Flood effects

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Responding to late season flooding

Flooding across many cotton growing valleys has had a significant impact on cotton growth. With the flooding coming at such a late stage in cotton development we discuss likely impacts and management options available for growers and consultants.

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Flooding affected many cotton fields in 2012

During the last week of January and first week of February 2012, significant flooding occurred across broad areas of southern Queensland and north-western NSW. The primary difference between this flood event and the 2010 floods is that this flood is later in the season when cotton is very advanced.

With many areas recording rainfalls in excess of 250mm, the Warrego, Paroo, Bulloo and Nebine catchments in Southern Queensland and the Namoi and Gwydir River catchments in NSW bore the brunt of this prolonged rainfall event. Compounding the flooding was rainfall received in November 2011, elevating totals in many areas over 700mm for the four-month period. The result of this high rainfall was major flooding in many of the valleys. Some rivers exceeded historical flood records at many locations. By mid-February, many down-stream areas are yet to be affected although it is anticipated that a number of areas will become flood affected in coming days or weeks.

Research into the waterlogging effects on cotton late in crop growth has shown that only small impacts on yield may result if crops have established their boll loads.

Most of the affected crops were in the advanced flowering or approaching cut-out stage.

Under these conditions, options for establishing new growth will be limited.

Management should focus on nursing the surviving crop back to a point where it can support fruit retained on the crop which can have time to

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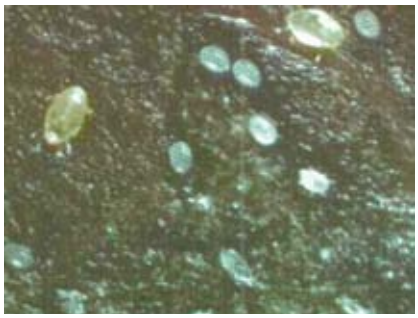
mature for the end of the season.

A range of responses to this event may have eventuated from complete crop failure to reductions in growth and yield. The effect depends on the severity (depth, water quality, flow) and length of inundation. Coupled with waterlogged soils, cloudy weather (low light) also causes further impacts on crops. Under these conditions, cotton plants are likely to cease growth (e.g. production of new nodes), and then shed squares and fruit as assimilate in the plant becomes limited.

In many instances, crops have reached the point (or it is rapidly approaching) when the last effective square that results in the last effective flower has occurred. While new squares can be produced, the risk of these not contributing to final yield is considerable. The time for a new square to produce a flower is on average 23 days while it takes 63 days for a boll on average to develop into a harvestable boll. As the season progresses these times (for nodes, squares and flowers to develop) increase as temperature and light decrease. Growers and consultants can determine squares and fruit that are likely to mature using the "Last Effective Flower Tool" in "CottASSIST". This resource is available online at http://cottassist.cottoncrc.org.au



ABOVE LEFT: Cotton is more adversely affected by flooding at the tail drain end of fields due to more severe waterlogging.
ABOVE RIGHT: Damage from Broad mites, Polyphagotarsonemus latus has been observed in several regions during 2012 and may be prevalent on late maturing flood affected crops. Photo courtesy D. Astridge QDEEDI

Experienced growers and consultants of Bollgard® II crops are well versed in the high retention rates of these crops and expect some shedding of fruit later in the season as fruit loads exceed the capacity of the plant to support all the fruit that is set. In some instances, shedding on high retention crops may have been accelerated by the flooding, resulting in similar fruit loads to what would have otherwise occurred.

The most important action for growers and consultants is to determine the remaining boll numbers on their crops, assess whether crops have cut out or are on their way to cut out using nodes above white flower (NAWF), and monitor and manage regrowth. Resources should be tailored to meet the crops' demands. To manage regrowth, use of mepiquat choride (PIX®) should be considered.

Post-flood affected cotton will commonly show deficiencies of nitrogen and sulfur. Recovery of cotton from nutritional problems may be slow where the plants root system is impaired due to waterlogging. Photo courtesy Duncan Weir.

NUTRITIONAL CONSIDERATIONS

For crops to again access soil water and nutrition, surface roots will need to once again come into contact with oxygen once fields dry out. When this has occurred, the use of leaf testing may provide some guidance as to the plants nutritional requirements. Foliar applications of nitrogen, phosphorus, iron zinc, and boron may alleviate immediate deficiency symptoms and help nurse plants along. Irrigation schedules may also need to be shortened to avoid stress as overall root function maybe impaired. Chapter 3 of NutriPAK contains specific information relating to the application of nitrogen and foliar fertilisers, although information concerning nutrient requirements for late season flood affected crops is limited.

MANAGING PESTS

Avoid overfertilising. This may induce unnecessary regrowth making defoliation more difficult, delaying overall maturity and picking, and could lead to further pest and disease issues later in the season;

Recovering crops can have delayed maturity and may also inherit pest problems from nearby fields that mature earlier. Be vigilant in sampling recovering crops so that emerging pest issues especially secondary pests such as aphids, mites and silver leaf whitefly are detected early and can be monitored and managed if required. Refer to the document

"Strategies to Manage Sucking Pests in Cotton in a Wet Season". http://www.cottoncrc.org.au/industry/Publications/Pests_and_Beneficials/Aphids__Bunchytop

Also be aware that broad mite has been detected in several cotton regions this year – information on this pest can be found in the Pests and Beneficials in Australian Cotton Landscapes Guide (p34) and recent Cotton Tales at http://www.cottoncrc.org.au/industry/Tools/Symptoms_Identification_Tool/Cotton_Symptoms/Broad_Mite

As many crops prior to the flooding event had high retention, some caution on responding to shedding needs consideration. Only consider PIX when crops are recovered fully, as the use of this growth regulator may add additional stress, or have no effect. Multiple small doses maybe better than a single large dose. Healthy regrowth is an indicator that a crop is again accessing soil water and nutrition.

