Regional and National Workshops
Fleabane — an emerging weed in southern farming systems

21 – 22 March 2012
Convention Centre
Charles Sturt University
Wagga Wagga
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**DAY ONE - 21ST MARCH 2012**

**REGIONAL FLEABANE WORKSHOP**

- Better understanding the spread of flaxleaf fleabane (*C. bonariensis*)
- Mature fleabane control in fallows
- Summer fleabane control
- The first step to successful fleabane control – in-crop management
- Fleabane management in mixed farming systems
- Flaxleaf fleabane control in lucerne based pastures

**NATIONAL FLEABANE WORKSHOP**

- Better understanding the spread of flaxleaf fleabane (*C. bonariensis*)
- Dispersal of *Coryza bonariensis* (flaxleaf fleabane) seeds
- Fleabane response to climate change and potential for biocontrol
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### Day 2

**National Fleabane Workshop (cont.)**

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Fleabane control strategies with Amicide Advance and Sharpen<br>Frank Taylor (Nufarm) |
| 9.30 – 10.00 | Mature fleabane control in fallows<br>Andrew Lockley (Landmark) |
| 10.00 – 10.30 | The first step to successful fleabane control - in-crop management<br>Tony Cook (NSW DPI) |
| 10.30 – 11.00 | **Morning Tea** |
| 11.00 – 11.20 | Chair: Steve Walker (QAAFI)  
Fleabane management in mixed farming systems<br>Chris Minehan (RMS) |
| 11.20 – 11.40 | Fleabane management in pastures<br>Hanwen Wu (NSW DPI) |
| 11.40 – 12.10 | **Session 3: Future management strategies and research needs**  
Seed dispersal systems impact success of weed management systems – the case of fleabane<br>Roger Cousens (University of Melbourne) |
| 12.10 – 1.00 | **Lunch** |
| 1.00 – 2.30 | Summary and Panel Discussion –management and control, where does the research take us from here?<br>Roger Cousens (University of Melbourne), Steve Walker (QAAFI) and Mark Harris (RMS) |
BIOGRAPHIES

Dr Catherine Borger

Dr Catherine Borger is a Research Officer with the Department of Agriculture and Food WA, based in Merredin, WA. Catherine has a Bachelor of Science (Agriculture) Hons and a PhD from the University of Western Australia.

Dr Borger started work at DAFWA in 2002 working on herbicide resistance management. From 2004-2007 I completed a thesis at UWA on the biology and management of prickly saltwort (Salsola australis). Since 2007 Catherine has worked at DAFWA on projects related to the biology and management of emerging weed species, the management of resistant weed species and integrated weed management techniques including improved herbicide performance and improved crop competitive ability.

Tony Cook

Tony Cook, Technical Specialist Weeds, has 22 years experience in weed research for NSW Department of Primary Industries. After graduating in 1988 from The University of Sydney with a bachelor of Agricultural Science, he commenced work in Glen Innes as a Technical Officer in 1989. His initial roles were to conduct applied research into cropping and pasture weeds in northern NSW. Whilst still employed in the department, he transferred to Tamworth in 1995. The job had evolved such that his roles now include developing effective integrated weed management of pasture, cropping and environmental weeds. Tony regularly reviews data packages submitted to the APVMA for label changes or Pesticide Permits.

In 1998, Tony graduated from The University of New England with a Master of Rural Science degree. His thesis was titled “Reducing seed production using late post-emergence applications of selective herbicides to manage wild oat (Avena spp.) populations.” The data from his thesis lead to a commercial practice known as Selective Spray-topping, a highly effective management tool for controlling herbicide resistant wild oats in wheat.

More recently Tony has had major roles in projects that included the improved control of alligator weed, fleabane, parrot’s feather, galenia, Coolatai grass, various woody weeds and Giant Parramatta grass and the prevention and management of herbicide resistant weeds.
Professor Roger Cousens

Professor Roger Cousens is based in the Department of Resource Management & Geography, The University of Melbourne and is an Adjunct Professor, Charles Sturt University. Roger has over 25 years experience in weed ecology, starting at the Weed Research Organisation (UK), then via University of Sydney, Department of Agriculture Western Australia, La Trobe University to present position. He is also an Honorary Member of the Weed Science Society of America (2011).

Roger has over 150 research publications, including books *Dynamics of Weed Populations* (1995), *Western Weeds: The Weeds of Western Australia* (two editions), and *Dispersal in Plants: A Population Perspective* (2008). Particular emphasis has been on competition between weeds and crops, population dynamics and dispersal.

