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N J. Thomson

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COTTON GROWING ON THE ORD RIVER

Cotton growing is nearing the commercial stages on the Ord River, with the first farm scale crops now ready to harvest on the Pilot farm, and the Kimberley Research Station.

It is already backed by some years of experimental work at K.R.S., which has provided the background for this article giving the first recommendations on cotton growing for future settlers in the Ord River Irrigation Area.

By N. J. THOMSON*

THE cotton plant has been grown by man from time immemorial for its valuable fibre which can be readily spun into thread and used to make clothing. Today, cotton is the most important natural fibre in the world and cotton growing is a vast, world-wide industry.

Australian production, concentrated in Queensland, has in the past been small, and has supplied only a small portion of Australian demand. During the last decade 95 to 97 per cent. of our raw cotton has had to be imported from overseas, mainly from the U.S.A. This represents a considerable drain on overseas balances and the Commonwealth Government is anxious to increase Australian production.

Experiments conducted at Kimberley Research Station over the last few years give rise to the expectation that the Ord River area could supply much of Australian market requirements in the near future.

The economics of cotton production on the Ord River are unknown but a preliminary lead in this direction should be obtained from the current crop of cotton being grown on the pilot farm.

Cotton belongs to the mallow family, the Malvaceae. This family includes the common ornamental hibiscus and the rosella.

A number of species of cotton are grown for their fibre, but the type most widely grown, is American upland cotton (Gossypium hirsutum). As the name implies, this type originated in America and is now cultivated in many parts of the world.

Investigations at Kimberley Research Station into the suitability of the cotton plant for farm culture on the Ord have been concentrated mainly on this cotton type.

LAND PREPARATION AND PLANTING

Initial land clearing must be of a high standard as cotton farming involves the use of expensive specialised machinery, which can be easily damaged by tree remains.

Land preparation is similar to that followed for safflower, rice and other crops grown in the area. The land has to be
A mature cotton crop on the Kimberley Research Station

ploughed, cultivated and levelled before planting.

Ploughing may be done by either disc or mouldboard, to a depth of at least six inches. Following ploughing, the land is left exposed to the elements for two or three months and is then broken down into a finer tilth by disc harrowing or cultivating with a tyne cultivator.

The land is then levelled by means of the land plane. Levelling is a most important operation and it is essential to obtain a smoothly graded surface with an even fall.

Cotton is very susceptible to waterlogging and Kimberley Research Station results show that even small depressions will adversely affect crop growth and yield.

Cotton may be planted on the flat, using border check irrigation, or on ridges, using furrow irrigation. Experience gained at Kimberley Research Station has shown that planting on ridges with furrow irrigation is the most practicable since it facilitates emergence and allows better control of irrigation. Planting machines are available that will ridge, fertilise and sow in the one operation.

Ridges should be from six to eight inches high and smoothly oval in shape. The seed is placed along the midline—the highest point of the ridge—at a depth of from \( \frac{1}{2} \) to \( \frac{1}{4} \) inches.

It is essential that high quality seed of at least 90 per cent. germinability, should be used; with such seed a planting rate of from 10 to 12 lb. per acre, is ample to give a satisfactory plant stand.

Experiments at the station have shown the plant stand can vary between one and
four plants a foot of row length, without affecting yield.

TIME OF PLANTING

Kimberley Research Station results have shown that cotton plantings must be restricted to the hot summer months, November to February.

November and early December are usually hot and dry, with little rain. It is easy to establish and maintain weed-free cotton by mechanical cultivation at this period. However, these early plantings mature at a time when there is a considerable risk of wet weather which can cause harvest losses.

January and February are the wettest months and plantings may often be difficult to establish and maintain free of weeds at this time. Such plantings mature in the very dry period from June onwards, however, and arid conditions are ideal for harvesting.

It will probably pay farmers to make staggered plantings during the wet season, reserving land clear of weed for the later plantings. This would allow a spread of operations, with more efficient use of machinery and labour. This would be an important advantage at harvesting time.

FERTILISER REQUIREMENTS

Phosphatic and nitrogenous fertilisers are needed on the Cununurra clay for vigorous cotton growth and high production. No response to potassium fertilisers on these heavy clay soils has yet been obtained (Anon 1958, 1960.)

Phosphate

Two hundredweight of superphosphate should be applied on virgin land. It is not yet known what further yearly dressings will be required, but experiments have demonstrated that superphosphate has residual effects and yearly dressings should be less than the initial dressing.

Nitrogen

Experiments at Kimberley Research Station have shown that cotton yields are substantially increased by the application of sulphate of ammonia at least up to 2 cwt. per acre. The figures in Table 1 show that in both the 1959-60 and 1960-61 seasons an extra 300 to 400 lb. of seed cotton per acre was produced by a 2 cwt. application of sulphate of ammonia. Excessive dressings should be avoided, as nitrogen fertilisers greatly stimulate vegetative growth and heavy dressings can give rise
TABLE 1
The Effect of Sulphate of Ammonia Applications on Yield of Cotton at the Kimberley Research Station.

