Queen Weedy bows out

Darren Aisthorpe, Extension Agronomist, CQ Grower Solutions, DEEDI, Biloela

After more than 25 years of service with DPI and DEEDI, CQ’s Principal Research Scientist (Weeds) and Weed Sciences Team Leader Vikki Osten accepted a voluntary separation package and retired on 10 February this year.

Vikki initially studied at the Queensland Agricultural College (now University of Queensland, Gatton) in the ‘early 1980s’, completing a Bachelor of Horticultural Technology (Honours) majoring in plant protection and specialising in weed science. From uni, she was employed at the Queensland Wheat Research Institute (QWRI) for two years before accepting her position in CQ.

Vikki first arrived in CQ in June 1987, spending two weeks in Biloela with Steve Walker, Regional Weed Agronomist, before moving across to Emerald as Steve departed to undertake further study in Western Australia. In 1988–89, she was seconded to Indonesia to work on a project (funded by the Australian International Development Assistance Bureau and the World Bank) to improve weed management in rain-grown cotton, which was a tremendous opportunity at the time.

On her return to Australia, she focused on a number of different projects, including assessing plant-back periods for products such as 2,4-D and dicamba for CQ conditions. This work resulted in label changes and reduced plant-back periods.

She also worked on a perennial weed management program that included a biological and ecological study of raspweed, funded by the Queensland Grain Committee; a Grains Research and Development Corporation (GRDC) project looking at the
management of Peak Downs curse, rapsweed, grey rattlepod, teucry weed and nutgrass; and a National Heritage Trust funded project addressing bitter bark management.

During the early 1990s, Vikki completed a Master of Agricultural Science (by research) through the University of Queensland. In the early to mid 1990s, she undertook research into CQ plant-back periods (the interval between spraying and safe re-planting of crops) for herbicides such as Glean®, Ally®, Atazine®, Flame® and Spinnaker®. This work covered most of the major crops grown within the region and provided a much greater understanding of the characteristics of residual herbicides within the CQ environment. Data were provided to industry to enable herbicide label changes.

In the mid-1990s, the importance of ley legumes was beginning to come to the fore within CQ and the need to manage weeds within these crops was identified as a high priority. Vikki conducted research on weed control in lablab, desmanthus and butterfly pea through a joint project led by the CSIRO, and then continued research into weeds within butterfly pea pastures through the CQ Sustainable Farming Systems (CQSFS) project in the late 1990s.

Vikki has been a long-serving and integral participant in the CQSFS project since it began in 1997. In 2003, a separate GRDC funded weeds research project for CQ began with Vikki supervising a new scientist (Gavin Lotz) to address management of difficult weeds, weed management in wide row crops and improvement of herbicide efficacy under adverse conditions. Meanwhile, Vikki was also leading a national project and participating in two others in the final phase of the Weeds CRC. In mid-2007, Vikki resumed research responsibilities in the CQ weeds project after Gavin moved to a permanent position and new role in Biloela. Some of Vikki’s work in CQ has included:

**CQSFS project (1997–2010) and then CQ Grower Solutions project (2011–12)**

- Continued the butterfly pea weed work
- On-farm weed monitoring
- Weedies Road Show—seven venues around CQ
- Sunflower weed management
- In-crop WeedSeeker use in conjunction with the Fitzroy Basin Association
- Wheat cultivar herbicide tolerance work
- Chickpea in-crop weed control
- Development and extension centred on management of feathertop Rhodes grass

**CQ weeds research project (2003–11) and components of other northern region weeds research projects (2005–11)**

- Feathertop Rhodes grass biology and management research
- Weed management in wide-row cropping systems
- Improving chemical efficacy under adverse conditions
- Integrated Weed Management (IWM) workshops
- Herbicide resistance research and development work resulting in the Stopping herbicide resistance in CQ brochure
- A comprehensive scoping study of north Queensland, central Queensland and near-coastal cropping systems

**Weeds CRC and Cotton CRC research projects (2002–08)**

- Water and nitrogen use by summer fallow weeds
- Weed management in dryland cotton systems
- Weed management risks in wide-row crop systems

When asked to reflect on her time in Emerald and at the Emerald DEEDI office, Vikki sat back and came up with some pretty amazing facts. ‘Since starting in Emerald, I have seen over 100 staff come and go; been through at least four departmental restructures; been through a major office upgrade; seen water go over the dam spillway six times; seen two major and three minor floods; and seen the town grow from 6000 residents to over 12 000 today. I also got married here and my son was born in the Emerald hospital—he is a local but I am not—even after 25 years!’