Roger’s current research projects include hawkweed eradication in the Australian Alps, the biogeography and population genetics of *Cakile* invasions in Australia and New Zealand, and the impacts of coastal invasive plants.

Mark Evans

Mark is the National Category Manager for both Seed and Technical Services for Ruralco, based in Wagga Wagga. He sits on the board of the Ag Institute and has been heavily involved with industry accreditation through the development of AgCredited. He is also involved with GRDC through the Agribusiness Reference Group and advisor update planning committee’s as well as having been involved with previous Weed CRC’s and Avcare (CropLife).

Ben Fleet

Ben is a research agronomist with the University of Adelaide’s School of Agriculture, Food and Wine, working on a Grains Research and Development Corporation funded project into emerging weeds in changing farming systems. He is also completing his PhD on trifluralin resistance in annual ryegrass. Ben has previously worked as an agronomist with Primary Industries South Australia and within the private sector.

Andrew Lockley

Andrew Lockley is an agronomist with Landmark Temora. He also covers livestock health and nutrition, and coordinates agronomic trials within the Temora area for Landmark. Research looks at coming up with solutions to grower problems and product development. Fleabane is a very topical problem at the moment and effective control throws up many challenges to look at.
Chris Minehan

Chris Minehan is a farm management consultant with Rural Management Strategies (RMS) in Wagga. He provides production advice, whole farm planning and strategic management advice to farm businesses in this region.

Chris grew up on a farm at Cowra and studied Agricultural Science at the University of Sydney. After completing a thesis on crown rot, Chris worked for four years as a consultant in Goondiwindi, Queensland for consulting firm Michael Castor and Associates.

Chris moved back to Wagga in 2010 and joined RMS in 2011. In addition to the time spent managing fleabane in the northern grain belt, Chris has carried out a number of trials locally, looking at fleabane management in a range of situations.

Dr Louise Morin

Dr Louise Morin has been involved in weed research since her postgraduate studies, when she combined her plant pathology expertise with weed science to develop plant pathogens as biological control agents for weeds (1988 MSc, McGill University, Canada; 1993 PhD University of New England, Australia). Since then she has been actively involved in this field of research and has worked with a wide range of fungal pathogens and weeds of natural, crop, and pasture ecosystems in Canada (Agriculture and Agri-Food Canada, 1993-94), New Zealand (Landcare Research, 1994-96) and Australia (CSIRO, since 1996).

She was Task Leader overseeing biological control projects in the former Cooperative Research Centre for Australian Weed Management in 2004-08 and is currently Team Leader for Temperate Ecology at CSIRO Ecosystem Sciences in Canberra.

Lawrie Price

Lawrie Price is the Research Manager for Northern Grower Alliance (NGA). NGA is a farmer/agronomist group that conducts applied agronomic research in response to prioritised northern region grain grower needs. NGA receive funding from the GRDC. NGA has nodes based on the Liverpool Plains, Walgett, Moree/Narrabri, Goondiwindi, Mungindi/St George and the Darling Downs.

Lawrie is an agricultural science graduate who has previously worked for 18 years as a researcher with various chemical companies and for five years with the Queensland DPI (now DEEDI) on the Eastern Farming Systems project.
Maurie Street

Maurie Street is CEO of Grain Orana Alliance (GOA), a GRDC funded grower solutions group operating in the central/North cropping belt of NSW. GOA works to investigate and provide solutions to issues restricting grain production raised in the local areas. Fleabane control constantly arises and currently is high on the priorities list. As such, over the last 3 years GOA has undertaken work to address this issue. Much work has already been done by other key authorities such as the DPI and DEEDI, so GOA has worked to demonstrate/validate some of these past findings for local growers and agronomists, but also pursue other pathways not yet investigated. Key areas GOA have worked on include; Screening common glyphosate tank mix options for the control of medium to large fleabane in fallow; the use of paraquat and tank mixes based on paraquat to control fleabane; and in-crop residual herbicides to improve the control of fleabane.

Frank Taylor

Frank Taylor is the Nufarm Research and Development Officer based in Toowoomba, Queensland. Frank has many years experience in R&D trials, focusing on new product development and product fit in cropping systems throughout New South Wales and QLD. He has over 10 years experience investigating fleabane control options and strategies.

Dr Steven Walker

Dr Steven Walker’s current position is as Associate Professor with the newly formed Queensland Alliance for Agriculture and Food Innovation (QAAFI) at The University of Queensland.

Dr Walker was formerly the Leader of the Weed Science team for Department of Employment, Economic Development and Innovation and Program Leader in the CRC for Australian Weed Management.

