A GOOD WEED

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Sonchus oleraceus (common sowthistle), a weed similar to fleabane, affecting most situations, glyphosate resistant and spread easily by wind-blown seeds *Image: Andrew Storrie*

Featured stories in this edition

In this issue

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Editor's note

We have intentionally skipped the winter edition of A Good Weed due to delays with the autumn edition, which subsequently delayed the winter edition. This edition has more content due to the backlog of articles. Enjoy the content.
Tony Cook, newsletter editor

Message from the President

Welcome to our spring edition of 'A Good Weed' and welcome to all our new members of the Society. The benefits of your membership of the Society include:

Opportunity to network with others interested in weed management

- Discounted registration for Society seminars and workshops
- Opportunity to apply for Society Travel Awards
- The Society newsletter, *A Good Weed*, delivered quarterly
- Access to the Society electronic newsletter, the *Punnet Tray*
- Discounted registration to attend the Australasian Weeds Conference
- Discounted registration to attend the NSW Biennial Weeds Conference
- Additional financial prizes for the winners of the Buerckner and Stephenson Local Government Awards and the NSW Weed Industry Award.

All our members are receiving a $100 discount to attend this year's NSW Weeds Conference at Armidale and they can obtain a similar discount at the Australasian Weeds Conference in September 2018 to be held at the Novotel, Manly.

The NSW Weeds Conference with the theme "Experience the Highs – working smarter together" is looking to be a great event. Come and see the Weed Society team at our stand to collect your free copy of the Weed Society publication called '50th Jubilee: A history of the Weed Society of NSW 1966 – 2016' edited by Rex Stanton. It's a great read.

Our AGM and Annual Dinner is to be held at Grafton this year and we will be having the meeting at the DPI Research Institute followed by a tour of the Bio-control facility with Troy Brown. I am looking forward to this trip and I hope many members will attend.

If you would like to continue receiving this wonderful newsletter "A Good Weed" and our publication "Punnet Tray", can you please ensure that all your contact details including address and email are up to date, so that the Society can continue to provide this service to you. Contact the Secretary of the Society with all new details.

Finally yet importantly, I would like to remind all non-financial members for 2017 that their membership fees are now overdue.

Happy weeding

Kim

Welcome to our new members

Geoffrey Riley (Inverell)
Dr Michael Walsh (University of Sydney)
Zachary Growns
Emily McCarthy (Strathfield)
Christopher Clausen (CMC mapping)
Troy Brown (NSW DPI Grafton)
Anthony Schofield (Greater Sydney LLS)
Wendy Bushell (Midcoast council)
Aaron Preston (Wagga Wagga)
James Mwendwa (Wagga Wagga)
Kate Boyd (Uralla)

There has been a large influx of other new members and they will be mentioned in the next edition of A Good Weed. Thank you for joining.

Enjoy the excellent services that the NSW Weed Society provides. Hope we meet you at the NSW Weeds Conference at Armidale.

NSW Weeds Conference - news

New England Weeds Authority to host 19th NSW State Weeds Conference in Armidale from 16 - 19 October 2017

New England Weeds Authority in conjunction with the Weeds Society of NSW and the NSW Department of Primary Industries will host the 19th NSW Weeds Conference at the University of New England, Armidale from 16 -19 October 2017.

The Chairman of New England Weeds Authority, Councillor Mark Dusting said "*we are delighted to be hosting such a prestigious conference that will bring together delegates from not only across the State but from interstate as well. With the recent introduction of the new Biosecurity Act 2015, and the fact that the financial impact of weeds on agriculture alone costs approximately $2.5 billion a year in lost production and an estimated further $1.8 billion annually in control activities, there has never been a more important time to come together to meet the many and varied challenges faced by weed professionals and the industry in general.* He added, *Conference will be a unique opportunity for the State's weeds professionals and related industry representatives, researchers, market and industry analysts, government officials and policy makers to showcase their work, network ideas and share in a vision for the future of the weeds industry".*

The Conference Organising Committee have been working hard over the last few months to ensure that delegates will not only have an enjoyable stay in Armidale and the New England region but they will also be challenged, captivated and inspired by the renowned speakers at the Conference, the spectacular field trips, impressive trade displays, conference dinner as well as importantly discussing problems and issues of mutual interest.

The theme of the conference, **"Experience the highs – working smarter together**" looks to build on the successes of the past whilst looking to the future as the industry transitions into a new era in weed management and control under the new Biosecurity legislation, an approach that must be based on regional cooperation as well as providing a common focus for the actions of the various land managers across all tenures. With this in mind session themes have been based on Biosecurity in Action; Technology & Innovation; Community, Extension & Social Marketing; Collaboration & Case Studies with a special feature being the Open Debate titled, ***"A landholder biosecurity duty is the best approach to managing established weeds".***

The Conference opening will include local dignitaries along with Mr Scott Hanson, Director General, NSW Department of Primary Industries, with the key note address by Prof David Lamb, McClymont Distinguished Professor (Research), Precision Agriculture Research Group, University of New England who will be speaking on "*Connecting to our farm-*

Fleabane: coming at you from all angles

Fleabane is a weed that should get the attention of all people. Every state and territory has this weed and this weed should deserve the title as the most ubiquitous species in Australia. There are many other species that could claim to have infestations in all states and territories of Australia, but it is the diverse situations that this weed favours, making it the standout characteristic of this weed.

There are many situations that fleabane can survive and thrive. The following list is by no means the complete list of preferred fleabane environments:

Irrigation areas
Fallow paddocks
Fence lines
Around building / structures
Within crops, especially non-competitive crops
Under various horticultural vines/trees
Road sides
Weed of establishing forestry plantations
Summer crops such cotton and sorghum
Neglected areas
Horticulture and viticulture
Weed of poorly competitive pastures
Residential areas
All soil types, but prefers the lighter sandy loams
Almost all moisture levels – drought tolerant to fully saturated soil

It shouldn't take long to walk outside along and find a fleabane plant growing in the cracks of the concrete. This typifies a classic colonising plant! Researchers have claimed that most seed will fall relatively close to the plant but a small proportion is capable of long distance travel, via high altitude air movement and water run-off. A plant producing approximately 100,000 seeds – a small proportion is still a good quantity of seed.

