

Nurseries learning from the turf industry:

By Todd Layt: revised 2014 edition

There is the potential to greatly reduce hand weeding and keep plants greener in winter in nurseries across Australia, New Zealand, South Africa and the USA.

Biographical information

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Todd Layt is a well-known plant and turf breeder, with tens of millions of his varieties being sold in Australia, USA, Europe, Japan and New Zealand. He specialises in breeding tough landscape plants. Prior to founding Ozbreed, he owned and ran a successful turf farm and a large wholesale nursery that specialised in native grasses, strappy leaf plants, wetland plants, and other revegetation plants.

Todd Layt designed this investigation, supervised the growing of the plant and turf plots for this trial, as well as helping with data collection and writing this paper. He also made photographic records of this investigation.

Introduction

A variety of chemicals and other specialist products are widely used in the turf industry. Many of these can have major benefits for the nursery industry, but only if they are ultimately registered or trialled in the growing of plants. Oxadiazon, sold under the brand name of Ronstar in Australia, is one such chemical that has a dual use in the turf and nursery industries. Oxadiazon is now available in liquid form in some countries, for example in New Zealand it is sold under the brand name Oracle, but it does not appear to have a nursery registration.

A new product for use on turf in Australia, sold under the brand name of Barricade with the active Prodiamine, has been used for some time in the USA both on turf and in the nursery industry for growing plants in pots. This pre-emergent has only been registered for use as a turf pre-emergent in Australia, but in the USA it is a major chemical used to stop or reduce weed germination in many pot grown nursery crops. It is planned to be registered for ornamental nursery use soon. Many use it in the USA due to its lack of adverse effects on pot grown plants and its ability to greatly reduce weed infestation. In Australia, most nurseries appear to use Rout and Ronstar. Although good for weed control, I have witnessed firsthand the adverse effects on certain crops several times, particularly strappy leaf plants. Rout seems to be better suited to woodies, such as trees. The post emergent component of Rout is toxic to many plants. Another problem with these chemicals is they have to be applied in granular form. Often spraying over the top is more efficient and the use of a chemical such as Prodiamine could greatly reduce costs for southern hemisphere nurseries.



With the help of Syngenta, Ozbreed has for a three year period tested Prodiamine on a number of popular Australian nursery grown plants. As Ozbreed has these plants in the USA where the chemical is registered, it was easy to test these plants in the past to Prodiamine. Barricade is widely used by nurseries growing Ozbreed plants in the USA. Indications are that this chemical has the potential to greatly reduce hand weeding in nurseries. Ozbreed also took cuttings and divisions of plants that had the chemical applied three months prior and monitored the effect. Ozbreed also conducted testing of Oryzalin. This chemical is registered for use on ornamentals in Australia, New Zealand, South Africa and the USA. Another chemical widely used in the USA is Isoxaben. In Australia and the USA it is sold as Gallery and is registered for nursery use. In the USA it is often combined with Prodiamine to make one of the most effective pre-emergent combinations. Barricade is an un-scheduled chemical, which means it has very low toxicity and is safer to use, and Gallery is a Schedule 5 chemical, which is at the safer end of the spectrum. In the USA and South Africa Snapshot is a widely used pre-emergent and has the active ingredients of Trifluralin and Isoxaben. Another pre-emergent used in the USA for nurseries is Tower herbicide, which has the active of Dimethenamid P available as FRONTIER®-P in New Zealand and Australia, and Outlook in Australia, but these are not registered for nursery use in these countries. Merango, with the active of Indazalfam, is available in the USA, as too is Pendimethalin. Pendimethalin is available in the USA and NZ but is not registered for nursery use.