<table>
<thead>
<tr>
<th>Season</th>
<th>Application rate ammonium sulphate cwt./acre</th>
<th>Yields of seed cotton lb./acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2,071</td>
</tr>
<tr>
<td>1959-60</td>
<td>0</td>
<td>2,254</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2,384</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2,335</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2,490</td>
</tr>
<tr>
<td>1960-61</td>
<td>0</td>
<td>2,335</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3,018</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2,284</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

The last irrigation application is made just after the first bolls start opening. With late planted crops, irrigation frequency from May onwards is usually at 10-day intervals.

HARVESTING
Cotton is picked by hand in many parts of the world. However, mechanical pickers are taking over from hand pickers in all high wage countries and Ord River cotton will undoubtedly be machine picked. This year will see the first mechanical picking of Ord River cotton, following the arrival of a picker on the Station.

Recommendations from many countries show there are several essentials for machine picking.

Cotton should not be picked while moist from rainfall or dew, but should be left until it has dried out thoroughly.

The ground should be free of sticks and stones, which can, if scooped up, severely damage a machine.

It is also important that the crop be weed free. Weed seed, particularly from grass, is very difficult to remove during ginning and the aim must be to produce a weed free crop.

It is desirable to have as little leaf as possible in the harvested sample. Defoliation often occurs naturally in Ord River cotton following the withholding of irrigation water, but if late rains are received, renewed growth with fresh leaf production will take place. Chemical defoliants, which are now available will induce quick leaf fall when sprayed on the plants.

Experiments with defoliants are only in the preliminary stages at the Station, but results are encouraging. The defoliant is usually applied when about 70 per cent of the bolls are open. Leaf fall occurs within a few days and the crop is then ready for first picking. The picking machines harvest only the cotton from open bolls, leaving green bolls unharmed. Within two to four weeks the rest of the bolls open, and it is then necessary to make a second pick.

Destruction of Plant Residues after Harvest
If cotton plants are left standing after harvesting they provide reservoirs of insect
infestation and should therefore be destroyed as soon as possible after harvesting. It is necessary to chop the plants into the smallest possible pieces before ploughing in, and different means of doing this are being investigated.

Following chopping, the land should be ripped or ploughed with a minimum of delay.

Yields and Fibre Quality
The yields at Kimberley Research Station have ranged from 1,400 to over 3,000 lb. per acre in the last three years. The average over this period has been 2,200 lb. per acre of seed cotton.

A large number of samples (over 600) from various experiments, have been appraised for commercial quality by the Queensland Department of Agriculture and Stock. Spinning tests have also been conducted by private interests on cotton from the Station. In general the quality has been good and well up to market requirements.

The best quality fibre has been obtained from late plantings. These samples have all been from hand picked cotton, however, and some lowering of grade is to be expected from machine harvested cotton.

Experiments are now being conducted to determine the best methods of obtaining high quality fibre from machine picking. A clear picture of this aspect should be available in the near future.

Varieties
It has already been mentioned that work has been mainly concentrated on varieties of American upland cotton. However, Egyptian cotton (G. barbadense), which has long fine, strong fibre, has been grown at the Station with promising results. There is only a relatively small market for this type of cotton in Australia and it poses harvesting and ginning problems, but if a demand developed it should be possible to produce Australia's needs in the Kimberleys.

The standard upland variety is Deltapine 15. This variety is one of the principal U.S. varieties and has proved adaptable, performing well in many different environments. It has proved a consistently high yielder and has good fibre quality.

Unfortunately, the present strain has little resistance to bacterial blight (discussed under Pests, Diseases and Weeds), and varieties equal or superior to Deltapine 15 in yielding ability but with greater resistance to bacterial blight are being sought.

The most promising of the new introductions are Pope and Rex, both of which have shown high yielding ability and good fibre quality.

All these varieties were bred in America for quite different conditions from those found in this environment and as soon as possible it is planned to implement a breeding programme to produce varieties more suited to our requirements.

To obtain uniformity of fibre it will be necessary to restrict the number of varieties to be grown by commercial producers and probably no more than one, or at the most two varieties, should ever be allowed to be grown commercially.

PLANT GROWTH AND DEVELOPMENT
Cotton is sown during the hot summer months and consequently emergence is rapid, occurring in from three to four days.

The plant, at this stage, has two large seedling leaves. It grows slowly for the first three weeks and is only 10 inches high, with about 12 leaves at the end of this time.

The first floral buds are noticeable by the end of four weeks. They are known as squares, because of the shape of the three large bracts which surround the bud and give it a characteristic box-like appearance.

From this stage growth and development become very rapid.

The first flowers are produced about six weeks from emergence, when the plants are about twenty inches high. The flowers are large and showy with a resemblance to hibiscus flowers. They have off-white petals at opening, which change to pink by the second day.

