DEPARTMENTAL NOTES

COTTON CULTIVATION IN CEYLON*

THE first mention of cotton in Ceylon is to be found in BK LXXII. of the Mahavansa, dated about 1164 A. D. but it is likely that it was used long before that time. As far back as 161 B. C. (BK XXV.) there is mentioned the existence at Anuradhapura of a canopy of " 8000 pieces of cloth of every hue ", and it is feasible to suppose that the cloth was cotton cloth. The cotton would of course be Indian cotton, for it is quite certain that no other kind was available in those early days. Perhaps I should here explain that there are in cultivation very many forms of cotton, and there are almost as many opinions on the way they should be classified. I do not propose to waste either your time or mine in discussing this matter; commercially cottons are divided into long, medium and short stapled according to the length of the fibre which grows from the seed coat, and which forms the cotton of commerce.

Long-stapled cottons have a fibre of $1\frac{1}{2}$ inches length or more, and include Sea Island types, which produce the longest of all fibres (up to $1\frac{3}{4}$ or $1\frac{7}{8}$) and Egyptians, with a fibre length round about $1\frac{1}{2}$ in. Sea Island cotton was formerly grown in the Southern states of N. America, but has now been abandoned there, largely because of the ravages of the boll weevil. It requires a sea-board climate and is now grown almost entirely in the W. Indian islands. It is the most valuable of all the cottons, but is a poor yielder, and the market for this type of cotton is strictly limited. The Egyptian cottons are a hybrid race, being built up from an indigenous brown cotton and a white Sea Island type. They exist in two types, a brown or khaki cotton resembling the original tree cotton of Egypt, which grows well but is unsuitable for dyed fabrics on account of its colour, and a white, which is now being developed to a greater extent than the other. Though not so hardy, it is white and can therefore be dyed, and it is earlier than the brown and is therefore not so subject to the attacks of the boll-worm. Egyptian types are essentially to be grown under irrigation (under which they were evolved) and have done consistently well only under those conditions. The plants are tall and straggling in habit.

* Being the text of a talk given by Dr. J. C. Haigh, Botanist of the Department of Agriculture, to the Committee of the Low-country Products Association, in Colombo, on October 9, 1941.

Medium-stapled cottons have a fibre length of 1–1¼ inches, and form the bulk of the European spinning market. The chief source of supply is the U. S. A., where the American uplands varieties have been developed, although it is likely that the original type came from Asia. The Cambodian cotton that has been grown in Ceylon for many years belongs to this type. It is naturally a perennial, but is treated agriculturally as an annual, chiefly for pest control. It will grow on most soils, but too-heavy types should be avoided in dry tropical areas, as the cracking which occurs in dry weather will injure the numerous side roots ; in temperate climates, this factor is not of importance. Uplands cottons will mature with only 20 inches of rain if it is well distributed ; heavy rain produces excessive growth on light soils and may check growth entirely on heavy soils, by producing a water-logged condition. Too much rain also encourages pests, particularly the boll worm. These cottons are planted in rows about 3 feet apart, on ridges if the rainfall is heavy. They require a growing season of about 3 months, during which the weather should be hot and wet, with rain falling at frequent intervals ; this should be followed by a dry season of about the same length, during which the plant flowers, and matures its bolls. The crop ripens uniformly, so that there are few pickings at harvest time.

Short-stapled cottons have a fibre length from ½–1 inch and are represented in commerce by the Indian types. They are also naturally perennial, and have a short, coarse but strong fibre. Like the upland types, they have a long taproot, but whereas in the Upland cottons the lateral roots run horizontally and are near the surface, those in the Indian cottons go down at a much more acute angle. These types are therefore drought-resistant and will grow in climates with not more than 10 inches of rain per annum. They are planted more closely than the upland types (18 inches instead of 3 feet) or they may be planted at the same spacing and interplanted with grain crops (*e.g.*, Kurakkan). They are the earliest of all the cottons, maturing in 4–4½ months, and producing small bolls, which are picked at frequent intervals.

I have found no record of cotton cultivation in Portuguese times, but the Dutch had a local cotton industry and may have been responsible for the introduction of New World cottons into the East. That industry received a severe set-back when Government imposed a tax on manufactured articles, but it persisted, and may even have flourished in out-of-the-way villages. Various introductions were made in the early days of the British occupation, and a traveller in 1816 reports that " although all kinds of cotton will grow freely in Ceylon, yet none is cultivated because of lack of capital, and all cloth is

imported ". This statement cannot be strictly true, because there are records of a very old industry in Batticaloa which produced sheeting, towelling and table wear, and which is likely to have been a relic of Dutch times ; nevertheless, there seems to have been no cultivation on a large scale.

