Australian Cotton
Cooperative Research Centre

COTTON information sheet

Sowing decisions with reduced water supply

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Under conditions of reduced water availability, research over a number of years has indicated that optimum area to irrigate is that which allows around 5 to 6 ML per ha for the irrigated crop. Dryland cotton in any remaining area is a legitimate option. Before you sow consider your nitrogen application rate, cultivar choice and sowing date to ensure that an excessively vegetative or late crop does not occur.

When water becomes the limiting resource to production, the relative importance of various management decisions begins to change. Two key questions arise:

- What area of land should be prepared for cotton? and
- What proportion of this area should be irrigated?

The answers are a function of the total water supply available for application to the crop from all sources: from the river and bore allocation, and farm storage. No single option is the best in every season, but research has indicated which option is the best when taking into account year-to year variation in weather.

How much cotton should I plant and irrigate with limited water?

The question really has two components, given that dryland production on part of the farm may be a profitable option: How much should I plant and how much of this should I irrigate? These questions are difficult and can only be properly approached using simulation models so that year-to-year variation in the amount and distribution of rainfall can be taken into account.

Generally the answer is to aim to irrigate an area that will allow 5 to 6 ML of supply per ha, (Table 1). To allow an appreciation of the risk level involved, the numbers are also presented as the known supply required which will ensure that the break-even yield is attained in 9 years out of 10. In most cases the supply which maximises the average returns is greater, and so based on the long-term weather record, the risk of failing to break-even using this supply is less than 1 in 10. Note that these figures refer to the available supply, not the expected application, and are calculated based on an irrigation efficiency of 75% (That is, 75% of the water supplied is used by the crop as evapotranspiration. and 25% accounts for storage, distribution and application losses). If your irrigation efficiency is markedly less than this, the figures will need to be adjusted accordingly.

Table 1: Water supply required on September 1 (pre establishment) and re assessed prior to first crop irrigation (Dec 1) to reduce the risk of failing to break even to less than one in ten and the supply which maximises returns per megalitre (N.B. Assumes an irrigation efficiency of 75%).

	Supply (ML/ha) on September 1 to :		Supply (ML/ha) on December 1 to:	
Region	Break-even in 9 years out of 10	Maximize returns per megalitre	Break-even in 9 years out of 10	Maximize returns per megalitre
Emerald	4.5	5	2.3	3
Darling Downs	5.0	5	3.2	3
St George	5.5	5	3.5	3
Border Rivers	5.2	6	3.2	4
Gwydir Valley	5.3	6	3.4	4
Namoi Valley	5.2	6	3.2	4
Macquarie Valley	6.3	6	4.0	4

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This supply required can be re-examined just prior to the first irrigation. At this time, the supply that needs to be on hand is less, as the water to establish the crop has already been dealt with. The long-term weather record suggests an irrigation supply of 3 to 4 ML per ha will maximise returns at this point.

The question of what total area to sow to cotton is independent of the question of how much to irrigate: dryland cotton may be a legitimate cropping option for the remaining, non-irrigated area. This depends on your location. The decision of how much dryland cotton to sow should be based simply on those factors which dictate whether dryland cotton production is viable. Key variables here are the amount of stored soil moisture and the anticipated rainfall. You may also wish to consider other cropping options with a lower variable cost structure.

Irrigation with limited water

By and large, the general practice when irrigating with limited water is to adhere to the optimised irrigation strategy for your region using the suggested level of supply. This will mean a reduction in the irrigated crop area. Watering-up is preferred to pre-irrigation, although the general management difficulties associated with watering-up need to be borne in mind. Don't risk stretching the irrigation interval beyond the target deficit. While this may pay off in some seasons, it is better to skip the last irrigation to allow maximum chance of catching rainfall or increased allocation before locking in to a reduced yield potential. With very severe shortages there may be some advantage in delaying first irrigation a little.

Pre-planting management decisions

A number of agronomic decisions will need to be made at or prior to sowing. These decisions include nitrogen application, sowing date and varietal selection. The critical requirement is to ensure that agronomic management does not result in excessive crop vigor or delay maturity too much.

When water is limiting the crop response to nitrogen is less. Further, there is the risk that excessive fertiliser will promote early growth and hence increase the rate of water consumption and also delay crop maturity. Delayed maturity may lead to the risk that crop development will cease before a good boll load has been matured. Carefully assess the correct nitrogen application rate in light of measured soil nitrogen or previous field history.

The optimum date of sowing differs between a fully irrigated crop and a dryland crop. This is partly dependent on the rainfall distribution in your area. As a general rule, as yield potential declines due to the water supply decreasing, the expected decline in yield potential with sowing date begins somewhat later (Table 2). This is because the crop is already yield-limited and so doesn't need as much season length to achieve the water-limited yield potential. Excessive delay, however, may increase the risk of quality down grades due to the risk of maturing late bolls in cool weather.

Table 2: The sowing date after which yield declines for different irrigation supply. The higher the potential yield (higher irrigation supply) the greater the growing time required to reach max potential yield for that supply.

Region	Irrigation supply per hectare		
	2 ML*	4 ML*	6 ML
Emerald	30 Nov	30 Nov	30 Nov
Darling Downs	15 Nov	30 Oct	30 Oct
St George	30 Nov	15 Nov	15 Nov
Border Rivers	30 Nov	15 Nov	30 Oct
Gwydir Valley	15 Nov	15 Nov	15 Oct
Namoi Valley	15 Nov	30 Oct	15 Oct
Macquarie Valley	15 Nov	30 Oct	30 Sep

* It should be noted that some of the supply levels are below that which might be expected to provide break-even returns

Many studies in Australia (for example recent work by W.N. Stiller, CSIRO) have shown that the cultivars which do best under limited water or dryland conditions are generally those which do best under irrigated conditions also; so choose a maturity type suited to your region. The exception to this is that okra-leafed cultivars as a group do relatively better under dryland conditions. Siokra V-16 and Sicot 80 are consistently the best performing cultivars in Australian dryland trials and also have good fibre length. If sowing is significantly delayed in the hope of receiving planting rain or further soil recharge, a shorter season cultivar than usual may need to be considered. Siokra 1-4 often performs well in these situations. Although the disease scenario changes between fully irrigated and dry situations, fusarium susceptible varieties should never be considered where any fusarium risk exists.

What about skip row?

If the decision is made to extend the irrigated area so that the irrigation supply is pushed below 5-6 ML per ha, partially irrigated skip row may become an option in some regions. The point at which skip row production becomes economic over solid planted crops is dictated by yield expectation, price per bale and the differential between the variable input costs for solid and skip row production. When growing skip, it is imperative to ensure that the lower input costs are realised. Skip row should particularly be assessed as an option if yield expectations considering the available water supply fall below 4 bales per ha. The ability of skip row to buffer against negative impacts of water stress on fibre quality should also be borne in mind.

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