He currently leads a weed research program on the issues relating to herbicide resistance, modelling, integrated weed management in grain and cotton farming systems, safe and effective use of herbicides, non-chemical tactics and weed ecology.

Dr Walker is an active member of:
- Australian Glyphosate Sustainability Working Group
- National Integrated Weed Management Initiative
- Executive committee for Weed Society of Queensland
- Delegate for Council of Australasian Weed Societies CAWS)

In 2008 Dr Walker was awarded the CAWS medal at the 16th Australian Weeds Conference.
Dr Michael Widderick

Dr Michael Widderick is a senior research scientist with Queensland DEEDI based in Toowoomba. He has extensive experience in developing integrated weed management (IWM) strategies for difficult to control weeds, including those with herbicide resistance. Michael is currently developing IWM strategies for fleabane and other key weed species of the northern cropping region, and is the Queensland collaborator on the Australian Herbicide Resistance Initiative.

Michael is an active member of the Weed Society of Queensland and until recently served as the society’s secretary. He is also the current vice-president of CAWS (Council of Australasian Weed Societies).

Dr Hanwen Wu

Dr Wu completed his Masters study on Organic Farming at Wageningen University (The Netherlands) in 1996 and received his PhD in Agriculture (Allelopathy) from Charles Sturt University (CSU) in 1999.

He then worked as a Postdoctoral Research Fellow at CSU for two years and as a Weed Research Agronomist for three years on integrated weed management of summer weeds with DEEDI in Toowoomba. Dr Wu joined NSW DPI in 2006 as a senior Weeds Research Scientist and team leader. He has 10 years experiences in fleabane research and has published a number of papers on fleabane biology and management.
Better understanding the spread of flaxleaf fleabane (*C. bonariensis*)

Hanwen Wu, EH Graham Centre, NSW DPI, Wagga
Email: hanwen.wu@dpi.nsw.gov.au

Flaxleaf fleabane (*C. bonariensis*) is native to South America. It was introduced into Australia in the 1840’s, and its importance has increased in the northern grain region since the 1990’s. It was identified as a major crop weed in northern New South Wales and southern Queensland in early 2000’s. The weed has now widely spread into southern states and severely infests cropping lands, roadsides and other non-agricultural areas. The widespread occurrence of flaxleaf fleabane in all states in Australia indicates the weed does not have a specific climatic and soil type requirement, although it was found more common on lighter soils.

A number of factors have contributed to its rapid spread, including reduced cultivation as a result of wide adoption of no-till farming systems, reduced use of effective pre-emergence herbicides and ineffective post-emergent herbicides. In addition, its unique biological characteristics also contribute to its invasion.

Fleabane is a difficult to control weed due to its unique biological features, and high management input is required. An integrated approach, incorporating chemical and non-chemical control options should be adopted to manage fleabane and prevent the development of herbicide resistance.
Mature fleabane control in fallows

Andrew Lockley, Landmark, Temora
Email: andrew.lockley@landmark.com.au

Fleabane is becoming a major weed in southern NSW and populations in the Temora area have rapidly exploded with the wet summers. Smaller fleabane plants present some flexible control options, but what happens when we are dealing with mature, larger plants?

In the 2011 summer, the opportunity arose for Landmark Temora to undertake a large scale trial looking at control options for fleabane plants on the verge of flowering. The paddock was an old lucerne stand, presenting a good range of summer weeds with an excellent fleabane population. The initial spray treatment included 22 mixes, with a range of costs, actives and residuals. There were then eight treatments over sprayed at 12 and 21 days after the initial spray.

The best of the single application sprays achieved around 80% control, with most being commercially unacceptable. However, when a double knock strategy was adopted controls improved to well over 90%. The key to controlling fleabane is a double knock. The first spray options are determined by cost, residual, plant backs and what other weeds are present. While the second spray needs to target application techniques to improve the results. Some treatments, although not achieving full control, did reduce flowering and seed set.

Whether we like it or not, fleabane is now a part of our farming landscape. Similar to other weeds we need play a numbers game, and our strategies to control fleabane, need to reduce the seed bank.
Summer fleabane control

Maurie Street, Grain Orana Alliance, Dubbo
Email: maurie.street@grainorana.com.au

Trials have shown control of medium to large size fleabane is inherently variable, and there has been no consistently effective tank mix option for the control of larger plants, although there are some options that have proved to often work better. Herbicide spikes of 2,4-D with glyphosate have often performed close to the top. Trials have also consistently confirmed that with a two pass strategy using paraquat in the second pass, has often been the most reliable of all options.

