



A new weapon

*The long-awaited registration of the post-emergent herbicide methiozolin in Australia provides a new mode of action for turf managers to use in the war against *Poa annua*. John Neylan looks at research from Australia and overseas on its efficacy and stresses the importance of careful usage so as not to develop resistance.*

The turf industry has been waiting for the best part of 10 years for the herbicide methiozolin to be registered in Australia and finally it is here and ready for use. Methiozolin is a new herbicide to control *Poa annua* (annual wintergrass) in recreational turf and

has a new mode of action that is unlike other herbicides. Being a new mode of action in itself is a revolution as there has been no new post-emergent mode of action herbicides for broadacre weed control introduced to the Australian marketplace for about 30 years. The control of herbicide-resistant *Poa*

annua has been an increasing concern over the past decade and was highlighted in the article by Barua et. al (2020) in the last edition of Australian Turfgrass Management Journal (Volume 22.3 – *Multiple resistance in Poa*, pages 44-47). The reality is that we have run out of herbicide options for effective and consistent control. Now that we have new chemistry that provides good control of *Poa annua*, particularly in creeping bentgrass putting greens, it is critical that its use is carefully considered.

So what do we know about methiozolin? There have been numerous replicated trials undertaken in Australia and the USA with excellent results. These trials have been supplemented by local trials undertaken by golf course superintendents and turf managers to assess the herbicide under a wide range of climates, turfgrass species and varieties and management systems. What follows in this article is my perspective on methiozolin, drawing from the available literature and a methiozolin forum undertaken by Campbell Chemicals in November 2019.

HOW DOES METHIOZOLIN WORK?

PoaCure (active ingredient: methiozolin) was discovered and developed by Moghu Research Center Ltd., based in South Korea. Methiozolin is a new mode of action associated with cell wall metabolism and is unlike any existing herbicide mechanisms. The mechanism of action of methiozolin and related chemistry is not thoroughly understood and appears to be novel.

*Opposite page: Extensive efficacy and phytotoxicity trials, as well as special use permit trials, using methiozolin have been undertaken in Australia since 2012 prior to its eventual registration in May this year. Pictured is a couchgrass trial plot with a heavy infestation of *Poa annua* seven days after initial treatment at 4L/ha*

Left: The same plot from the opposite page but at 94 days after initial treatment and 50 days after the fourth application at the 4L/ha rate (see photo page 38 for plot at 121 days after initial treatment)





Methiozolin activity is based on root uptake and is enhanced by irrigation or rainfall before the spray dries on the foliage. Consequently, post-application irrigation is recommended. In research by Koo et. al. (2014) it was determined that when methiozolin was applied only to the foliage, almost no herbicidal activity occurred at any rate tested. In contrast, when the herbicide was applied only to the soil, efficacy was equivalent to the foliar and soil application. Therefore, herbicidal activity of methiozolin was clearly dependent on herbicide reaching the soil. Methiozolin activity depends on root uptake and has acropetal mobility, which means adjuvants and mowing are less likely to affect performance.

TAKE HOME MESSAGE #1:

- Methiozolin is a unique mode of action.
- Activity depends on root uptake and has acropetal mobility.
- The research demonstrates that irrigation after application is critical in effective uptake of methiozolin.
- Adjuvants are not recommended.

AUSTRALIAN RESEARCH

The research on methiozolin in Australia was undertaken between 2012-2014 by Sports Turf Consultants and consisted of eight efficacy and five phytotoxicity trials in four states – Victoria, New South Wales, South Australia and Western Australia – over two springs and an autumn.

The methiozolin (250g/L methiozolin EC) was applied at 1L, 2L and 4L of product/ha with four applications two weeks apart. Poachek (endothal) and Nominee (bispyribac-sodium) were included in the trials as industry standards along with an untreated control.