‘National recognition of her work through the CRCs’ was Vikki’s response when asked about highlights of her career to date. ‘Closely followed by a strong sense of satisfaction achieved when able to interact with local growers and help solve the issues they are facing.’ Her third highlight was one I was not expecting. ‘Earning the nickname Queen Weedy.’ She had earned it from the her weeds team colleagues some years ago and now wears it somewhat as a badge of honour or a tick of recognition from her workmates.

When asked if there were any regrets about leaving, her response was twofold. ‘On a personal level, like many retiring scientists, there is always the regret that I didn’t publish enough. But on a broader level, probably the loss of specialist weed research capacity to CQ and its unique climatic conditions is disappointing; having all the research conducted in southern Queensland and having the specialists visit from the south is not the same.’

So what does the future hold for the abdicating Queen of Weeds? Vikki indicated that she would be staying in Emerald. ‘Emerald is my home. I have no plans for moving away at this point in time.’ She is still unsure what her next career moves will be, but she does have a few options on the table that she is currently assessing. Given her passion for weed management is still there, don’t be surprised to see Vikki making a few guest appearances at various field walks and meetings from time to time.

---

**Weeds management in CQ?**

Participate in a 1-day workshop for grain growers and advisors on what’s new in managing problem weeds in CQ, particularly focusing on feathertop Rhodes grass, barnyard grass, fleabane and sow thistle. Topics include:

- Updates on herbicide resistance.
- Information on weed seedbanks and management.
- The past 25 years and what the future 10 years hold.
- How do glyphosate tolerant crops impact on our problem weeds?
- The latest information on strategies, new products and research.

**Dates**

<table>
<thead>
<tr>
<th>Day</th>
<th>Venue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuesday 20th March</td>
<td>Clermont Club, 48 Sirus St, Clermont</td>
</tr>
<tr>
<td>Wednesday 21st March</td>
<td>Main conference room, DEEDI, 99 Hospital Rd, Emerald</td>
</tr>
<tr>
<td>Thursday 22nd March</td>
<td>Settlers Motor Inn, 58 Dawson Hwy, Biloela</td>
</tr>
</tbody>
</table>

**For workshop registration**


**Note**: Through support from the GRDC and BASF, Bayer CropScience and Crop Optics, the cost is $55 (incl. GST) per person. Numbers are limited to 20 per workshop. Pre-registration is essential.
Two hit combo—making the second knock count!

Darren Aisthorpe, Extension Agronomist, CQ Grower Solutions, DEEDI, Biloela

The key messages when using knockdown herbicides on feathertop Rhodes or fleabane are:

- Plan to double knock—spraying after plant shutdown will compromise the bipyridyl efficacy. Don't consider application as an afterthought. Timing is the key!
- Keep rates robust—both first and second knocks need to be applied at rates that will give the maximum chance of killing the plant.
- Keep water rates high—bipyridyls rely on contact to work. More viable droplets will cause more damage.
- Time your spray applications to avoid hot, dry, stressed conditions during the middle of the day.

Be realistic in your expectations—double knocking works best with small, rapidly growing plants. If plants are large, mature and rank, the best you can expect is to limit seed set and reduce biomass to allow a tillage event and the use of a residual product post-tillage.

What is a double knock?

When it comes to weed management, the practice of double knocking involves the planned application of two (or more) practices to manage a target weed. The most common form of double knocking would be separate spray applications of two different chemical groups, e.g. a glyphosate (Group M) followed a few days later by a bipyridyl (Group L). A double knock could also involve any number of combinations including chemical application, tillage, burning and mulching.

The crucial element of the second knock or practice is to take out those targets that were not taken out by the first knock. This is essential, particularly when using Group A and B herbicides. If any plants survive the initial application of chemical, a resistant population of weeds will develop very quickly, rendering that chemical group useless against the target species.
Why use Group L products?

The bipyridyl group of herbicides or Group L herbicides are non-selective contact products that are very useful in rapidly inflicting a significant amount of damage to exposed plants’ cell structures. The active ingredient within these products works by using the process of photosynthesis (photosynthetic energy) to speed up the production of highly reactive forms of oxygen, including hydrogen peroxide from the water and oxygen in the plant, to destroy plant cells. The product is absorbed through the leaf and stem much more quickly than many systemic products; while the plants are photosynthesising, this process can take place quite quickly, with symptoms appearing in under an hour.

Bipyridyl products work very well as a second knock for a number of reasons:

- different mode of action, which minimises resistance threats
- very effective on hard-to-penetrate leaf structures
- useful in halting or preventing flowering and seed set
- as compatible as glyphosate when it comes to mixing and chemical antagonism. Just follow label instructions
- take out small to medium seedlings if there is extra germination between first and second knocks

Products are also available that combine paraquat (135 g active) and diquat (115 g active):

- found in products such as Spray Seed®, Revolver®
  - good all-round products for both grass and broadleaf weeds
- ideal for killing weed seedlings preplant and second knocks for flaxleaf fleabane.