While the floods and rainfall that have inundated crops in February are different to flooding that has occurred in other regions in recent years, some of the information gained from these events may be of help in managing the current situation.

A series of case studies on flooded cotton recovery in central Queensland 2011 undertaken by Jamie Iker of Spackman Iker Ag Consulting in Emerald is available at http://www.cottoncrc.org.au/Industry/Tools/Cotton_Seasonal_Prompter/Wet_Season and provides some useful information for growers and consultants about the effects of flooding and cottons capacity to compensate when season length allows time for new fruit to be produced in time for harvest.

COME CLEAN – GO CLEAN

The wet and humid conditions prevalent in crops following inundation may lead to an increased incidence of boll rots.

Abnormal shedding of late squares and young bolls is a common response to the stresses of waterlogging or continued cloudy, wet weather and thereby reduce yield.

To minimise the probability that pathogens such as Phytopthora nicotianae, Sclerotinia sclerotorium or Fusarium spp. which cause boll rots are present in flood affected fields, growers should ensure that they carefully manage regrowth. Growers and consultants are reminded though, that plants have been severely stressed and the addition of PIX is a further stress on the plant.

Growers should also enforce a strict "come clean go clean" policy for their farms. Flood waters are an ideal transport mechanism for fungal spores and it is easy to transfer spores deposited from flood waters to other fields and other farms. Also with the rainfall received, mud is readily transferred from one property/field to another and acts directly as an additional transfer mechanism. Information relating to boll rots and farm hygiene is available in the integrated disease management guidelines see the Cotton CRC website. All documents referred to in this article can be easily accessed on http://www.cottoncrc.org.au/Industry/Tools/Cotton_Seasonal_Prompter/Wet_Season

IMPLICATIONS FOR WEED MANAGEMENT

1] Flood waters may also bring an increased weed burden onto fields and may introduce new weeds. Growers should closely monitor any developing weed problems keeping in mind that flood affected crops may initially be relatively uncompetitive, especially if they have been partially defoliated. Portions of fields where cotton has died due to inundation and water-logging maybe particularly susceptible to weed incursions. This lack of competition, together with ideal conditions for weeds can lead to a rapid explosion of weeds. Of most concern, would be the introduction of glyphosate tolerant or resistant weeds, such as resistant awnless barnyard grass or feathertop Rhodes grass. These weeds will become major headaches in later years if they are allowed to set seed this autumn

Growers should consider the following implications for flooded fields.

2] A large flush of weeds is likely following flooding, and while these

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weeds may not adversely impact yield, they can still:

a. Harbour a range of pests and diseases,
b. Set a mass of seeds which may cause problems over following seasons,
c. Cause difficulties with picking. Infestations of sesbania, noogoora burrs, thornapples and vines, for example, can be a real headache at picking, and
d. Contaminate lint.

3] Even where fields have not been flooded, growers may find that prolonged wet conditions have accelerated weed growth and it may be necessary to invest additional weed management measures over the next few weeks. Nutgrass, for example, can spread rapidly in wet conditions and in the next few months small infestations have the potential to explode.

Growers in the northern areas should be particularly vigilant for infestations of sesbania and bellvine. Heavy infestations may only become apparent after they push through the cotton canopy and are already relatively large plants and difficult to control.

Where possible, growers should aim to control emerging weeds before canopy closure, as it will be difficult to achieve good spray coverage later in the season. High-clearance sprayers with shields can be valuable for applications following canopy closure, with Roundup Ready® Herbicide applications permitted to varieties with Roundup Ready Flex® technology up to 22 nodes of crop growth.

IMPACTS OF WATERLOGGING ON COTTON GROWTH

Inundation and waterlogging have a number of impacts on cotton plants and soils. One of the most immediate is the adverse effect on soil oxygen content. Waterlogging of soils displaces oxygen held in soil aggregates thus halting the exchange of oxygen to cotton roots. Oxygen exchange in roots drives respiration in plants which provides free energy used for the maintenance and development of the plant. Oxygen is the ultimate electron acceptor in the electron transport train, when oxygen is unavailable oxidative respiration stops and plant respiration becomes limited to glycolytic and fermentative metabolism which provides only 4% of the energy that the complete oxidation process provides. In addition to the physiological aspects of plant growth, waterlogging may also have a significant impact on nutrient availability and uptake. Access to nutrients such as nitrogen, iron and zinc become limited due to reduced oxygen availability. Additionally, some bacteria present in soils that usually utilize oxygen as the electron acceptor during respiration are able substitute nitrate nitrogen for oxygen. This results in the loss of nitrogen from anaerobic soils (denitrification) in the form of nitrogen gas (N2). Recovery of flood affected plants is complex.

The full effects of waterlogging are described in chapter 12 of NutriPAK which can be found on the Cotton CRC's website at http://www.cottoncrc.org.au/industry/Publications/Agronomy_Nutrition/NutriPAK and Chapter 3.3 of WaterPAK which is available at http://www.cottoncrc.org.au/Industry/Tools/Cotton_Seasonal_Prompter/Wet_Season ■

Weeds will rapidly invade areas where cotton has been partially defoliated or killed, such as this field where 2 flooding events have killed most plants in the tail-ditch end.