

Paterson's Curse Case Studies

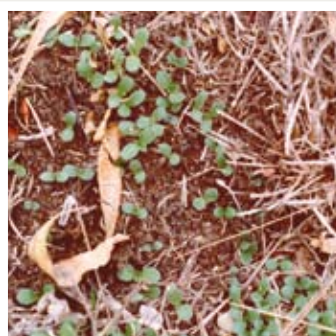
Four Case Studies of Farmers Managing
Paterson's Curse in Grazing Systems



HELPING PRODUCERS TO MANAGE WEEDS IN GRAZING SYSTEMS

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Paterson's curse (*Echium plantagineum*) is an aggressive, autumn-winter-spring growing annual or biennial weed, found throughout South Australia, Victoria, Tasmania, New South Wales and the Australian Capital Territory.

It competes aggressively with pastures and can completely smother them out. Paterson's curse is not readily eaten by stock but it contains pyrrolizidine alkaloids, which can be poisonous when eaten in large quantities, causing progressive liver damage and eventual death.

The weed is a prolific seed producer and can spread readily. It is a problem on around 20 million hectares throughout eastern Australia. Seed can remain viable in the soil for several years. It is spread by water, animals, wind, machinery and humans.

Case Study 1 – Pinelea

Andrew, Marie and Matthew Scott, “Pinelea”, Pyramid Hill, Victoria

Andrew and Marie Scott are second generation owners of Pinelea, a 1,150 ha property at Pyramid Hill, on the northern plains of Victoria, west of Echuca. Andrew’s parents purchased Pinelea in 1954.



The production system

In the past 10 years, Andrew and Marie have purchased two irrigation blocks totalling 103 ha, neither of which adjoin the home farm.

Their principle enterprises are a self-replacing Merino flock, cropping and hay production.

Andrew and Marie run 800 Merino ewes for wool production and sell some lambs.

This entire property is rotated between grazing and cropping, with the exception of 27 ha that is not arable. Each year they crop around 685 ha to dryland wheat, barley, peas and canola using a three to four year rotation, followed by pastures. The remaining 465 ha is maintained as pasture for grazing.

The irrigated blocks are used for grazing, or to produce vetch and Persian clover hay for sale.

Lucerne and clover pastures established after the cropping cycle are managed by set stocking throughout the year. Stock are supplementary fed during autumn to allow the pastures to increase their competitiveness against weeds.

Paterson’s curse

When Andrew and Marie purchased the irrigated blocks, both were highly infested with Paterson’s curse. This has now been reduced to a moderate level of infestation. The blocks were previously grazed by dairy cows and it is thought that bought-in hay was the original source of the Paterson’s curse seed.

Scattered infestations of Paterson’s curse have been identified on the home block since the 1960s but at much lower densities. Each infestation has been quickly eradicated, as the Scotts are acutely aware of the potential problem that Paterson’s curse may cause.

The incentive to act

Andrew and Marie’s goals for the farm are to maintain their current lifestyle at Pinelea and to leave a sustainable enterprise for the next generation.

They have been motivated to control Paterson’s curse due to its recognised impacts, including reduced carrying capacity, toxicity to livestock and contamination of hay.

Even with only scattered Paterson’s curse infestations on the home block, the potential for toxicity in sheep requires careful stock management. It is also very important to the Scott’s hay production enterprise to control Paterson’s curse, as contaminated hay would attract a discounted price.

Andrew and Marie said that they feel responsible to manage Paterson’s curse on their property for future generations and they have set a good example by managing it. They are also required under Victorian legislation to manage the weed.

Andrew and Marie’s initial aim was to stop Paterson’s curse from spreading to other farms, and then to eradicate it from the affected parts of their own property.



Deliberation

Andrew's father started the Paterson's curse control program on the property and Andrew and Marie decided to continue with it when they took over the management of Pinelea. With such a lot of time and money spent over the years, they thought that this effort would be wasted if they didn't continue.

They developed different strategies to control the varying levels of infestation on their blocks.

Firstly, they wanted to contain and eradicate Paterson's curse on the two irrigation blocks, and secondly, they want to prevent its establishment and eradicate any outbreaks on the home farm.

Andrew and Marie drew information and advice from various sources, including the former Victorian Lands Department; the Department of Sustainability and Environment; and the local Landcare Group.

The Landcare Group also helped raise funds for chemical costs and aerial spraying of inaccessible land.

The Scotts face two natural resource management issues – salinity and erosion. Both were considered as part of their Paterson's curse control strategy.

