

RAINGROWN COTTON - THE DIFFERENCES CENTRAL QUEENSLAND

BRUCE PYKE

(I.C.M.S. Research, Biloela, Q.)

Introduction

The attention focused on raingrown cotton at each successive biennial cotton conference has tended to increase. This implies that the conference organizers recognize there are differences between the production and problems facing the raingrown and irrigated sectors of the industry and that these differences give the raingrown sector its own identity.

This paper looks at some of the differences between raingrown and irrigated cotton in Central Queensland, in particular: differences in basic inputs and differences between major problem areas. The important management practices and the research needs of the raingrown crop in Central Queensland are also briefly discussed.

Basic Inputs - The Differences

Some of the differences between the basic inputs of raingrown and irrigated cotton in Central Queensland are discussed below:

- 1. Fertiliser:* very few raingrown crops are fertilised except for foliar fertilisers to address occasional zinc and sulphur deficiencies. Many growers consider the addition of N and P to a raingrown crops will not give a response in most seasons because yield is usually restricted by moisture stress.
- 2. Planting Date:* successful raingrown crops in Central Queensland have been planted anytime between early September and late January. Typically the largest proportion of crops are planted from mid-November to mid- January. Compare this to the much more condensed irrigated crop planting period of mid-September to mid-November with the largest proportion planted in October.

3. *Row spacing*: most raingrown crops are planted "on the flat" in a skip-row configuration. Generally this is a single skip, but wider spaced solid plantings (e.g. 1.35 m to 1.5 m centres) are used successfully by some growers who harvest with strippers. Nearly all irrigated crops are planted into hills on 1 m centres.

4. *Varietal selection*: on the surface, the main varieties chosen for raingrown and irrigated cotton are the same i.e. DP 90, Siokra L22 and Siokra 1-4. However, because raingrown crops are often planted in December-January, early maturing varieties like Siokra S324 are also used.

5. *Weed control*: as with irrigated cotton, raingrown crops receive a combination of pre-plant, incorporated and post-plant, pre-emergent herbicides as well as inter-row cultivation and chipping. However, there is less opportunity to adequately incorporate herbicides applied at planting in raingrown cotton and cost pressures often limit the amount of chipping that is done. With weed escapes in the row more likely in raingrown cotton, wick wipers are used on appropriate weeds e.g. Sesbania. Directed, post-emergent sprays are not widely used in raingrown unless the crop has good potential and cultivation is not possible.

6. *Insect control*: an increasing number of raingrown crops are having all possible insecticide treatments applied by ground-rig to reduce both costs of application and chemical. There are more opportunities in raingrown cotton to make use of natural mortality such as beneficials and high temperatures. Pest pressure is often lower than in irrigated cotton and the period, that raingrown crops are attractive to pests for, is frequently much less. Consequently, raingrown crops generally require only 40-70% of the number of insecticide sprays as irrigated crops.

7. *Defoliation*: because most raingrown crops in Central Queensland are stripper harvested there is very little tolerance for any green leaf or weeds when harvesting occurs. Therefore, many crops require a dessicant like sprayseed to be applied just prior to stripping. For low yielding crops, this may be the only defoliation, but for higher yielding crops it may be preceded or replaced by more conventional

defoliation treatments e.g. Dropp, Prep, Harvade or salt.

8. *Harvesting*: as indicated above, raingrown crops are mostly stripper harvested in Central Queensland. Studies have shown that although strippers reduce grades and increase cartage costs, they are cheaper to run and harvest more of the lower yielding crops (i.e. < 2.5 bales/ha) than pickers. With long-term average raingrown yields of less than 2.5 bales/ha in Central Queensland, the use of strippers is a cost effective practice. Practically all irrigated crops are harvested with spindle pickers.