Post-emergent's that are often used in Australia, New Zealand, South Africa and the USA include Fusilade. This will kill grasses and generally not harm non-grass plants. For example, it can kill Kikuyu and Couch out of Liriope and other non Poaceae plants. Sempra is another post-emergent that kills sedges without harming most other plants. Low rates of Round Up (Glyphosate) are often used to kill weeds in Mondo and Agapanthus in the cooler months. Yates Lawn granular weed and feed, which is a fertiliser high in soluble nitrogen with 50grams per kg of Iron (Fe) (Ferrous Sulphate), is often used to kill liverwort and moss without harming plants.

Non chemical weed control measures often used in the nursery industry include weed mats, mulch or fibre pot mats, and mulch on top of landscape pots for slow growing plants. Hand weeding is an expensive option, but some hand weeding is always necessary. Keeping a nursery clean and free from surrounding weeds also keeps weed infestation down.

Another product that is often used by the turf industry in Australia is Carbon Trader. Carbon Trader is a high loading formulation of Carbon (activated charcoal) that also contains small amounts of Nitrogen, Phosphorous and Potassium. It is used on turf to enhance winter growth and keep turf greener in winter. Ozbreed recently tested this on a large number of replicated turf plots and plants. This research indicates this product has potential in growing better winter and early spring crops of many plant types. It was also tested for improved cutting strike on Westringia plants.

Prodiamine and Oryzalin research

Literature review

In the USA many chemicals are available and widely used in the nursery industry. Several of these chemicals are not available, or are not registered for use in Australia, New Zealand and South Africa. The nursery industry in the USA have conducted many research projects on the use of pre-emergents, mainly through Universities. Chemicals such as Isoxaben and Metolachlor are also used in the USA to control nursery stock weeds. In Australia, the University of Queensland produced a document called



Weed Management in Woody Cut Flower Plantations. Chemicals available for the Australian nursery industry were discussed. However, it is hard to find Australian information on new nursery chemicals that are widely used in the USA, but are not registered in Australia, South Africa and New Zealand for nursery use. More southern hemisphere research and literature is needed on these chemicals so the nursery industry can lobby the chemical companies to implement the rigorous task of having the chemicals registered. It is absolutely necessary to only use chemicals as per label, however, industry funded research using permits could kick start companies spending the money in the southern hemisphere to get the product registered. Prodiamine is a perfect example of that; industry research has now sparked an interest in registering this product for the nursery industry. USA research shows Prodiamine moves less deeply in the soil or potting mix than Oryzalin, which could have major implications for free draining potting mixes we use in Australia. Both these chemicals are listed for many similar plants in the USA, although Oryzalin is not listed for many ornamental grasses, whilst some literature from the USA shows you can use Prodiamine on ornamental grasses.

Materials and trial set up

After researching the product in the USA for use on its plants, Ozbreed decided to conduct Australian research working with Syngenta under its permit. Between 10 and 50 plants of a large number of species were tested using different rates over a period of time. Plants were identified growing in gardens, tubes, plugs, and pots. These container plants were split into two groups: one as a control, and the other would have Prodiamine applied at different rates over a 12 month period. The rates would start at the label rate based on information gathered from the USA. Later, higher rates would be tested. In the garden, plants were selected to be sprayed, whilst other plants in the garden would act as a control.

Testing

The container grown plants were placed on plastic pallets, one row had the control plants and the other had the chemical applied. Plants in the garden were identified as the target group. After each chemical application, the irrigation was run for at least 15 minutes. In autumn 2011, a rate of 30ml per 100 square metres in 8 litres of water was applied to the target group. The plants were then observed. In winter 2011, the target plants received a rate of 45ml per 100 square metres. In mid and late spring 2011, the target group received a rate of 60ml per 100 square metres. In late spring 2011, some of the plants that were treated had cuttings and divisions taken from them, were placed in propagating trays in propagation mix and placed in a hot house with misting; these plants were then monitored. No more than 80 plants of any species were tested. There were 24 Shara™ Lomandra treated and 24 untreated; both treated and untreated were placed in a hot house on the 4th of May 2011. These were very weedy, but had just been hand weeded. The rate use was 45ml per 100 sq metres. The combination of the hot house and the extra amount of weed seed was expected to show visual differences.

