

OBSTACLES TO THE SPEEDY EVOLUTION AND TO THE SUCCESSFUL SPREAD OF ECONOMIC STRAINS IN COTTON

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Agriculture is India's premier industry and the basis of our national development. Among the various activities directed towards the promotion of Indian agriculture, plant-breeding in general and cotton-breeding in particular, occupy a place of supreme importance. Cotton is a commodity of world-wide importance and is one of the chief raw products of India playing a role of importance in the welfare of a large proportion of her population dependent on it either directly or indirectly. India ranks next to America, as a producer of the world's cotton and is responsible for about a fifth of the total world out-put, while Madras is responsible for about a tenth of India's total production.

The Indian cotton-grower is handicapped in more ways than one, in the competition for the world's markets. The production of lint per acre is exceedingly low, being a third of the average production of the cotton areas of the United States of America and the quality of the Indian cottons is poor, the bulk of it being short-stapled and unsuited for spinning yarn of high counts. These two basic defects together with defective methods of picking and some commercial mal-practices are greatly responsible for the low prices meted out to Indian cottons. With a vast area suited for the cultivation of cotton and with these defects staring in our faces, the need for the improvement of our cottons is obvious. In the following paragraphs, attention will be confined to a consideration of the chief obstacles to the quick evolution of economic strains and to their successful spread, resulting in the amelioration of the economic status of the cotton grower, having in view conditions in the Madras presidency which are no less representative of conditions outside, in general.

As with other crops, yield of lint is one important objective in cotton-breeding. We are all aware that a small sample of lint consists of innumerable white fibres, unicellular in their build, each fibre being ribbon-like and hollow in shape and structure, respectively, with a number of convolutions or twists when viewed under the microscope. Botanically, the cotton hair is the out-growth of the epidermal cell of the cotton seed. In most other economic crops, say for instance cereals, we are concerned with the yield of grain, a normal, at the same time, a vital part of most members of the flowering group in the plant kingdom. But, here, in cotton, our efforts are directed to the production of the maximum quantity of these epidermal cells of the seed coat and the total weight of these cells per acre will be the yield of lint per acre. This is the first objective of the cotton-breeder and is obviously one presenting considerable difficulties in cotton-breeding.

The second aim is the quality of this lint. There is, perhaps, no other important crop so much valued for the quality of its raw product as cotton. Length of these unicellular cotton fibres, strength, colour, lustre and uniformity in each of these heritable characters together go to make up quality in raw cotton. Quantity and quality ought to go hand in hand in plant-breeding work with cotton. Strains merely of heavy yielding capacities without the required quality will be of no use. If yielding powers were the only requisites, the cotton tracts of the districts of Tinnevely, Ramnad and Madura would probably have been one continuous expanse of Roseum cotton, known

popularly as 'pulichai' and there would have, perhaps, been no need for a cotton-breeding station to improve 'karunganni' cotton, in this tract. The reason why the growth of this 'pulichai' has been discouraged both by the Department and by the ultimate consumer is common knowledge. Experience has shown that there is a general trend for heavy yielding types to be associated with poor quality lint and this relation acts as a source of difficulty in the production of good yielders with the requisite quality of lint.

These characters of quality are only an imperfect guide at the best and in the present state of knowledge the cotton-breeder has to depend upon these properties in his line of work. The determination of the quality of lint presents very great difficulties and 'the final test of the quality of any material is its behaviour in use and as cotton is for the most part eventually used in the form of woven or knitted goods, it follows that ideally the quality of a cotton should be judged by the service it gives when made into such goods', and hence the need for conducting spinning tests of new strains is of paramount importance; and, at present, this aspect of the problem is outside the province of the breeder. These tests are conducted at the Indian Central Cotton Committee's Technological Laboratory at Bombay, and if at this stage, a strain is found unsuited for spinning yarn of good counts, it will have to be rejected and years of the breeder's labour will be in vain. The lack of simple spinning devices at the disposal of the cotton-breeder to enable him to retain or discard strains even at the early stages and more especially the primitive state of knowledge of the various lint characters that conduce to yarn strength and high warp counts are, some of the breeder's obstacles to the speedy evolution of economic strains.

Out of a total of 2,079,000 acres under cotton, the estimated area in Madras, 282,000 acres are under Cambodias, mostly under irrigated conditions, the rest being under rainfed cottons mostly of the indigenous types. The following observation, pertaining to environmental effects, will, therefore, apply to these latter class of cottons, in particular. These cottons depending upon the atmospheric rain for their resources, thrive under conditions very variable from year to year. This dependence on rain and its vagaries is the foundation of one of the chief of obstacles confronting the cotton-breeder. Thriving, as these cottons do, in arid climates in most parts of our presidency, the need for the conservation of moisture in the land is obvious and we are all aware of the specialised Ceded districts' implements which are used at various stages in its cultivation and which have found and are finding a place in cotton culture in the other cotton-growing tracts of the presidency. The constant use of these implements is noteworthy in the case of the cotton crop and together with a systematic rotation and a manurial scheme afford an environment regulated like clock work for breeding operations, so much so, strains springing from such conditions are often said to be too delicate for handling and consequently suffer under hap-hazard cultivation which is rather the rule than the exception, outside the station.