Production Problems - The Differences

There are a number of areas where raingrown cotton has to contend with problems which are not necessarily important for irrigated cotton. These are discussed below:

1. *Risk management*. Raingrown cotton is a riskier business than irrigated cotton. Hearn (1990) assesses that raingrown crops in Central Queensland will fail to breakeven, on average, in about 17% of years while Keefer (1990a and 1990b) uses more conservative figures to suggest that failure to breakeven could be in up to 38% of years. Consequently, raingrown cotton producers must be able to manage their crops such that they are able to survive the bad years. In doing so, there are some problem areas they must face for which we currently don't have all the answers. These include:

(i). Using a "planting rule" based on stored moisture vs opportunity cropping (i.e. no rule). Irrespective of crop, dryland farmers in Central Queensland tend to opportunity crop (i.e. if sufficient rain falls to ensure crop establishment, planting is initiated). Due to the high cost structure of raingrown cotton, however, opportunity cropping may increase the risks of failing to breakeven. Brian Hearn was asked to run some scenarios through his dryland model for the purposes of this paper. For these analyses conservative estimates were used for cotton price (\$350/bale) and growing costs (\$600/bale) which gives a breakeven yield of 1.71 bales/ha. A range of options and their combinations were compared including: no fallow vs fallow,

minimum vs conventional tillage, no "planting rule" vs a rule for planting with a full profile. The planting rule was that planting did not proceed until there was an 80cm depth of moist soil (i.e. 88 mm stored sub-soil moisture). In summary, the probabilities of failing to plant were decreased by fallowing and minimum tillage, but were increased by the application of the planting rule. For example, the lowest probability of failing to plant was 8% (1 year in 12) for fallowed, minimum tillage with no planting rule and the highest was 24% (1 year in 4) for non-fallowed, conventional tillage with a planting rule applied. The risk of failing to breakeven was decreased by fallowing, minimum tillage and use of the planting rule. For example, the lowest probability of failing to breakeven was 6% for fallowed, minimum tillage with the planting rule applied and the highest was 19% for non-fallowed, conventional tillage without a planting rule applied.

Most significantly, the probabilities of failing to breakeven increase dramatically for crops planted in the years "lost" through the application of the planting rule (i.e. those years in which planting was possible with less than a full profile). In this analysis the lowest failure rate was 43%. Obviously, a planting rule that takes into account stored moisture will reduce the risk of failure in raingrown cotton.

Growers are also becoming less willing to over-commit themselves with cotton. Cotton is seldom looked at as a single enterprise on the farm and is made to fit in with other cropping enterprises. Some growers also spread their risks with cotton by splitting their planting dates when they have received sufficient early rain to plant on by mid-November.

(ii) Compaction. Wheel-track and tillage implement compaction appears to be a significant problem in raingrown crops in Central Queensland. In cotton it is manifested by poor plant stand establishment and the inability of the crop to fully use the stored moisture. Yields and quality suffer as a consequence and the risk of crop failure to breakeven increases. Compaction also occurs under irrigated conditions, but in those instances growers have the opportunity to manage irrigations and fertiliser to account for the effects of the compaction if they know

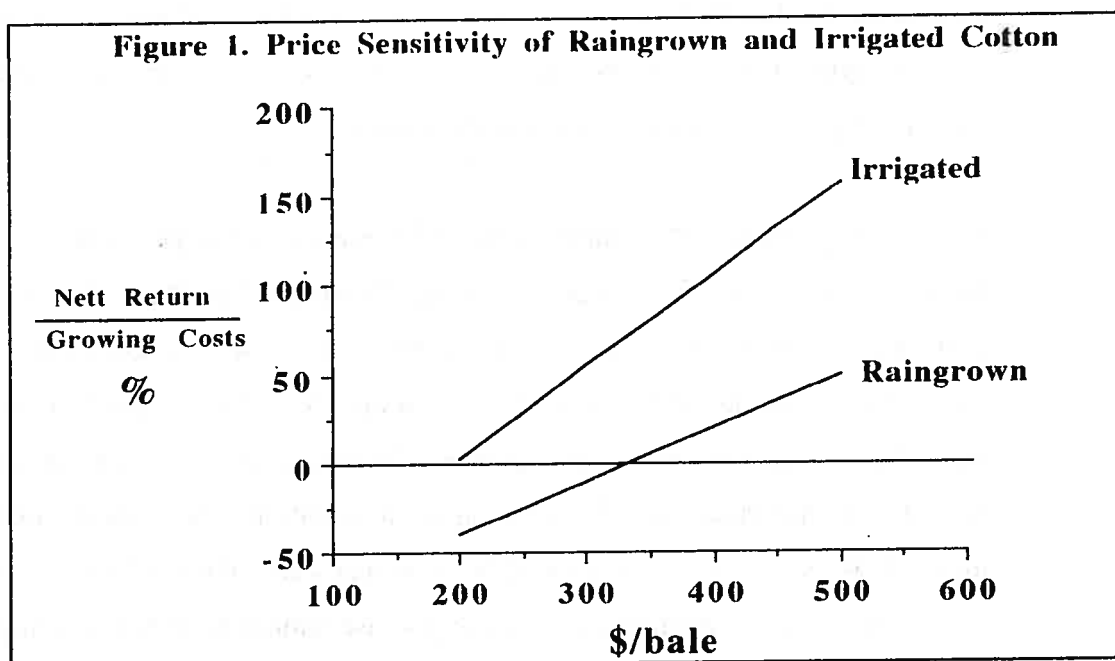
about it. Under raingrown conditions, however, there are no management options available to the grower that could reduce the effects on the crop if he finds he has a compaction problem after he has planted. If he knows before he plants at least he can decide not to plant cotton and consider either tillage or cereal crop options to address the problem. Soil pits need to become a more widely used tool for raingrown producers. Controlled traffic management of tillage and harvesting under raingrown conditions may also need to be considered as an option that could significantly reduce the incidence of compaction.