It appears from a study of Ceylon agriculture that periodically there arises an impetus towards the cultivation of some particular plant which is ordinarily grown only in small quantity. At intervals throughout the 19th century such an impetus was directed towards cotton cultivation. In 1833 Government distributed seed in large quantities, in 1848 the then director of the Royal Botanic Gardens, George Gardner, strongly recommended cotton cultivation for the North-Central Province and in 1851 his successor, Thwaites, distributed seed of an American variety, and a pamphlet of instructions for its cultivation. In 1853 Dr. Kelaart published useful notes on cultivation, recommending particularly the Sea Island variety, and the matter was warmly taken up by the Kandy Agri-Horticultural Society. This Society obtained from the Manchester Cotton Supply Association no less than 40 casks of Sea Island seed from America and in 1858 this was largely distributed throughout the Island. In 1859 Mr. J. A. Caley published an elaborate report on the present condition of cotton cultivation in Ceylon, with a map showing the districts suitable and the proposed ports for shipment. By this time it had been clearly shown that the moist region of Ceylon possessed too uncertain a climate to allow of regularly-good crops, however well the American kinds might seem to flourish in certain seasons. For many years after that, Peradeniya contrived with some difficulty (since it lies in the moist regions) to keep up a supply of seed of the different kinds, but by 1863 all interest in cotton had completely died out. The factors responsible are said to have been the unsuitability of the weather, the lack of an organized market and the high cost of production, which could not compete against the fall in the world price of cotton and the low cost of imported cotton goods.

For twenty years cotton cultivation was forgotten, but interest was revived again at the time of the coffee crash and in the 80's another wave of enthusiasm was started. Seed was again distributed from Peradeniya through the agency of the Revenue Officers, and some good crops were reported. More detailed records are available from this period of the performance of different types in various parts of the Island, and it is apparent that in spite of past experience, attempts were still being made to grow cotton in those areas which have rain in both monsoons. Indeed, good crops of Sea Island cotton were raised at Gampola and the quality of the lint received favourable reports from England ; but it is significant

that the best results were obtained in those years when the N. E. monsoon was considered to have failed. At this time (1888) the Ceylon Spinning and Weaving Co. was established and opened a mill in Colombo, and it was hoped that the provision of a regular market would stimulate cultivation. The hopes were not realized ; by 1891 enthusiasm had died, and for the next 10 years no mention of cotton is to be found in agricultural literature or reports. In 1901, however, it was announced that a railway was to be built to Jaffna, and it was urged that the opening up of the northern part of the Island which was confidently expected to follow the opening of the railway, would provide an excellent opportunity for the establishment of a cotton-growing industry. The idea was encouraged by the newly-founded British Cotton-Growing Association. The chief source of cotton to Europe was at that time the U. S. A., but consumption in that country was increasing faster than production, the attacks of the boll-weevil were spoiling an increasingly-large percentage of the crop and the amount of cotton available for export was becoming less each year. The threatened shortage caused great anxiety to the Lancashire cotton trade, and the new Association set out to establish a cotton-growing industry within the British Empire, and so to become independent of American supplies. Large-scale experiments were started in the Anuradhapura District, at Maha Illuppalama, with Indian cottons for the local market, and Egyptian and American varieties for export to Europe. Those with Indian cottons were soon abandoned ; it is true that cotton of excellent quality was produced and that yields equal to those in the Tinnevelly district of India were obtained, but the value of the crop, including the seed, was only Rs. 15 per acre, which was very much less than the cost of raising it. In fact, the cost was five times the returns, and although cotton grown under these conditions might be acceptable to a cultivator who took no count of the cost of his own labour, it was obviously not a commercial proposition. Attention was therefore concentrated on longer-stapled cottons, which produced excellent crops at first. They did not last ; the weed growth smothered them, the rains spoilt them, and enthusiasm for cotton cultivation was not equal to the strain put upon it. About the same time the mills went into liquidation.