This variability in control will most likely only increase as will the cases of control failure as fleabane populations develop greater levels of glyphosate resistance. Alternative herbicide options not based on glyphosate should be considered and implemented early to both maintain the viability of zero till farming systems and reduce the rate of further herbicide resistance development.

A number of trials now have demonstrated the potential for the use of paraquat and tank mixes based on this for control of medium to large fleabane or as the double knock agent. Trials have demonstrated a number of single pass applications have matched or outperformed the industry standards of glyphosate plus 2,4-D, achieving control in the 90% plus range.
The first step to successful fleabane control – in-crop management

Tony Cook, NSW DPI, Tamworth
Email: tony.cook@dpi.nsw.gov.au

Targeting weed management strategies when weeds are most vulnerable often leads to excellent results. This rule is very applicable when controlling fleabane. Early intervention using winter in-crop residual and early post-emergence herbicides is a key recommendation by many agronomists. Without such a tactical method, many winter crops will be a nursery for fleabane infestations. These weeds ultimately survive the harvesting process and become a major issue in summer fallows. With increased size, the weeds are harder to control and require more herbicide inputs via the double knock approach.

To circumvent this summer fallow issue, it is strongly recommended that winter in-crop management be used. Tactically, this approach uses many principles of integrated weed management. Firstly, soil disturbance at sowing may bury a large proportion of fleabane seed preventing them from emerging. Furthermore, applying herbicides either as pre- or post-emergence to weeds is extremely effective as weeds are most susceptible to herbicides when small. Lastly, if the crop is competitive, significant reductions in fleabane can be achieved. The major emergence of fleabane is typically in autumn near to time when many winter crops are establishing. Targeting multi-faceted integrated weed management at this time is therefore very rewarding and prudent.

In this paper many of the latest in-crop research findings will be reviewed. Following this, recommendations for potential areas of research will be highlighted with discussions on potential risks associated with commercially viable treatments.

It is understood that winter in-crop management of fleabane is not a stand-alone tactic. Other management tactics in the weeds’ life cycle are important (double knocking to prevent seeding). In addition, in-crop infestations are not the only issue, as the weed proliferates in fence-line, roadside and other non-agricultural areas. However, despite these other situations, in-crop management of fleabane should be the first and most effective strategy.
Fleabane management in mixed farming systems

Chris Minehan, Rural Management Strategies, Wagga Wagga
Email: chris@rmsag.com.au

Fleabane is an emerging weed problem in southern NSW, but has been a weed of significance in other parts of Australia for nearly 20 years.

Managing fleabane in mixed farming systems does not have to be difficult or expensive, provided an integrated approach is taken. Utilise crop and pasture competition, grazing, herbicides and cultivation to achieve cost effective control.

Fleabane requires sunlight to germinate and is relatively uncompetitive as a seedling. By growing competitive crops and pastures, reducing bare ground, and utilising pre-emergent herbicides, fleabane can be successfully controlled before it emerges. Once fleabane plants establish a strong root system, control becomes difficult and expensive.

Assessment of age (not just size) and plant stress is vital to the success of any fleabane control strategy.

When targeting fleabane with herbicides it is important to remember:
1. Glyphosate alone will not control fleabane without the addition of a hormone
2. When weeds exceed 70mm or start to elongate, a “Double Knock” with Glyphosate + Hormone followed by Paraquat is required for adequate control.

Factors that influence the success of a “Double Knock” treatment include:
- Herbicide choice + rate
- Interval between treatments
- Water rate and coverage, particularly in the second application.

Cultivation is an effective tool for controlling fleabane, provided it is aggressive enough to pull out older plants and bury the seeds. Strategic cultivation should be considered where there is an appropriate opportunity within the system.
Flaxleaf fleabane control in lucerne based pastures

Hanwen Wu and Eric Koetz, EH Graham Centre, NSW DPI, Wagga, Colin Plater, Dow AgroSciences, Wagga and Neil Durning, AGnVet Services, Wagga
Email: hanwen.wu@dpi.nsw.gov.au

Currently, little information is available on the effective herbicide control of fleabane in degraded lucerne pastures. Pasture has been an integral component to the success of mixed farming systems in southern Australia. Recently, many pasture paddocks have become heavily infested with fleabane. Mature fleabane plants set millions of seeds, replenishing the soil seedbank. Ineffective control of fleabane in pastures could therefore be a vital source of seeds for invasion to other paddocks or farm properties, due to the long distance dispersal capability of the weed.

There are no registered products currently available for fleabane control in lucerne based pastures.