(iii) Pest management. With the exception of harvesting costs, pest control costs are the major growing cost in raingrown cotton, often exceeding 20% of total variable costs, whereas it is unusual for irrigated pest control costs to exceed this amount. Given that containing costs is one of the main options raingrown producers can use for reducing risks once the crop is planted, the minimization of pest control costs becomes an important issue. Under raingrown conditions, the natural mortality of major pests such as *Heliothis* caused by beneficials and other factors can at times be exploited. The problem with attempting to use natural mortality to compliment insecticidal control is that it does not always operate at the same level and it can be easily disrupted by the inappropriate choice of insecticides (e.g. synthetic pyrethroids and certain organo-phosphates).

(iv). Preparation for stripper harvest. Strippers are cheaper to operate than pickers and they are more cost effective in raingrown crops with a yield potential below about 4 bales/ha which accounts for most of the crops produced in Central Queensland. Reliance on strippers for harvest does carry some problems and risks of its own, in particular obtaining satisfactory defoliation/dessication for the machines to work efficiently and removal of regrowth after rain has delayed harvest.

2. *Price Sensitivity*. Cotton price falls do not affect the decision to plant the irrigated crop as much as they do for the raingrown crop. Figure 1 compares the nett return (i.e. gross margin) expressed as a percentage of the growing costs for a

range of cotton prices for irrigated and raingrown crops. For this analysis the average figures prepared by the QDPI (Daniels *et. al.* 1992) have been used for yields - irrigated 6.25 bales/ha and raingrown 1.5 bales/ha and for growing costs - irrigated \$1200/ha and raingrown \$500/ha. For raingrown cotton to have similar price sensitivity as irrigated cotton, yields would have to average 2.6 bales/ha.



Key Management Practices

1. *Moisture conservation tactics.* There are a range of moisture conservation tactics available to raingrown cotton producers. These include minimum tillage, stubble retention, soil pitting or "dyking" implements and skip-row or wider solid planting configurations. The better producers are starting to combine some of these where they are appropriate. In addition, more emphasis is now being placed on knowing what the stored moisture profile is like in each field before the decision to plant cotton is made.

2. *Pest management.* During the 1980's many of the raingrown cotton crops in Central Queensland were grown in the Bauhinia Downs area surrounded by mixed pasture and cropping land. This appears to be a fairly stable situation for pests and beneficials with *Heliothis* oviposition seldom exceeding 100% (i.e. 1 egg/terminal)

and seasonal average oviposition of around 35%. Under these circumstances natural mortality could be exploited and frequently several weeks at peak flowering could pass without spraying and without escapes (Mike Stone pers. comm.). Recently, most of the raingrown cotton in Central Queensland has been planted on the Central Highlands SE and North of Emerald. This is a much more cropping intensive area, pest pressure is higher and although the use of natural mortality is more difficult, it is still possible.

The key to managing pests in raingrown cotton in Central Queensland is to give beneficials every opportunity to colonize the crop. This means watching the use of organo-phosphates for mirids, using reduced rates of endosulfan and/or *B.t.* at appropriate times, avoiding synthetic pyrethroids if beneficials are at useful levels and rechecking close-to-threshold decisions rather than recommending a spray. The average yields of raingrown cotton are nowhere near the levels at which plant compensation cuts out (Brook and Hearn, 1992). In addition, disbudding research (Titmarsh, later in these proceedings) shows that, although moisture availability is a major yield limiting factor in raingrown cotton, significant compensation for pest damage still occurs. In other words, there is a much greater risk to the viability of raingrown cotton through adopting a hardline earliness strategy and increasing costs, than there is through a strategy that seeks to manage natural mortality and plant compensation.