A change in procedure was made in 1909, as a result of the visit of the Director of Agriculture in Nyassaland. He suggested that since the heavy rains of the N. E. monsoon encouraged undue vegetative growth, and the untimely rains of March spoilt the ripening crop, the planting season should be changed, at least where irrigation facilities were available. For the next two years, therefore, cotton at Maha Illuppalama was planted in February, when the N. E. monsoon was over.

It did no better than before; the winds of July whipped off the seed cotton, and the crop was not fully gathered in before it had to be uprooted to prepare the land for the next season. A return was made to the old system, and an attitude of resignation to the difficulties and limitations of cotton cultivation was officially adopted.

This attitude was encouraged if not produced, by a report made by Professor Wyndham Dunstan of the Imperial Institute, who visited the Island in 1910 on behalf of the British Cotton Growing Association. He wasted no words in sympathy and few in encouragement. He considered that no experiments should have been necessary to prove that Indian cottons could not be grown with profit in Ceylon; that attempts to grow Egyptian cotton, which has a long maturing period, were not likely to be successful in any area in which there was not complete control over the water supply, that there was no evidence that Sea Island could be properly established and that in any case a cotton of such superfine quality would require much more careful attention than it would be likely to get; and finally that systematic and properly-conducted (how unkind!) experiments should be made with types of American Uplands, which had hitherto received little attention. The appointment of an expert was recommended, but was not supported by Government, who considered that in the then-flourishing state of the rubber, coconut and tobacco industries, the small profits to be made from cotton cultivation were insufficient to attract capitalists, even were expert advice available.

About this time, the late Sir Marcus Fernando reported the results of trials made in the Kurunegala district of sowing cotton in between rows of coconut trees. Good quality cotton was produced, and yields were sometimes encouraging, but the crop was often ruined by untimely rain. His example was not followed.

The centre of interest now shifts to the Hambantota district of the Southern Province, where experiments were started about 1912, largely as a result of the enthusiasm of Mudaliyar Amarasekera, but little serious attention was given to the crop until 1920, when free seed was distributed and experiment stations were opened. At this time there was a depression in the rubber industry, and many people were looking for other crops to grow. The Mills had been saved by the aid of the BCGA and joined in the search for land on which to grow cotton. Trials were also made in the Northern and other Provinces, and in 1922 seed was distributed sufficient for planting 600 acres. Past encouragements and warnings were alike ignored, and a fresh start was made with a complete range of varieties from short-stapled Indians to long Sea Islands. Yields were good (5½ cwts. from Sea Islands, 6 cwts. from Uplands, 4 cwts. from Egyptian) and

the department of Agriculture made arrangements to purchase seed cotton for cash from small growers. It also made arrangements to sell such seed cotton to the Spinning and Weaving Mills, at a price to be agreed upon each year. The price was for seed cotton delivered in Colombo; the department collected, graded and forwarded it, and deducted only the cost of transport and travelling expenses; no charge was made for the time of the officers engaged in this work.

In 1923, 1,600 acres of cotton permits were taken out, but the weather interfered with the clearing operations and not more than 400 acres were cultivated. The crop was sold to the mills at Rs. 25 per cwt. of seed cotton, and the cultivator made five times as much money as he could from grain crops. In 1924 the acreage was estimated at 1,500, crops were not so good, but prices were still high. In 1925 Mr. E. R. Hilson, Cotton Specialist to the Government of Madras, visited the cotton areas of Ceylon and reported on their possibilities. He considered that soils were generally suitable, but that dry zone areas could be classified by their rainfall. The Hambantota district was considered good, Embilipitiya, Anuradhapura and Vavuniya fair, Dambulla worthy of trial, Bibile suitable only in dry years. He advocated the introduction of a rotation system, and advised that an American Upland cotton be grown, of the type of Durango and Cambodia. His recommendations were adopted in that only seed of the Cambodia variety was henceforward issued to cultivators, although a number of types continued to be tried on experiment stations. Schemes of rotation were also put into operation. In 1927 world prices broke, and Government, fearing that to pay an economic price to the cultivator would kill a healthy young industry, subsidized the producer to the extent of Rs. 5·50 per cwt; even then he received only Rs. 20·50. The following year a government grant of Rs. 1·70 per cwt. was required, but the price paid to the cultivator had now fallen to Rs. 19·50 per cwt. In 1929 it was Rs. 18·50 and in 1930 it fell further to Rs. 16. In 1931 it was only Rs. 10, and *this* figure was considerably above world average. In was only natural that this steady and depressing fall in price should discourage the cultivator and the crop from the Hambantota District fell from 2,273 cwt. in 1930 to 819 cwt. in 1931, a large proportion of the chena permits not having been sown. The price went up to Rs. 12 in 1932, being still above market average, but the crop fell to 200 cwt., and in 1933 it was down to 126 cwt. That was the nadir; in 1934, the crop had increased to 956 cwt., at the same price, partly as a result of the increased price and partly because of an especially-favourable season which gave yields above the average. In 1935 the crop was 1,500 cwt., in 1936 it was 3,000, and in 1937 4,000 cwt., and the price was still Rs. 12 per cwt. It will