List of plants tested

In early 2012, another set of plants with a wider selection of genus were organised, again split into two groups. These included Lomandra, Dianella, Westringia, Callistemon and more. The target group had Oryzalin applied at the label rate.

Results

For Prodiamine

Observations and monitoring showed a reduction of weeds in the first trial in early autumn 2011 at the USA rate of 30ml per 100 square metres, but some broadleaf weeds were noted. No difference was noted between the health of the target group and the control in any of the plants. Weeds were more numerous in the control than the target plants.

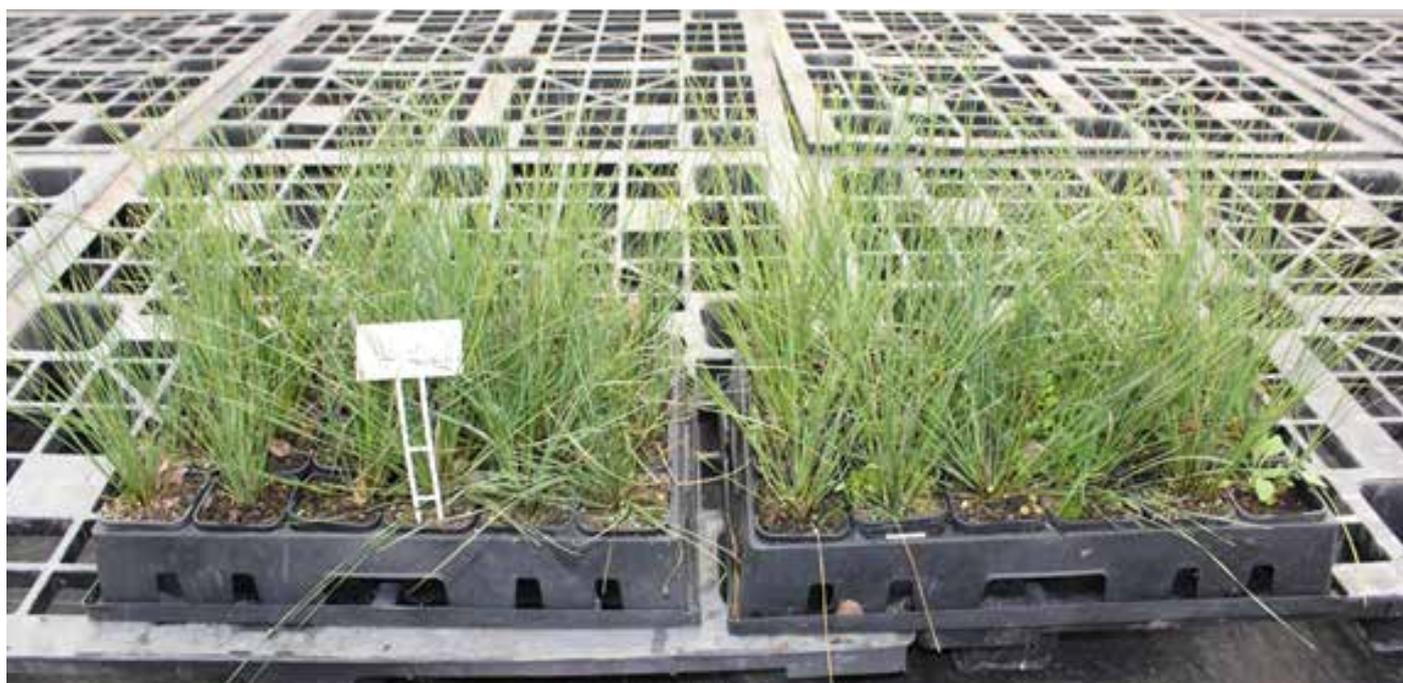
Observations and monitoring showed a larger reduction of weeds in the second trial in mid-winter 2011 at the rate of 45ml per 100 square metres, but there were still some broadleaf weeds noted. No difference was noted between the health of the target group and the control in any of the plants. Weeds were far more numerous in the control compared to the target plants.

