Managing cotton weeds with new herbicide technologies

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Weed management in cotton has always been a complex business. It has been characterised by high use rates of herbicides pre-planting, at planting and post planting. Management has depended heavily on cultivation and chipping.

Specialised equipment or equipment configuration was required for banded, directed, shielded and spot application of herbicides — partly because of the lack of products with selectivity over the top of cotton.

But things may be getting easier with Roundup Ready cotton varieties and the release of Syngenta's new selective herbicide, Envoke (trifloxysulfuron-sodium) in the latter part of 2002. Envoke is a post-emergent herbicide that is selective enough to be applied over-the-top of cotton. It provides control of important weeds such as noogoora burr and has good activity against a number of problem weeds including peachvine and nutgrass.

These new technologies are very attractive to cotton growers and are sure to be rapidly adopted for a range of reasons.

Greater flexibility in post emergent weed control

Glyphosate tolerant cotton is a tremendous breakthrough and provides an opportunity to easily control most weeds in the plant line up to the four leaf stage of the crop. Envoke has good activity on a range of broadleaf weeds including noogoora burr, nutgrass, peachvine and Sesbania.

Control of noogoora burr in the plant line with Envoke. The row in the centre of the picture was left unsprayed and will have to be manually chipped.

TABLE 1: Biomass reduction (%) of 2-4 leaf peachvine

	Envoke+glyphosate 15g/ha+1035 g ai/ha	glyphosate 1035 g ai/ha
Peachvine	99	79

TABLE 2: Biomass reduction (%) of 3-6 leaf nutgrass at 36-58 DAT

	Envoke (30 g/ha)	glyphosate (1035 g ai/ha)
Nutgrass	68	66

TABLE 3: Biomass reduction (%) of 4-8 leaf noogoora burr (average of 3 trials), 2-8 leaf Bathurst burr (average of 3 trials) and 2-10 leaf peachvine (average of 6 trials) at 21-45 DAT

	Envoke (15 g/ha)	Staple (120 g/ha)
Noogoora burr	93	65
Bathurst burr	80	35
Peachvine	79	80

Depending on the spectrum of weeds present and whether the cotton is herbicide tolerant, Envoke may be used alone, or in combination with glyphosate to compliment activity on hard to kill weeds. Envoke can be used over-the-top of cotton up to the eight leaf stage, whereafter directed application is recommended to ensure that adequate coverage of weeds occurs (that is: to ensure weeds are not shielded by the cotton foliage).

More options for the control of problem weeds

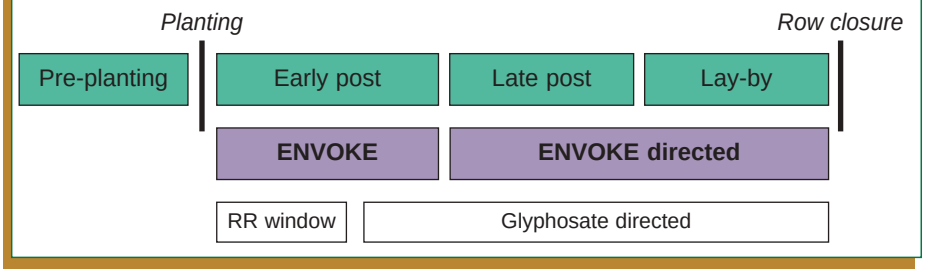
Problem weeds are those weeds not readily controlled by current weed control practises. Examples include nutgrass, which is not readily controlled by cultivation, peachvine which tends to be reasonably tolerant to glyphosate and noogoora burr which is not easily controlled post emergence in conventional cotton or outside of the Roundup Ready window.

The choice of glyphosate and/or Envoke provides options for the control of these weeds. The combination of Envoke and glyphosate can result in excellent control of peachvine compared to glyphosate alone. Envoke provides similar control of young actively growing nutgrass to glyphosate and can be used in sequence to deplete nutgrass. Envoke is active on noogoora burr and provides an excellent means to control this weed in Roundup Ready or conventional cotton.

Reduce manual/mechanical weed control

The use of pre-emergent herbicides which require physical incorporation, and which are not compatible with more sustainable management techniques like mini-

FIGURE 1: Timing options for Envoke application: timing depends on the spectrum and size of weeds, and depending on whether the crop is herbicide tolerant, can be used to complement glyphosate in a weed management program



mum tillage, limit the efficiency of the farming system. The use of inter-row cultivation is inefficient because it compacts the soil with each pass. This is not conducive to moisture retention and the method is not very selective — resulting in damage to cotton roots. Hand chipping is slow, expensive and dependent on a supply of suitable labour. Reduced reliance on these forms of weed control can bring benefits in several areas.

Improved sustainability

Many cotton herbicides are now very old. Fluometuron was first reported in 1964 and trifluralin in 1960, and as with most herbicides of this era require high use rates. Envoke is applied at 15 to 30 grams per hectare compared to Roundup Ready herbicide at 1500 grams per hectare, and fluometuron with rates up to a maximum of 7000 grams per hectare.