Salinity on the irrigation blocks makes it necessary to grow salt-tolerant, deep-rooted crops, to help lower the water table.

On the home block, Andrew and Marie have overcome erosion on their sloping land by direct drilling crops to maintain groundcover.

Diversity in the approach

Andrew and Marie use a number of methods to manage Paterson's curse at Pinelea, depending on the level of infestation.

Herbicides

Heavily infested irrigation blocks are managed with applications of herbicide.

Selective herbicide is applied in spring to prevent seed set, specifically targeting Paterson's curse in the hay producing blocks to reduce seed contamination.

Spot spraying with a broadleaf herbicide controls Paterson's curse along fence lines.

A spray/graze approach is used to prevent seed set in spring. The pasture and weeds are sprayed with a sub-lethal amount of herbicide, then grazed to reduce seed set to a manageable level.

Scattered infestations on the home farm are eradicated with herbicides.

Broadleaf herbicide is applied in spring during the three to four year cropping rotation, to remove the broadleaf weeds, including Paterson's curse, in crops.

Broadleaf herbicide is applied to pasture in spring by spot spraying. Inaccessible areas are also spot sprayed with a broadleaf herbicide in winter and spring, to control Paterson's curse along fence lines and other areas where the boom spray cannot be used.

Aerial spraying in spring to prevent seed set of Paterson's curse on heavily infested, inaccessible areas such as rocky outcrops is an option when infestations are particularly bad.

Grazing management

Careful management of sheep grazing ensures that the pastures are vigorous enough to be able to compete against emerging Paterson's curse.

During autumn, Andrew and Marie supplementary feed grain to the sheep to try to take some pressure off the pasture. Aside from this break, paddocks are set stocked.

Cattle movements are restricted to prevent the movement of animals from the infested irrigation blocks into cleaner paddocks during seed set.

Pastures

Pastures are monitored to ensure that there is a variety of pasture available; it's important that sheep don't suffer from toxicity from overgrazing Paterson's curse. If the levels of Paterson's curse increase to cause toxicity, Andrew moves stock out of the paddock or supplementary feeds.

Pasture management helps to maintain groundcover and herbage mass levels. The dominant pasture species are lucerne and clover, which provide competition in winter and spring, helping to prevent the establishment of Paterson's curse. These pastures are under sown every four years, after the cropping cycle.

Diligence

Control of Paterson's curse is integral to the Scotts' whole farm management. Diligent monitoring and management of Paterson's curse outbreaks at Pinelea are part of the day-to-day farm activities.

Control of Paterson's curse is based on constant monitoring of weeds and pastures, and careful planning to prevent the incursion and establishment of Paterson's curse. For example, the timing of herbicide applications is critical to prevent seed set and reduce further establishment of the weed at Pinelea.

Benefits and costs

The Scotts have estimated their direct costs of Paterson's curse management to be about \$19,000 per annum. This includes chemicals and an additional 250 hours of labour associated with their management program, but excludes aerial spraying costs.

The control of Paterson's curse at Pinelea has helped to maintain farm productivity. If Paterson's curse was left unchecked, Andrew estimates they would have lost 30% of carrying capacity. Valued at \$67/ DSE, this equates to \$29,000 per annum across the total grazing area.

By reducing Paterson's curse at Pinelea, Andrew and Marie can also produce marketable hay. They estimate that the price discount on hay contaminated with Paterson's curse would be at least \$5 per round bale, equating to \$5,500 per year for their enterprise.

Accounting for these costs and benefits, the estimated net benefit of their Paterson's curse strategy is \$15,500 per annum.

Annual costs and benefits of weed management

Costs

Chemical control and labour \$19,000

Benefits

Avoided 30% loss of carrying capacity \$29,000

Avoided price discount for hay \$5,500

Annual net benefit \$15,500

Andrew and Marie still maintain a long-term view that Pinelea will eventually be free of Paterson's curse, thereby increasing the value of the property.

Keys to success

Andrew and Marie believe that the critical factors for successful management of Paterson's curse have been continual monitoring for Paterson's curse on the whole farm, and controlling the weed during the cropping and pasture cycle.

They have decided that they are not going to live with Paterson's curse and remain determined to eradicate it from their property.

Summary

Andrew and Marie Scott have effectively managed Paterson's curse at Pinelea through planned crop rotations, applying in-crop herbicides, maintaining competitive pastures, and spot spraying to control weeds.

Careful monitoring and quick eradication of scattered plants is effective on the less infested home farm.