Observations and monitoring showed a complete reduction of weeds in the third trial in late spring 2011 at the rate of 60ml per 100 square metres, and no broad leaf weeds were noticed in the target plants. No difference was noted between the health of the target group and the control in any of the plants except for two varieties; there were minor adverse effects in the Gazania and Scaevola at this rate. Both of these plants were in small 3cm wide plug sizes for the trial. The control had lots of weeds, while the target plants had no weeds at all. A full spread sheet showing rates and effects on plants was created for the full chemical report.

Both the garden and container trials showed similar results, although it was noted that the second trial in the garden reduced weeds more than in the containers.

After each trial period, all the plants were hand weeded.

The separate trial of 24 plants of Shara™ Lomandra treated and placed in the hot house showed how well the Barricade stopped weeds at the 45ml rate (see photo taken in August 2011).



Shara™ Lomandra on left sprayed with Barricade at 45ml per 100 square metres, plants on the right were not sprayed.



The above photo shows Shara™ Lomandra in September 2011 in an outside trial. The tray on the left was treated with Barricade at 45ml per 100 square metres, and the one on the right was not treated.

Results using the plants sprayed with Prodiamine, and for that matter Carbon trader, before propagation (3 months before), compared to the controls are listed in the following tables and graphs. The Mundi™ Westringia was from cuttings and the Shara™ Lomandra was from division.

Number of plants rooted out of 98 cell tray						
Date counted	MUNDI sprayed with Barricade	MUNDI without Barricade	MUNDI with Carbon Trader	MUNDI without Carbon Trader	SHARA sprayed with Barricade	SHARA without Barricade
21.10.11	8	6	4	1	11	19
28.10.11	27	39	16	19	25	35
4.11.11	34	58	39	35	30	40
16.11.11	56	53	64	66	36	56
18.11.11	56	54	64	70	44	58

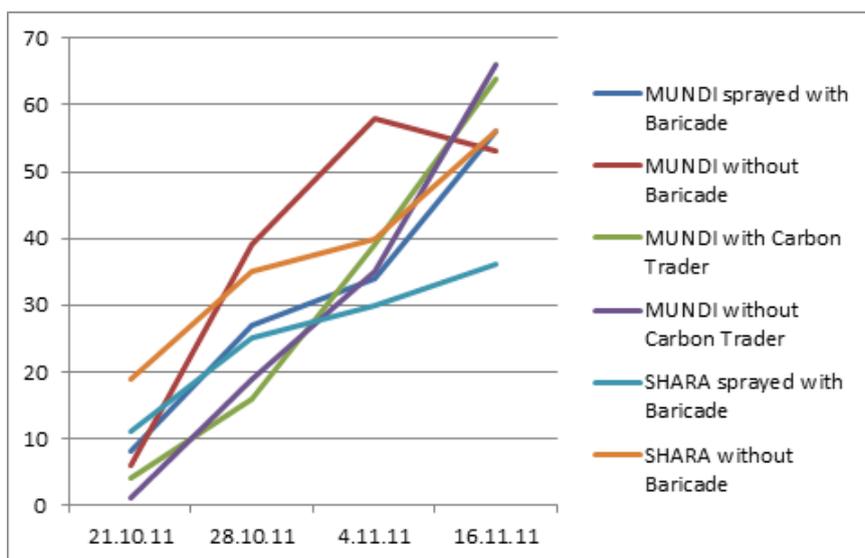


Difference in sprayed vs not sprayed

Note: the following numbers are calculated by taking away the number of the control plants from the number of the plants sprayed with chemicals (from the table on the previous page).