A fleabane control trial was conducted in a degraded lucerne pasture in southern NSW, with 35 herbicide treatments applied on 1 July 2011. This trial targeted small fleabane plants and evaluated some residual herbicides for long-term control. The results showed that most treatments did not achieve commercially acceptable control. But the addition of suitable Group C herbicides such as atrazine and simazine to Paraquat provided excellent residual control. While these treatments gave better control it is important to be aware that many herbicide treatments caused significant pasture damage, in particular subclover and chicory.

A second fleabane control trial in lucerne pastures was conducted to target mature fleabane soon after grazing, with 25 treatments applied on 2 December 2011. Similarly, only a few double-knock treatments gave excellent control of fleabane. These included 2, 4-DB ± flumetsulam (or ± a Group C herbicides) followed by 7 days later Paraquat ± atrazine (or simazine).

Although fleabane plants can be grazed by sheep, its re-growth characteristic makes the grazing option ineffective. It is therefore important to control fleabane after grazing, otherwise it will flourish as a result of little competition.
Notes
Flaxleaf fleabane (*C. bonariensis*) is native to South America. It was introduced into Australia in the 1840’s, and its importance has increased in the northern grain region since the 1990’s. It was identified as a major crop weed in northern New South Wales and southern Queensland in early 2000’s. The weed has now widely spread into southern states and severely infests cropping lands, roadsides and other non-agricultural areas. The widespread occurrence of flaxleaf fleabane in all states in Australia indicates the weed does not have a specific climatic and soil type requirement, although it was found more common on lighter soils.

A number of factors have contributed to its rapid spread, including reduced cultivation as a result of wide adoption of no-till farming systems, reduced use of effective pre-emergence herbicides and ineffective post-emergent herbicides. In addition, its unique biological characteristics also contribute to its invasion.

Fleabane is a difficult to control weed due to its unique biological features, and high management input is required. An integrated approach, incorporating chemical and non-chemical control options should be adopted to manage fleabane and prevent the development of herbicide resistance.
Wind mediated seed dispersal is difficult to accurately assess, but is the key to successful management of weeds like *Conyza bonariensis* (Flaxleaf fleabane). Primary dispersal is influenced by abscission requirements and environmental conditions. Secondary dispersal events are influenced by vegetation type and environmental obstacles. This research investigated abscission requirements of *C. bonariensis*, and considered total dispersal in field conditions.

Experiments were conducted to examine seed release thresholds of seed heads at varying age and at varying orientations (in relation to the direction of the air flow). While seed loss increased with increasing wind speed, average loss from seed heads increased from 49.4% on the day they opened to 92.8% from seed heads open for ten days. Further, there was an average seed loss of 76.4% when wind was directed towards the base of the seed head (simulating an updraft), compared to 58.8% loss for wind directed towards the top of the seed head (simulating a downdraft). Seeds were released in the strongest wind events, and were more likely to be released in updrafts rather than downdrafts.

It has been established that minor changes to abscission will have major impacts on maximum dispersal distance. The abscission requirements of *C. bonariensis* seed will maximise the potential for long distance dispersal to occur. Field based research involved releasing *C. bonariensis* seeds on a farm and noting the location of rosettes growing in the following season. Most rosettes were found within an environmental obstacle (i.e. vegetation along roadsides or fences, dense stubble) rather than in the open fields.

*C. bonariensis* is capable of germinating within open fields, this suggests that following initial dispersal, seeds continued to travel in future wind events until they reached an obstacle that could provide shelter from the wind. Incorporating this data into models gave an accurate approximation of dispersal. The model output indicated that *C. bonariensis* seed in the Merredin region can travel over 800m from the parent plant in primary dispersal events, and may experience secondary dispersal depending on vegetation cover and environmental obstacles.
Fleabane response to climate change and potential for biocontrol

Louise Morin
CSIRO Ecosystem Sciences
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*Conyza bonariensis*, commonly named flaxleaf fleabane (hereafter referred to as fleabane), is becoming an increasing problem in minimum tillage farming systems in Australia. While herbicides generally provide effective control of fleabane, the occurrence of glyphosate resistance in fleabane populations in north-east Australia is a main concern. Biocontrol is a tool that could be added to the current management options for this main weed of cropping systems in Australia.

Colleagues Pippa Michael (Curtin University) and John Scott (CSIRO) have recently developed a species distribution model for fleabane using the niche model CLIMEX based on plant growth and germination experiments and information from the distribution and biology of the species. The model indicates that fleabane has not yet reached the full extent of its distribution in Australia. With climate change however, the distribution of fleabane is projected to contract southwards and become mostly confined to the coastal regions of southern Australia, particularly in eastern Australia.