Systemic products versus contact products

Traditionally the vast majority of herbicides used in CQ have been systemic herbicides. Systemic herbicides have had some significant advantages over contact products for a number of reasons:

- generally have been highly effective on most weeds in CQ
- very forgiving on application practices and timing
- low application water rates.

When a sufficient number of ‘viable’ droplets of a systemic herbicide come into contact with a leaf or stem, there is a reasonable chance that the chemical will inflict terminal damage on the target plant. However, as minimum and zero tillage practices, which rely on chemical herbicides for weed control, have become entrenched within farming systems, herbicide resistance has emerged as a major issue.

A combination of factors—including the plant’s physiological attributes, sub-lethal dosages, poor farm hygiene and less than ideal spraying practices—have resulted in a ‘selection process’ taking place on our hardest to kill weeds, which not only survive herbicide applications but prosper. This has led to the issues we now face with plants such as feathertop Rhodes and fleabane.

These include:

- Higher rates are needed to perform the same task.
- Plants seem to be able to ‘grow out’ after appearing to be initially affected.
- Performance is patchy, even at high rates, with some plants dying and others only mildly affected.

Contact products such as bipyridyl herbicides (Group L), when used following an application of a systemic product, may be able counter some of these issues and optimise efficacy in some situations. The amount of damage inflicted by Group L herbicides is determined by the extent to which plants are covered by viable droplets.

In simple terms, the greater the number of viable droplets that land on the plant surface, the greater the damage inflicted. All technical experts strongly recommend water rates in excess of 80 L/ha (preferably 100 L/ha) to maximise coverage in a broadacre situation. Any plant material which is shielded or shaded by stubble, clods or other plant residue will be unaffected by the application.
‘Therefore one tactic is to apply bipyridyls early in the evening so that you get 8 hours of dark. Some product will translocate during this time which may improve control (but you have to wait for complete darkness before you start spraying as even a few minutes of light will start the process).

‘Another demo I ran at previous training workshops is to spray some weeds and then immediately (in less than 1 minute) cover half the plot with a heavy tarp and weigh it down so no light gets in. Then come back in about 48 hours. The sprayed and exposed area will be well browned out. Take off the tarp and the other sprayed weeds will look like nothing has happened. Give them some sunlight and they will have caught up within another 36 hours.’

Some experts in the field have also noted that when mixing paraquat products with Group C products (Atrazine®, Simazine® or Diuron®) and, to a lesser extent, Group I products (2,4-D, MCPA), there may be a small amount of reaction occurring between the two actives. This reaction may slow down the rate of cell destruction caused by the paraquat, allowing for slightly greater translocation than if paraquat were applied by itself. However, please note these improvements are generally minimal or will only be obvious under certain conditions.

Thirdly, keep rates robust and water rates high, particularly when targeting problem weeds in less than ideal conditions. Always maintain a water rate above 80 L/ha and use maximum label rates, as it is cheap insurance to ensuring you are optimising the efficacy of your application. Mark Congreve also indicated that bipyridyls are instantly bound to soil colloids, so if the spray water contains dirt or organic matter you will lose a lot of active very quickly.

Finally, if mixing with a phenoxy (Group I) based herbicide, remember that bipyridyls have similar compatibilities to glyphosates, and therefore there may be some antagonism between the two products. Jason Sabeeney from Syngenta advises that if mixing the two actives, you should never exceed the 2:1 ratio on the phenoxy side, i.e. 2 parts bipyridyl:1 part phenoxy.

**Double knock—timing of applications**

When should you apply a second knock? The simple answer is ‘before the weeds start shutting down from the initial knock’. You have to time the gap between the two applications so that the initial application—e.g. a glyphosate (Group M), haloxyfop (Group A) or phenoxy (Group I)—has enough time to fully move through the plant, but not enough time to take full effect, which would cause the plant to limit or shutdown photosynthesis and so reduce the efficacy of the bipyridyl application.

The speed of translocation for various chemical products varies, as does the uptake rate of different plants. Plant size also plays a considerable role in how long it takes for a systemic chemical to fully move around the plant. Weather is the final variable which must be considered in the timing puzzle. In warm, damp, lush conditions plants will move a systemic herbicide through their system much quicker than in cold, dry or very hot conditions.

**Robust single application of glyphosate after 13 days**

However if a systemic herbicide has already been applied (and has fully translocated throughout the plant and started to take effect), the additional physical damage inflicted by the bipyridyl product can be enough to finish off the weeds if conditions and application are suitable. This is why the process of double knocking has been so effective in the management of fleabane in southern areas.

**What is a ‘viable’ droplet?**

To be ‘viable’, a droplet must land on the target and stay fluid long enough to have a percentage of its active ingredient absorbed into the plant tissue. If droplets are too small, they can evaporate before absorption or contact with the target; if too large they may bounce off the target plant.