Date counted	Mundi sprayed with Barricade - not sprayed	Mundi Carbon Trader - no Carbon Trader	Shara sprayed with Barricade - not sprayed
21.10.11	2	3	-8
28.10.11	-12	-3	-10
4.11.11	-24	4	-10
16.11.11	3	-2	-20
18.11.11	2	-6	-14

NOTE: Mundi™ Westringia trays moved from hot house to shade house on 16.11.11



For Oryzalin

Observations and monitoring showed a reduction of weeds in the first trial evaluation in mid-autumn 2012 at the USA rate of 45ml per 100 square metres in 8 litres of water, but some broadleaf and grass weeds were noted. No difference was noted between the health of the target group and the control in any of the plants. Weeds were only slightly more numerous in the control than the target plants. The results for the Oryzalin were less weed reduction than for the 45ml per 100 square metres used in the Prodiamine test for container plants.

Further testing of Oryzalin at the higher rate of 80ml and 100ml per one hundred square metres was conducted in late 2012. Broadleaf weeds were reduced mostly at 80ml and totally at 100ml with no harm to the plants in the trial. A later trial showed Agapanthus, Cordyline and grasses can be harmed by the Oryzalin at these rates. Spraying on the potting mix and not on the leaf of these plants seems to reduce injury greatly.

Discussion

Prodiamine in these tests clearly showed a reduction in weeds. The most promising result was at the higher rate of 60ml per 100 square metres, where over summer no weeds were found in the target plants. It must be noted that a residual from previous applications may have added to this, however, with 4 months or more between applications, most of the chemical should have dissipated. Summer is also the worst time for weeds, and to get a result like this at that period is encouraging.

Prodiamine is widely used in the USA as a nursery pre-emergent. These trials show how effective it can be in Australia and how the plants generally do not appear to be adversely affected by the application. It must be noted that all plants used were well rooted into their container or the ground. As Oryzalin and Prodiamine are root pruners, it would be advisable to ensure plants are well rooted before applying this. It may not be advisable to plant a plug into a pot and make an application immediately, it may be better to wait a few weeks till the roots are down closer to the bottom of a pot. This still needs to be tested, as it is possible the plug would already have its roots deep enough. As potting mixes are well draining, it would be reasonable to expect the pre-emergent to move deeper into the potting mix substrate than it would in a normal garden soil. Testing needs to be conducted on planting into gardens, with immediate follow up applications of these chemicals. If successful, this could save the landscape industry large sums of money on weed control after planting.

At the higher rates of 80ml and 100ml, Oryzalin had good results for weed suppression, although at the lower rates it was disappointing. In some regions a permit would be needed to use the higher rates. In the USA, Ixozoben and Prodiamine are used together. Testing in Australia on native species is needed to see how effective and safe it is. In the USA a broader selection of weeds can be controlled by using both together. In late 2014 a trial will be conducted at 45ml per 100 square metres of Barricade and 7.5 grams of Gallery per 100 square metres in 8 litres of water, with irrigation immediately after application.

Propagation using plants that had Prodiamine applied three months before only had minor slowdown in rooting, and in the long run had little effect on the total success of plants rooted. So it may be safer to not recommend the use of Prodiamine on nursery propagation mother stock for at least 3 months prior to cuttings and division. It must be noted it is rare for nurseries to use pre-emergent chemicals on cutting and division mother stock just prior to propagation.

Carbon Trader

Literature review

There are many listed theories on why or what activated carbon does to turf, seed and soil and plants.

These include:

- *Increases / enhances photosynthesis in the plant
- *Increases cellular strength in the plant
- *Allows the plant to store more carbohydrates
- *Provides a food source for microbes
- *The carbon attracts heat and lifts the turf canopy temperature
- *Deactivates naturally occurring toxins in the soil

None of these theories have been proven with multiple replicated trials; hence there is no definitive evidence on the effects of activated carbon on turf or plants. This research did not delve into why this

product may work, but just tested whether it improves winter quality on plants and turf or if it improves propagation on plants. A literature review showed testimonials from a number of turf maintenance professionals that Carbon Trader improved winter colour on turf.