be noticed that the price had been constant for five years and I must now explain how it came to be so. In 1932 an import duty of 5 per cent. *ad valorem* had been put on raw cotton; the following year the mills complained that their business was being ruined, at least in part because of the import duty. The company did in fact go into liquidation shortly afterwards, but an agreement was made between the mortgagors and Government, that in exchange for the removal of the import duty, the mills would undertake to purchase each year up to 10,000 cwt. of seed cotton at a price that was to remain stabilized for an agreed number of years, and would return to the Department, free of charge, such amounts of seed as it needed for issue to cultivators. The price was fixed at Rs. 12 per cwt., and there can be little doubt that the existence of a sure market and a fixed price stimulated cultivation.

Production in 1938 fell off a little and the price paid was only Rs. 11·70 per cwt. because the mills claimed that the cotton was not of that first grade for which they had stipulated to pay Rs. 12. The falling-off in quality was in part due to heavy rain at the time of harvest, but the mills had complained the previous year that the quality was not up to standard and that it had in fact been deteriorating for some time. The cause of such deterioration is not far to seek, since no systematic selection of seed had been practised. It is an established fact that even in a commercially-pure variety of cotton, continuous selection of seed is necessary if the standard of the lint is to be maintained, but it cannot be claimed that the cotton grown in Ceylon was even commercially pure. It is true that since Hilson's recommendation, made in 1925, none but Cambodia seed had been issued to cultivators, that a fresh supply of this seed had been obtained from India in 1929, and that, in recent years at any rate, the seed supplied to villagers had been taken only from the cotton grown at Liyangahatota, where conditions were considered to be particularly suitable for cultivation. Nevertheless, varieties other than Cambodia were grown on departmental stations even after 1925, varieties other than Cambodia had formerly been issued to cultivators, and were bought by the mills, and it would be expecting a miracle to think that no mixing of seed would take place. In these circumstances seed selection was all the more necessary if quality was to be maintained. When I was appointed Botanist in 1931, I suggested a programme of cotton improvement, but the proposal was dropped because the area under the crop was too small to justify the amount of time and labour that selection would require. When, however, the mills complained that quality was deteriorating to such an extent that the cotton could no longer be called first grade, it was obvious that something must be done, and a programme of selection was started

with freshly-imported seed of Cambodia and of two other varieties of similar type that have been evolved, one in S. Africa and one in Uganda, since Hilson recommended the variety most likely to be successful under Ceylon conditions. Other Upland types from Africa have since been added and recently, on the orders of the Hon. Minister for Agriculture and Lands, Sea Island and Egyptian types have been introduced. All these cottons are being grown on an experiment station at Tissamaharama isolated from village areas, where individual plant selections are made each year and are kept free from contamination by being covered with cloth selfing-bags to prevent the access of foreign pollen to the flowers. Samples of lint of these varieties have recently been submitted to the mills for examination, and some of them appear to be very promising; it will however, be several years before a final choice can be made. Cotton requires from 3–5 years in a new enviroment before it is acclimatized, that is before it will give its best performance, and our newest introductions have been grown for one year only. Nevertheless, a move has been made towards producing a better and more uniform lint which will assure the cultivator a steady and reliable return for his labour. It is of interest to record that there is at present no opening at the Colombo mills for the longer-stapled Egyptian and Sea Island types, because of the nature of the spinning machines used there.

