THE DISTRIBUTION, SPREAD AND MANAGEMENT OF BLADDER KETMIA, ANODA WEED AND VELVETLEAF IN AUSTRALIAN COTTON FARMING SYSTEMS

Stephen B. Johnson[1], Ian N. Taylor[2], Brian M. Sindel[1],
Graham W. Charles[2], and Leah MacKinnon[1]
Australian Cotton Cooperative Research Centre
University of New England[1],
NSW Agriculture[2],
Australian Cotton Research Institute, NARRABRI NSW 2390

Summary

Malvaceae weeds are becoming an increasingly significant problem in Australian cotton farming systems. Narrow and wide leaf bladder ketmia, *Hibiscus trionum* var. *trionum* and *Hibiscus trionum* var. *vesicarius* respectively, have been found on 85% of all cotton fields surveyed. Anoda weed (*Anoda cristata*) has become widespread in many Queensland (Qld) cotton growing areas and continues to spread into New South Wales (NSW), while velvetleaf or swamp chinese lantern (*Abutilon theophrasti*) is thought to be currently isolated to small areas of northern NSW. This paper examines the distribution and potential spread of each of these species, and contains some photographs to enhance identification.

Species-specific control of these weeds is difficult to achieve because of their genetic, physiological and phenological similarities to cotton. This paper also outlines the "Best Bet" Management options for these weeds, sourced from a series of grower, on-farm agronomist and consultant interviews. This information has been published in WEEDpak.

Distribution and spread

Narrow and wide leaf bladder ketmia

Narrow leaf bladder ketmia (Figure 1a) was probably introduced into Australia, while wide leaf bladder ketmia (Figure 1b and c) is thought to be an Australian native (Harden 1992). Narrow leaf bladder ketmia is widely distributed in eastern NSW and coastal Qld. In NSW, it extends westward onto the north-west and central west slopes. Wide leaf bladder ketmia is commonly found throughout western NSW, the Macintyre valley, on the western parts of the Darling Downs and further north into Qld. The two varieties co-exist around a line roughly along the Newell highway from Dubbo to east of Moree and then to Jimbour on the Darling Downs (Figure 2). Narrow leaf bladder ketmia can be found east of the line, while wide leaf bladder ketmia can be found west of the line.

There are two types of wide leaf bladder ketmia (Figure 1b and c). The type found in NSW and southern Qld cotton growing areas has a pale cream or yellow centred flower, and the northern type, found on the western Darling Downs extending into central and northern Qld, has a crimson/red centred flower. The two types are quite similar in all other respects.

Although both narrow and wide leaf bladder ketmia appear to be restricted to these areas of distribution, that is east and west of the line outlined on Figure 2, each variety has the potential to spread onto farms and fields that do not have the weed within the respective areas of distribution. The seeds have a hard seed coat and thus may remain dormant for considerable periods in the soil. Both varieties may be spread via irrigation water, in mud attached to machinery, or on machinery itself. Good farm hygiene is required to manage these weeds effectively. Bladder ketmia is difficult to manage once it has seeded freely. Remember the old saying - *one years seeding makes seven years weeding.*

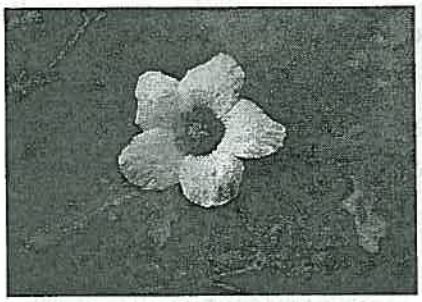

Fig 1a. Narrow leaf bladder ketmia.

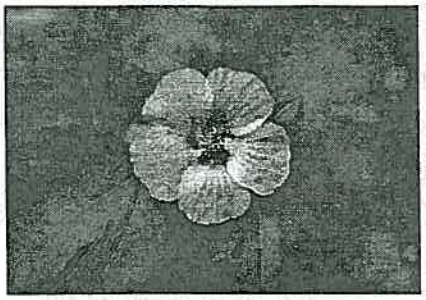

Fig 1b. Wide leaf bladder ketmia (yellow flower centre).

