

Preparing for harvest to preserve fibre quality

By Michael Bange, Greg Constable, Stuart Gordon, Robert Long, Geoff Naylor and Rene van der Sluijs*

This article is part of a series adapted from FIBREpak to raise awareness of issues that affect fibre quality. In this article we summarise important information that relates to preparing the crop for harvest. Key management considerations to optimise quality following the first open boll are:

- Appropriate irrigation management for finishing the crop and avoiding regrowth.
- Managing aphid and whitefly infestations to avoid sticky cotton.
- Accurately determining crop maturity.
- Ensuring timeliness of harvest operations to avoid wet weather.
- Effective application of harvest aids.

A perfect system to attain the highest quality cotton would be to have a field with 70–80 per cent open bolls, generated from uniform flowering and boll retention resulting in an abrupt cutout that had ample water and nutrition to meet only those requirements of the fruit present at cutout. Leaves would have matured naturally and allowed for easy defoliation at an appropriate time when temperatures were warm. The crop would be ready to harvest when the chances of rainfall were small.

Irrigation management for finishing the crop

Crop management to synchronise crop maturity dates and harvesting operations with climate and weather is one aspect of timeliness. Excess nitrogen rates or events which cause late regrowth (such as excess soil moisture at harvest) can interfere with

defoliation practices and picking. Therefore fibre quality can be reduced as lint can be stained by the soft regrowth and additional moisture can be added to modules which promote rot and increase the risk of module fires.

Substantial amounts of leaf trash increases the need for additional lint cleaning in the gin that can further damage the fibre. Delayed growth may also mean that fibre development may also occur in cooler weather (reducing fibre maturity/lowering micronaire).

Unnecessary and late season growth also supports late season insects which can damage yield and quality by feeding on developing bolls (*Helicoverpa*) and secreting honeydew that can cause stickiness (whitefly and aphids). In wet or humid weather leafy crops may also contribute to boll rot.

The timing of last irrigation is a balance between ensuring that:

- (1) There is enough moisture to allow the growth and maturity of harvestable bolls; and,
- (2) That fields are dry enough to assist defoliation, limit regrowth, and minimise picking delays and soil compaction.

The broad aim is to have soil moisture at normal refill points by defoliation.

Determining crop maturity

Sampling to assist in the determination of crop maturity needs to be conducted on plants that are representative of the crop. Methods include:

- **Per cent bolls open** – Crops can be safely defoliated after 60–65 per cent of the bolls are open. This is a useful method to track how quickly a crop is approaching maturity. This method is simple and works well in crops with non-uniform distribution of fruit.
- **NACB (Nodes above cracked boll)** – In most situations four NACB equates to the time when the crop has 60 per cent bolls open. This is a useful methodology on crops that are uniform in growth, and is less time consuming than per cent open bolls; therefore a greater sample size can be taken.
- **Boll cutting** – An easy and effective method to determine if the youngest harvestable bolls are mature or immature.

Consider only monitoring bolls that will be harvested and use a range of approaches especially if the crop has non-uniform maturity.

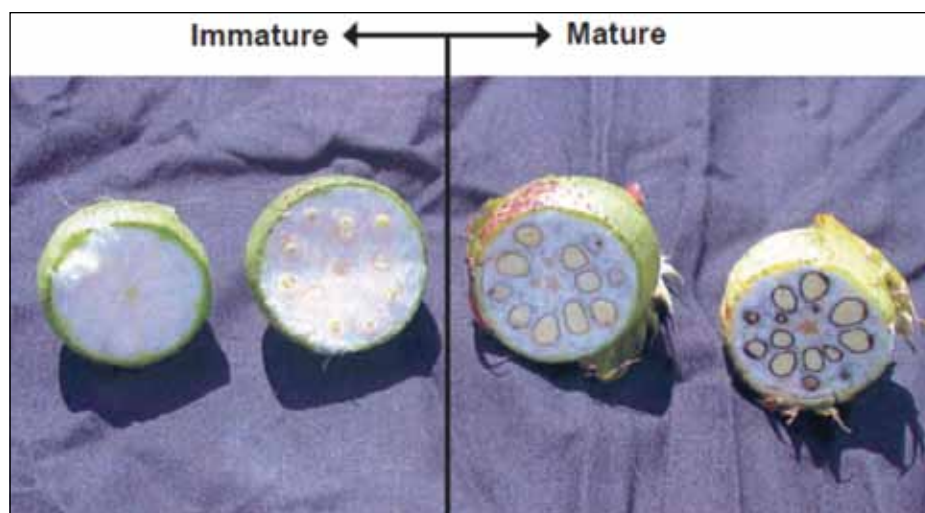
Managing aphid and whitefly infestations to avoid sticky cotton