Materials and trial setup

Replicated trial plots of turf that were installed a few years earlier for other testing work were used. They were all fertilised, watered and mown identically. The soil they were growing on would be classed as poor; these plots were designed that way originally. The turf types used in this trial are all listed in the results section. Some of the plots were treated with Carbon Trader and some were left as a control. Replicated plots were available for Couch and Kikuyu, while for Buffalo and Zoysia plots, only one plot of each variety was available. For the Couch, two plots of each variety were available; half of each plot was treated, the other half left. This meant each variety had 2 plots treated and two controls. On the Kikuyu one plot of each was treated and one plot of each of the three varieties was left as a control. With the Zoysia and Buffalo, half of each plot was treated. As there were many plots of each species, the trial was well replication on a species basis.

Plants in trial gardens were selected and some were treated with Carbon Trader, while others were left as a control. Ornamental grasses, Westringia, Hardenbergia, Callistemon, Agapanthus, Lomandra, Nandina and Liriope varieties were treated.

Testing

Label rates of Carbon Trader were used at the higher rates. A knapsack was used to apply the Carbon Trader. The first treatment of Carbon Trader was on the 9th of May 2011. Evaluations and photos were taken at different times over winter. A second application was made in July. Cuttings of Westringia were made to see if the use of Carbon Trader improved strike in propagation.

Results

The table on the next page shows the results from the turf plot evaluations. A number of people undertook the evaluations, and from the results it is clear that Carbon Trader made a difference to winter quality of turf in general, with some varieties showing more difference than others. Based on this data, Carbon Trader improved the average winter colour and quality of the turf over all plots by an average of 24%. Buffalo types showed no real significant difference between varieties at this evaluation. One month later differences in Buffalo types were clearer. The most winter active type, a variety of Kikuyu called Kenda® turf, showed bigger differences between



The plot in the front was the best colour getting a rating of 9. It was the Kenda® Kikuyu sprayed with Carbon Trader. Notice in the background the colour of other plots is not as good.

varieties. One month later Couch differences between treated and untreated were less visible and only just noticeable, but Kikuyu differences were slightly more evident; however, these evaluations at the later date were only done by one person, so were not included in the full data due to the possibility of error.

1-Jul-11	Without Carbon Trader					With Carbon Trader				
	Todd	Marina	Stephen	Nathan	Average	Todd	Marina	Stephen	Nathan	Average
RE Couch	4	2	2	3	2.75	6	5	3.5	4	4.625
Lg13 Couch	4	2	3	3	3	5	3.5	5	3	4.125
GP Couch	4.5	2	2.5	3	3	6	3.5	5	4	4.625
Leg Couch	4	2	2	3	2.75	5	3.5	4.5	3	4
RS Couch	3.5	1.5	2	3	2.5	4.5	2	2.5	3	3
Cy Couch	3.5	1	2.5	2	2.25	4.5	3.5	3	3	3.5
Kenda Kikuyu	8	8	7.5	8	7.875	9	9	9	9	9
Common Kikuyu	6	6	5.5	6	5.875	8	7.5	8	8	7.875
Competitor Kikuyu	6	6	5.5	6	5.875	7	7.5	6.5	8	7.25
Em Zoysia	6	6	6	6	6	8	8	7.5	7	7.625
B1 Buffalo	6	6	7	6	6.25	7	7	8	7	7.25
KP1 Buffalo	6	7	7	6.5	6.625	7	7	8	7	7.25
Nr Zoysia	6.5	5	6	5	5.625	8	6	7	6	6.75
P42 Buffalo	6.5	6.5	6	6	6.25	7	7	7	6	6.75
P3 Buffalo	6	6	5	5.5	5.625	7	7	6.5	6	6.625
SW1 Buffalo	6	6	5	5.5	5.625	7	7	6.5	6	6.625
Mat1 Buffalo	5.5	5	5	5	5.125	6.5	6	6.5	6	6.25
P6 Buffalo	5.5			4.5	5	6.5			6	6.25
Total Average					4.88889					6.076389

Clippings at the end of winter were taken from the Kikuyu plots, and significant differences between the treated and non-treated plots were found. More clippings were measured from the treated plots (see below).