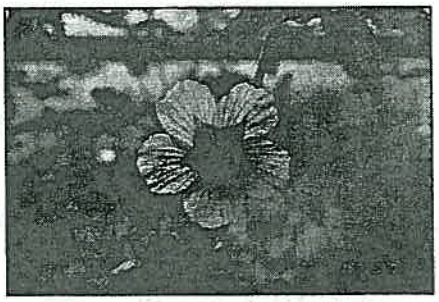

Fig 1c. Wide leaf bladder ketmia (crimson/red flower centre).

Fig 1d. Anoda weed seedling.

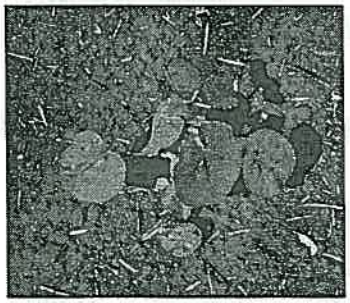

Fig 1e. Velvetleaf seedling.

Figure 1. Photographs of narrow and wide leaf bladder ketmia, anoda weed and velvetleaf.

Anoda weed

Anoda weed (Figure 1d) is an introduced weed and is common around southern and central Queensland (Harden 1992). It is a problematic weed in cotton crops around the St. George, Darling Downs, Mungindi and South Burnett areas. Isolated infestations have also been found on cotton farms around Theodore, Goondiwindi, Moree, Wee Waa, Narromine, Warren and Bourke.

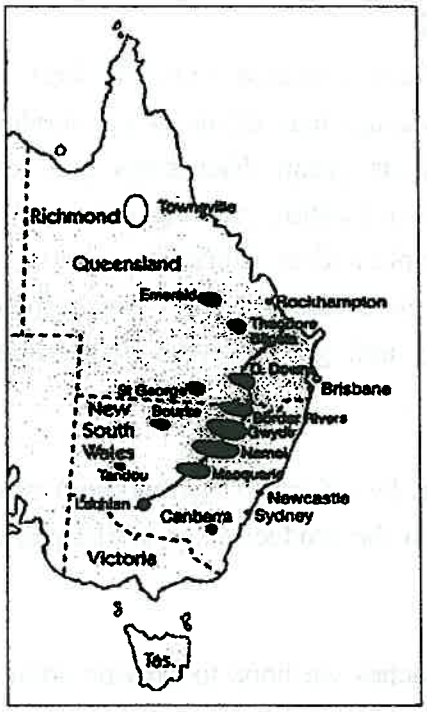

Figure 2. Cotton growing areas in eastern Australia. The line on the map represents the integrade of narrow leaf bladder ketmia from the east and wide leaf bladder ketmia from the west.

The seeds of anoda weed are readily spread on machinery, harvesting equipment, in harvested cotton lint, and probably in water. Considering this, the weed has the potential to spread into all cotton growing areas where it does not currently occur, for example to Emerald, the Lachlan/Murrumbidgee and to Tandou. Anoda weed is already spreading from isolated infestations in the Wee Waa and Narromine areas.

Velvetleaf

Velvetleaf or swamp chinese lantern (Figure 1e) has a more isolated distribution within Australian cotton growing areas. Currently, infestations have been found in the Gwydir (west of Moree), upper and lower Namoi (Boggabri, Narrabri and Wee Waa) and Macquarie valleys (north west of Warren). Seeds are spread predominantly through irrigation and floodwater. The spread of this species further downstream from each of these areas, particularly in floodwaters therefore appears likely. Other mechanisms of spread include seeds carried in mud attached to machinery, or on machinery itself. Cotton growing properties that extract river water for irrigation downstream of known infestations should be considered as high-risk areas for velvetleaf spread. It is highly likely that velvetleaf will continue to spread onto clean farms and clean fields in the future. Good farm hygiene is required to manage velvetleaf, and indeed all the Malvaceae weeds effectively. Refer to WEEDpak for further details on the importance of good farm hygiene and a case study on preventing the spread of velvetleaf using good farm hygiene practices.

Best bet management

The following pages have been extracted from the Best Bet Management section of WEEDpak. The Best Bet Management Guide is a compilation of management options derived from a series of focus group discussions and interviews with growers and consultants from all of the major cotton growing regions. The aim was to pass on the experiences of a range of people and to determine effective control methods for some of the more common, difficult to control weeds. The herbicide options listed are those recommended by consultants and growers who participated in the focus groups and interviews.