Through these control strategies, Andrew and Marie have prevented Paterson's curse from becoming widely established on the home farm and they are lowering the level of infestation on the irrigation blocks.

Taking into account the costs and benefits of retaining carrying capacity and preventing contamination of hay, the net benefit of Paterson's curse control is \$15,500 each year for the Scotts.

Top tips ✓

Andrew and Marie's advice for managing Paterson's curse:

- ✓ Managing Paterson's curse is a lot of hard work, but keep at it!
- ✓ Don't be frightened of the expense or the time taken to manage Paterson's curse, as the benefits are worth it, particularly if you can stop it from establishing.
- ✓ Develop a strategy for each farm or block to suit the level of infestation that exists.
- ✓ Make control of Paterson's curse part of your overall farm management.
- ✓ Manage crops and pastures to make it difficult for Paterson's curse to establish.

Case Study 2 - Winona

Colin Seis, "Winona", Gulgong, New South Wales

Colin and his family are the fourth generation to own Winona, an 840 ha property that has been in the Seis family for 150 years. It is situated 20 km north of Gulgong, in the Talbragar River Catchment of central west New South Wales.



The production system

Through the boom years of 1930 to 1960, wheat was grown in rotation with improved pastures, which were fertilised annually with 100 kg/ha of superphosphate.

A variety of factors caused an economic "crash" in the 1970s and, as a result, when Colin took over the management of Winona in 1980, he implemented a very different management strategy.

Winona primarily supports an 18 micron wool enterprise and a sustainable cropping program.

Pastures are mostly summer and winter-growing perennial native grasses, including Warrego summer grass, wallaby grass, common wheat grass and microlaena.

Oats are grown for fodder and grain, using a pasture cropping system that is rotated around the arable areas of the farm.

The family is moving towards a production system that uses no herbicides and relies only on organic fertilisers. They are aiming for a sustainable carrying capacity of 7,000 DSE.

Their goal of returning the property to its pre-European settlement condition means that complementary strategies for the control of Paterson's curse had to be developed.

Increased groundcover and a greater proportion of perennial species helped reduce the areas degraded by dryland salinity, reduce the area of bare ground, and lower the water table through increased water use by pastures.

Paterson's curse

In 1980, after a major bushfire at Winona the previous year, Paterson's curse and other annual weeds comprised 60% of total groundcover. In some paddocks, 100% of the ground was covered by weeds.

Colin tried spraying with herbicides but this only increased pasture maintenance costs and didn't address the cause of the problem - bare ground available for colonisation by the aggressive weed.

The main impact of the Paterson's curse infestation was to reduce carrying capacity to 4,200 DSE, compared with current levels of 6,500 DSE. The weed had little impact on the cropping enterprises as cultivation, in-crop herbicide use and pasture rotations provided good control.

The motivation to act

In 1979, a bushfire forced the family to change their strategic direction.

It destroyed most of the farm buildings, 3,000 sheep, all of the pastures and 25 km of fencing. This spiralled the business into huge debt and forced a major re-think on how they were currently managing the farm, including the control of Paterson's curse and other weeds.

Colin was concerned about the sustainability and profitability of traditional farming methods. The property's soil was becoming acidic, pastures were failing to respond to traditional fertiliser programs, and areas of bare ground and dryland salinity were expanding.

In order to restore the property to its pre-European settlement condition of "a grassy woodland environment with 3% trees," Colin was motivated to try something different to manage weeds.

An added incentive for Colin is the personal satisfaction he gains as the property's condition improves.

Deliberation

Adopting a rather unconventional approach to Paterson's curse control meant that information was hard to find and the NSW Department of Primary Industries DPI agronomists at the time found it difficult to offer support.

Colin approached Dr Christine Jones, formerly from the University of New England, who provided him with a detailed insight into the agronomy and ecology behind pasture cropping. Dr Jones' advice and support led Colin to implement his alternative approach.

He enrolled in a Grazing for Profit™ course to learn about time-controlled grazing as a tool to improve groundcover. He said that he gained a good understanding of how to plan a strategy involving grazing and rest periods to maximise the performance of his pastures and livestock.

Staff at the Wellington office of the then NSW Department of Land and Water Conservation were also very supportive of an approach that focussed on increasing the proportion of native perennial grasses in the pasture mix. They provided considerable assistance by setting up a pasture transect survey program to monitor changes in groundcover and pasture composition.

This support and discussion has continued with the staff who transferred to the Central West Catchment Management Authority.

