

MALVACEAE WEEDS

COSTING AUSTRALIAN COTTON GROWERS

MORE THAN \$60 MILLION A YEAR?

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Summary

The weed management costs incurred by Australian cotton growers represent a significant and often under estimated loss to cotton cropping gross margins. Although there are likely to be a number of weeds present in cotton cropping fields at any one time, some species are more problematic than others. For example, weeds in the family Malvaceae (those related to cotton) are causing increasing problems in many areas, in particular bladder ketmia (*Hibiscus trionum*), anoda weed (*Anoda cristata*) and velvetleaf (*Abutilon theophrasti*). This paper examines the costs of weed control between fields with and without bladder ketmia, anoda weed and velvetleaf.

The successful management of Malvaceae weeds will rely on the use of a range of integrated weed management (IWM) methods, for example, herbicides, cultivation and chipping, and farm hygiene practices to prevent the spread of these weeds on and around the farm. The management of bladder ketmia alone in cotton crops is likely to cost cotton growers around \$290/ha/yr, while the costs for anoda weed and velvetleaf are \$255/ha/yr and \$215/ha/yr respectively. Between \$74 and \$119/ha/yr of these costs are associated with chipping since post emergent herbicide registrations for these species are limited. In contrast weed control costs for a 'typical' heavily infested weedy field are around \$265/ha/yr, while those for a relatively clean or lightly infested field are \$145/ha/yr.

By estimating the proportion of cotton cropping area covered by the most common Malvaceae weed, bladder ketmia, the total cost of weed control for this species alone was estimated to exceed \$58 million/yr. The cost of controlling weeds in fallow fields, irrigation systems and in non-cropping areas on farm has not been included in these calculations however and represents an additional cost to weed control on farm. While these costs are relatively high, they are by no means the final word. By implementing the management methods outlined in this and the companion management papers relating to the Malvaceae species in these proceedings, the costs of controlling these weeds can be subsequently reduced and possibly eliminated from the farm budget. This will result in appropriate savings and considerable benefit for growers. Hence while the cost of controlling these weeds is large, the return on investment in sound IWM is also likely to be just as large.

Introduction

There are various estimates on the costs of weed control to Australian cotton growers. One recent figure estimates that costs are likely to exceed \$400/ha/yr when both control costs and resulting yield losses are considered (Taylor and Walker 2002). A number of factors will impact on the size of the monetary losses associated with weeds (Taylor *et al.* 2002); in particular the number and range of different weed species present (Johnson and Hazlewood 2002).

Weeds in the family Malvaceae, and in particular bladder ketmia (*Hibiscus trionum*), anoda weed (*Anoda cristata*) and velvetleaf (*Abutilon theophrasti*), are becoming increasingly common in many parts of the Australian cotton industry (Johnson *et al.* 2002). Research has yielded a number of control methods that need to be implemented in IWM strategies to reduce the impact and spread of these weeds (Johnson 2004a, b). It is therefore appropriate to examine the cost of existing weed management practices on gross margins, to understand the size of likely savings once these weeds are better controlled.

This paper examines the likely costs of weed control between fields with and without bladder ketmia, anoda weed and velvetleaf, and then compares these costs to heavily and lightly infested fields. An industry-wide management cost estimate is given for the most problematic and widespread of these one of these species, bladder ketmia, so that the scope of the problem that Malvaceae weeds cause and the potential for increased returns in successful management can be properly understood.

Calculations

The successful management of any weed is likely to rely on a suite of management methods in an integrated weed management (IWM) strategy. In particular the use of herbicides, cultivation, chipping and sound farm hygiene practices are needed to prevent the spread of these weeds on and around the farm.

