

REPORT ON A VISIT TO COTTON GROWING AREAS OF QUEENSLAND

A. W. CHARLES.*

INTRODUCTION.

COTTON was first grown in Queensland in about 1860 and since 1920 the industry has been assisted by a system of guaranteed prices. In the immediate pre-war decade, relative stability was reached with about 40,000 acres planted each year, producing up to 20,000 bales of seed cotton. The peak area planted was 70,000 acres. The industry was maintained at a fairly high level throughout the war as a matter of national emergency but from 1948-51 planting slipped away to a mere 2,500 acres when competing forms of land use were clearly more profitable than cotton growing. These forms of land use included dairy and beef cattle raising, sheep raising and grain farming, particularly sorghum. Acreages have been low and fluctuating since 1951 but 5,000 acres was planted to cotton in 1958-59, 20,100 acres in 1959-60 and 40,000 acres in 1960-61. On the basis of land preparation for the 1961-62 crop, it is anticipated that 40,000 acres of cotton will be planted this year. The upsurge in interest may be attributed primarily to two factors, namely:—

(a) The lesser attraction of the previously mentioned competing forms of land use, particularly grain sorghum growing. The price for coarse grains has fallen considerably in recent years and indications are that it will remain at a low level; and

(b) The wider use of cotton picking machines, the efficiency of which is being constantly improved.

It has always been difficult to find sufficient pickers to cope with cotton crops in years when large acreages have been planted. The

mechanical picker eliminates much of the uncertainty of cotton growing and also enables the industry to build up a stable cost structure. Not only does the mechanical picker compete fully with hand picking on a price basis, but it can pick about an acre per hour, replacing anything from 20 to 100 hand pickers, depending on the type of crop. The pickers in operation in Queensland are only single-row pickers and each will do about 1,500 acres in a season but double-row pickers, with a corresponding increase in coverage, are now being operated in the United States. The Board operated 19 pickers in 1960-61.

In spite of the increased interest in cotton growing in Queensland in recent years and the possibility of significant production in other States, especially in the north-west of New South Wales where new irrigation projects will soon be operating, it does not seem likely that home-grown cotton will fill the Australian demand in the near future. In the last quinquennium Australia used about 100,000 bales of cotton per annum, of which 95 per cent. was imported. Cotton fabrics were also imported on a large scale.

Against this background of a market which is not being satisfied by local production, prospects are promising for selling Territory produced cotton in Australia, if in fact there are suitable areas for growing the crop in the Territory and it can be produced economically. It was to investigate cotton growing in Queensland with a view to assessing prospects for the industry in the Territory that the writer visited Queensland.

* Chief, Division of Plant Industry, Department of Agriculture, Stock and Fisheries, Port Moresby.

PRODUCTION.

Varieties.

There are three main varieties being grown in Queensland, namely, "Empire", "New Mexico (or New Mexican) Acala" and "Miller". The varieties "Lankart", "Bobshaw" and "D & PL-15" are also grown as well as a number of others which have persisted in certain areas only. "Miller", which has a short but strong staple and is hardy and adapt-

However, State-wide yields always include a number of failures and do not necessarily give the whole picture. Under dryland farming conditions yields of at least 600 lb. of seed cotton may be expected in an average season if land preparation and crop maintenance are good. Double this yield may be obtained in very good seasons and irrigated crops should regularly yield upwards of 1,000 lb. per acre. Maximum yields as high as 2,000 lb. have been



Plate I.—An irrigated crop of the variety "Empire" at Gibbergunyah, Dawson Valley, 10 weeks old and in excellent condition. [Photo I. F. Wood.]

able to a range of environments, is the most popular. "Empire" has the longest staple but is weaker than "Miller" and much more sensitive to environmental vagaries. The former is favoured under irrigation and is also grown by dryland farmers with good land preparation aimed at moisture conservation. "New Mexico Acala" is another high quality variety but is also more sensitive than "Miller". As with other crops, certain varieties show particular adaptation to specific areas.