Sticky cotton is a major concern for spinning mills. Plant sugars in immature fibres, contaminants from crushed seed and seed coat fragments, grease, oil and pesticide residues are all potential sources of stickiness. A significant proportion of all cases of stickiness are attributable to honeydew exudates of the silverleaf whitefly (*Bemisia tabaci* B-biotype) (SLW) and the

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Excess nutrition to the crop requirements can lead to problems with defoliation and regrowth resulting in excess trash at harvest. (PHOTO: CSIRO)



Bolls that are mature have seed coats that are turning brown. (PHOTO: Cotton Seed Distributors)

cotton aphid (*Aphis gossypii*). The sugar exudates from these insects can lead to a build-up of residues on textile machinery which results in irregularities and stop-pages in sliver and yarn production. A reputation for stickiness has a negative impact on sales, exports and price for cotton from regions suspected of having stickiness.

Presence of honeydew on the surface of cotton late in the season can also contribute to reductions in grade as it provides a substrate for sooty moulds and other fungal growth. Honeydew on cotton can also retain plant debris, sand and dirt whipped up by wind and rain. The level of contamination by honeydew is directly dependant on the numbers and species of insects present. Control of these pests is especially important once bolls start to open. Consider:

- Use of varieties less favourable for insect colonisation such as those with tall open canopies and okra leaf.
- Adopting sound IPM strategies to avoid the risk of generating or exceeding aphid or SLW problems. Sample pests and manage according to recommended strategies (see Cotton Pest Management Guide).
- Avoiding late maturing crops or regrowth as these will be 'sinks' for adult aphids and SLW which are migrating from crops defoliated earlier.
- Practicing good weed control during and after the crop cycle to remove potential host plants.
- Growing cotton away from other crops that are potential alternate hosts to whitefly and aphids.
- Good defoliation and timely harvest practices as crops may retain vegetable debris, sand and dirt lifted by wind. Late harvests allow these impurities to accumulate causing increased processing problems.

Timeliness of harvest operation

Cotton that is severely damaged from weather is also undesirable in textile production because the lint surface has deteriorated and this is perceived to reduce dye uptake. It also can increase the roughness of the fibre which alters its frictional properties and thus how the fibre performs in the spinning mill.

As cotton weathers it becomes grey due to moisture from both humidity and rain, exposure to ultraviolet radiation and from fungi and microbes that grow on the lint or wash off the leaves. Damage to the fibre will reduce micronaire and fibre strength



Silver leaf whitefly honeydew can be a substrate for fungal growth such as sooty moulds. (PHOTO: Michael Bange, CSIRO)

making fibres susceptible to breakage during the ginning process, increasing short fibre content leading to inefficient yarn production.

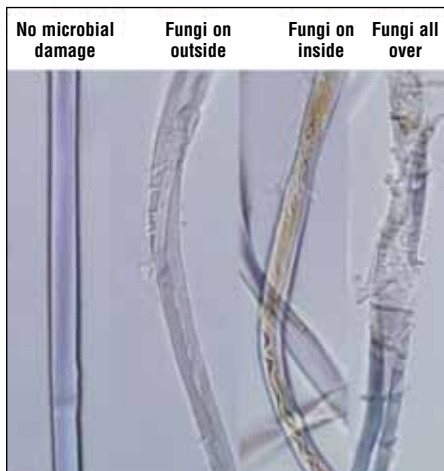
Under very humid conditions fungi can multiply on the lint causing 'hard' or 'grey locked' bolls which can reduce both quality and yield. If bolls are opened prematurely by frost they may have a yellow colour and also may have gossypol stain.

Growers should examine their harvest capacity, regional weather patterns, and have monitored their crop development to avoid excessive weathering. Specific considerations include:

- Time harvest to avoid excessive rainfall once bolls are open. See regional summaries for rainfall frequencies in harvest months in FIBREpak.
- Plan to have the crop defoliated before first frost. The last effective flower tool on the Cotton CRC CottASSIST website can be used to identify the risk of frost for your locality.

Effective application of harvest aids

The term harvest aid will be used here to include defoliants, conditioners, dessiccants, boll openers, and so on. Harvest-



Photos of fungi affecting the quality of fibre.

(PHOTO: Stephen Allen, Cotton Seed Distributors)

aids prepare the crop for a timely and efficient harvest. Defoliation induces leaf abscission allowing the leaf to fall off. Harvest aids allow timely and efficient harvest of the lint to reduce quality losses from weathering and leaf stain from excess leaf trash.