A common site: Fleabane showing the attributes of a good colonising plant (Image: Andrew Storrie)

Chronology of Fleabane dominance

About 30 years ago flax-leaf fleabane (*Conyza bonarensis*) was barely on anyone's radar. Back in the 80's there were a few registered label use claims on herbicide products for its control. No-tillage farming practices were commonplace in cropping districts and glyphosate seemed to be working well. Step by step this weed has developed in several ways to become one of the most problematic weeds in Australia.

Chronology of how fleabane has got the upper hand

Pre 1980's: Fleabane was a minor weed and control was mainly achieved by selective herbicides and regular cultivation

1980's: No-tillage farming practices allowed surface germinating fleabane seeds to emerge however glyphosate and selective herbicides were working well

1990's: The regular use of glyphosate meant that fleabane populations were starting to show signs of increased tolerance. Fleabane considered a relatively uncommon weed.

2000-2005: Fleabane numbers on the increase in south east QLD and northern NSW

2006-2010: Populations collected and variations in responses to glyphosate with greater survival rates if

populations sourced from areas with high frequency of glyphosate use. Glyphosate resistance confirmed in flax-leaf fleabane in 2010. Wet weather in 2010 saw blow-out in fleabane in southern NSW

Beyond 2010: Steady increases in fleabane along roadsides and fence lines. Tall fleabane confirmed as glyphosate resistant in 2012. Fleabane labelled an emerging weed in all other states.

2016: South Western NSW - a population was confirmed resistant to paraquat within a vineyard.

Fleabane species

Around the world there are 60 species, all of which are found in the temperate climate zones. In Australia there are 7 species recognised, all of which are naturalised and not native.

According to "The Flora of NSW Volume 3" (1992) the following species are found in NSW and other States:

- *Conyza bonariensis* – flax-leaf fleabane
- *Conyza leucantha*
- *Conyza chilensis*
- *Conyza sumatrensis* (also called *C. albida*) – tall fleabane
- *Conyza canadensis* – Canadian fleabane
- *Conyza parva*
- *Conyza bilbaoana*

Tall fleabane (left) vs. flax-leaf fleabane (right)
Image: John Hosking

Tall fleabane growing well over 1 m tall and with a few branches Image : Andrew Storrie

Flax-leaf fleabane, a well branched and not capable of growing over 1 m Image : Brisbane City Council

Characteristics of the main 3 fleabane species in the northern grain region (NSW)

Characteristic	Flax-leaf fleabane	Tall fleabane	Canadian fleabane
Mature plant height (m)	1	2	1.5
Stem branching	Unbranched below flower head	Single stem	Single stem
Inflorescence shape	Lateral branches over-topping main stem	Pyramid	Pyramidal
Floret colour	White to pink	Straw	Cream
Floret bracts	Densely hairy	Densely hairy	Hairless
Receptacle	Smooth pitted	Roughly pitted	Smooth pitted

(Source : Andrew Storrie - Management of flax-leaf fleabane workshop 2007)

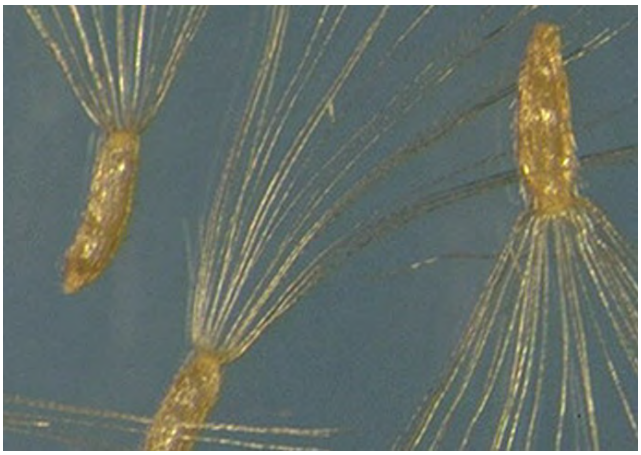
As for most weeds, better control is achieved when trying to control smaller weeds. We therefore need to hone our skills to identify fleabane at the smaller rosette stage. Discerning between *Conyza* species at the rosette stage would be much harder. In this article there are images of seedling and small rosette flax-leaf fleabane, however the other two species tend to have much broader leaves with less hair than *C. bonariensis*.

Newly emerged seedling flax-leaf fleabane Image : Bec Miller

Industry recommendation is to spray rosettes less than 5 cm diameter Image: Tony Cook

Ecology

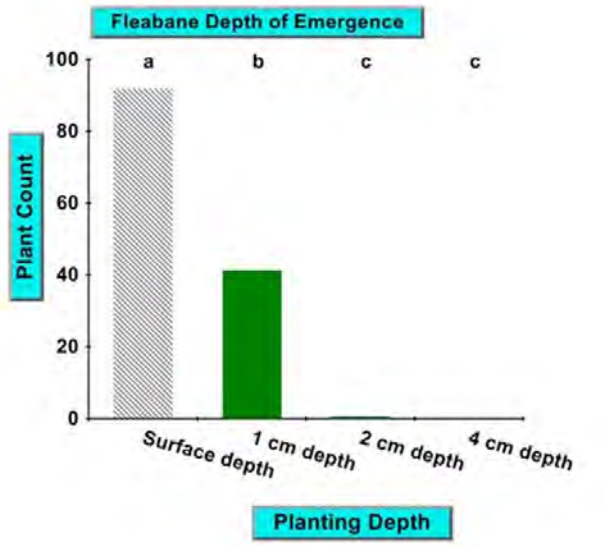
One rule of thumb for plant seed production is the greater the number of seeds produced per plant the smaller each seed will be. A plant such a fleabane that can produce around 100,000 seeds per plant will therefore have very small seeds. Although a moderate proportion of these seeds are non-viable, the survival and success of this species is due to sheer multitudes of seed. Being such a light-weight seed, it assists with better wind dispersal with thanks to fine filamentous hairs that are influenced by the wind (see image below). The vast majority of seed is known to travel mostly within 100 m of the parent plant however longer distances (500 m) are not rare.