Yields.

Only in occasional very good years does the average State yield reach 500 lb. per acre.

obtained and an irrigated crop of 108 acres produced 164,000 lb. in 1957-58 at Theodore. Yields in excess of 3,000 lb. of cotton seed per acre have been reached on commercial acreages in the United States. There is little doubt that the availability of moisture is the most important factor limiting yields in Central Queensland.

Climatic Conditions.

Cotton requires a minimum growing season of six months free from frosts, with relatively high day temperatures. In the American cotton belt, the average summer maximum temperature is 77 degrees F. along the northern boundary



Plate II.—An excellent mature crop of the variety "New Mexico Acala" at Thangool, Callide Valley.

(The area on the left has been hand-picked once. The crop yielded 2,000 lb. of seed cotton per acre. It was not irrigated but the season was excellent and the standard of farming very high.)

[Photo I. F. Wood.]

and this is considered to be about the minimum required for growing commercial cotton. The average maximum temperature is as high as 95 degrees F. in the Imperial Valley of California, where excellent cotton is grown.

Average summer temperatures in Central Queensland are not quite as high as this but severe heat waves with temperatures up to 110 degrees F. do occur. These extreme temperatures damage the crop, causing boll shedding and premature opening of nearly mature bolls, giving tight, poor quality locks.

Although cotton is a deep-rooted and fairly drought-hardy plant, it is notable in times of moisture stress that the crop suffers first and the bolls are freely shed before the plants show other signs of distress. The rainfall in the main cotton areas of Queensland is less than 30 inches per annum with under 20 inches falling during the growing period of the crop. In much of the American cotton belt, the annual rainfall is about 40 inches and commonly up to

55 inches or more. Not only is the rainfall relatively low in Queensland, but the distribution is poor and erratic, with a relatively high probability of periods of up to six weeks with little effective rainfall at any time during the growing season. The figures in Table 1 for a good cotton area show that there is a saturation deficit during every month of the growing period in an average season, so that the crop must have conserved moisture or irrigation water to draw on.

Table I.

Precipitation and Evaporation at the Regional Experiment Station, Biloela, during the Cotton Growing Season

	Precipitation (points).	Evaporation (points).
November	289	803
December	355	910
January	409	883
February	493	652
March	280	691
April	106	578
May	157	461
June	167	351

Soils.

Cotton is grown successfully on a wide range of soil types, ranging from sands to fairly heavy clays. It does best on friable loams with a fairly heavy, but not impermeable, clay sub-soil which holds moisture well. The chemical data in Table II are taken from two cotton soils at the Biloela Regional Experiment Station.

Table II.

Chemical Data for Cotton Soils at Biloela.

(1) Good virgin soils.—

pH	....	....	6.8	6.3	6.3
Available P_2O_5	....	....	400	400	400
Total N per cent	....	....	0.12	0.10	0.20
Exchangeable K (m.e. per cent.)	....	....	0.93	1.33	3.84 *
Total exchangeable bases (m.e. per cent.)	....	....	25.2	29.4	26.6
K per cent. total exchangeable bases	....	....	3.69	4.52	14.43 *
SO_4	....	....	2	21	12

* Exceptionally high.

(2) Rather poor soils.—

Avail. P_2O_5	....	....	222	284
Exchangeable K (m.e. per cent.)	....	....	1.33	1.29
Total exchangeable bases (m.e. per cent.)	....	....	22.8	23.4
K per cent. of total exchangeable bases	....	....	5.8	5.5
N per cent.	....	....	0.123	0.081

The main soil types on which cotton is grown in Queensland are:—

(a) Alluvial Soils.

These are mainly deep soils, varying from dark grey to grey-brown in colour, and are either clay loams or loams. Their basic fertility is high and they prove productive under all crops. The natural cover is usually an open forest, the dominant tree being red gum, sometimes called blue gum (*Eucalyptus tereticornis*).

(b) Sandy Soils.

