

Germinating ideas

By CSD Extension and Development Team

This edition of Germinating Ideas will focus on developments in weed management systems for cotton production and the importance of using herbicides wisely to sustain the advantages of these systems into the future.

New era of weed control

Growing cotton has changed in many ways over the years, not least of all with the advancements in weed control practices.

It is worthwhile reflecting on weed control challenges of days past. To think that it is less than a decade ago since:

- Heavy nutgrass infestations were taking cotton fields out of production;
- Burrs and numerous other broadleaf weeds were impacting yields, contaminating cotton and increasing production costs;
- Crop replants due to residual herbicide damage or heavy early weed burdens were common;
- Cultivation set up and operation was a slow, time-consuming process and often resulted in significant root pruning if not more serious mechanical damage; and,
- Organising chipping and spot spraying crews was a full time job.

Few growers would like to wind back the clock when it comes to controlling weeds in cotton (see photo), something most obvious when growing alternative crops or considering the potential impacts of herbicide resistance.

Technology has led the way

Developments in biotechnology, global positioning satellite (GPS) technology, selective chemistry, spraying technology and machinery have all played a role in transforming weed control in modern cotton production systems.

Glyphosate tolerant varieties have led the way in tackling some of the more challenging weed management issues. Roundup Ready technology came on the



Cotton seedlings emerging amongst a heavy nutgrass and Noogoora burr infestation in a cotton field near Gunnedah (late November, 2001).

scene in 2000–01, not that long ago. By 2008–09 almost 90 per cent of the Australian cotton crop was planted to glyphosate tolerant varieties, with Roundup Ready Flex cotton varieties making three quarters of this and providing much wider flexibility in application timing.

Selective herbicides have provided additional tools for controlling weeds in cotton, particularly the broadleaf herbicides for band spraying over the row. Experience with Liberty herbicide, (glufosinate-ammonium), over the past couple of seasons has also demonstrated the value of this alternative herbicide group. In 2009–10, the first Bollgard II variety to be stacked with Liberty Link technology will be released.

Global positioning satellite (GPS) technologies have greatly improved the precision of tillage and row spraying op-

erations, virtually eliminating guess row and overspray issues. GPS mapping has assisted agronomists in focussing on problem weeds within sections of fields and better assessing the impacts of these weeds through yield mapping.

With advances in spraying technology, growers now have the capacity to cover larger areas of crop quickly and efficiently. High clearance, self propelled spray rigs can now spray crops of varying crop heights, row widths and application conditions. Shielded spray equipment has allowed non-selective herbicides to be used in susceptible crops.

Optical weed sensing spraying systems can now target only the weeds, not the bare ground, and provide considerable cost savings in herbicides. While mainly being ...50▷

used for fallow spraying, this technology also has a fit in row cropping situations for which it was originally developed and may become an invaluable tool for managing resistance.

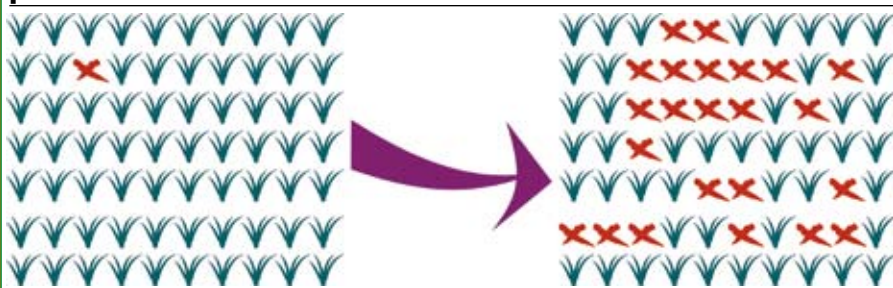
Emerging challenges as weeds adapt

Growers should not throw away their cultivators, shielded spray equipment and alternate herbicide chemistry just yet. While technology has generally made growing cotton a lot easier, weeds have proven their ability to adapt to modern farming systems.

Most farms have a range of tougher to control weeds and often the more problematic species are those naturally tolerant to herbicides including glyphosate. Cropping systems which rely mainly on herbicides for weed control are likely to see field populations of weed species such as sow thistle and fleabane increase, often referred to as 'species shift'.

Herbicide resistant weeds have an inherited ability to survive and reproduce after the application of a rate of herbicide that would normally control that species. Given the increasing popularity of Roundup Ready/Flex technology and minimum tillage practices in the cotton industry, the risk of glyphosate resistant weeds being found in cotton fields in the future should be highlighted. The third case of glyphosate resistance reported in summer fallows in northern NSW, while not in cotton, does send a clear message for growers not

FIGURE 1: Selecting for herbicide resistance (denoted by the cross) allowing a naturally resistant weed to set seed and proliferate



Source: The NHR Reporter, Oct 2006.

to be over-reliant on glyphosate for weed control in their cropping system.