Each seed is about 1 mm long and suited for long distance travel

Ready to launch into action—only takes a gusty warm day and thousands of seeds can chance their luck to find a place suitable for the next stage of the life cycle Image : Tony Cook

Light-weight seed can have a disadvantage; it needs to germinate near the surface of the soil because the energy stored in the seed for germination is low, thus energy consumed trying to push through soil to emerge is likely to be a fatal outcome. Research indicates that burying beyond a depth of 1 cm will essentially stop germination. This is one reason why no-tillage farming systems have suited this weed – a higher number of seeds are sitting on the soil surface where there is a greater chance of emerging.



(Source: GRDC)

Lighter seed also means a seedling that is very small and prone to competition. Healthy crops and pastures sown at good densities tend to have very few fleabane issues courtesy of competitive pressures.

Fleabane can germinate all year, but prefers "cool to mild temperatures with damp soil conditions". These ideal conditions are more likely in autumn or spring. Small micro-environments can encourage more germination of seed. Since the seed is generally on the soil surface, fleabane seed requires the surface to be damp for ample time to allow the seed root to contact soil and develop down the soil profile. For example, a crack in the pavement or road will allow more water to run into the gap and keep the soil damp for longer. Many crops typically have a sowing furrow. These furrows stay damper for longer periods due to ponding and being less exposed to sunlight and have often greater numbers of fleabane. A very heavy short summer storm on a fallow paddock is less likely to trigger and emergence event if the next few days are hot and dry, quickly removing moisture from the soil surface. Fleabane seed will not germinate at summer temperatures above 35° C. A combination of cool and wet summer will trigger the blowout of fleabane.

Impacts in cropping regions

Not much thought was given to fleabane in cropping areas about 30 years ago (just when no-tillage farming began its rapid expansion), even though it did exist in relatively small numbers. It became a priority weed in the early 2000's and by 2004 the first workshop was conducted to determine what was known about the weed and to determine research gaps.

Another workshop commenced in 2007 and better control techniques were discussed. These tended to focus on post-emergence control in fallow using the double-knock tactic (a systemic herbicide applied first then approx. 5 days later with a desiccant herbicide). Many of these treatments were effective but not registered. A high priority was made to get some of these treatments registered. Another aspect of the workshop was the lack of in-crop research and the deficiency of general pre-emergence control of this weed.

The number of registered options for fleabane control prior to year 2000 was dicamba, Spray.seed® and atrazine for cropping paddocks.

Thankfully with the help of many researchers from state institutions, private organisations and chemical companies the number of registered options today is significantly greater. It does take considerable effort and time to gather enough data to present to the APVMA for registration and those that are involved with getting new registrations are recognized. It is a confirmation that the weed has become a significant issue very quickly as shown by the need to get many herbicides registered. The list of registered herbicides is as follows (next page)

List of herbicides registered for fleabane control

2,4-D amine

clopyralid

bromoxynil

atrazine

glyphosate

dicamba

Spray.seed®

saflufenacil

isoxaflutole

Tordon FallowBoss®

terbuthylazine

Imazapyr

Paradigm®

flumioxazin

Grazon Extra®

Most of these herbicides have cropping paddock registrations but some have non-crop registrations. There is sufficient mode-of-action diversity within this group of registered actives to allow for better management of resistant populations and ample choice to control various growth stages (from pre-emergence, early post-emergence and late post-emergence options).

There are many more herbicides that could potentially be added to this list over time.

In summary, the cropping areas have had the occasional blow-out with fleabane in the past but have a better understanding of its ecology and the various methods of control. It is still a priority weed species but the numbers in paddocks appear to be at a manageable level. A long period of wet weather may hinder control options and allow fleabane to mature in-crop. These plants get cut by the header in late spring/early summer and become difficult plants to control.

Flax-leaf fleabane re-sprouting after being cut by the header—very difficult to control

Image: Andrew Storrie

The cropping industry is still making progress. They have identified that persistence of fleabane can be attributed to poor farm hygiene. Non-crop areas such as fence lines, around building, road sides and irrigation channels are a significant source of mature plants producing seed that can blow back onto relatively clean cropping areas. New registrations are coming for these situations and some are already available.

Old dead stems along the fence line were remnants of fleabane plants. White wooden pegs on the left was an in-crop fleabane experiment. The best experimental sites are usually adjacent to dirty fence lines due to seed being blown onto cropped paddocks

Image: Tony Cook

Transfer of knowledge into other areas

Registered fleabane herbicides can be suitable, in some cases, for those people managing fleabane in other areas of NSW. There are more road side and fence line registrations, so please check labels for the product that best suits your needs.

Some of the knowledge gained from the research in the cropping industry can also be transferred across to other industries, such as grazing industries, horticulture and viticulture. Many of the actives or herbicides used in broad-acre cropping may also have registration in these alternative industries.

Consequences of herbicide resistance

There is likely to be more populations of flax-leaf fleabane that are resistant to glyphosate than susceptible ones due to the widespread distribution of resistance on the register. Tall fleabane is also glyphosate resistant but not as widely spread around NSW. Fleabane will flourish in areas where glyphosate is the primary or sole method of weed control, such as road sides and fence lines (see previous images). The management of these areas need urgent and significant changes, but to get the changes required in these situations is not a smooth process. Unfamiliarity with newer treatments and the peace of mind when using glyphosate are common causes of inactivity with respect to change.