There are limited areas of sandy soils, also probably alluvial in origin although quite different from the typical alluvials. They are grey to reddish-grey sands overlying clay and the vegetation is a broad-leaf iron bark association (*E. melanophloia*). Al-

though good crops have been grown on these soils, especially with irrigation, they dry out quickly and are limited both in extent and value for cotton production.

(c) Brigalow and softwood scrub soils.

This is a large and rather heterogeneous group, covering a wide expanse of sediments and basaltic soils, fringing the alluvials. The brigalow soils are typically grey to grey-brown clays to clay loams, with a self-mulching surface horizon, and are fairly well drained. Free lime is usually present at varying depths in the profile and fertility is high. The dominant timber is brigalow (*Acacia harpophylla*). The softwood scrub soils fall into the same land unit as the brigalow soils but occur usually at higher elevations on basalt residuals. They are red to brown and grey-brown clays and clay loams, self-mulching and with good physical structure. The fertility is high but the moisture holding capacity is not usually as good as that of the better class of Brigalow soils. The dominant species on these soils are *Flindersia collina*, *Bridelia exalta* (scrub ironbark), *Atalaya hemiglauc* (whitewood) and the distinctive bottle tree (*Brachychiton rupestris*).

(d) Black earths.

These soils occur on plain country and are self-mulching with high fertility and good physical structure. They are probably derived from basaltic alluvium. The black earths are mainly open grassland with little timber.

All the above soil types are used for cotton, especially the alluvials and brigalow and softwood scrub soils.

Soil Preparation.

Cotton requires good land preparation and for dryland culture in Queensland early ploughing to conserve moisture is essential, especially in virgin country. Only conventional cultivating equipment is required. Over the years the tendency has been to move land preparation further back into the preceding season and the fallow frequently commences about nine months before the crop will be sown in order to conserve the moisture from the summer monsoons. In any case, cultivation must start not later than about June for dryland cotton, although where irrigation is available it can be later, especially

on old land. After the initial ploughing, a second cross-ploughing is usually necessary, preferably followed immediately by one or more workings with a spike-toothed harrow to prepare a fine and even seed bed.

Planting.

A good tilth is necessary in the cotton seed bed. If mechanical harvesting is contemplated, it is also important that it be free of sticks and stones as these can cause serious damage to the fingers of the harvester.

The recommended month for planting in Queensland is October, in time to take full advantage of the summer rains and the warmest part of the growing season. About 15 lb. of seed per acre gives a good even stand. The 4-row planter has now largely superseded the old 1- and 2-row horse-drawn machines, and 40 inches between rows, which suits mechanical pickers, is becoming standard. Row spacing used to be 4 feet or 4 feet 6 inches and the older varieties usually have a more dwarfed habit.



Plate III.—A tractor mounted, 4-row planter.

(The split wheel behind each dropper firms the soil on either side of the seed but leaves it loose directly above, thus creating good conditions for germination.)

[Photo L. F. Wood.]

It is very important that the rows be as straight and the planting as perfect as possible to increase the efficiency of inter-row cultivation. In really well planted cotton, cultivating machinery can get to within about 2 inches of the bases of the plants and weed more efficiently than is possible if the rows are crooked.

Thinning.

Thinning is usually carried out by cross-harrowing the young plants. This must be done early as harrows cease to pull the plants out

efficiently when they are about 5 inches high. Light spike-toothed harrows are most satisfactory. For hand picking, the desired final stand is about one plant per foot of row, but for machine picking the density should be twice as great to keep the plants dwarfed, and in America, especially under irrigation, three plants per foot has given extremely high yields. Older style spacings, which may suit the Territory because of the long growing season and the likelihood that hand picking will be used initially, were 4 feet or 4 feet 6 inches between the rows and 1 foot 6 inches between plants. With these spacings, hand hoes were frequently used for thinning, although this practice is rarely used in Queensland today.

Cultivation.

