *jassids* respectively but as they were found to be late for the conditions of Madras, further work is necessary in this direction to evolve suitable types.

(3) Potentialities for fibre length, strength, fineness and immunity to pink bollworm, *jassids* and *Blackarm* are exhibited in wild species of cotton like *G. thurberii*, *G. raimondii*, *G. armourianum*, *G. anomalum* etc. Although these cottons are as such useless for cultivation and many of them have no lint, when suitable crosses are made with the cultivated types and fertility induced and stability fully restored by techniques like colchicine treatment, back-crossing etc., exceptionally long-linted types resistant for pests and diseases may be obtained. Careful planning, and an intimate knowledge of cytogenetics and genetics are required as adjuncts to the normal plant-breeding programme.

(4) Another method by which the quality of lint could be stepped up along with high yield is by exploitation of hybrid vigour. Successful results in this direction have been reported both in Madras and Bombay States with a staple length of $1\frac{1}{4}$ " and an yield of 1,000 lb. of kapas (under Madras conditions) in the inter-specific cross Cambodia-2 x Sea Island as a rainfed crop in the West Coast. Another advantage of the hybrids is that they can be continued as ratoons in the second year and yields as high as 1,500 lb. of seed cotton could be realised immediately without waiting for purification etc., normally practised in the plant breeding programme. Further researches are necessary and as suggested by Dr. Harland, various pure breeding lines of perennial *Moco* and acclimatised perennial *barbadense* types have to be utilised for further study to fully exploit the possibilities of heterosis in the production of extra-long-staple cottons. Care is however necessary in this kind of work to see that the seeds of F_1 hybrids are not utilized for multiplication. This project will have to be treated as a special one and the areas grown should be carefully demarcated; where other American varieties are not under cultivation. The chief problems in this work are the production of hybrid seeds in large scale every year and the high cost of production of seeds.

(5) In the attempts to improve the quality of Cambodia cotton, the problem of pests and diseases needs careful consideration. Pests like *jassids* and diseases like *blackarm* cause serious losses and have of late become items of regular study in the plant breeding programme.

Fortunately, some information is available on the mechanism preventing deposition of eggs on the leaves in the case of *jassids* by the work of Parnell and others. Hairiness of laminae is considered to be one of the major factors and the genetics of hairiness of laminae has been worked out by Knight and others. Research is still in progress to explain the *jassid* resistance in glabrous-leaved types like *G. armourianum*. Similarly in the case of "*blackarm*", a series of genes controlling the inheritance of resistance are involved and resistant varieties have been built up by Knight and others. Efforts are also made to combine *jassid* and *blackarm* resistance in the same plant. In the case of Madras Cottons also, such studies are necessary in greater detail in the coming years to build up types resistant to both *jassids* and *blackarm* as a whole-time study under the long-range programme. Under the short-term plan, the only possibility to control *jassids* is with the aid of pesticides like 'Endrin', 'Folidol' etc.

(6) In the breeding of American cottons, the problem of immaturity of fibres is an important consideration. A type which is immature tends to produce yarn which will be "neppy". Varieties which are least neppy and possessing high maturity percentage have to be synthesised through a survey of all types of cultivated American cottons and studying intrinsic fibre maturity in the wild cottons like *G. thurberii* and *G. raimondii*.

(7) In the programme of purification of varieties, the possibilities of building up perfectly homozygous lines by the exploitation of haploids in both the American and Asiatic cottons needs careful consideration. Haploid plants which have only one complement of chromosomes in the somatic tissues are rare and methods of artificially inducing it at will, just as chromosome complement in a plant is doubled at will by treatment with colchicine, will have to be attempted in the breeding programme. Likewise, parthenogenesis to induce the development of apogamic plants as recently discovered by Balasubramaniam by crossing *G. hirsutum* x *raimondii* hexaploid having 78 chromosomes with Karunganni cotton (26 chromosomes) needs careful consideration. The importance of such studies has been recently pointed out by Dr. Harland also, to isolate homozygous lines in cotton.

(8) On the extension side, it is necessary to multiply the approved strains in a pure state and in order to rapidly multiply the seeds to cover the entire tract, Agricultural Co-operative Societies should be organised in every taluk centre and they should act as official agents on the model of Bombay and Madhya Pradesh States. In this direction, one Cooperative Society has recently been organised to multiply and distribute seeds of Madras Cambodia Uganda 2 in Srivilliputhur taluk. State legislations like the Cotton Control Act, Cotton Growing

and Pressing Factories Act and 'Cotton Transport Act should be tightened up to prevent mixing up of varieties . By the implementation of the Cotton Control Act in stages the area under cotton in the different tracts will be fully covered with improved seeds in due course.

(9) The average low yield of seed cotton in this State and other States of the Indian Union should be up-graded by increasing irrigation facilities, manuring, application of pesticides etc , on a national basis.

(10) The cotton crop that is grown is at present valued mainly for its fibre and the seed is used for cattle food. In countries like the U. S. A. and recently in Pakistan, cotton seed is crushed and the oil extracted is used for many industrial and domestic purposes. In India, cotton seed oil is extracted in Punjab, Rajasthan, PEPSU and Madhya Pradesh States and the oil is used for Vanaspathi and the cake sold as cattle food or manure. The 'Linter' that is extracted from the seed after ginning is used in the manufacture of cellulose, carpets, ropes etc. Thus the seed that is used as cattle food in this State could be utilised for oil industry and the cake used for cattle food and manure. This step will not only help the cultivator in getting the maximum monetary returns for the cotton seed, but also helps in curbing the use of uncertified seed for sowing purposes. The Cooperative Societies will then be in a position to stock the full quality of sowing seeds with confidence and induce the cultivators to go in only for approved seeds sold by recognised agencies.

(11) Other factors like price support, export and import policies, regulated markets, and certification of lint will go a long way in inducing the cultivators to grow cotton over large areas and attain the targets fixed under the Second Five - Year Plan even earlier than expected.