As mentioned previously, successful fleabane management in cropping areas was partly due to the effective tactic of double knocking in fallows (not to disregard the use of good crop competition and selective herbicides). Controlling isolated well developed plants in fallows was crucial as it stopped these plants producing vast quantities of seeds, and thus short-circuits the life cycle (via seed bank replenishment). However, double knocking is under a big threat due to populations in southern NSW developing paraquat resistance. Paraquat was the herbicide of choice as the second knock component. The dire prediction is that these paraquat resistant biotypes will eventually spread by wind throughout NSW thus negating the usefulness of double knocking. Alternative desiccant herbicides need to be researched to replace paraquat or better pre- or early post-emergence options are required to significantly reduce plant numbers reaching maturity.

Fleabane is here to stay. It is a well-designed plant and many researchers are trying to keep ahead of this weed by developing new chemical and non-chemical control methods to keep numbers very low.

Flax-leaf fleabane enjoying the road side environment

Image: Andrew Storrie

Bio-control of boxing glove cactus: A knock-out success

Boxing glove (or coral) cactus (*Cylindropuntia fulgida* var. *mamillata*) is native to south-western USA and northern Mexico. In Australia, it is a weed of national significance (WONS) and invades Queensland, New South Wales, South Australia and Western Australia. The weed is a significant pest which is able to form dense infestations. As a result, the access of animals to feed is reduced and other farm activities are hindered. It also poses a danger to landholders and livestock due to its sharp spines.

Through a collaborative project between Biosecurity Queensland (QDAF) and the NSW DPI (Weed Research Unit), an insect biocontrol agent was identified and tested to target boxing glove cactus. The insect, a sap-sucking bug or cochineal (*Dactylopius tomentosus*, cholla biotype) was originally imported from South Africa, where it has proven to be very damaging. Within relatively short periods of time, entire populations of boxing glove cactus have been killed, in scenes reminiscent of the biocontrol of prickly pear.

With funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit programme (co-ordinated by MLA), first releases of the cochineal took place in Queensland (March 2016), NSW and WA (April 2016) and SA (July 2016). To date, the cochineal has established at nine sites in these states. At one site in Qld near Longreach, all plants in the monitoring area have been infected and 60% have been killed by the cochineal. The cochineal has also spread up to 220 metres from the point of release. Similar results have been seen at other sites in Qld (Hebel), NSW (Tibooburra) and WA (Kalgoorlie). The cochineal for boxing glove cactus continues to be reared under a national initiative by officers in QDAF and NSW DPI for direct field release or to supply local government and NRM groups to release.

Host-specificity testing has been completed on another six biotypes of the cochineal, by researchers at QDAF, to target other species of *Cylindropuntia*. Once official approval for release has been granted by both Department of Agriculture and Water Resources and the Department of Environment, field releases of these cochineals will also be conducted. These biotypes target Hudson pear, snake cactus, jumping cholla and candlestick cactus.

For further information regarding the biocontrol of boxing glove cactus contact:

NSW: Andrew McConnachie (andrew.mcconnachie@dpi.nsw.gov.au)

or

QLD: Michael Day (michael.day@daf.qld.gov.au) or Peter Jones (peter.jones@daf.qld.gov.au)

Boxing glove cactus monitoring site, before (left) and 18 months after release (right) Image : Andrew McConnachie

Macspred Australia—latest news

Over 25 years of Australian innovation in vegetation management products

Macspred Australia, proudly Australian owned and operated, has been servicing the non-crop vegetation management industry with a range of specialist herbicides made for Australian conditions for over 25 years.

Management update

This year Macspred has seen a few changes in management with the retirement of Managing Director Stephen Stewart after 27 years. Mark Frances who has been with Macspred for 20 years and is based in Adelaide takes on the role of Managing Director. Mark is backed by the Head Office team at Ballarat where the manufacturing facility is located. Our Northern team and office is managed by Ray Gurney in QLD. Paul Wilcox looks after NSW sales and is based in Tamworth.

New website (Coming Soon)

We look forward to presenting to our customers a new image and website this year which will clearly define the markets that we service and the products for each market.

New products

Macspred are excited to announce some new products to the range this year including:

Macspred Glymac 510 Bio

Macspred Glufosinate 200

Macspred Trimac Granule

We will have some more products to announce later this year and during 2018.

By next year our glyphosate range will be extensive and will offer our customers a complete range of formulations catering for the non-crop market.

Research

Macspred are currently running a number of research trials around Australia designed to look at glyphosate resistance and options that can be used in non-crop vegetation management programs. These will include use of residual herbicides including new registrations.

Macspred invest over $100,000 each year into research and in addition we are working with multinational companies and researchers to look at new chemistry for our markets in Australia.

Building stronger relationships

Our aim is to build stronger relationships with our customers, suppliers and the non-crop industries. Our focus is on research and innovation to develop specialist products that address the needs of our customers.

The team at Macspred Australia look forward to servicing our customers into the future.

NSW Weed Society AGM—15 November 2017

Clarence Valley Council has the pleasure of welcoming you to Grafton for the NSW Weed Society AGM

We look forward to presenting our city at the tail end of the Jacaranda Festival. The Jacarandas should still be in bloom for your visit while attending.

The meeting will be held at the historic Grafton Primary Industries Institute (NSW DPI), home to research and agricultural extension for over 110 years. There will be an opportunity to listen to presentations from staff working in the field of weed management on the NSW North Coast, along with a tour of the Biological Control facilities.

Following the meeting there will be a dinner to be held at (TBA restaurant) in Grafton.

There are plenty of accommodation options as well from 4 star Motels in the CBD - to bed and breakfasts in the countryside.