Once the plants are about 6 inches high, cross-harrowing is an effective method of weeding and does little damage, especially on a hot day when the plants are flaccid. Cross-harrowing can be continued until the plants are quite large and it removes many weeds which are missed by inter-row cultivation. However, inter-row cultivation must be resorted to, as required, when the plants develop further. Mid-mounted equipment and good planting lines make for maximum efficiency and minimum damage. Well prepared new land naturally requires less weed control than old land. Rod weeders are being used by some growers and may do a better job than conventional tined equipment.

Fertilizing.

As moisture is the main limiting factor under dryland farming conditions in Queensland and, furthermore, most cotton is grown on soils which still retain much of their virgin fertility, responses to fertilizers have been rare and insignificant except on irrigated cotton. Irrigated cotton at the Regional Experiment Station, Biloela, has responded fairly consistently to nitrogen, phosphorus and potash. It is important that the mixture contain not too much nitrogen or excessive vegetative growth may reduce the crop and make mechanical harvesting difficult or impossible. As only about 5 per cent. of the cotton crop is at present irrigated in Queensland, there are not many data on the use of fertilizers on the different soil types.

In the United States, where rainfall in the cotton belt is higher and many of the soils have been worked for a long period, cotton is con-

sidered fairly sensitive to mineral deficiencies and regular and heavy fertilizing is common. The mixtures recommended in most areas are higher in phosphorus than nitrogen or potassium. Cotton lint takes practically nothing from the soil, being essentially a carbohydrate, but cotton seed does remove appreciable nutrients.

Pests and Diseases.

Cotton diseases are of minor significance in Queensland, which is entirely free from several major diseases occurring in America and other countries. The only diseases seen at the time of the visit were angular leaf spot and black arm, both of which are caused by the bacterium *Xanthomonas malvacearum*. Neither was causing serious damage but it is understood that in some seasons black arm can be serious. It attacks the laterals which carry the bolls, causing them to die beyond the point of attack.

The pest situation is more complex. There are insects which attack cotton at all stages of growth. Some, such as cutworms, thrips and the cotton tip worm, may injure the seedlings; *Heliothis* larvae destroy squares and bolls; rough and pink boll worms and yellow peach moth larvae attack mainly the older bolls; the harlequin and stainer bugs puncture bolls, allowing entry of moisture and fungi; and loopers, leaf perforators, web spinners, aphids and jassids injure foliage.

Many of the serious insects attacking cotton in overseas countries, particularly the destructive cotton boll weevil, are not found in Australia.

Until fairly recently, efforts were directed at the control of insects at an early stage. However, there is currently a revolution in practice, following experiments carried out by the Queensland Department of Agriculture. These experiments have demonstrated that control of the early insect pests results in holding a larger percentage of the early-formed squares and bolls. Later, however, boll fall from sprayed plants is heavy and sudden, whilst that from unsprayed plants is gradual, so that the number of bolls ultimately matured is rarely significantly increased by early spraying. Spraying has resulted in appreciably increased yields on the first picking but not in greater total crop yields. These findings apply to well-grown crops in average seasons. Poorly developed crops which have insufficient vigour to replace the squares and

bolls lost by insect attack, and late-sown crops where the onset of cool conditions prevents replacements, are benefited by early spraying.

D.D.T. gives good control of most pests and Endrin is the insecticide of choice for loopers. The current recommendation of the Queensland Department is to give no spraying at any stage in a good crop unless the infestation of a particular insect becomes unusually heavy. In 1960-61 loopers were severe in many maturing crops and aerial spraying with Endrin was used effectively.

HARVESTING.

Time of Picking.

It is a matter of judgment when picking should commence. The bolls open gradually and the lint loses bloom and quality if exposed to the weather for too long. This loss of quality has to be balanced against the number of bolls open, which determines whether picking will be worthwhile. Ideally, a good crop of cotton should be picked up to five or six times and this may be done on small family holdings where few, if any, outside pickers are employed. However, it is more usual to pick only two or three times.



Plate IV.—Bolls ready for picking.

(The boll on the left would soon begin to lose quality if not harvested.)