We have now surveyed the history of cotton cultivation in Ceylon, and in order to ascertain what it has taught us, I propose to ask, and to attempt to answer, a few questions. First, are conditions in Ceylon suitable for cotton cultivation. Climatically, the wet zone may be ruled out because it does not have the dry period necessary for the ripening of the crop; the dry zone is nowhere ideally suitable (but that may be said of any area in the world except those in which there is no rain) because of the irregular distribution of the rainfall. Sowing time cannot be earlier than October (I am speaking now of dry land areas), which means that flowering comes in January and harvesting in March-April. The rain during the N. E. monsoon is generally too heavy (except of course when the monsoon fails) and produces either a stunted growth (on heavy soils) or a prolific one (which is a waste of energy). It also produces a growth of weeds which often proves to be too much for the cultivator to tackle, perhaps because it has also laid him low with fever. Rain in January causes the shedding of flowers, buds and young bolls by producing a temporary saturation of the subsoil; this could perhaps be cured by deep drainage, but deep drains are not commonly found in chenas. Rain in March-April may spoil the lint in the opened bolls, may cause more shedding, and will certainly interfere with picking. The

only remedy here appears to be to pick quickly when it is fine. Earlier sowing is desirable, so that the plants may be established before the fury of the monsoon descends and drowns the seed or young seedlings, but early sowing is limited by the incidence of rain. Later sowing to bring flowering time in February, the driest month, exposes the seed to the risk of drowning just mentioned.

Rain, then, either in its abundance, its irresponsibility, or its absence, appears to be the chief enemy of the cotton plant—which is a paradox since without it cotton could not be grown at all. Under present conditions of cultivation, other pests are not of great importance ; there are a few insects which have little more than a nuisance value, and rats and elephants sometimes ruin the cultivator's work. Soils generally are suitable, although in the northern part of the Island there are areas of clayey soil which are not to be recommended. The answer to this question then appears to be that conditions in parts of the dry zone are suitable for cotton cultivation.

The next question is : How should it be grown ? Commercial cultivation appears to have been rejected, and perhaps with reason under present conditions. The uncertainty of the rainfall (it is estimated that the odds against a good year are about 3 to 2) the sparseness of labour in areas of suitable climate, leading to high cost of production, and the smallness of the profit because of low market prices, all combine to drive away capitalist enterprise. Figures of cost are unfortunately not available, but I give, for what they are worth, similar figures from one of our experiment stations. In considering them, I would like you to bear in mind (1) that Government experiment stations have the reputation, whether deserved or not, of being more expensive to run than would be a privately-owned property, (2) that the area from which these figures are calculated is small, and that costs are likely to be increased thereby, (3) that, on the other hand, it is possible that the yields are rather higher because of the small area, which would perhaps offset the increase in cost.

Income and Expenditure statement from an area of 3 acres grown under cotton, being part of a rotation area on a dry-zone experiment station.

Year.	Cost per acre.	Return per acre.	Profit or Loss per acre.	Yeld per acre of seed cotton.
	Rs. c.	Rs. c.	Rs. c.	
1938–39 ..	48 95 ..	26 11 ..	Loss' 22 84 ..	3 cwt. 65 lb.
1939–40 ..	58 2 ..	68 73½ ..	Profit 10 71½ ..	6 ,, 57 ,,
1940–41 ..	49 75 ..	77 0 ..	Profit 27 25 ..	6 ,, 38 ,,
Average ..	52 24 ..	57 28 ..	Profit 5 4 ..	5 ,, 53 ,,

		Rs.	c.	
Rates of pay	Men	0	60	per day
	Boys	0	45	,,
	Women	0	30	,,

Analysis of cost of cultivation (average of 3 years).

	Rs.	c.
Preparatory cultivation	4	24
Manures and manuring	9	10
Seeds and sowing	3	80
After-cultivation	13	51
Watering (one season only)	0	15
Harvesting and cleaning	19	98
Pest control	1	45
	52	23

In view of these figures, it is for those responsible for agricultural enterprise to decide whether, in view of the limitations that have been outlined and the returns to be expected, they will invest their money in cotton cultivation on a large scale. There remains peasant agriculture. Cotton is now grown entirely in chenas, and all authorities are agreed that, if cotton cultivation is to be a success, it must take its place in a scheme of rotation. The chena cultivator has neither the money to buy implements or fertilizers, nor the interest in the land to use those things if he had them. The land therefore remains unstumped (which reduces the stand of plants and therefore the yield) and unweeded (which reduces the yield still further). The average yield on chenas is not more than 2 cwt. seed cotton per acre ; on experiment stations, under a system of rotation, it is considerably higher. Experiments on stations have shown that the limiting factor in cotton cultivation is weed growth, and that a luxuriant crop of weeds will mask any manurial or spacing effects. For twenty years the officers of the department have endeavoured, by precept and by practice, to persuade the peasantry to adopt a form of rotation, and have failed. This failure is perhaps natural—the cultivator will not till what he does not own, and the tendency in recent years has been to reduce the size of chena permits rather than to increase them. Further, it is not yet proved that it is practicable for the peasant cultivator to adopt a system of rotation ; an experiment to test this point is now being conducted at Kurandankulam, but results are not yet available. Rotation programmes have been worked out for most areas of the Island and are available when required.