Travel by car – 620km from Sydney; or rail direct to Grafton; or by plane to the Grafton Regional Airport – services offered by REX Express

While in town make the most of checking our the best of what the Clarence has to offer, whether it is our Clarence Coast, Clarence Country or the mighty Clarence River itself.

We look forward to seeing you at the AGM!

For more information go to Councils website – https://www.clarence.nsw.gov.au/

Or CV Tourism - http://www.clarencetourism.com/

NSW DPI institute at Grafton

Outline

12pm – welcome and lunch at Grafton Primary Industries Institute

1pm – inspection of Grafton Primary Industries Institute – biological control facilities

2pm – presentations – North Coast projects on weeds management

4pm – AGM meeting

6pm – dinner and presentations

9pm - close

Clarence Valley

clarence VALLEY COUNCIL

Project Summary: Plant Sure – environmentally safe ornamental plant scheme

This project aims to prevent future environmental impacts from weeds by reducing the availability of high risk (weedy) ornamental plants from supply and trade in NSW. Invasive plants (weeds) are a significant threat to biodiversity and the environment: around 5% of the 25,360 plants introduced into Australia for ornamental purposes have become environmental weeds, equating to some 1,366 weed introductions.

The NSW Government through the NSW Environmental Trust has provided $1 million over the next 5 years to develop and implement a voluntary scheme to promote the use of environmentally safe ornamental plants. The Plant Sure project will help to identify and reduce high risk (weedy) ornamental plants from being grown, supplied, sold or installed in NSW through an ongoing, viable and credible voluntary accreditation or certification scheme. The scheme will also aim to assist the green industry to maintain diversity and interest in ornamental plants by allowing a more proactive approach to assessing new plant introductions.

A consortia led by the Nursery & Garden Industry of NSW & ACT with representatives from industry (Australian Institute of Horticulture) and government (NSW Office of Environment and Heritage, and Department of Primary Industries) will work in partnership with researchers and industry professionals to develop the scheme. Additional project supporters and advisors include staff from the Botanic Gardens & Centennial Parklands, Local Government, NSW Weed Officers Association, Local Land Services, Australian Association of Bushland Regenerators and the Invasive Species Council.

A 'national-ready' and 'sector ready' voluntary accreditation or certification scheme will be developed to engage relevant industries in promoting environmentally-safe plants and remove or avoid using plants that pose an environmental weed risk. The Scheme will be underpinned by a robust plant assessment and categorisation process that will provide confidence for industry and consumers that their plant choices are safe for the environment.

The approach will engage and support the green life industry by showcasing their environmental stewardship and developing a strong brand to support a 'self-sustaining' independent scheme into the future. It will include education and training components to elicit long-term attitudinal and behavioural change in ornamental plant suppliers and consumers, and increase community knowledge and awareness of environmental weed issues.

The project will be delivered in two phases: Phase 1 involves a) identifying a suitable decision support process to assess the weed risk of ornamental plants; and b) investigating appropriate accredita-

Banksia spinulosa

Hairpin banksia

'Birthday Candles'

tion or certification mechanisms to deliver the Plant Sure scheme. The first phase of the project began in May 2017 and includes:

- a review and adaptation of existing plant and weed assessment tools and categorisation frameworks used in Australia and globally, including existing decision support tools. Best practice will be identified and a rigorous ornamental plant assessment process and decision support tool will be developed and tested; and includes: :
- a review of existing voluntary accreditation or certification programs and standards for similar projects (e.g. invasive species, sustainability, etc.) to determine what components should be included in the Scheme and what type of Scheme (e.g. accreditation or certification) is most suitable. The output will be a summary of one or more 'model' Schemes that will achieve project objectives for consideration by project stakeholders.

Upon completion of the above work, the Consortia will work with stakeholders to 'test' the plant assessment process and modify as necessary to develop a process that is suitable for a wide range of ornamental plant users. In addition, model 'schemes' will be trialled and modified to develop an effective, broad-reaching Scheme.

Phase 2 will build on these outcomes to: 1) further develop the Scheme in collaboration with stakeholders, including associated communication platforms, 'branding' and promotion; 2) assess plants currently used by industry, and categorise ornamental plants according to their environmental weed risk (e.g. 'high risk' plants would be removed from use, while 'safe' plants would be promoted in the Scheme); 3) establish auditing and compliance protocols; 4) engage and train industry participants in the voluntary scheme; and 5) develop and implement behaviour change and public awareness campaigns to encourage consumer and industry uptake.

Plant Sure project partners are keen to work with the community and all green-life industry groups across Australia that have an interest in the responsible use of ornamental plants, to ensure the plant assessment process and the Scheme are relevant, user-friendly and available to everyone. Please contact us if you are interested in being involved!

For further information,

Des Boorman, Project Manager
Nursery & Garden Industry of NSW & ACT
des.boorman@ngina.com.au
Mobile: 0427 775 086

Hardenbergia violacea

Chemcert 10 Point Herbicide Use Flow Chart

Ever used robust rates of a non-selective post emergent herbicide such as Roundup or other glyphosate formulations and not had a good kill and wondered why?

The targeted weeds looked green enough at the time of spraying and you noted 5 mm of rainfall the day before spraying to help freshen the weeds up. Yet the result was poorer than expected.

Turns out this is not an uncommon problem, for after a period of hot dry conditions weeds seek to conserve moisture loss by thickening the waxy cuticle on their leaf surface, thereby limiting herbicide uptake.
So you're examining the reasons why you had such a poor glyphosate kill. Your mind quickly assumes it must be resistance or tolerance by the weed to the herbicide used, given all the talk on the subject and the fact that you are a savvy spray applicator with state of the art equipment.