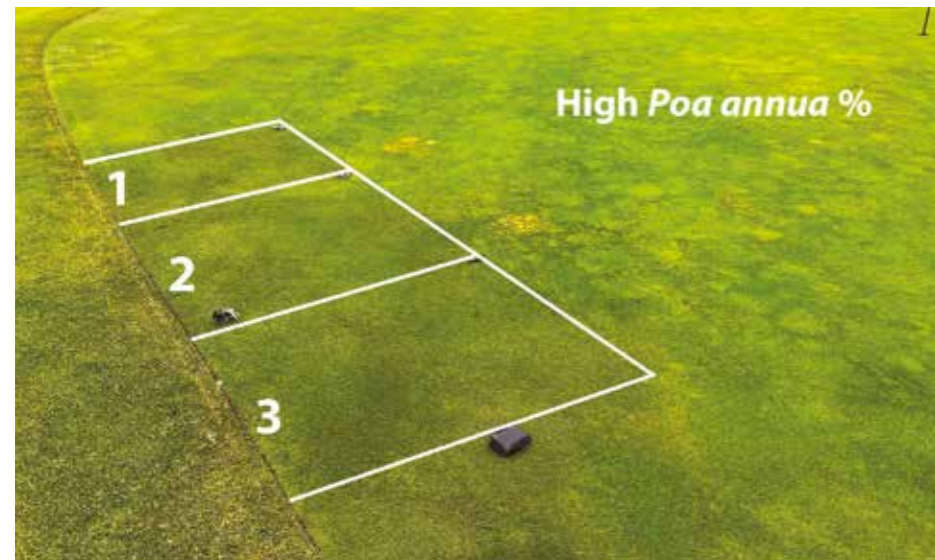
The trial work can be broadly summarised as follows:

- All rates of methiozolin provided a significant reduction in *Poa annua* compared to the untreated control.



The same couchgrass plot (as pictured on the previous two pages) but at 121 days after initial treatment

- All rates of methiozolin provided equivalent or better control than the two industry standards.
- The trials indicated a maximum of 77-88 per cent control from the spring applications of methiozolin at the 2L and 4L product/ha rate.
- Methiozolin is slower acting than Nominee and Poachek with the effect on the *Poa annua* not being apparent until about 4-5 weeks after the initial application.
- The 2L and 4L rates of product/ha provided significantly better control than the 1L rate of product/ha. There was no significant difference between the 2L and 4L rates of product/ha.
- In some trials where there was a high infestation of *Poa annua*, the 4L rate of product/ha resulted in an unacceptable turf quality because it removed the *Poa annua*



too quickly, leaving voids which disrupted the putting surface.

- There was phytotoxicity noted at one site due to the turf having been previously treated with paclobutrazol.
- There is possibly the need to increase nitrogen applications to fill in the voids once the *Poa annua* plants are killed.
- On high cut turf there was excellent control of *Poa annua* in kikuyu and couch at all rates.
- Excellent safety on many turfgrass species including couch, kikuyu, perennial ryegrass, tall fescue, creeping red fescue and hard fescue. (Author's note: Check for phytotoxicity on your turf by undertaking on-site trials).
- Can be used in both autumn and spring, however, slow bentgrass growth during winter may be an issue with the filling in of voids vacated by the dead *Poa annua*.
- The research in Australia is consistent with research undertaken in the US.

TAKE HOME MESSAGE #2:

The research demonstrates;

- Safe on a wide range of turfgrass species.
- Slow acting.
- 2L and 4L rates of product/ha is the most effective.
- Equal to or better than the industry standards.
- Interaction with other PGR's needs to be managed.
- Understand *Poa annua* percentage and impacts of a 'quick kill'.

US RESEARCH

There have been numerous research trials undertaken in the USA and they have all demonstrated a high level of *Poa annua* control. In searching the Turfgrass Information File database there are 163 references to the use of methiozolin and while I only read a small selection, they all highlight its potential as a unique and effective herbicide.

There were two papers in particular that provide some important take home messages. Research by Brosnan et.al. (2017) indicates that methiozolin is an effective option for controlling annual bluegrass phenotypes with target-site resistance to several herbicides. This is most important where herbicides such as endothal and bispyribac-sodium are providing limited control.

A paper by Yelverton (2015) provides a good summary for any new, effective herbicide against *Poa annua* and that *Poa annua* will not

User trials are a critical part of understanding the performance of any new herbicide. Pictured is a trial undertaken on one Australian golf club's practice putter. Plot 1 (methiozolin at 4L/ha monthly – four applications); Plot 2 (2L/ha monthly – four applications); and Plot 3 (1L/ha fortnightly – eight applications)

necessarily be completely eliminated. Yelverton (2015) sums up that while most are hoping that methiozolin will be registered for use, it should be remembered that it is only another tool in the overall management of *Poa annua*.

TAKE HOME MESSAGE #3:

- High level of efficacy.
- Option for controlling herbicide-resistant *Poa annua* biotypes.
- Another tool and not necessarily the lone "silver bullet".

METHIOZOLIN FORUM

Research under relatively controlled conditions provides an excellent basis for understanding the efficacy of any new herbicide. However, for practical purposes the research is often limited to particular locations, climates and weed biotypes and doesn't always reveal the complete story.