Machine picking does not prevent several pickings of one crop, although close-planted cotton, which is most suitable for machines, is usually completely stripped after two pickings.

Damp cotton will not gin satisfactorily and there is also a real danger of heating and even spontaneous combustion if the lint is baled wet



Plate V.—Children often assist their parents at picking time.

or too much green leafy material is included. There is no objection to picking while there is still dew on the bolls, provided the cotton is dried in the sun before baling.

Picking Rates.

The award rate for picking in an average crop in Queensland is currently 4d. per lb. of seed cotton but, in fact, few growers are able to obtain pickers below about 6d. per lb. This is too much to pay when the gross value of the crop is only 14d. per lb. and mechanical harvesting is advancing rapidly.

Mechanical pickers.

Two pickers of similar type are being used in Queensland, namely the International Harvester Company model and the John Deere. Both are single row drum types which pick the locks of cotton by means of slowly revolving spindles which move horizontally through the bushes as the machine advances. The loose, fluffed-out locks from mature bolls are wound around the spindles but immature bolls and branches pass between them with little or no damage. An occasional immature boll is broken off but the bushes are hardly damaged by the passage of the machine.

The machine picks 85-95 per cent. of the crop, depending on its condition. It does not operate satisfactorily in weedy and uneven crops. In the past, hand picked cotton has been pre-

ferred to machine picked. The machine is naturally less selective and the suction mechanism which carries the locks away from the spindles also carries up a certain amount of leaf trash which is very difficult to remove from the lint. However, recent developments in cleaning machinery in America have removed much of the objection to machine picking. Machine picked cotton has one definite quality advantage; only mature locks are harvested. The hand picker takes more of the diseased and slightly immature locks as he is paid by weight and they all help to keep up the tally. Thus, machine picked cotton is of more even staple and strength than hand picked.

Machines hired from the Cotton Marketing Board pick for 4d. per lb. of seed cotton. This figure covers transport and other costs around the district as well as actual picking costs. It is estimated that an owner-operated machine on a large enough acreage to keep it occupied can operate at 2d. per lb. In the past, much of Queensland's cotton has been grown in small areas but the current development is towards large individual areas grown by farmers who specialize in cotton as their major cash crop. It is economic for them to purchase their own mechanical pickers.

The pickers are expensive but are so mounted on a light tractor that they may be removed during the off-season and the tractor used for normal farming operations, which helps to make them more economical. The two essentials for their satisfactory use are that the crop must be



Plate VI.—A cotton picking machine at work.

clean, i.e., the ground well prepared and free of sticks and stones, which are likely to break the spindles, and the crop reasonably free of weeds, and that the cotton be handled by a modern ginnery with adequate cleaning equipment.

TRANSPORT.

Transport in the Field.

The hand picker puts his cotton in a sack which is carried to the headland. Machine picked cotton goes straight into a large box mounted on top of the machine and is likewise usually dumped at the headland in a large pile on the ground or on a tarpaulin. There it may either be baled or handled in bulk.

Transport from Farm to Ginnery.

The seed cotton is transported by road or rail to the ginnery. The approximate dimensions of an average bale are 5 feet 9 inches x 2 feet 9 inches x 2 feet 9 inches, i.e., nearly 25 cubic feet. The average weight is 450 lbs. Seed cotton cannot be compressed much more than this or some oil will be expressed, staining the lint.

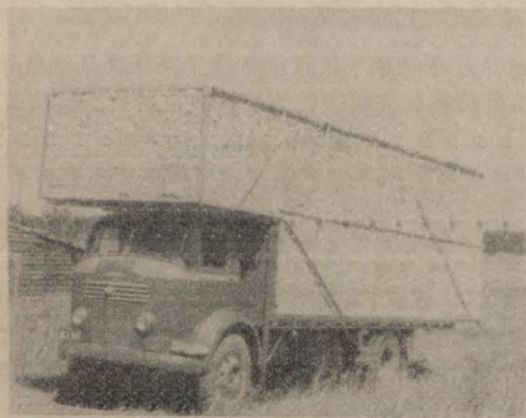


Plate VII.—A fully loaded truck, of seed cotton.
(The truck carries 10,000 lb. of seed cotton.)