3. *Soils management.* Soils have been the neglected component of raingrown production for too long and it is now becoming apparent that good soil management from a structural and probably from a nutritional point of view is essential for viable cotton production. Soil pits to inspect soil structure are becoming more widely used to determine the extent and management options for compaction problems. Raingrown producers are paying more attention to soil nutrition through soil sample analyses and through crop rotations which include grain legumes, particularly chickpeas.

Raingrown Cotton - Research Needs

There are many areas where the benefits of research, that is based on irrigated cotton, can be used directly or adapted for use in raingrown cotton. For example, there have often been calls for specialized cotton varieties for raingrown conditions, but in all cases where some of the better performing overseas raingrown varieties have been tested in Australia, they have failed by a considerable margin to outyield the current irrigated varieties. Another example of a research and extension program developed in irrigated cotton that can be adapted for raingrown conditions is SOILpak.

There are research areas where raingrown cotton does have some priorities that are unlikely to be covered by irrigated research. These are summarized below under their major discipline headings:

1. Agronomy. Nutrition of cotton soils needs to be monitored through soil tests and strip trials, in particular comparing the effectiveness of crop rotations with and without grain legumes.

The value of pitting/dyking implements needs to be evaluated for skip-row and solid planting configurations.

Plant establishment improvement through the use of water injection needs to be considered.

What are the implications of using low rates of pix to achieve a more compact bush for stripper harvest?

The improvement of current raingrown cotton crop models and their integration with other crop models would allow the performance of various strategies to be tested (e.g. crop rotations, fallowing, planting rules and opportunity cropping).

The performance of cotton herbicides under raingrown conditions needs improvement.

2. Entomology. It has already been noted that there are many occasions in Central Queensland when natural mortality can be used to reduce insecticidal inputs. This

does not always occur. Why this happens needs to be the centre of further evaluation. Studies to compare the effect of mirid control vs no mirid control on the resultant ability to use natural mortality of *Heliothis* need to be considered.

3. *Soils*. The incidence, severity and chief causes of compaction in raingrown soils need to be more comprehensively understood. Can soil pit inspections be "calibrated" to determine the level of compaction at which cotton should no longer be considered a cropping option? In addition, can controlled traffic options reduce the amount of compaction and are they practical under raingrown conditions?

4. *Plant Breeding*. The present level of raingrown production does not seem to warrant a specialist plant breeder. Many of the current commercial varieties perform well under raingrown conditions (Pyke *et. al.*, 1990) and the area planted to raingrown cotton is not being restricted by the lack of its own special varieties, but rather by seasonal conditions, cotton and other commodity prices.

5. *Extension*. In Central Queensland, most of the adaptation of research findings, and indeed some of the research has been conducted by consultants. While this has been effective, it does sometimes mean that the movement of research out to growers has been slow. Perhaps there is a need for the industry to have some extension facilitators if it is not possible for the researchers themselves to do their own extension. For example, SOILpak has been a considerable success to all those taking part in its training sessions largely due to its very good extension facilitators. Perhaps other disciplines could consider this form of extension package.

References

- Brook K. and B. Hearn (1992). Earliness, Pest Damage and Compensation. Facts to fuel the debate. *The Australian Cottongrower* 13 (2) 14-26.
- Daniels J., G. Harris and S. Huff Eds. (1992). Central Queensland Crop Management Notes. Queensland Department of primary Industries. pp 260
- Hearn A.B. (1990). Prospects for Rain-fed Cotton. In *Proc. Fifth Australian Cotton Conference* p. 135-144

- Keefer G. D. (1990a). Raingrown cotton: risks and opportunities. *The Australian Cottongrower* 11 (2) 52-59.
- Keefer G. D. (1990b). Usefulness of rainfall records in prediction long term viability of raingrown cotton. In *Proc. Fifth Australian Cotton Conference* p. 145-153
- Pyke B., P. Reid and N. Thomson (1990). Varieties - The Dryland Needs. In *Proc. Fifth Australian Cotton Conference* p. 15-22

Acknowledgements

The author would like to thank Brian Hearn (CSIRO Narrabri) for conducting the risk and probability analyses for the scenarios presented in this paper.