The prospects for biocontrol of fleabane in Australia are promising. Similar annual Asteraceae plants e.g. Parthenium weed, *Ambrosia artemisiifolia* and Noogoora burr, have been targeted with biocontrol with some success in Queensland. Fleabane does not have close relatives in Australia, which will facilitate the selection of candidate agents that do not pose a risk to non-target plants. In its native range in Central and South America, several putative host-specific rust fungal pathogens and plant feeding insects are known to be associated with the genus *Conyza*, although no systematic surveys have been carried out on fleabane. Rust fungi in particular are recognised as highly promising candidates for weed biocontrol based on past experiences, including in cropping systems (i.e. skeleton weed rust). The key steps and potential hurdles that may be encountered in establishing a biocontrol program for fleabane will be discussed.
Why glyphosate is not working

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Flaxleaf fleabane (Conyza boneriensis) has become a major weed problem in fallows across the no-till farming systems of southern Queensland and northern NSW in the last decade. In most situations, glyphosate gave only poor control. Consequently, the survivors produced prolific amounts of air-blown seed that then moved across paddocks and farms, resulting in widespread and dense infestations within several seasons.

To determine whether this weed had developed glyphosate resistance, seeds were collected randomly from different cropping and non-cropping situations across this region. Seedlings from these seeds were then treated to a range of glyphosate doses in three pot experiments. The majority of the populations from fallows were not controlled even with high glyphosate rates.

In contrast, all populations from situations without a history of glyphosate spraying were highly sensitive to this herbicide. As the result of this research, flaxleaf fleabane was confirmed as the first glyphosate-resistant broadleaf weed in Australia as recorded on the Australian Glyphosate Sustainability Working Group website. Subsequent research investigated the impact of weed size and soil moisture on the response of glyphosate-susceptible and glyphosate-resistant populations. The implications for management of this problem weed are discussed.
Flaxleaf fleabane has become highly prevalent across many districts of South Australia in both summer fallow and roadside environments. Herbicide control of fleabane in summer fallow has proved difficult due to poor spraying conditions and presence of large plants after harvest. Weed control on roadsides and other non-crop environments is largely dependent on glyphosate, which tends to be not very effective and there have been confirmed reports of resistance to this herbicide in Queensland. Glyphosate resistance from non-crop areas could easily spread into cropping areas and cause management difficulties. This risk was highlighted by glyphosate resistance screening undertaken in 2011. Eighty two fleabane populations were collected from roadsides, railway tracks and irrigation channels in QLD, NSW, VIC, SA and WA. More than 50% of fleabane samples contained individuals resistant to glyphosate.

Three fleabane herbicide efficacy trials have been conducted in summer fallow, one at Bute in 2010, and at Bute and Pinnaroo in 2012. In the 2010 trial, effective control of fleabane was not achieved by any herbicide treatment investigated but the combination of glyphosate, 2,4-D amine and metsulfuron provided the highest level of control (60%) at 43 days after application. It is too early to report on the findings of the fleabane control trials being undertaken in 2012.

There is no doubt, research effort is needed to develop effective management options for fleabane, especially for large plants which are routinely encountered after harvest in southern Australia. There is also a need to raise awareness of fleabane as a weed of summer fallow situations. As fleabane can disperse readily over long distance, management strategies are needed for non-crop habitats so that the risk of glyphosate resistance spreading into agricultural systems can be minimised.
Fleabane within south eastern Australia

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Discussions with agronomists from a range of locations around South Eastern Australia have found that the incidence and severity of fleabane varies depending on rainfall timing and crop rotation.

Increased summer rainfall over the last three years has seen fleabane germinating late in crop with rain affected harvests the management of this weed has been reduced through ineffective use of herbicides in many areas. This situation has probably impacted by the influence of tolerance to glyphosate and the development of glyphosate resistance in some areas.

Regions impacted include most cropping zones of SE Australia, including areas of Tasmania which are just starting to see fleabane infest roadsides and encroach on cropping paddocks.

The key focus for advisors this year will be to manage the risk of fleabane germinating late in crop by using post-emergent herbicides which have residual characteristics as pre-emergent herbicides for end of season control or suppression. In addition to this advisors will be looking to manage germinated and established fleabane using double knock techniques which have been widely adopted in N NSW and Queensland farming systems.

Depending on the pulse crop to be grown and the soil pH there is still a significant amount of research which needs to be completed to provide viable herbicide options for Southern rotations where fleabane is either a developing weed or already established.