Bulk handling on semi-trailers carrying up to 20,000 lb. of seed cotton is increasing. Three methods of loading are employed. The cotton may be tipped direct from the picker into the trailer but this is unsatisfactory, except where a farmer owns his own vehicle, as it may take days to pick sufficient cotton to fill it. Blowers are sometimes used to carry the cotton from the

ground to the trailer but the locks are fluffed-out in the process and several men are required to tramp it down again. This makes the process expensive. A blower which is not operated at the right speed may damage the seed and it is hard to clean cotton which has been through a blower. This method is therefore not very efficient. A third method which appears cumbersome at first sight is considered to be the best yet evolved because it keeps the cotton compressed, minimizing labour, and damages neither seed nor lint. In this method the cotton is dragged by a tractor onto the trailer in a mesh net, taking a load of 1,000 lb. at the time.

Processing.

At the official opening of the new ginnery at Glenmore, there was an opportunity to see a fully equipped modern ginnery as up-to-date as any in the world. The old ginnery at Whinstanes was also seen.

At Glenmore, Lummus machinery has been installed throughout. The three principal makers of cotton processing machinery in America are the Murray Company, the Hardwicke-Etter Company and the Lummus Company. Examination of the specifications of the machines produced by each suggested that there was little to choose between them. The Cotton Marketing Board sent their Chairman to America to see the machinery produced by these and other firms and they eventually decided on Lummus machinery, partly because it is now manufactured under licence in Britain and thus available from the sterling area, but, more particularly, because he considered it to have one or two superior features when compared with the machinery produced by competing firms.

All the major manufacturers produce 90-saw gins but the Lummus Company has recently turned out their "Super 88" with a slight modification which doubles the output compared with the old type 90-saw gin. The modification was produced as a result of examining high-speed photographs of the gins in operation. They found that the rapidly turning saws were not operating at the fullest efficiency because the seed cotton tended to collect between the saws. The modification feeds the cotton continuously directly onto the saws.



Plate VIII.—Unloading directly from the harvester to a farm truck.
(The harvester bin holds 700-800 lb. Bales of cotton in right foreground.)

[Photo I. F. Wood.]



Plate IX.—Cotton being loaded onto a semi-trailer by a portable blower.

[Photo I. F. Wood.]



Plate X.—Using a net to load a truck.

(This method of loading with a net is preferred because it does not damage the seed and uses a minimum of labour for trampling.)

[Photo I. F. Wood.]

Perhaps the most important variation in the Lummus machinery, however, is the process of cleaning the lint after it is ginned. The competing manufacturers use a mechanical process, whereas Lummus with their "Superjet" cleaning use an air blast. It is claimed that this method of cleaning damages the fibres less than mechanical methods.

The complete new installation at Glenmore cost £90,000. The old machinery was considered to be fit only for scrap after dismantling. The new installation is as modern as anything in the world, with the very best of cleaning equipment. Apart from greater output and efficiency it can clean machine picked cotton to a level at least approaching that of the best hand picked cotton, which was impossible in the old gin, and the new baling press produces denser bales, which minimizes freight. At present the ginnery can handle 32,000 lb. of seed cotton per day and its output can be doubled, if required, with relatively little modification.

The main stages in processing are as follows:—

1. The seed cotton is weighed.
2. It is then carried by conveyor tubes to a hot-air tower dryer, which removes any remaining moisture.



(These are manufactured under licence by Platt and Co. in England and will be converted to "Super-88's" with twice the output.)



Plate XII.—The automatic hydraulic baling press.