Air induction (AI) nozzle designs now reduce the risk of bounce occurring and improve coverage as the droplet is full of air and will splatter on contact. However as droplet size increases, the number of droplets decreases; where coverage is important, increasing water rates is advantageous.

**Maximising bipyridyl efficacy**

There are some key points to consider to maximise the efficacy of your bipyridyl applications.

Firstly, and most importantly, the plant needs to be as healthy as possible for the product to work most effectively. As discussed, the active ingredient works only when the plant is photosynthesising. Heat, stress or plant shutdown will minimise the amount of cell damage which can occur; hence spraying in hot, dry conditions, particularly with lower water rates, will reduce efficacy.

Secondly, photosynthesis requires sunlight! An obvious comment I know, but a good thing to remember if you want to improve the efficacy of your bipyridyl applications. Mark Congreve, formerly from Syngenta, shared the following information about why this fact is so important:

‘The reason bipyridyls don’t generally move or translocate is that they destroy cell structure extremely rapidly and before the plant has the time to translocate the product. To activate bipyridyls, sunlight is required.'
Robust application of glyphosate + paraquat (applied day 7) after 13 days

There is no simple formula to help you decide when to apply a second knock. However, Dr Steve Walker and the rest of the DEEDI weeds team are undertaking extensive research, particularly on feathertop Rhodes, to better predict ideal application timing.

Current general rules of thumb for the second knock timing are:
- For feathertop Rhodes, when the first knock is:
  - glyphosate (Group M): 6 to 8 days after initial application
  - haloxyfop (Group A): 3 to 7 days after initial application.
- For fleabane, when the first knock is:
  - glyphosate (Group M): 6 to 14 days after initial application
  - phenoxy (Group I): 6 to 14 days after initial application.

Please remember that these are only guidelines. The size, age and health of the plant and the growing conditions will help determine where in that range to apply. The key message is: assess your situation and time applications appropriately.

Target size and control expectations

As many growers will attest, once feathertop Rhodes (or fleabane) reaches maturity it is almost impossible to completely control using single knock chemical practices alone. Unfortunately feathertop Rhodes is very difficult to control, even when using practices such as double knocks with robust rates of haloxyfop (Group A) followed by a robust bipyridyl (Group L) application, as is now allowed under permit, prior to planting mungbeans.

Using this combination on large mature plants and expecting complete control is not only unrealistic but highly risky, as it will cause plants to develop resistance to Group A products more quickly, should any of the surviving plants produce viable seed.

The smaller the target plants the greater the chance you have of achieving 100% control using double knock applications, and the cheaper it will be. If the majority of weeds can be targeted at seedling to pre-tillering stages, then a robust rate of glyphosate followed by a paraquat treatment 6 to 8 days later can be very effective and cost-effective. If there is only a small amount of other plant residue in the field at the time, consider adding a Group K or Group C herbicide (please check label requirements for various scenarios) to your second knock as a residual to give you longer lasting control during fallow or into your next crop.

In summary

Bipyridyl products in a double knock scenario are not the silver bullet many growers are looking for when it comes to the management of feathertop Rhodes or fleabane. However, when used as part of a well thought out management plan, using rotations and crop competition along with knockdown and residual products, bipyridyls do offer a lot of extra flexibility and extra efficacy to our current list of registered knockdown herbicides.

As a single application product, bipyridyls can be quite effective in controlling small to medium seedlings. At the other end of the growing spectrum, they can be quite effective as a rapid desiccant to reduce biomass, halt seed set and allow for tillage or burning events to occur before the plant recovers.

But it is within the context of a planned double knock application that bipyridyls really begin to become an effective tool. Many experts in the use of bipyridyls indicate that they can enhance control somewhere between 10% to 30% over what a single knock systemic application would have achieved.

Acknowledgments

I would like to say a huge thank you to the experts who contributed their time, thoughts and experience to help me write this article. Without their valuable contributions and input this article would not have been possible. Thank you to:
- Chris Preston, Associate Professor, Weed Management, School of Agriculture, Food and Wine, The University of Adelaide
- Frank Taylor, Research and Development Officer, Nufarm Australia Limited
- Jason Sabeeney, Solutions Development Manager, Syngenta
- Laurie Price, Research Manager, Northern Grower Alliance
- Mark Congreve, Senior Consultant, ICAN
- Michael Widderick, Senior Research Scientist (Weeds), DEEDI
- Steve Walker, Associate Professor, The University of Queensland, Queensland Alliance for Agriculture and Food Innovation (QAAFI)
- Vikki Osten, former Principal Research Scientist (Weeds), Weed Sciences Team Leader, DEEDI.