Long term management will include the need to discuss road-side management with councils and other land holders to reduce the risk of increased levels of herbicide resistance in this weed which can affect neighbouring farming paddocks.
Adjuvants and spray application on mature fleabane

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Fleabane has been one of the most difficult to control weeds in the northern grain region and as such has been near top of the agenda as an issue for the Northern Grower Alliance. Since 2008 NGA has conducted over 60 trials against fleabane looking at many different aspect of this weed. In this paper I will address some of the more significant trials which have helped shape the way the grains industry in the North tackles this weed. This includes work on large flowering fleabane in the summer fallow.
**Fallow management of fleabane - double knocks, residuals and timing**

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*Conyza bonariensis* is one of the most widespread and difficult-to-control weeds of the sub-tropical cropping region, particularly in glyphosate-based, zero-tilled fallows. We identified effective alternative to glyphosate for fallow control of this weed and examined the impact of weed age on efficacy.

A range of knockdown herbicides and glyphosate mixes provided 62-100% control of young seedlings (≤1 month old). However efficacy decreased significantly with increasing weed age. The consistently most effective treatment for large rosettes was the double-knock (sequential) tactic of glyphosate + (2,4-D + picloram) followed seven days later with paraquat, providing 92-100% control. When this double-knock tactic included atrazine or diuron in the second knock, 100% control of pre-bolting weeds and subsequent emergences was achieved.

The residual herbicides atrazine, diuron, chlorsulfuron and isoxaflutole gave 94-100% control of new emergences for three months in fallows preceding and in early growth of sorghum, cotton, wheat and chickpea respectively.

The strategy of using a residual and double knock in fallow will minimise replenishment of the seed bank and markedly lower the risk of further evolution of glyphosate resistance. Effective fallow management will also result in reduced weed pressures in subsequent crops.
Fleabane management with Amicide Advance 700 and Sharpen WG

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Two herbicides that can be used in a fleabane management strategy include Amicide Advance® 700 and Sharpen® WG. Amicide Advance® 700 is a new amine formulation of 2,4-D, which has a new registration for control of fleabane in fallow, and in both wheat and barley. Sharpen WG (registration pending) is a new Group G herbicide which has been developed as a partner herbicide to Roundup® Attack™, also has registration for fleabane control in fallow.

The best strategy for managing fleabane is to target small, young weeds 4-6 weeks after germination. Targeting fleabane at the rosette stage, when the plants are small and young is the key to achieving consistently good control.

When using Amicide Advance, selecting the correct fleabane control strategy will depend on the size of the weeds. More consistent control is obtained targeting small rosettes (cotyledon-12 leaf), with a tank mixture of Amicide Advance 700 plus Roundup ATTACK. Against elongating to flowering plants (often targeted in the spring and summer) high levels of fleabane control can be achieved with a tank mix of Amicide Advance 700 plus Roundup ATTACK followed by a sequential application of Nuquat®.

Sharpen WG contains the active ingredient saflufenacil – branded as KIXOR® which will have a label claim for control fleabane up to the 6 leaf stage when tank mixed with Roundup Attack. Knockdown is very rapid, with desiccation in as little as 4 days, depending on environmental conditions. The use rates of Sharpen will ranged from 17-34 g/ha plus Bonza Spray Adjuvant (1%).

Coverage is an important aspect of fleabane control. Both Amicide Advance and Sharpen WG have a coarse spray quality recommendation. So a minimum of 70 L/ha of water should be used.
Mature fleabane control in fallows

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Fleabane is becoming a major weed in southern NSW and populations in the Temora area have rapidly exploded with the wet summers. Smaller fleabane plants present some flexible control options, but what happens when we are dealing with mature, larger plants?

In the 2011 summer, the opportunity arose for Landmark Temora to undertake a large scale trial looking at control options for fleabane plants on the verge of flowering. The paddock was an old lucerne stand, presenting a good range of summer weeds with an excellent fleabane population. The initial spray treatment included 22 mixes, with a range of costs, actives and residuals. There were then eight treatments over sprayed at 12 and 21 days after the initial spray.

The best of the single application sprays achieved around 80% control, with most being commercially unacceptable. However, when a double knock strategy was adopted controls improved to well over 90%. The key to controlling fleabane is a double knock. The first spray options are determined by cost, residual, plant backs and what other weeds are present. While the second spray needs to target application techniques to improve the results. Some treatments, although not achieving full control, did reduce flowering and seed set.

Whether we like it or not, fleabane is now a part of our farming landscape. Similar to other weeds we need play a numbers game, and our strategies to control fleabane, need to reduce the seed bank.
The first step to successful fleabane control – in-crop management

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Targeting weed management strategies when weeds are most vulnerable often leads to excellent results. This rule is very applicable when controlling fleabane. Early intervention using winter in-crop residual and early post-emergence herbicides is a key recommendation by many agronomists. Without such a tactical method, many winter crops will be a nursery for fleabane infestations. These weeds ultimately survive the harvesting process and become a major issue in summer fallows. With increased size, the weeds are harder to control and require more herbicide inputs via the double knock approach.