It will be a woeful tale to narrate the harmful effects of untimely rain on a crop of cotton. There is, perhaps, no other crop which is so susceptible to shedding as cotton. Imagine the ryot who had prepared his land carefully and manured it properly, who having had timely rains had sown his improved and carefully selected cotton seed with great dexterity when the soil was under the best of conditions, who has had the assurance for a vigorous and a healthy crop from the village astrologer, whose propitiations to his village deity to present or counteract insect and fungoid pests were particularly to his good and

whose eyes were bright and whose heart was full of joy and who is all thankfulness to the Almighty at the sight of his crop luxuriant with vigorous healthy buds predicting a bountiful yield and consequently, a year of full meal, sufficient clothing and perhaps, something to lay by. And lo! the sky grows unexpectedly dull, clouds gather and grow thick and unwanted precipitation follows. His hopes are blasted as he soon sees his crop growing bare, quarrelling as it were, with its various productive units, the buds and the bolls and eliminating them from off their connections. Thoughts of a half meal, scanty clothing and the memory of the village money-lender grow imminent in the mind of the ryot at the sight of this bud and boll shedding which may be called the cotton-blast.

The result of this shedding is often a delayed crop, though somewhat poor both in quantity and quality, provided no further rains occur; and, if further rains, again at the wrong time, occur, very poor late crops will result and such deferred crops are mostly poor in quality due to the severity of insect attack and due to the mechanical action of the rain. This year, the Cotton Breeding Station, Kovilpatti, and the tract round about experienced last season a severe set of such conditions and an unprecedentedly low acre yield for the season has been the result. The increases in the yields of lint of improved strains over the yields of mixtures from which they might be extracted by breeding methods, particularly by selection, are very often smaller than those due to the effects of good weather conditions over the effects of bad years. To put it more explicitly, other things being equal, an improved strain under bad weather conditions generally fares worse than the ordinary crop grown from bazaar seed under favourable weather conditions. It will, therefore, be obvious that the fight with nature is very keen in plant-breeding work with cotton and in its cultivation.

A breeding station has very often to cater to the needs of tracts differing in the environments they provide to the cottons grown therein. The breeder has to evolve strains suitable for different tracts and this adds to his difficulties. In the 'Tinnies' tract, the northern half comprising the district of Ramnad and part of Madura, is suited to the growth of early maturing strains as the monsoon sets in earlier than in the southern portion which is congenial to the growth of long duration varieties and each of these tracts now grow specially improved strains, A 10 in the north and C 7 in the south.

'There are few of the world's great crops which are more liable to be badly damaged by insect pests than cotton and it is certain that the annual loss on their account, throughout the world, runs into many millions of pounds sterling. Luckily, the most serious of all the pests, the Mexican cotton boll weevil (*Anthonomus grandis*) which has spread like a scourge over almost the whole of the cotton belt of the United States, is not so far known in India, but there is a constant danger of its introduction.' The stem-weevil (*Pempheres affinis*), the pink and the spotted boll-worms (*Platyedra gossypiella* and *Earias fabia*, respectively), are the chief insect pests in our presidency. The Red and the Dusky cotton bugs (*Dysdercus cingulatus* and *Oxycarenus laetus*, respectively), the cotton aphid (*Aphis gossypii*) and the cotton Leaf-Roller (*Sylepta derogata*) rank among the minor insect pests of cotton. The wilt disease in Bombay and the Black-arm disease in our own presidency are the fungoid and the bacterial diseases, respectively, of cotton in India. The havoc done by all these pests at various stages of the crop's growth is again a handicap to the breeder and to the grower of the improved cottons.

The cotton seeds with their adherent lint are located within the fruit called bolls with a variable number of compartments or locks ranging from the rare two to five. Experience has shown that a five-celled boll contains the greatest number of seeds and a three-celled the least and though the lint from a seed located in a boll of a higher locular composition weighs less than that of a seed from a boll of a lower locular composition, the total quantity of lint per boll is greater in the former case. And, even within a lock, the weight per seed is the maximum for the seed located in the middle of the lock and the weight of lint per seed is greatest lower down the lock. Further, bolls of higher locular composition are produced at a certain period, generally early in the season and unlike most other crops of importance, the harvesting period spreads over a very long time (from March to July, a period of about five months, in the Tinnevely district) and consequently, there is a very wide range of variation in the quality of raw cotton and its weight per seed. Experiments have, again, shown that the weights of lint and seed, per seed, and lint length decrease with the advance of the season as also the strength and the spinning quality.

