

Cotton response to Flood

Thanks to Michael Bange, Greg Constable & Susan Maas for assistance with this article

After experiencing the biggest flood since Burrendong Dam was built on top of nearly 13 inches of local rainfall over the past month I thought it would be useful to have a look at industry experience from flooding at this stage in the season.

The big questions have been:

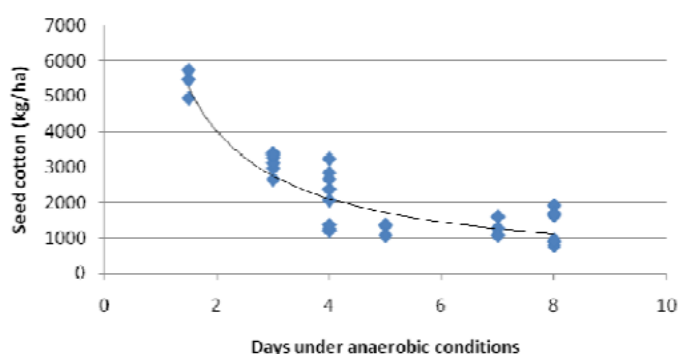
How long can cotton survive submerged under water?

What impact will the waterlogging have on yield?

How should I manage the crop from now on so that it reaches its best yield potential?

In a Namoi survey conducted in 2000, Dr Pongmanee Thongbai recorded soil oxygen in flooded fields. Below is a plot of days in zero oxygen (anaerobic) conditions during and after flooding versus hand picked yield (Seed Cotton Yield in kg/ha). Cotton in this flood was at pre flowering. This graph highlights the range of impacts that inundation can have on yield.

Seed Cotton Yield (kg/ha)



Aneorbic growing conditions will continue until some of the fine roots at the soil surface are no longer in saturated soil. Drying hills are sufficient to relieve anerobic conditions even though water remains in the furrows.

For crops that are not killed outright, the situation is the same as waterlogging. There can be reduced growth directly from lack of oxygen at roots and indirectly from lack of N due to denitrification losses. Sometimes there are negative interactions with nutrients such as Fe and P. Many crops will recover naturally. Crops need sunshine on the leaves & oxygen at the roots.

Where there have been nutritional disorders with N and Fe, foliar sprays have been used but it needs to be emphasised that the foliar spray is only trying to address a problem that has already occurred – the crop will not necessarily be as good as it would have been. A crop will

use something like 5 kg N/ha/day and 10 g Fe/ha/day, so rates of foliar sprays should consider those demands (some foliar sprays only have a few hours of nutrition).

With a lot of damage occurring at tail drain ends, management of uneven plant stages will be a particular challenge. The use of cutout rates of Pix late in the growing season may be an option to assist with evenness of maturity.

For crops coming out of water logging and no longer inundated, management of the vegetative growth is going to be an issue. Refer to Cottassist Crop Development Tool, to help with PIX decisions.



Waterlogging

Thanks to Stephen Yeates, Michael Bange & Ian Rochestor for their assistance with this article.

The major and immediate effect of waterlogging is blocking transfer of oxygen between the roots and the soil atmosphere. Plant roots may become so oxygen deficient that they cannot respire. As a consequence, root growth and absorption of nutrients is decreased leading to less overall plant growth. Water logging is accentuated by rainfall after irrigation, cloudy conditions, and inadequate land preparation. Symptoms of waterlogged cotton include a general yellowing of the crop and stunted growth. Waterlogging can increase sodium uptake which may then affect the uptake of other nutrients and the growth of the plant.

In addition to the physiological impacts of waterlogging on the crop there are also significant impacts on nutrient availability and uptake. The availability of Nitrogen (N), Iron (Fe) and Zinc (Zn) (reduced) and Manganese (Mn) (increased) are directly affected by the decline in soil oxygen, and uptake of N, K and Fe by the roots is also impaired.

Nitrogen

Denitrification of soil mineral N, may result in less N being available to crop even after water logging has ceased. Foliar N is more effective in increasing the yields of waterlogged cotton when applied one day before irrigation under hot, sunny conditions. Application to a field that is already water logged will not necessarily alleviate existing damage. Growers may be tempted to apply more N fertiliser to replace what may have been lost – leaf testing will indicate if this is necessary.

Recovery from waterlogging and fruit shedding is easier to manage on younger crops. Crops suffering from a combination of early shedding and reduced N uptake can cut-out prematurely that is the flower will reach the top of the plant with very few bolls set. Adding N in this situation can cause a second flowering & significantly delay maturity.

Phosphorus and Potassium

Waterlogging is possibly involved in premature senescence of cotton. Under waterlogged conditions, uptake of P and K by the cotton crop may be reduced, predisposing the crop to the premature senescence syndrome.

Iron

The young leaves of iron deficient plants become yellow between the veins (chlorosis). The veins usually remain green, unless the deficiency is severe and the whole leaf may eventually turn white. Although the plant may contain high concentrations of iron, most of it is unavailable for chlorophyll production and the leaves lose their green colour. Foliar application of 200 g Fe/ha with a ferrous sulphate may return foliage to its normal colour within 2-3 days.

Nutrient monitoring and application

Petiole testing is not an option during cloudy, inclement weather. However, leaf tissue testing is the better option when weather conditions improve, to identify which nutrients may be lacking. Nutrilogic can help interpret results. (<http://cottassist.cottoncrc.org.au>)

Foliar fertiliser formulations that include N, P, Fe and Zn will probably be the most helpful, but best to wait until the sun shines.

Irrigation Management

As the plant, and in particular the root system has developed during a very wet period, when the weather warms up and soils dry out, irrigation scheduling will need to be responsive to the potential smaller root system, with shorter and more regular irrigations, particularly during periods of heat. Use of probes for scheduling as well as responding to signs of stress in the plant is needed.

Vegetative Growth Management

Due to the indeterminate nature of the cotton plant the vegetative and reproductive growth occur in parallel and it is important to keep the reproductive and vegetative growth in balance. Crops that are too tall and rank are difficult to manage and pick and will not yield at potential, however short determinate crops may be limited in yield potential and can struggle to compensate if fruit loss occurs during future cloudy periods.

It is important to closely monitoring vegetative growth rate (VGR), fruit retention & boll size. If excessive vegetative growth is detected, the use of mepiquat choride (PIX®) should be considered. Growth regulator applications combined with moisture stress can result in yield reductions. Multiple small doses of Pix are often better in these situations.



Flooded plants tail drain vs head ditch

Cotton CRC researchers will be in the Macquarie on the 10th or 11th January to inspect flood affected cotton and discuss management options for the rest of the season for surviving crops. I will circulate more information once dates and venues are confirmed. If you have any specific questions or photos of affected cotton please send them through to me. I can pass on to the researchers so they can prepare some information for us before they come down.