Defoliation can assist in reducing moisture in seed cotton needed for harvest and can reduce boll rot. Boll opening is also accelerated by defoliation as removal of leaves exposes bolls to more direct sunlight, promoting increased temperatures for maturation and opening boll walls.

Application of harvest aids should consider timing, the type of chemical used, and rates. The effectiveness of harvest aids is dependant on uniformity of plant growth, weather conditions, spray coverage, and adsorption of the chemical by the plant.

Optimum timing of harvest aids must strike a balance between further boll development and potential losses from adverse weather and the inclusion of immature fibre which can lower micronaire and increase neps. Avoiding regrowth resulting from residual nitrogen and moisture in the soil will also contribute to harvest aid effectiveness, as regrowth is more difficult to defoliate. Key points to consider for harvest aid management:

Timing

- Ensure defoliation practices occur before the onset of frost. Frost can cause damage to the abscission zone making defoliants ineffective.
- Aim to have soil moisture at refill points at defoliation. Severely water stressed crops will not allow defoliants to act effectively.
- If boll openers are applied prior to boll maturation they may cause young bolls to shed and potentially reduce yield and quality.
- Avoid application of harvest aids when there is a risk of rainfall shortly after. Some defoliants are taken up slowly by the leaves and will wash off by rain, resulting in incomplete defoliation.
- To avoid regrowth it is prudent not to defoliate an area larger than can confidently be harvested within two to three weeks.

Rate and chemical selection

- Older leaves are easier to remove than younger leaves. Higher rates of defoliant will be needed for young healthy leaves.
- Cool temperatures, low humidity and water stress prior to defoliant applica-

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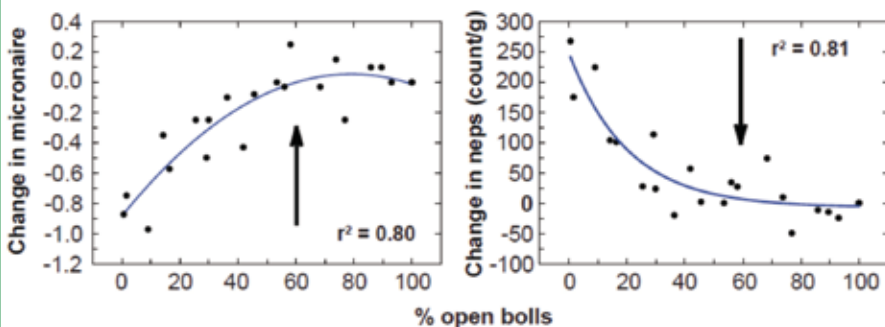
tion can increase the waxiness and thickness of the leaf cuticle reducing the efficiency of chemical uptake. Wetting agents or spray adjuvants can assist with this problem.

- Because leaf drop requires production of enzymes, the speed with which a leaf falls off is highly dependant on temperature. There are different optimal temperatures for harvest aid performance. Hormonal defoliant and boll openers have a higher minimum temperature of around 18°C compared with herbicide defoliant that have minimum temperatures ranging from 13 to 16°C. Higher rates are often needed to offset the effects of low temperatures.

Application

- Low humidity during application decreases uptake because chemicals dry rapidly on the leaf.
- For penetration of harvest aids lower into the canopy consider using larger droplet size or directed sprays in the case of ground rig use.
- Using combinations of harvest aids with different modes of action and multiple applications can enhance defoliation.

FIGURE 1: Impact of time of defoliation on micronaire and neps



Defoliation before 60 per cent bolls open lowers micronaire (reduced fibre maturity) and increases neps

Multiple applications are beneficial because leaves deep in the canopy can be covered fully.

- If increased waxiness of the leaves is suspected, applying the harvest aid in warmer conditions can assist chemical penetration as the waxy layer is more pliable.

CONCLUSION

For more detailed information on these topics refer to the 'Integrated Pest Management Guidelines', the 'Cotton Pest Management Guide' and FIBREpak.

FIBREpak contains information for managing fibre quality at every step, from pre-planting to processing. The aim is to provide all those

involved in producing and delivering fibre with: Knowledge of what aspects of fibre quality they can influence; options for managing those aspects; and an understanding of the needs and constraints of the other participants in the fibre supply chain. FIBREpak can be ordered online at the Cotton CRC's website www.cottoncrc.org.au/content/Industry/Publications/Fibre_Quality/FIBREpak/

***CSIRO Plant Industry (Narrabri) and CSIRO Materials Science and Engineering (Geelong) Cotton Catchment Communities Cooperative Research Centre, Narrabri.**



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