3. It passes through a series of cleaners which remove the grosser impurities, such as stones, stalks, metal fragments, etc., using mainly gravity and magnets.
4. It is fed to the saw gins, which remove the lint from the seed.
5. The seed falls by gravity onto a belt, whence it is carried to another part of the factory.
6. The fibres, now separated from the seed, are further cleaned by the "Superjet" cleaner.
7. The fibres are combed to put them in line and then delivered to a condenser, where they are made into a loose sheet.
8. The lint thus condensed goes to the press, where it is automatically tamped and compressed to a pre-determined weight. The press compresses to a density of 88 lb. per cubic foot and the size and weight of bales is automatically determined.

MARKETING.

All Australian cotton is sold through the Cotton Marketing Board.

The marketing of Papua and New Guinea cotton was discussed at the Cotton Marketing Board in Brisbane. The Board Chairman was most co-operative and is prepared to arrange the

ginning of Territory cotton, if desired, either on an experimental or commercial basis, and is also prepared to handle the marketing of ginned fibre. Arrangements can be made to have Territory seed cotton fumigated and to have the seed processed after ginning to eliminate any danger of introducing pests and diseases to Australia.

POTENTIAL IN PAPUA AND NEW GUINEA.

Both ecological and economic factors have to be considered in assessing the potential of the Territory for cotton production. Most of the Territory is too wet for commercial cotton production. However, the Papuan dry belt and the central Markham Valley may have suitable annual rainfall with satisfactory distribution. The alluvial soils of Papua, particularly at the Kemp Welch River, the Brown River and the Mekeo region, would appear to be suitable for cotton production. Of these three areas, the Brown River is the least fertile but, because of its ready accessibility, fertilizer could probably be used economically there. The better alluvial soils of the Markham Valley should also be suitable for cotton. The soils in none of the areas mentioned have much in common with typical cotton growing soils in Queensland from the viewpoint of derivation or physical characteristics. However, the analysis of the better Markham soils is not unlike that of the good cotton soil at Biloela, given earlier in this report. Perhaps the most important point with regard to the Markham Valley is the ability of cotton to tolerate rather high alkalinity, even to the extent of tolerating free lime at relatively shallow depth. Lime is often found at a depth of no more than 2 feet on brigalow soils which grow good cotton. Cotton is not, however, restricted to such soils and should do well on the less alkaline alluvials of such areas as the Mekeo.

Agricultural Problems.

Before commercial cotton growing is likely to be agronomically successful in Papua and New Guinea, certain investigations are necessary. There are data going back forty years or more from small trials and the results have been promising but further trials are necessary if a major industry is contemplated. The main trials which need to be carried out are as follows :—

(a) *Variety Trials.*

There is no information available on the relative adaptation of modern cotton varieties to the environments of the Territory. It is important in this regard that quality tests be associated with variety trials. Environment can affect the length of the staple and, even more markedly, the strength of the fibre. Staple length can be estimated adequately in the Territory but test lots would have to be sent to Australia for ginning to fully assess quality. The Territory environments have sufficient in common with those parts of Queensland and the United States to suggest that adapted varieties could be found.



Plate XIII.—A lock pulled out to show the staple length.

(b) *Spacing Trials.*

It is not unlikely that, for cotton to be hand picked, fairly wide spacings would be desirable in the Territory with the constant high temperatures and adequate rainfall during the growing season, although closer spacings would be necessary as the industry developed and machine picking was introduced.

(c) *Time of Sowing Trials.*

Trials are under way in the Markham Valley with duplicate sowings in the Mekeo, covering the leading Australian varieties planted at different times and with different spacings.

(d) *Disease and Pest Control Trials.*

In the initial trials in the Territory, full insecticide coverage is being given to pre-

vent pest damage obscuring the results. However, later experiments to determine what is the minimum necessary control in commercial crops will be essential.

It is not envisaged that insuperable agronomic difficulties will be encountered. Some variations from Australian practice are likely. The rainfall in potential cotton growing areas of the Territory is higher than in Queensland so that less effort need be made to conserve moisture. As it is also recognized here as an undesirable practice to leave the soil bare for a prolonged period, cultivation operations, although basically similar, would be compressed in time. One or two dry season ploughings would destroy weeds and grasses and this would be followed by fine working with harrows or a similar implement to prepare the seed bed.