In understanding the more complete story, new herbicides are often provided to turf managers to trial on their own patch under their management regime. This exposes the herbicide to a greater number of variables and tests the robust nature of the herbicide.

In the USA, an experimental use permit (EUP) programme was initiated to further improve methiozolin use patterns for golf putting greens, fairways and tees, and investigate potential edaphic or environmental variables (Askew et.al. 2014). With over 165 golf courses signed up for the EUP programme, it allowed the company and the industry to gather more valuable information on the best-use strategies for the product under more controlled conditions.

In a similar fact-finding programme, Campbell Chemicals initiated numerous trials around Australia to also better understand the herbicide and how it performed under Australian conditions. At a discussion forum held in late 2019, Australian turf managers involved in the permit trials were provided with the opportunity to share and discuss their observations of using PoaCure, with a summary of the findings outlined below:

- *Poa annua* has to be actively growing. (Author's note: As a general observation on the growth pattern of *Poa annua*, it tends to be in peak growth in early autumn and early spring.)
- Phytotoxicity was noted on Penn A1 and Penn A4 creeping bentgrass and was related to segregation and some of the weaker strains being more susceptible to the methiozolin. Greens that have strong segregation are probably best treated in the spring.
- On a high traffic area with a high percentage of herbicide-resistant *Poa annua*, methiozolin provided close to 100 per cent control.



When using methiozolin, care needs to be taken where there is segregation in the bentgrass. Greens that have strong segregation are probably best treated in the spring

- Patience is important as methiozolin is very slow acting.
- Concern with some uncontrolled plants. (Author's note: It is unlikely that any selective herbicide will control all plants. Observation after initiating a herbicide programme is critical in assessing the success of the strategy. As part of any integrated weed control programme, manual removal of the persistent biotypes will always be required.)
- Avoid the use of paclobutrazol prior to initiating a methiozolin programme due to the possibility of an adverse interaction.
- In bentgrass surrounds or higher cut areas, methiozolin was not as effective with a 60-70 per cent kill and then recovery. (Author's note: In trials undertaken in 2019 on high cut turf or turf with a deep organic matter layer, methiozolin was not as effective. This was mainly associated with the post-herbicide water application – i.e.; not enough water applied – and the herbicide not getting to the root system.)
- Browntop bentgrass is severely affected.
- From a practical management perspective it was expressed that being able to make two applications rather than four would be easier to manage. (Author's note: In trials undertaken in 2019 there were interruptions to the programme due to rain or wind on the dates when the herbicide was due to be applied. This again impacted on the overall level of *Poa annua* control.) Methiozolin has been trialled on other turf species and some of the comments from turf managers involved included:
- In Queensland, Windsor couch and Greenlees Park couch exhibited good tolerance.
- Tidwarf couch hybrid is sensitive to methiozolin in Queensland.
- On ryegrass turf where *Poa annua* is resistant to ethofumesate, PoaCure removed 95 per cent of the *Poa annua*. It has had no adverse effects on the ryegrass or the root structure. During the question and answer session included as part of the methiozolin forum, there were several important concepts discussed among the group. Among these included;
- **Resistance or tolerance?:** Where there are some *Poa annua* plants unaffected or recover after application of methiozolin, it may not be herbicide resistance but rather herbicide tolerance. The response from Moghu was that the level of control is in response to the rate of application. That is, increase the rate on more persistent plants and if there are strongly persistent plants, remove by other means. (Author's note: If higher rates are used, only do so after extensive trialling. More is not necessarily better.)
- **Persistence:** The persistence of methiozolin in the soil was raised. The response from Moghu was that efficacy lasts a long time (potentially up to three years). It persists in soil for an extended time particularly when multiple applications are made. It is possible that germinating *Poa annua* can be killed due to methiozolin in the soil. Over four applications at 2L/ha at two-week intervals, PoaCure may cross over new germinations.
- **Does the use of penetrants affect efficacy?** Methiozolin binds to soil particles and in leaching columns methiozolin doesn't move. Penetrants were considered unlikely to assist.



- **What effect does thatch have?** On pure sand there is greater movement of methiozolin compared to where there is a vegetation layer. Some thatch is considered acceptable. (Author's note: Research was conducted to evaluate methiozolin sorption to various sand-based soil media, typical of many golf course putting greens (Flessner et al., 2013). Overall, the results indicate that methiozolin is available for plant uptake but binds enough to soil to resist leaching from the rootzone. The results also indicated that organic matter content greatly influenced soil sorption.)
- **Placement:** In the general discussion around the placement of methiozolin, it was emphasised that it needs to be absorbed by the *Poa annua* roots for effective control. Therefore it is important that the turf manager understands where the *Poa annua* roots are.