Owing to the peculiarities enumerated above and owing to the very long harvesting period which by itself is a handicap in comparison to the crops of brother breeders, the need to make out, for every single plant, representative samples from the material picked during the whole of this harvesting season, for the testing of yielding power and quality has become imperative. Avoiding details, the stages of sampling, ginning, an operation requiring an amount of care to obviate the mixing of seed and combing for the determination of the staple length take a great amount of time, thus acting as a limiting factor to the handling of a large number of plants so essential to increase the chances of striking at useful strains.

Most Indian cottons suffer from the admixture of a good proportion of dirt and leaf due mainly to defective methods of picking and consequently fetch low prices. The admixture of this leafy matter from the leaves and bracts, parched up and rendered brittle due to extreme temperatures is again a peculiarity of cotton and even under very careful harvesting, the admixture of a certain amount of this extraneous matter with the picked kapas is unavoidable. However, a slightly higher premium may prove to be an incentive to careful picking.

Further, a very common abuse in trade, is the adulteration of superior quality cotton with cheap inferior commodity, so much so, that the grower of improved cottons often fails to get a premium for his cotton. It is, generally, very difficult to detect this admixture for any but expert graders. In spinning operations, more than one kind of cotton is used and this is the reason why even worthless cottons find a sale and a value. This is one of the chief post-evolution obstacles of a strain for its successful spread and cultivation. It is a consolation to note, that some of these bad practices are being remedied by means of two important weapons, the Cotton Transport Act and the Cotton Ginning and Pressing Factories Act. The Cotton Transport Act protects a 'definite area of cotton by prohibiting the importation of cotton into the area except under licence.' Prior to the application of the provisions of the Act, inferior cottons used to find a free entry into areas producing stapled cottons for purposes of mixing and 'the reputation of several valuable Indian cottons was ruined, with consequent loss to the growers of the good varieties.' The second of the two Acts viz., the Cotton

Ginning and Pressing Factories Act is a necessary complement to the Cotton Transport Act inasmuch as it enjoins the owner of the press to mark his bales in a prescribed manner and to send compulsory weekly returns of cotton pressed. This Act has been able to check 'abuses and malpractices which have had an adverse affect on the cotton trade and on the cotton-grower in the past.

Cotton, being a commodity of world-wide importance and as America is the country producing the maximum portion of the world out-put, market prices are mostly dictated by America. India is more or less dependant on America in her export trade of cotton. A plentiful American crop may mean poor return for the Indian peasant. This dependence on America very often entails wide fluctuations in the prices and a ryot may grow poor or rich according to the circumstances of the case.

Despite the various ameliorative measures, the ryot often fails to get the prices he deserves for the quality of his cotton. There are various reasons for this sad state of affairs. The general low intellectual level of the ryot, his dependence on the money-lender, the existence of the middleman and the lack of co-operative agencies for the marketing of his commodity on correct lines stand prominent among such reasons. The spread of compulsory education and the starting of innumerable co-operative village-banks and sale societies for mutual benefit—these only can fetch the peasant the profits he is entitled to. If education, thrift, self-help and mutual help were to become his watch-words, the situation will easily be solved. The Indian Central Cotton Committee are interesting themselves in the finance of the cotton crop and as a result of their investigations on the subject, valuable recommendations for the improvement of the methods employed might be the outcome.

The last, but not the least in importance, is the consideration of the maintenance of the purity of improved strains in the hands of the ryots. The peculiar operation, in respect to cotton, namely that of ginning or the separation of the lint from the seed, acts as a source for the mixture and the consequent deterioration of the improved seed. The maintenance of a pure stock at the breeding station, therefore, becomes most necessary, if the breeder's efforts of years are not to be lost. Again, since most of the ryots are in the habit of disposing of their produce as kapas, the need to meet the large and growing demand for the seed of the new strains is most imperative and the necessity for the extension of seed farm areas will be more keenly felt than ever before.

As enumerated in this paper, there are ever so many difficulties constitutional, environmental, commercial and technical, in the way of the evolution and the successful spread of economic strains in cotton. The responsibility for the solution of these problems cannot be placed on any one group of persons. It is one in which the full co-operation of growers, spinners, ginners, breeders, the cotton trade and agricultural workers is required.

'Under the constructive programme of the cotton breeder, desirable characteristics found declaring themselves in any of the lines will be keenly watched for and developed, and despite the various obstacles that have to be surmounted and the length of time necessary, new strains thus developed will after being thoroughly purified and tested, be released from the breeding stations for the benefit of the ryot and the country's economic development.'

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