The answer to the second question is then that cotton should be grown as a rotation crop in village settlements. Until, however, the chena cultivator is weaned from his present

practice, and not only encouraged, but also helped, to become a mixed farmer, cotton will continue to be grown in chenas, with all the disadvantages attached to that form of cultivation.

The third question is what kind should be grown ? During the past century, every conceivable type of cotton has been tried, and it is significant that, whilst much prominence has been given to the excellent crops obtained from Sea Island and Egyptian types, those types have failed to persist, whereas the more ordinary Upland type has always been grown and is still being grown to-day. Desirable as it may be to wish to grow Superfine cottons, it is commercial commonsense to grow that type which produces the best gross return, and experience in Ceylon indicates that an Upland type answers that description. Moreover, we have a market in Colombo for our cotton that can take only two types—short-stapled Indian and medium-stapled American Upland, and of the two, there is no doubt that Upland is the more profitable. So long, therefore, as cotton is grown under dry land conditions and is sold in the local market, the type to be grown is a medium-stapled American Upland. Of the 17 varieties now being tried at Tissamaharama, 12 are of this type. On the question of supplying the local market against developing an export trade, there can be little argument. With ruling market prices, we could not hope to compete in world trade. In 1938 my department recommended that all Government requirements of cloth should be bought from the Spinning and Weaving Mills ; the proposal was turned down because it was shown that the material already supplied by the Mills, which amounted to about half of that used by Government, was inferior in quality to and higher in cost than that supplied by the Crown Agents. Nor are we likely to be forced into the export market by the overproduction of local requirements. Under the terms of the present contract, the mills will take up to 10,000 cwt. per annum, but that is only a fraction of their total requirements ; our peak year to date has been 4,000, and it has been estimated that under present conditions of cultivation we are not likely to exceed double that amount, *i.e.* 8,000 cwt. Our present output occupies the mills for one week per year ! In addition to seed cotton required by the mills there are the possibilities of a hand-loom industry to be exhausted before export has to be considered.

The next question to be asked is how should it be disposed of ? The question has already been answered above, but there are differences of opinion on the method to be used. Under present conditions, seed cotton is bought in the villages and transported to Colombo ; it is there ginned, and the seed required for the next sowing is transported back again. The cost of transport is considerable (it costs more to transport seed cotton from Hambantota to Colombo than it would from

Bombay) and is borne by the cultivator, so that he loses perhaps Rs. 1·50 to 2 out of the Rs. 12 paid by the mills. It is true that he gets more than he gives, for not only is the organization for the purchase of seed cotton arranged for him, but the time of the buying staff is charged to Government account, so that the disposal of the crop is done for him more cheaply than he could do it himself. Nevertheless, suggestions have been made to save the cost of transport to the cultivator by establishing a ginnery in the Hambantota district. The suggestion was first made in 1934 by Mudaliyar Amarasekera, and again in 1938 by Mr. D. M. Rajapakse, Member of the State Council; it was turned down on both occasions, for what appear to be good reasons. It was argued that a minimum consumption of 4,000 cwt. per annum would alone justify a ginnery, which even then would work for only one month in the year ; that although the Hambantota district was the largest cotton producing area, yet cotton was being grown, and in increasing quantities, in other parts of the Island and that either seed cotton from those areas must continue to be sent to Colombo or other ginneries must be established, and that on these grounds the establishment of a ginnery in the Hambantota district was both impracticable and uneconomical.

I have dealt up to now with future development under conditions of cultivation such as now obtain, but I must, in conclusion, mention that irrigation schemes in the dry zone are now beginning to function, and will offer another possible field for cotton cultivation. It should be possible under conditions of controlled water supply and drainage to produce bigger yields than are produced in chenas ; it may be possible to grow longer-stapled cottons for an export market, perhaps by reviving Mc Call's method of sowing in February and cultivating throughout the dry weather. Whatever happens, the possibilities of cotton as a rotation crop under dry zone conditions will continue to receive the attention of the Department of Agriculture.