Many growers continue to rate the control of Roundup Ready cotton volunteers as a weed management issue and more problematic when there are more back-to-back fields. There is an increasing range of registered options for controlling volunteers. In many respects, herbicide tolerant weeds and volunteer cotton issues have become the 'IWM enforcers' in that tactics other than glyphosate applications are required for their management.

Keeping the pressure on Fleabane

Flaxleaf fleabane (*Conyza bonariensis*) has become one of the persistent and difficult to control weeds throughout cotton growing regions. Fleabane is problematic due to its ability to emerge year round, tolerance to water stress, prolific seed production with no dormancy requirements, and relative tolerance to glyphosate herbicides.

Fleabane has proven most difficult in

those situations where soil disturbance is infrequent and there is a high reliance on glyphosate sprays. Fleabane infestations on irrigation farms were initially more obvious in non-crop areas such as irrigation channels and fence lines. Fleabane is also emerging as a wider problem in both fallows and cotton crops.

From a management perspective, fleabane is not a major weed on all farms. This relates partly to farm hygiene and early response to contain. Like other problem weeds, the key to getting on top of fleabane comes from attacking all parts of the weed lifecycle and keeping the pressure on reducing seed set. Tactics used to control fleabane are often beneficial in managing other weeds including Roundup Ready/Flex volunteers.

As is the case with many weeds, fleabane control is best achieved on young plants, when planned as part of a crop rotation, and where a range of herbicide modes of action and tillage are used as appropriate. Some control options include:

- The double knock technique using the application of glyphosate and/or phenoxy herbicide followed seven to 14 days later by paraquat/diquat;
- Liberty herbicide also appears to have activity on both fleabane and volunteers;
- Return to using residual herbicides in winter fallows;
- Optical sensor sprayers applying high rates of alternate chemistry can be a very economic clean up spray option, particularly in preventing seed set; and,
- Strategic tillage after a large weed flush can be used in fallow or in-crop to combat weed escapes and provide further diversity in weed control.

Resistance prevention better than cure

Glyphosate resistance is caused by an over-reliance on glyphosate to control weeds. The repeated use of any herbicide



Technology now provides cotton growers with many more options for controlling weeds.

TABLE 1: Management options influencing the risk of developing herbicide resistance

Management option	Lower risk	Higher risk
Cropping system	Varied rotation	Crop monoculture
Cultivation system	Tillage controlling primary flush and/or weed escapes	Continuous zero tillage
Weed control strategy	Using integrated weed management principles	Relying on herbicides only
Spray regime	Many modes of action for each target weed	Single mode of action
Herbicide control in previous years	100% control with no seed set	Few survivors setting seed
Weed numbers	Low	High
Monitoring of control level	Regular	Rarely

Source: "Stopping herbicide resistance", Queensland DPI.

exposes weed populations to selection pressure, allowing resistant plants to survive and increase (Figure 1).

Weed scientists regularly appeal to Australian farmers not to ignore the importance of using an integrated weed management (IWM) strategy. The reality is that many farmers do not practice IWM because of added short-term costs. These may be the direct costs of using alternative herbicides and cultivation, or indirect costs such as restricted opportunity cropping and soil compaction.

The development of glyphosate resistance can be a more costly proposition as growers may be:

- Forced to use different control methods and other herbicides of which there may be fewer options, they may be more expensive and less effective;

- More restricted in their ability to grow certain crops and to double-crop;
- More reliant again on tillage; and,
- Dealing with the problem for many years, until all resistant weeds seeds are gone from the soil seed bank.

Further information can be found on industry websites such as www.grdc.com.au and www.dpi.qld.gov.au.

Evaluating your resistance risk

Preventing weed resistance from occurring in the first place is the best cure. This is the ultimate goal of Crop Management Plans for stewarding herbicide tolerant technologies.

Growers should be able to use Roundup Ready systems as the foundation of in-crop weed control as long as they build in sufficient diversity into their weed control strategies. How well this is happening re-

ally comes down to a farm-by-farm, field-by-field assessment.

Taking the time to consider the main weed management options currently being used in the cropping system can help in assessing the risk of developing herbicide resistance (Table 1). Maintaining good field records and monitoring the effectiveness of weed control further aids this process.

A more detailed assessment would examine the cropping program for specific fields. Consider the frequency of glyphosate applications to control weeds in fallow, and in-crop, particularly if mainly growing glyphosate tolerant cotton varieties. Assess how often alternative herbicides with different modes of action are used in fallow or in-crop, including crop rotations.

The use of tillage mainly for end of season pupae busting or pre-season bed preparation will not have the same effect on resistance management as a strategic cultivation to control a primary flush of weeds or stop weed escapes setting seed. Where the increased use of minimum tillage practices or Roundup Ready Flex technology has further changed the risk assessment, growers need to consider how to strike a better balance using IWM principles.

To conclude, in appreciating how much easier and more effective weed control is today, it is equally important to ensure that herbicides, as the basis of these weed management systems, are used wisely and sustainably for the future.

Further information can be found at websites such as the www.weedsrc.org.au 



Fleabane continues to proliferate in crops, fallows and non-crop areas.