As has already been mentioned, it is unlikely that the small amount of pest control practised in Queensland would be sufficient in the Territory where no marked cool season is experienced to reduce insect populations drastically. As cotton plants could become perennial in the Territory and could, under irrigation, be grown at any time of the year, it might be necessary to have a period of the year when all cotton had to be destroyed to minimize the build-up of pests. Unfortunately, there are alternative hosts for the majority of them. After harvesting, bushes may be cut and burned or destroyed in various ways. Plate XIV demonstrates the use of a forage harvester for bush disposal. Slashers have also been used with variable success.

The Territory planter would have a definite advantage in picking as native labour should be able to pick for not more than 2d. per lb. Mechanization would probably become necessary if the industry developed rapidly.

In Queensland it has not been found necessary to defoliate cotton crops for mechanical harvesting. However, defoliation by means of chemicals is often necessary in America and it is likely that it would be necessary here where there is no oncoming winter to check vegetative growth. Chemicals are now available which are said to defoliate quickly, thoroughly and cheaply.



Plate XIV.—A forage harvester used for bush disposal in a well-grown crop.
(The strip just in front of the tractor had already been treated with a chain slasher, which was less satisfactory.) [Photo I. F. Wood.]

Economic Problems.

The economics of cotton growing in the Territory are obscure and difficult to predict without basic information on yields and costs of pest control. One of the major problems to be faced would be that of freight, both by land to seaport and then by sea to Australia.

As already stated, a bale of seed cotton has a volume of nearly 25 cubic feet or more than half a shipping ton. At 14d. per lb., cotton is worth only around £25 a bale so that shipping freight on Territory seed cotton would be economically crippling. Seed cotton cannot be compressed appreciably more than it is in a wool bale. It would thus seem impossible for Territory-grown seed cotton to be transported to Australia for ginning unless special freight assistance were forthcoming. It is understood that cotton growers in States other than Queensland do receive Commonwealth assistance in freighting their seed cotton to Queensland ginneries.

The other problem in sea transport of seed cotton is that it can be hazardous to handle

with the possibility of heating and even spontaneous combustion if it is not thoroughly dried or if much green leaf is included.

It seems clear that a local ginnery would have to be established to minimize shipping freights. The capitalization for this ginnery is a problem. There would be very little to commend the establishment of anything other than a modern ginnery capable of turning out the best quality cotton. Even if this installation were made in stages i.e., only the minimum cleaning equipment were installed initially on the basis that all cotton would be hand picked in the early stages, capitalization would be at least £20,000 to £25,000. An adequate baling press alone costs nearly £10,000. When the factory was expanded to cope fully with machine picked cotton, the smallest practical installation would cost at least £40,000 to £50,000.

Given a central ginnery, however, there is no reason why individuals should not grow small areas of cotton for processing at the

ginners and it could have a future as a native crop provided the pest control problems are not too great. Cotton would not be a crop only for the large-scale specialist. Production from small properties would no doubt be baled for transport to the central ginners while bulk handling could be looked for on the larger properties if the industry developed. A point in favour of cotton growing, even on the small scale, is the fact that no specialized equipment is required by the individual farmer. Conventional land preparation and conventional row crop maintenance only are required.

ACKNOWLEDGEMENTS.

I wish to acknowledge with thanks the help so readily given by officers of the Queensland Department of Agriculture who arranged the tour of the cotton growing areas, especially Messrs. K. Henderson, W. Steel, I. Wood and I. Swann. These officers, particularly Mr. Wood, gave their time freely to conduct Mr. J. O. Smith of the Department of Territories, and myself over cotton growing properties and contributed much from their wide fund of knowledge of the industry. Mr. Johnson of the Cotton Marketing Board and officers at the Glenmore ginners also did everything in their power to make the visit pleasant and informative. My thanks are also due to Mr. J. Stevens, Manager of the Regional Experiment Station at Biloela, and to his staff, for an instructive day at the Station.