To circumvent this summer fallow issue, it is strongly recommended that winter in-crop management be used. Tactically, this approach uses many principles of integrated weed management. Firstly, soil disturbance at sowing may bury a large proportion of fleabane seed preventing them from emerging. Furthermore, applying herbicides either as pre- or post-emergence to weeds is extremely effective as weeds are most susceptible to herbicides when small. Lastly, if the crop is competitive, significant reductions in fleabane can be achieved. The major emergence of fleabane is typically in autumn near to time when many winter crops are establishing. Targeting multi-faceted integrated weed management at this time is therefore very rewarding and prudent.

In this paper many of the latest in-crop research findings will be reviewed. Following this, recommendations for potential areas of research will be highlighted with discussions on potential risks associated with commercially viable treatments.

It is understood that winter in-crop management of fleabane is not a stand-alone tactic. Other management tactics in the weeds’ life cycle are important (double knocking to prevent seeding). In addition, in-crop infestations are not the only issue, as the weed proliferates in fence-line, roadside and other non-agricultural areas. However, despite these other situations, in-crop management of fleabane should be the first and most effective strategy.
Fleabane management in mixed farming systems

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Fleabane is an emerging weed problem in southern NSW, but has been a weed of significance in other parts of Australia for nearly 20 years.

Managing fleabane in mixed farming systems does not have to be difficult or expensive, provided an integrated approach is taken. Utilise crop and pasture competition, grazing, herbicides and cultivation to achieve cost effective control.

Fleabane requires sunlight to germinate and is relatively uncompetitive as a seedling. By growing competitive crops and pastures, reducing bare ground, and utilising pre-emergent herbicides, fleabane can be successfully controlled before it emerges. Once fleabane plants establish a strong root system, control becomes difficult and expensive.

Assessment of age (not just size) and plant stress is vital to the success of any fleabane control strategy.

When targeting fleabane with herbicides it is important to remember:
3. Glyphosate alone will not control fleabane without the addition of a hormone
4. When weeds exceed 70mm or start to elongate, a “Double Knock” with Glyphosate + Hormone followed by Paraquat is required for adequate control.

Factors that influence the success of a “Double Knock” treatment include:
- Herbicide choice + rate
- Interval between treatments
- Water rate and coverage, particularly in the second application.

Cultivation is an effective tool for controlling fleabane, provided it is aggressive enough to pull out older plants and bury the seeds. Strategic cultivation should be considered where there is an appropriate opportunity within the system.
Flaxleaf fleabane control in lucerne based pastures

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Currently, little information is available on the effective herbicide control of fleabane in degraded lucerne pastures. Pasture has been an integral component to the success of mixed farming systems in southern Australia. Recently, many pasture paddocks have become heavily infested with fleabane. Mature fleabane plants set millions of seeds, replenishing the soil seedbank. Ineffective control of fleabane in pastures could therefore be a vital source of seeds for invasion to other paddocks or farm properties, due to the long distance dispersal capability of the weed.

There are no registered products currently available for fleabane control in lucerne based pastures.

A fleabane control trial was conducted in a degraded lucerne pasture in southern NSW, with 35 herbicide treatments applied on 1 July 2011. This trial targeted small fleabane plants and evaluated some residual herbicides for long-term control. The results showed that most treatments did not achieve commercially acceptable control. But the addition of suitable Group C herbicides such as atrazine and simazine to Paraquat provided excellent residual control. While these treatments gave better control it is important to be aware that many herbicide treatments caused significant pasture damage, in particular subclover and chicory.

A second fleabane control trial in lucerne pastures was conducted to target mature fleabane soon after grazing, with 25 treatments applied on 2 December 2011. Similarly, only a few double-knock treatments gave excellent control of fleabane. These included 2, 4-DB ± flumetsulam (or ± a Group C herbicides) followed by 7 days later Paraquat ± atrazine (or simazine).

Although fleabane plants can be grazed by sheep, its re-growth characteristic makes the grazing option ineffective. It is therefore important to control fleabane after grazing, otherwise it will flourish as a result of little competition.
Seed dispersal of fleabane

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This presentation will briefly review the contrasting ways that we use to predict potential seed dispersal and to estimate dispersal distances, including the mistakes that are commonly made. It will summarise what we know about dispersal in fleabane and emphasise what we don’t know.
Notes