Some of the options given may be off-label. Neither the Australian Cotton CRC nor any of the departments represented in the production of WEEDpak supports the off label use of herbicides.

By documenting these approaches we hope to provide some useful alternative strategies that may encourage and assist growers to re-assess their current methods and management strategies. It is worth highlighting that there is a great deal of variation between fields and between farms. Growers should not seek to use a prescriptive weed management approach but instead tailor an integrated weed management strategy to their own agronomic practices and farming system.

Reference

Harden, G. J. (editor) (1990). *Flora of New South Wales, Volume 1.* University of NSW Press, Kensington. pp. 320-340.

Acknowledgements

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Bladder ketmia narrow leaf (*Hibiscus trionum* var. *trionum*)

Introduction

Bladder ketmia is a summer-flowering annual weed. It belongs to the same family as cotton (Malvaceae) and is very difficult to control in crop with herbicides alone. While individuals are not overly competitive, bladder ketmia plants often occur in dense stands that can cause considerable localized yield losses. In recent surveys conducted from Hillston in southern NSW to Emerald in Queensland, bladder ketmia was found to be the most troublesome and widespread weed, infesting nearly 85% of the cotton properties surveyed. Bladder ketmia has a rapid growth rate, is a prolific seeder, and can produce seeds just 48 days after emergence. Bladder ketmia is extremely difficult to control for two reasons, the seeds germinate continuously throughout the season and being closely related to cotton restricts the range of herbicides that can be used due to the risk of also damaging the cotton.

Disclaimer: *This section contains recommendations from consultants and growers and may include off-label recommendations that are not supported by the Australian Cotton CRC.*

Management in cotton crops

Herbicides	*Pre-plant*	Diuron 3 L/ha + Trifluralin 2.3 L/ha Roundup 3-4 L/ha+ Goal 75 mL/ha Roundup Ready herbicide 1.0 kg/ha
	Planting	Cotogard 4 L/ha on a 40% band 40% band Cotogard/Cotoran + 4 L/ha Stomp Roundup Ready herbicide 1.5 kg/ha
	In-crop	Two applications of Roundup Ready herbicide 1.5 kg/ha
	Lay-by	Gesagard 3 L/ha 1.5 kg/ha Roundup Ready herbicide Diuron 1.6 kg/ha Starane + Cotoran
Cultivation		1-2 inter-row cultivations per season.
Chipping		Manual chipping is essential to control bladder ketmia in the plant line and prevent replenishment of seeds into the soil seed bank.

Management in fallow situations

Herbicides	Roundup 3-4 L/ha + Goal 75 mL/ha on small plants. Starane in late December.
Cultivation	Cultivation is very effective for bladder ketmia control when plants are young.

Bladder ketmia wide leaf (*Hibiscus trionum* var. *vesicarlus*)

Introduction

Wide leaf bladder ketmia is very similar to narrow leaf bladder ketmia, except the leaves are less deeply lobed and not as deeply notched. The flower colour is different, with the centre either being a pale yellow or a deep crimson (for the ecotype found in Queensland). It is a prolific seeder and appears to be more susceptible to some herbicides than is the narrow leaf variety.

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Management in cotton crops

Herbicides	*Pre-plant*	Diuron 3 L/ha + Trifluralin 2.3 L/ha Roundup 3-4 L/ha+ Goal 75 mL/ha Roundup Ready herbicide 1.0 kg/ha
	Planting	Cotogard 4 L/ha on a 40% band 40% band Cotogard/Cotoran + 4 L/ha Stomp Roundup Ready herbicide 1.5 kg/ha
	In-crop	Two applications of Roundup Ready herbicide 1.5 kg/ha
	Lay-by	Gesagard 3 L/ha 1.5 kg/ha Roundup Ready herbicide Diuron 1.6 kg/ha Starane + Cotoran
Cultivation		1-2 inter-row cultivations per season.
Chipping		Manual chipping is essential to control bladder ketmia in the plant line and prevent replenishment of seeds into the soil seed bank.