Average of Kikuyu clippings colour		
Combined scores	With Carbon Trader	Without Carbon Trader
Kenda® Kikuyu	8	6.5
Competitor Kikuyu	5	2.75
Common	7	2.75
Average of all Kikuyu	6.67	4
Average weight of Kikuyu clippings in grams per plot		
Combined Scores	With Carbon Trader	Without Carbon Trader
Average of all Kikuyu	909	334

Photo of clippings of the Kikuyu



Treated and non-treated plants were visually monitored and clear differences were noticed. In most cases, the ones treated with carbon trader appeared to be a darker colour, however, at some stages this was due to the black nature of Carbon Trader, and this black could still be seen in small dots on the

leaves of the plants. The photos used to show the differences were taken once this black had mainly disappeared to the naked eye. In many cases the plants appeared to grow more with Carbon Trader. These evaluations were of an informal nature and were not structured like the evaluations on turf. Further, more structured evaluations are needed, however clear differences could still be seen between many untreated and treated plants. For whatever reasons these differences occurred, this could allow many nurseries to ship better looking plants in winter and early spring, or to slightly protect plants in colder areas. Note: it took 3 to 6 weeks for most plants to no longer show the small dots of black on the leaf.



The plant on the left was treated with Carbon Trader around a month earlier, while the one on the right was not.

Discussion

Carbon Trader has shown that it does improve turf quality in winter. Early evidence shows it may help some plants. For retail quality nurseries, Carbon Trader could certainly be advantageous for quality in winter and early spring shipments. The last application of Carbon Trader should be done at least between 3 to 6 weeks before shipment. Larger leaves showed black dots for longer than small leaf types. This means that when shipping plants, for example, Westringia may be able to be done much sooner after application than Hardenbergia (this plant has a larger leaf than Westringia varieties). This research does not clearly prove Carbon Trader improves winter quality on plants, but it does suggest that it may have some effect.



The Callistemon's on the right were treated with Carbon Trader, while the ones on the left were not.

For turf, there are important implications that a warm season turf can get a high quality rating of 9 out of 10 after many frosts, near the middle of winter with Carbon Trader. This shows a combination of Carbon Trader and Kenda® Kikuyu could eliminate the need for over-seeding in many cooler winter regions of Australia. Furthermore, a turf that actively grows in winter could result in far better wearing sports fields for winter sports such as Rugby, AFL and Rugby League.

Conclusion

The use of Prodiamine and Carbon Trader is widespread in the turf industry. This research shows that Prodiamine clearly reduces weed invasion without damage to most plants. Registration of this product would greatly help Australian nurseries. Syngenta has indicated that they will aim for registration of this product over the next 12 months in Australia. New Zealand and South Africa need to lobby for this to happen.

Higher rates of Oryzalin were effective for weed control in nursery pots; however the fact that it moves deeper in the potting mix according to literature, needs to be tested and taken into account. In NZ and South Africa where Prodiamine is not available, Oryzalin at higher rates will help weed control, but it is important for users to check the legality of doing so. Mixing Gallery with Oryzalin or Prodiamine needs to be tested in Australia.

Carbon Trader clearly shows benefits for many turf types in winter. Although early indications are that it may also have benefits for plant quality, this assertion needs to be tested in a more controlled way. That being said, it may be worth a try for nurseries wanting to improve the winter and early spring quality of their plants, particularly for those in colder areas.