Potential weed control costs have been estimated for a number of different situations (Table 1). Firstly 'typical' fields with both 'light' (1 weed/10m²) and 'heavy' (1 weed/m²) weed pressure were examined. These typical fields were assumed to contain a range of species, (see assumption 3 in assumptions section). The fields were then compared to those that contain 'heavy' (1 weed/m²) infestations of bladder ketmia, anoda weed and velvetleaf. Since cotton fields contain a number of other weed species, very light infestations of the range of species outlined in assumption 3 were assumed to have been present (1 weed/25m²) necessitating other general weed control practices, in particular the use of some herbicides (see assumption 5). Mixtures of the Malvaceae weeds on fields were not considered in this simple example.

The typical costing of the common herbicides, their application, cultivation and chipping costs has been outlined (Table 2). The data for this analysis has been drawn from various sources (Campbell 1998; Taylor and Walker 2002; F. Scott, NSW Agriculture economist, pers. comm.).

The costs associated with managing Malvaceae weeds

The control of bladder ketmia is likely to cost cotton growers just over \$290/ha in cotton crops (Table 1). The cost of control of anoda weed is around \$255/ha and that for velvetleaf \$215/ha if all herbicides listed were used. In contrast, weed control on a 'heavily' infested field is around \$265/ha, similar to that for anoda weed, and more expensive than that for velvetleaf. These costs greatly exceeded the weed control costs on a 'lightly' infested field of nearly \$145/ha.

This analysis indicates that infestations of bladder ketmia, anoda weed and velvetleaf increase weed control costs from between 150-200% when compared with weed control costs on 'lightly' infested fields. This cost will have a serious impact on gross margins of cotton growers and this can best be illustrated by considering bladder ketmia as a worst case scenario. Taylor and Inchbold (2001) indicate that over 80% of all Australian cotton farms have infestations of bladder ketmia present. Assuming that around 50% of these farms have serious enough infestations on them to need treatment as outlined in Table 1, and that 500,000 ha of cotton are grown, then the total cost of control for bladder ketmia alone represents in excess of a \$58 million impost to the industry. This amount represents nearly a \$30 million increase in weed control costs when compared

with clean fields. It is important to note that these values are very conservative representing weed control in-crop and not in other on-farm areas. These costs do not allow for yield losses.

Table 1. Weed control costs on a 'typical' field with 'light' and 'heavy' infestations of a range of weeds (as outlined in assumption 3), and 'heavy' infestations of bladder ketmia, anoda weed and velvetleaf. A 'heavy' infestation can be defined as one with 1 weed/m² and a 'light' infestation as one with 1 weed/10m². Herbicide costing (\$/ha) includes application costs, outlined in Table 2.

Weed control measure	'Light' field	'Heavy' field	Bladder ketmia	Anoda weed	Velvetleaf
<i>Herbicide trade names applied</i>					
<i>Planting</i>					
Cotogard	-	1 @ \$24.40 \$24.40	1 @ \$24.40 \$24.40	1 @ \$24.40 \$24.40*	1 @ \$24.40 \$24.40*
Trifluralin	-	1 @ \$19.29 \$19.29	-	-	-
<i>Over-the-top</i>					
Roundup Ready herbicide	1 @ \$15.19 \$15.19	1 @ \$15.19 \$15.19	1 @ \$15.19 \$15.19	-	1 @ \$15.19 \$15.19*
Staple	-	-	-	1 @ \$32.55 \$32.55	-
<i>Layby</i>					
Diuron (early)	-	-	1 @ \$30.21 \$30.21	-	-
Gesagard	1 @ \$24.17 \$24.17	1 @ \$24.17 \$24.17	1 @ \$24.17 \$24.17	1 @ \$24.17 \$24.17*	1 @ \$24.17 \$24.17*
<i>Shielded</i>					
Roundup Ready herbicide	1 @ \$17.80 \$17.80	-	1 @ \$17.80 \$17.80	1 @ \$17.80 \$17.80*	1 @ \$17.80 \$17.80*
Cultivation	0	2 @ \$6.31 \$12.62	2 @ \$6.31 \$12.62	2 @ \$6.31 \$12.62	2 @ \$6.31 \$12.62
<i>Chipping</i>					
Rogue	1 @ \$37.07 \$37.07	-	-	1 @ \$37.07 \$37.07	2 @ \$37.07 \$74.14
Heavy	-	2 @ \$59.30 \$118.60	2 @ \$59.30 \$118.60	1 @ \$59.30 \$59.30	-
Roundup Ready	\$49.00	\$49.00	\$49.00	\$49.00	\$49.00
License fee/ha					
Total cost/ha	\$143.23	\$263.27	\$291.99	\$256.91	\$217.32

*Unregistered herbicides for these weeds, but are registered for the control of other weeds present.