TAKE HOME MESSAGE #4:

- Methiozolin is very effective.
- Every site is likely to be different – understand the site conditions.
- Water rate is important depending on local factors.
- Trial first.
- Manually remove survivors.

BEST MANAGEMENT PRACTICES

Any discussion about a new herbicide and in particular a new mode of action must include a discussion about where it fits within a 'best management programme'. As we have seen when the first sulfonylurea herbicides (SU) came onto the market, over use can quickly render the herbicide ineffective due to weed herbicide resistance. So as methiozolin comes onto the market it is important to think about it in terms of a well-considered herbicide resistance strategy.

CropLife Australia (2014) and Resist Poa (2020) provide several key strategies to be considered in managing weeds generally, and *Poa annua* specifically;

- Effective herbicide resistance management requires a balance of chemical and non-chemical tactics.
- Emphasis on providing a dense and competitive turfgrass sward. A holistic approach of managing soil and plant health is required in order to do so.
- Rotation of herbicide mode of action groups within and across years. Think about where methiozolin will fit within this strategy.
- Emphasis on both pre-emergence followed by early post-emergence means of control, which effectively reduces the amount of *Poa annua* exposed to post-emergence strategies.



Bentgrass segregation can result in some patches being more sensitive to methiozolin in autumn-winter

- Use labelled rates at appropriate timings and stages of growth.
- Identify and monitor surviving weed populations and check for resistance. This can be done through Plant Science & Consulting (<http://www.plantscienceconsulting.com.au/>).
- If resistance is suspected, do not use the same product or mode of action.
- Scout after application and avoid allowing weeds to go to seed or proliferate vegetatively.

TAKE HOME MESSAGE #5: Methiozolin must be integrated into a herbicide resistance management plan.

CONSIDERATIONS WHEN USING METHIOZOLIN

The following do's and don'ts have been drawn from information provided by Nadeem Zreikat (Colin Campbell (Chemicals) Pty Ltd) and an article by Jim Baird (2017).

- Know your *Poa* percentage – don't guess.
- You need to know the health of the turf and it has to be actively growing. Need to apply N throughout the programme.
- Understand your grass type and how it may react to methiozolin. Not to be used on browntop bentgrass and red or Chewings fescue.

- Stop the use of paclobutrazol two weeks before the programme starts.
- Don't apply methiozolin during high stress periods (e.g. height of summer and winter).
- Avoid waterlogged conditions. If rain is predicted, hold off until the turf dries and the profile drains.
- Renovations – if hollow coring, apply PoaCure two weeks before and wait two weeks before the next application.
- If overseeding, wait a minimum of 45 days after the last application.

In a 2017 article titled 'Annual bluegrass control in California' that appeared on Golfdom, University of California turfgrass specialist Jim Baird makes the following comments;

- Increasing the rate, shortening the application interval or applying close to wet and/or freezing weather can accelerate PoaCure activity. In most cases it results in the sudden loss of *Poa annua*.
- The herbicide severely injures colonial and velvet bentgrasses. Some creeping bentgrass cultivars appear to be more sensitive to PoaCure, as are various segregates of other cultivars. (Author's note: The 'sensitive' cultivars are not named and it is important to trial an area first.)
- PoaCure is a root-active herbicide and irrigation following application is essential to achieve desired results. This is especially important for higher-cut turf to help deliver the herbicide through the canopy and organic matter into the underlying rootzone.
- Heavy rainfall following applications speeds up activity, often beyond desired expectations. It also may cause injury or loss of desired turf.

TAKE HOME MESSAGE #6:

- Methiozolin is potentially an excellent new tool in *Poa annua* control.
- DON'T overuse it – as a new herbicide it must be integrated into a broader herbicide resistance management plan.
- Do your homework before using it on your surfaces. Trial it under your own site and management conditions.
- For golf greens, consider the cost of a programme vs resurfacing.

ACKNOWLEDGEMENTS AND REFERENCES

Thanks to Nadeem Zreikat, marketing development manager Colin Campbell (Chemicals) P/L for making the information available and providing contact with US researchers. A full list of references for this article can be obtained from the Australian Sports Turf Managers Association - contact admin@agcsa.com.au.

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