Management in fallow situations

Herbicides	Roundup 3-4 L/ha + Goal 75 mL/ha on small plants. Starane in late December.
Cultivation	Cultivation is very effective for bladder ketmia control when plants are young.

Anoda weed (*Anoda cristata*)

Introduction

Anoda weed is an annual species that germinates throughout the cotton season but produces the bulk of its mature seed from February onwards. Seeds are readily spread on machinery, harvesting equipment, in harvested cotton, and probably in water. There are limited means of managing this weed in-crop. One on-farm agronomist stated that *you cannot even see it until it comes up above the cotton. You do not know you have got it until the seed is maturing.* Another consultant stated that *it has the ability to spread rapidly.* An investigation into the biology and management of anoda weed is currently in progress. Contact Stephen Johnson at ACRI for further information.

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Management in cotton crops

Herbicides	*Pre-plant*	Zoliar applied at label rates.
	Planting	Staple 60 g/ha is effective on young plants. Cotogard or Cotoran 4 L/ha with Stomp 4 L/ha.
	In-crop	Staple at 60 g/ha is effective on small plants, particularly those that germinate prior to December and January. Anoda weed continues to emerge throughout the season. Two Roundup Ready herbicide sprays in Roundup Ready crops at 1.5 kg/ha.
	Lay-by	Cotogard/Stomp or Diuron applications. Roundup Ready herbicide 1.5 kg/ha in Roundup Ready crops.

Cultivation Normal inter-row cultivation will remove plants in the furrows and on the edges of hills.

Chipping The most effective means of removing small infestations of anoda weed is hand chipping. Anoda weed is difficult to distinguish in cotton because the plants have a similar colour. Manual chipping on two occasions is recommended, one pre-Christmas to remove vegetative plants and the other, before mid February, to remove plants that have developed seed heads.

Farm hygiene Good farm hygiene will reduce the movement of this weed both on farm and between farms.

Rotation crops An Atrazine/Starane mix is effective for control in dryland sorghum crops.

Management in fallow situations

Herbicides Roundup or Zoliar are effective in reducing the numbers of this weed in fallow.

Cultivation Broad acre cultivation will help prevent this weed from going to seed.

Swamp chinese lantern/Velvetleaf (*Abutilon theophrasti*)

Introduction

Swamp chinese lantern/Velvetleaf is an annual species that germinates throughout the cotton season and produces seeds from mid-December. Seeds are readily spread in irrigation water or via overland flows, and probably on machinery. The weed is a large problem in summer cropping in the USA but is, as yet, isolated in distribution in NSW. One consultant stated that *it is only sticking its head up a little bit now. We use spot chipping and it is not a huge concern.* An investigation into the biology and management of swamp chinese lantern is currently in progress. Contact Stephen Johnson at ACRI for further information. Other details on the importance of farm hygiene in managing this weed can be found in the case study (WEEDpak section F2).

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Management in cotton crops

Herbicides	*Pre-plant*	Glyphosate applied as a broad acre application.
	Planting	Cotogard or Cotoran 4 L/ha with Stomp 4 L/ha.
	In-crop	Two Roundup Ready herbicide sprays at 1.5 kg/ha in Roundup Ready crops.
	Lay-by	Roundup Ready herbicide and Cotogard applied at 2.5 L/ha. Roundup Ready herbicide at 1.5 kg/ha in Roundup Ready crops.
Cultivation		Care should be taken when cultivating through swamp chinese lantern patches so as not to spread seeds of this weed.
Chipping		Chipping can be used to effectively control small infestations in crop. A late or spot chip should be used to remove any large plants late in the season.
Farm hygiene		Good farm hygiene is required to prevent swamp chinese lantern from spreading. For example, storages and channel banks should be kept free of the weed to prevent the spread of seeds in irrigation water.

Management in fallow situations

Herbicides	High rates of Roundup Ready herbicide, or a mixture of glyphosate applied at 1.5 L/ha mixed with 2,4-D amine applied at 2.4 L/ha with added wetter are effective. The wetter is needed to ensure adequate penetration of the herbicide mixture into the large hairy/velvet-like leaves.
Cultivation	Care should be taken with cultivation through swamp chinese lantern patches so as not to spread seeds of this weed.