Table 2. Costing of weed control operations used in Table 1.

Herbicide/operation	Rate/ha	Unit cost/ha	Total cost/ha
Herbicides			
Cotogard	4.0 L (50% band)	\$11.73	\$23.46
Trifluralin	2.3 L	\$7.98	\$18.35
Roundup Ready herbicide	1.5 kg	\$9.50	\$14.25
Staple	0.06 kg (50% band)	\$1053.76	\$31.61
Diuron	1.9 kg	\$14.03	\$26.66
Gesagard	3.5 L (50% band)	\$11.78	\$20.62
Herbicide application			
Broadacre	NA		\$0.94
Shielded	NA		\$3.55
Inter row cultivation	NA		\$6.31
Chipping			
Light (rogue)	\$15/hr		\$37.07
Heavy	\$15/hr		\$59.30

Assumptions made for weed control costs

As with any estimates, a number of assumptions need to be made. Those used in this paper have been outlined below.

1. Only the control of weeds in cotton crops has been examined. No attempt has been made to determine the cost of controlling these weeds in fallows, in irrigation channels or storages, or in non-crop areas. However, such control measures need to be undertaken to ensure that successful IWM is achieved across the whole farm.
2. The seed bank of the weed has not been considered. The seed bank may be increased or decreased on a yearly basis depending on the success of the control measures undertaken to manage seed production and to encourage degradation of seed in the seed bank. A large seed bank will result in an on-going problem over many years. In contrast, good control aims to deplete the seed bank and hence the problem in future years.
3. The weed species in the typical ('light and 'heavy') weed pressure fields were a mixture of broadleaf, and to a lesser extent, grass weeds. The weeds present could include Hunter burr (*Xanthium italicum*), Bathurst Burr (*X. spinosum*), fierce thornapple (*Datura ferox*), peachvine (*Ipomoea lonchophylla*), with some barnyard grass (*Echinochloa colona*) and liverseed grass (*Urochloa panicoides*) plants. It was assumed that nutgrass was not present.
4. No pre-plant residual herbicides were used on the 'typical' field with the light infestation of weeds.
5. Full complements of herbicides were used on fields with 'heavy' weed infestations. All herbicides are registered and have been recommended from previous research (Johnson 2003). Herbicides marked with an * are not registered for application of weed species at the top of the column (anoda weed and velvetleaf). It was assumed that these herbicides would have been applied to fields containing these species in an effort to control the very light infestations (1 weed/25m²) of other species present (see assumption 3). This represents a valid on-label use pattern.
6. Employment on-costs are not accounted for in the chipping costs.
7. This data should not be used for other purposes, for example to calculate herbicide loadings or to make resistance management assessments, since neither pre-plant nor post-harvest recommendations have been included above.

Discussion on reducing the costs of management

These costs are not the final story. Rather, they give some indication on the size of savings that can be made once IWM strategies are implemented against these weeds and successful management has been achieved. In addition, ensuring that farms and fields remain free of these weeds by practising good farm hygiene, and by controlling these weeds when they are present, will help reduce the problems that farmers need to manage and will help these benefits be achieved.

Successful management of these weeds will rely on a range of IWM methods that include herbicides, cultivation, chipping, and good farm hygiene practices. To help implement good IWM against these weeds, please refer to the papers *Best management of bladder ketmia. What you can do to make a difference* and *Stopping the spread. Best management of anoda weed and velvetleaf* in these proceedings (Johnson 2004a, b). It should always be remembered that while the costs of weed control are very large, there is good return on investment in implementing successful IWM on farm.

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