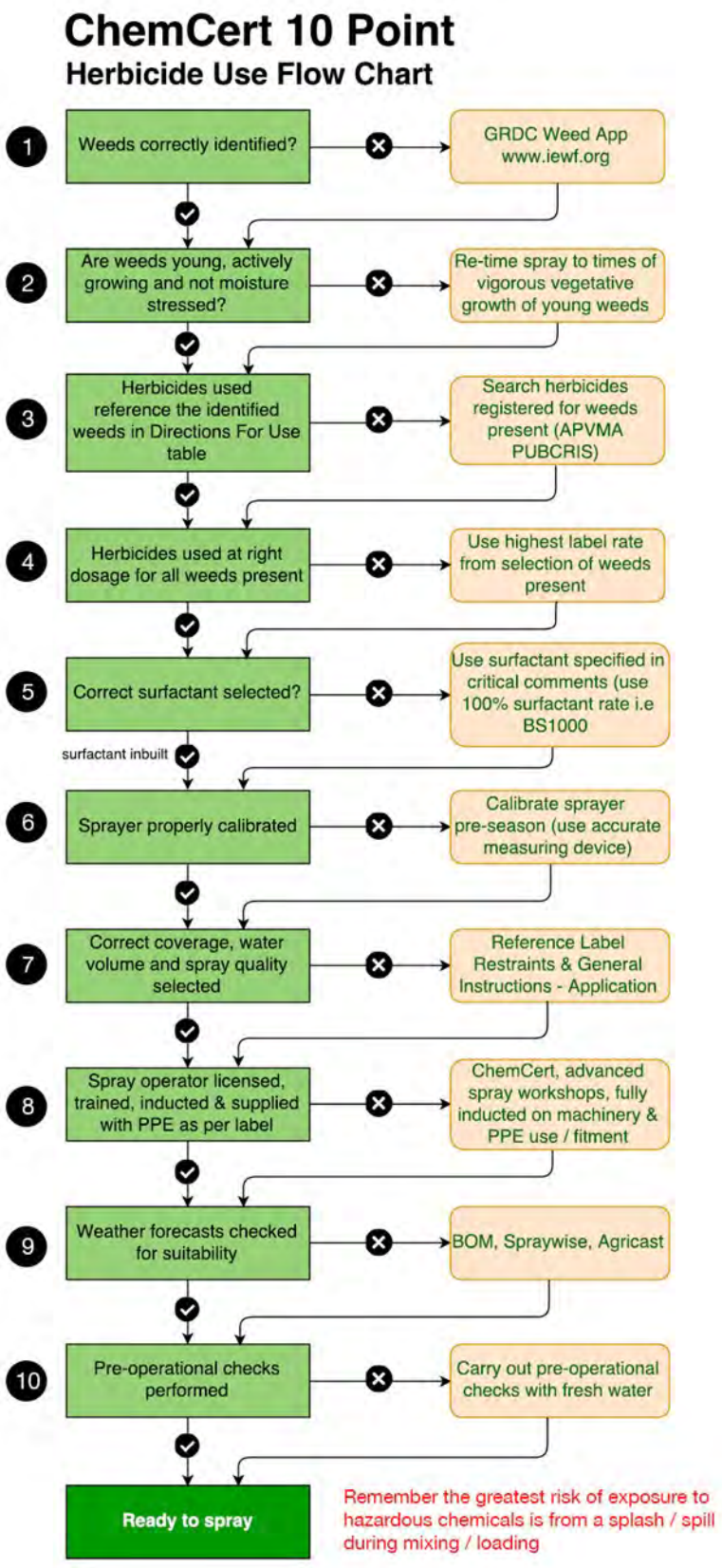
In our article Tips for Diversity and Integration in Weed Control (http://www.chemcert.com.au/news/tips-for-diversity-and-integration-in-weed-control), published last January, we detailed herbicide resistance testing. By way of recap a "Quick Test" from Plant Consulting costs $150 for one MOA; $495 for 5 MOAs and their website details the correct sampling process, remembering the test is for grasses and some broadleaf weeds.
So Quicktest in hand, you're lucky: resistance is not yet a problem at your location, so cross that factor for poor weed control off your list, at least for those species tested.
So if not resistance, then just how great an impact can moisture stress have on the efficacy of herbicides on target weeds?

Dr Dave Minkey found that over the range of conditions encountered in his research, the glyphosate 450 rate for 90% control ranged from 150mL/ha to 3L/ha. This represents a 20-fold difference in rate to kill the same sized weed, as a result of seasonal conditions and the interactions between temperature and moisture stress. So, in cool and wet weather with high RH at spraying, the lethal dose of glyphosate to kill wheat could be as low as 150mL/ha. By contrast if ryegrass is sprayed in hot and dry weather, the rate could be 3L/ha or higher.

In the above referenced article from AHRI it states that *"when plants are moisture-stressed they:*
1. Develop a thick, waxy cuticle on their leaves that is a barrier to herbicide uptake. After a rain event, the weeds freshen up as they start to grow again but the waxy cuticle remains, so even though rainfall helps, it doesn't completely undo the harm that has been done and these weeds will remain relatively hard to kill. If conditions improve and new leaves emerge with a normal, thin cuticle, the weeds can become more susceptible to an herbicide.
2. Translocation is slow during moisture stress so translocated herbicides struggle to reach their site of action."

With an understanding of the critical importance of healthy weeds (free from moisture stress) for herbicide applications to be effective, it's a good policy to work through a flow chart for many of the key factors that will help contribute towards the aspirational goal of achieving close to 100% weed control.