The fruit of the cotton plant is known as the “boll.” Like some fruit trees (such as apricots) the cotton plant produces far more buds and flowers than the number which eventually produce mature bolls. Natural shedding of squares and very
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young bolls is quite profuse, the amount depending on climatic conditions.

The fruiting pattern of cotton after first flowering may vary appreciably, depending on the variety of cotton and the conditions of growth.

In the Kimberleys the following general pattern usually occurs:

After first flowering, square, flower and boll production continues for from six to eight weeks. About 14 weeks after emergence boll formation virtually ceases and the first formed bolls crack open, exposing the "seed cotton" which, on drying, fluffs out of the boll wall or "burr." The cotton fibre known as lint arises as long extensions of the surface cells of the seed coat.

At maturity, cotton crops at Kimberley have varied from three to six feet in height.

Cotton sown early in the planting season—in November—usually grows consider-

ably larger than late cotton, sown in January and February.

The lint then has to be separated from the seed by "ginning." This takes place in a large factory known as a "ginnery."

The farmers' concern is merely to supply seed cotton.

PESTS, DISEASES AND WEEDS

Insect Pests

Cotton is a very attractive plant to insects and control of insects is everywhere a major problem in cotton growing. This is especially true in the Kimberleys, where insects, when unchecked, have occasionally caused almost complete loss of the crop.

The major insect pests are pink boll worm (Pectinophora gossypiella), corn ear worm (Heliothis punctigera and Heliothis armigera) and the rough boll worm (Earias huegeli). A number of other insect species
Spraying an experimental cotton crop to control insect pests

of usually minor importance may also become troublesome under certain conditions.

During the last few years, under experimental conditions, insects have been well controlled with DDT and Endrin sprays applied at weekly intervals. Specialised research by an Entomologist started in the 1959-60 wet season and this work is now being intensified to detail an economic control schedule for commercial producers.

Weeds

Cotton is very susceptible to weed competition during the seedling stage.

Van Rijn (1962) has detailed the important weed species found in the area and has indicated methods of control. The standard procedures of weed control on the Station in the past have involved pre-irrigating and cultivating the land before sowing, then inter-row cultivation and hand-weeding.

On new land a pre-irrigation and cultivation are very effective, but the usefulness of this technique diminishes with land carrying heavy weed seed loads.
Inter-row cultivation by means of ridging equipment and side cultivating knives, is a ready means of controlling inter-row weeds.

The main problem then is control of weeds within the rows of cotton. A form of rotary cultivator which is run directly over the rows at high speed—six to eight miles an hour—has been tried as a method of eliminating these weeds. Fair success has been obtained with this device, but in many cases it will still be found necessary to hand weed to finally remove weeds.

Selective chemicals offer a means of eliminating or reducing mechanical and hand weeding. Promising results are being obtained with Diuron (Van Rijn 1962) and the place of this chemical in weed control in cotton should be known in the near future.

A major objective should be to keep land free of weeds and not to allow weeds to seed. Where this procedure has been adopted on the Station weed infestation has been reduced to very low levels and weeds have practically ceased to be a problem. Measures to achieve this desirable state of affairs include keeping channels free of weeds, cultivation of wet season fallow land to keep it continually bare, and taking pains to remove all weeds from crops, even if they are only present to a minor degree.

PROSPECTS FOR COMMERCIAL DEVELOPMENT

The Ord River Scheme offers many advantages for the establishment of a cotton growing industry.

A large but compact area of irrigable land of high production potential, is available only 60 miles from the port of Wyndham. A ginnery could be easily sited so that the distance of cartage from the most outlying farms to the ginnery, would be no more than a few miles.

The long dry season is particularly suitable for harvesting operations.
Modern large-scale farming methods will be needed for successful commercial production of cotton on the Ord River. A helicopter was ideal for spraying this season's farm scale crops on the pilot farm and Kimberley Research Station.

Cotton seed oil cake, a by-product of oil extraction from the seed, is a valuable livestock food concentrate and could be of great value to the already established cattle industry.

Cotton's success as a crop, however, will hinge on a high level of production being maintained under commercial farming.

Successful commercial production will involve highly organised farming with forward planning, care and attention being applied to every phase of growing and harvesting of the crop.

Capital outlay and running expenses will be considerable, and to achieve satisfactory financial returns high production will have to be the keynote of Ord River cotton farming. It will be a matter of extending horticultural principles to the large scale.

Provided these conditions are met, with the guarantee of a large internal market available for cotton products, there is every reason to believe that cotton will be the major crop for the Ord River Scheme.

ACKNOWLEDGMENTS

The author wishes to thank the Queensland Department of Agriculture and Stock for grading the large number of cotton samples received from the Research Station. Great credit is also due to those who first saw the possibilities of cotton culture in this area, together with the early research workers at the Station who carried out the preliminary experiments, often under conditions of great difficulty.

REFERENCES

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