Cotton growers can expect to be increasingly challenged to reduce the level of synthetic inputs in an attempt to reduce real or perceived impacts on the environment and the community. The use of effective post emergent herbicide options can complement techniques like reduced tillage.

Opportunities now exist to reduce inputs of high rate pre-emergent herbicides and move towards new lower rate technology. In Roundup Ready cotton, lower rates of pre-emergent herbicides can be used as insurance against early weed competition, allowing rapid establishment prior to glyphosate application.

Evasion of herbicide resistance in the cotton industry to date is in part due to the wide range of techniques used to control weeds. Reliance on one product could rapidly lead to herbicide resistance.

Glyphosate is recognised as a highly effective herbicide and an integral part of cotton production. It is off patent and has become relatively cheap. The increasing adoption of reduced tillage practices, and the introduction of glyphosate tolerant crops with in-crop use of glyphosate will increase reliance on this important herbicide.

Prior to 1996 there were no confirmed cases of glyphosate resistant weeds. Five years later the situation is very different. Resistance has been confirmed to annual ryegrass (*Lolium rigidum*) in Australia, US and South Africa. Resistance has also been confirmed in Italian ryegrass (*Lolium multiflorum*) in Chile, crowsfoot grass (*Eleusine indica*) in Malaysia and in Canadian fleabane in the US (*Conyza canadensis*).

Envoke is a sulfonylurea herbicide and belongs to Group B Mode of Action (ALS inhibitor). As another example of how resistance to a specific group of herbicides can evolve, the introduction of Group B herbicides to Australian cereal crops provided farmers with safe, effective means to control weeds in crop and allowed the development of new agronomic packages. But the success of these herbicides has meant that herbicide resistance to the Group B's is now widespread in certain grasses and broadleaf weeds.

A very healthy noogoora burr.

The rotation of herbicides with different modes-of-action will reduce the risk of resistance to any one herbicide group. Further, sustainable weed-management systems require the integration of a range of diverse methods. The selected strategies should be adapted to specific regional situations and should make economic sense.

Integrated strategies, embracing but not wholly herbicide-dependent, can be cost-effective and sustainable. These integrated strategies are necessary to preserve the continued efficacy of herbicides in the long term.

New problem weeds

Biological systems have been shown to respond to whatever we do. The introduction of new broad spectrum herbicides can be expected to provide us with a new range of problem weeds. Peachvine for instance is not readily controlled by glyphosate. Following repeated glyphosate applications it could be expected to become a more significant weed relative to other weeds, which are very sensitive to glyphosate. Weeds with staggered germination may become more important if reliance is mostly upon herbicides without residual.

Xanthium species vary in sensitivity to, and therefore control by, herbicides including Envoke. Italian Cockleburr (or Hunter burr) is more widespread than initially thought and can now be found in some cotton growing areas within New South Wales. This species is morphologically very similar to noogoora burr and can only be confidently distinguished by its seed. Both species can occur in the same field.

Italian Cockleburr (*Xanthium italicum*) at 2–8 leaf stage is usually desiccated by Envoke but may begin to regrow from the base about three to four weeks after application. Noogoora burr (*Xanthium occidentale*) is well controlled when Envoke is applied according to directions. To manage Italian cockleburr more than one application of a herbicide may be required.

Follow application recommendations

Avoid over exploiting any new technology. In the case of both Roundup Ready herbicide and Envoke, adhere to the application recommendations.

Glyphosate applied off label to glyphosate tolerant cotton has been reported to severely affect yield.

Envoke is a selective herbicide that is well tolerated when applied post-emergent over-the-top of cotton, providing the use recommendations are followed. The selectivity in cotton is due to the fact that the compound is only poorly translocated from the treated foliage in cotton, whereas it is very well translocated in sensitive weeds. Envoke can be combined with glyphosate to compliment the spectrum of weeds controlled.

When application is made over-the-top of Roundup Ready cotton in mixture with glyphosate, use only approved glyphosate formulations. Additionally use only the surfactants recommended on the Envoke label, such as BS1000 or Agral at 0.25 per cent. Crop phytotoxicity may occur under conditions that increase the uptake of the herbicide into the cotton leaf or reduce its ability to metabolise Envoke.

These conditions include cooler, wet (or humid) and overcast conditions. Additionally, the use of some mixing partners which increase leaf surface penetration of Envoke can increase phytotoxicity.

Do not mix Envoke with an insecticide as this may produce a more severe crop effect (particularly OP insecticides). Visual symptoms usually include transient interveinal chlorosis including mottling, and/or reddening of the top leaves within one to seven days after application. Crop recovery is normally rapid, within 14 to 21 days of application. In some cases stunting (height reduction and/or internodal shortening) is also associated with symptoms and recovery may be slower.