For an excellent range of articles from one of our sponsors (Chemcert), refer to http://www.chemcert.com.au/news/


ChemCert 10 Point
Herbicide Use Flow Chart
1
Weeds correctly identified?
GRDC Weed App www.iewf.org
2
Are weeds young, actively growing and not moisture stressed?
Re-time spray to times of vigorous vegetative growth of young weeds
3
Herbicides used reference the identified weeds in Directions For Use table
Search herbicides registered for weeds present (APVMA PUBCRIS)
4
Herbicides used at right dosage for all weeds present
Use highest label rate from selection of weeds present
5
Correct surfactant selected?
Use surfactant specified in critical comments (use 100% surfactant rate i.e BS1000
surfactant inbuilt
6
Sprayer properly calibrated
Calibrate sprayer pre-season (use accurate measuring device)
7
Correct coverage, water volume and spray quality selected
Reference Label Restraints & General Instructions - Application
8
Spray operator licensed, trained, inducted & supplied with PPE as per label
ChemCert, advanced spray workshops, fully inducted on machinery & PPE use / fitment
9
Weather forecasts checked for suitability
BOM, Spraywise, Agricast
10
Pre-operational checks performed
Carry out pre-operational checks with fresh water
Ready to spray
Remember the greatest risk of exposure to hazardous chemicals is from a splash / spill during mixing / loading

A novel "Compound Sowing Technique" boosts crop competition

Competitive crop cultivars, manipulation of row spacing, seeding rate and crop agronomy have been widely adopted to improve crop competition against weeds. However, all these methods do not address the man-made open space due to sowing rows. The crop interrows, the open niche for weed growth, have not been properly addressed in previous crop competition studies. An innovative "Compound Sowing Technique (CST)" was developed to dramatically boost crop competition on weeds, especially the competition between the interrows.

Two field trials were set up at different locations in southern NSW to evaluate the CST impact on weeds and the crop yield of wheat in 2016. This technique comprises of the conventional row-sowing of a main crop such as wheat at a reduced rate (such as 60-80% of the normal sowing rate) and broadcasting a suitable broadcast species. Three broadcast species were evaluated at two row spacings (22.4 cm and 45 cm) in the presence or absence of IBS trifluralin at the Rock and Marrar field sites. The main crop wheat was sowed at 50 kg/ha, together with a broadcast species of wheat at 40 kg/ha, Gland clover at 10 kg/ha, French Serradella at 10 kg/ha and a no-broadcast control. Gland clover and French Serradella was killed by herbicides in early September 2016 to avoid moisture competition to the main wheat crop. The initial annual ryegrass density at the Rock site (48 plants/m^2) was almost double that at the Marrar site (25 plants/m^2).

Among the three broadcast species, wheat was the most competitive, followed by Gland clover and French Serradella. Without the IBS treatment of trifluralin, CST wheat (broadcast wheat) at the Rock site significantly reduced annual ryegrass biomass by 71-77% at both the narrow (22.5 cm) and the wide (45 cm) row spacings in comparison to the no-broadcast control. Similarly it caused biomass reduction of ryegrass by 50% at the narrow spacing (22.5 cm) and by 27% at the wide spacing (45 cm) at the Marrar site.

The combination of CST wheat with IBS treatment of trifluralin further increased the suppression on annual ryegrass biomass from 71-77% to 88-90% when compared to the combination of no-broadcast + no-trifluralin at the Rock site, whereas it increased the biomass suppression from 50 to 60% at narrow spacing and from 27 to 70% at the wide spacing at Marrar site.

Compound sowing technique (CST) achieves strong interrow competition (left) as compared to the conventional sowing (right) ***Image: Dr Jeff Hoffman***

CST wheat resulted in higher overall wheat yield (by 15-22%) than the conventional sowing (no-broadcast wheat) at the Rock site, whereas the yield difference was not significant between the CST Gland clover, CST French Serradella and the no-broadcast control. There were also no significant yield differences between the broadcast treatments and the no-broadcast control at Marrar site.

The trial data have shown the strong competitive effects of CST on annual ryegrass between the interrows across both sites in 2016 and the main crop wheat yield was not affected. In order to maximise the "weeding" benefits of this techniques, there is a need to determine the suitable pre-emergent herbicides to minimise damages to broadcast species emergence, suitable legume species for broadcasting, sowing rates of the main crop and broadcast species, and the impact of site/seasonal climatic conditions on the effectiveness of CST.

Combination of a cereal crop with a broadcast legume species will have additional benefits of nitrogen fixation and biodiversity. The early growth of legume species will compete with weeds in the interrows before canopy closure. The residues of the legume species killed by the herbicides will continue to cover the interrow space, which could potentially reduce soil moisture loss in spring, a critical period for improved crop yields.

Improved interrow competition due to the broadcast wheat

Improved interrow competition due to the broadcast Gland clover

Using DNA barcoding to identify and study *Panicum* spp. infestations in the Riverina region of NSW

Panic grasses (*Panicum spp.*) are annual or perennial grasses that are globally distributed from temperate to tropical regions. Currently, there are at least 38 species of panic grasses in Australia. They are found in all states and territories in late spring and summer, and some of them have become more prevalent in recent years in the Riverina region of NSW (Fig. 1). Panic grasses produce a panicle inflorescence, which generally detaches at maturity and is disseminated by wind, accumulating on roadsides, along fence lines, and in fenced yards and paddocks.

Several introduced panic grasses have been categorised as noxious weeds and cause crop and pasture losses due to competition with pasture forbs and grasses. *Panicum* spp. are responsible for 19.4% (18/93) of the reported cases of photosensitisation in grazing livestock in Australia (Fig. 2), rendering these grasses the number one cause of photosensitisation among all other reported species, including *Lantana* spp. 16.1% and *Pithomyces chartaru* 15.1%. The reported toxic constituents associated with photosensitivity in panic grasses are steroidal saponins and sapogenins, although their exact roles in the pathogenesis of liver damage to grazing animals resulting in secondary photosensitisation have not yet been fully elucidated. Of importance to further toxicology studies associated with *Panicum* spp., is the ability to confidently identify and differentiate common panic grasses at the species level, currently a difficult task.

Fig. 1: Mature Panicum hillmanii plants along the train track near Wagga Wagga, NSW.

Fig. 2: Sheep exhibiting photosensitisation lesions on the muzzle and the pinna associated with panic grass ingestion.

To date, the identification of *Panicum* spp relies solely on morphological features of these grasses with particular emphasis on leaf hairs, seed size, plant height, colour and growth habit. However, this approach is time-consuming and requires a high level of expertise in taxonomy. Misidentifications of *Panicum* spp. are frequent. For instance, historical and anecdotal records indicate that the main *Panicum* spp. in Riverina region is witchgrass (*Panicum capillare*). Charles Sturt University (CSU) researchers are now performing recent surveys of local populations of panic grasses, and have determined that the vast majority (82.7%) of samples commonly collected in this region were identified as Hillman's panic (*Panicum hillmanii*), a morphologically similar species that has not been reported in this region previously. Hillman's panic was introduced as a seed contaminant in forage crops from North America in the 1800's. For positive morphological identification, seeds and inflorescences from a mature grass are required for correct identification. Delayed identification may lead to less efficacious chemical management of these summer pasture and fallow weeds, and thus enable the further spread of this weed. Therefore, a rapid and reliable identification method for panic grasses at an early growth stage is required for both land managers and graziers.

CSU researchers Yuchi Chen and Dr. Xiaocheng Zhu are using DNA barcoding for plant identification at the Panicum species level. This molecular method of identification compares the sequence of one or a few standardised DNA regions (or "barcodes") for identification. It has been proven highly effective for plant species differentiation, and has also been successfully applied in vegetation and floristic surveys, ecological forensics, regulatory enforcement, and studies of detailed community phylogeny, comparative biology and phylogenetic diversity.

Three commonly used DNA barcoding regions (two chloroplast and one nuclear) were selected for identification by barcoding in *Panicum* spp. These regions were sequenced for six common *Panicum* spp. in the Riverina, and the survey included voucher specimens of identified *P. effusum, P. hillmanii, P. laevinode, P. decompositum, P. gilvum* and *P. capillare*. The sequencing results clearly demonstrate that these six panic grass species can be separated at the species level regardless of their growth stage (Fig. 3). Further studies to verify the reliability of this method will include additional panic grass species using vouchered specimens for most *Panicum* spp. in the Riverina region. This research will not only provide additional tools for *Panicum* spp. identification and improved efficacy of weed management, but will prove fundamental for determination and assessment of potential toxicity in the Panicum genus to grazing livestock.

For more information, contact Yuchi Chen or Dr. Xiaocheng Zhu, Plant Interactions Research Group, Graham Centre for Agricultural Innovation, Charles Sturt University.
T: 0405920998, E: yucchen@csu.edu.au

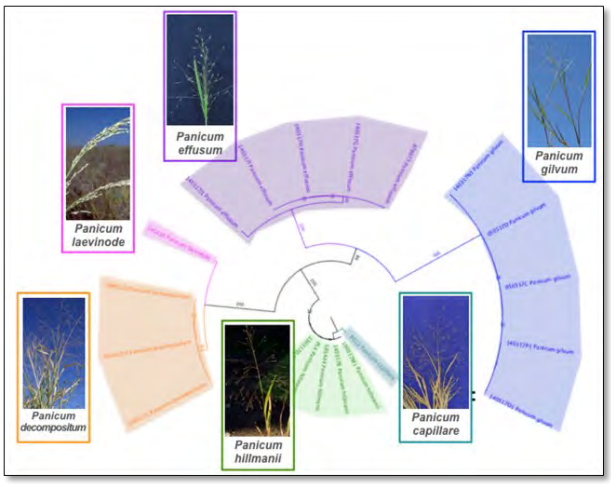


Fig. 3: The phylogenetic tree created using ITS sequences for 20 samples of six common *Panicum* species in the Riverina region of NSW including *P. effusum, P. hillmanii, P. laevinode, P. decompositum, P. gilvum* and *P. capillare*.

New member profile

James Mwendwa

James Mwendwa is a GRDC scholar and Research Associate at Charles Sturt University. He is currently investigating mechanisms of weed control in weed suppressive Australian winter commercial wheat genotypes and sustainable weed control techniques, plant physiology, and analytical chemistry. He is using liquid chromatography coupled with mass spectrometry (LC-MS/MS QTOF and QQQ) to analyse, identify, profile and quantify primary and secondary metabolites of interest in weed suppression through both targeted and non-targeted metabolic profiling. His weed research work also includes barley and canola crops.

James is a graduate of MSc in animal Science and Bachelor of Applied Science in Animal Science from the Massey University, New Zealand with majors in Animal and pasture production. He has practical experience in livestock management, agronomy, pasture research and forage production.

He began his career as an Animal Health Technician in Kenya and later worked as a Dairy Consultant for DairyNZ in New Zealand after his studies at Massey university. He was involved in the co-ordination and facilitation of potential solutions within the regional extension strategy, which included whole farm analysis, cost analysis, animal health, financial budgets and cash flow, feed budgets, networking and extension activities. From 2010 to 2014 James worked for Central West Farming Systems Inc at Condobolin NSW as a Research Agronomist. He was involved in weed research, crop water use efficiency, crop variety trials, fallow weed management, crop rotations, nitrogen fixation by legumes, pasture management, stubble management, soil carbon and nitrous oxide emissions management.

His research interests include weed suppressive crops especially cereals and pasture crops, invasive weed biology, chemistry and genetics, analytical chemistry of plant bioactive compounds, the interactions between plant metabolite exudates and soil microbial community, the role of microbes in weed suppression and farming systems; grazing management, crop rotations, mixed faming systems. James' career focus is to contribute to agricultural research to improve crop and land productivity and sustainability with a national and global focus on food security.

Welcome to the NSW Weeds Society James

In the next edition of A Good Weed we investigate weed hygiene along road sides and fence lines

The Weed Society of New South Wales Inc. acknowledges the generous support of the following organisation for their sponsorship of the Society and this Newsletter