Diversity in the approach

Colin decided that his main strategy to manage Paterson's curse was to increase the competitiveness and proportion of perennial species in his pastures. He set a goal to focus on managing native pastures for 100% groundcover.

To achieve this, the Seis family developed a system that they refer to as "pasture cropping". This involves planning grazing management with time-control grazing, and strategic use of selective herbicides in a zero tillage cropping phase. A number of steps were involved in changing the system.

Pastures

The first step in the plan was to cease the annual application of fertilisers on pastures, despite advice from professional advisers.

This was based on the assumption that improved pasture species were phosphate dependent and required annual top-dressing for survival and production. Conversely, it was thought that without fertiliser, pasture species that were not dependent on high levels of phosphate, such as native grasses, would return.

Colin also assumed that it was likely that there had been a considerable build up of phosphate in the soil from years of fertiliser application.

Cropping

The traditional farming system removed all perennial pasture species in the fallow phase, prior to sowing a cereal crop. After harvesting the cereal crop, a sub clover and annual ryegrass pasture mix was sown, fertilised with superphosphate and grazed for three to four years, before being fallowed in preparation for the next crop rotation.

When Colin took over management, he adopted an alternative pasture cropping system.

Instead of fallowing, the groundcover of perennial native species is now maintained and grazed until sowing time. A single-pass operation is used to sow the crop seed and fertiliser in 30cm rows in to the grazed pasture, with very little disturbance to the surface groundcover.

The crop is generally grown for one year and then the reinvigorated pasture is grown for another three to four years before the next cropping phase.

The duration of the cropping and pasture phases is flexible, depending on soil type and the native pasture species present. The crop is usually oats, which is grazed then harvested for grain. Colin has sown lupins, and is considering sowing grazing wheat in same way.



Summary

Colin has effectively managed Paterson's curse at Winona by

- ✓ Managing the pasture cropping system for 100% ground cover.
- ✓ Matching available pasture and animal requirements with time-controlled grazing.
- ✓ Strategic herbicide use in a zero till cropping phase.

Colin has managed to eradicate Paterson's curse in those areas of the property where he can maintain 100% groundcover, 100% of the time.

The outcome of this approach has been a 55% increase in stocking rate, a \$15,000 reduction in pasture maintenance costs, and a 20% reduction in crop establishment costs. The net impact on total farm gross margin has been almost \$62,000 per year.

Top tips ✓

Colin's advice for managing Paterson's curse is:

- ✓ Fix the reason the weeds are there - cover the bare patches and the weeds will not germinate.
- ✓ Aim for 100% groundcover, 100% of the time, with 80% perennial grasses and 20% sub clover.
- ✓ Take before and after photos, so that you can see what you have achieved and measure it.

Grazing management

As part of implementing a planned approach to grazing, Colin divided Winona into 56 paddocks of 15 ha each and improved the stock watering system. This was done over a period of years and the cost was partly offset by the sale of surplus cultivation machinery and an annual saving in pasture maintenance costs of approximately \$15,000.

In the early years of the pasture cropping system (1980-1985), stocking rates remained at their weed suppressed levels until pasture productivity increased. The stocking rate has continued to increase as overall soil and pasture health improves. Colin has a target stocking rate of 7,000 DSE as a long-term goal - a 60% increase on the stocking rate in the early 1980s.

Herbicides

Broadleaf herbicides are used selectively to kill problem weeds, before sowing the crops in the rotation.

Diligence

The commitment to improving groundcover and increasing the proportion of perennial pasture species has enabled the Seis family to control Paterson's curse at Winona.

Continual focus is needed to effectively prevent weed establishment. Colin acknowledged that he spends more time planning and monitoring than his father did, and he attributes much of his success to time spent in the office.

Each year, as part of an ongoing program, Colin monitors the contribution of each plant group to groundcover in the pasture along established transects. His monitoring records the green and dead portions of useful species and weeds such as Paterson's curse.

Regular soil testing and the pasture monitoring results help Colin plan future herbicide applications and changes to the grazing and rest periods.

Benefits and costs

The major benefit of the system has been a 2,300 DSE increase in carrying capacity. This has increased net farm returns, after enterprise overheads, by almost \$62,000 a year. This has been driven by increased pasture productivity per hectare and extended grazing periods in cropping paddocks, from Colin's unique approach to pasture cropping.

Pasture overhead costs have been reduced to zero, as herbicides and fertilisers are applied in the cropping phase.

There is no need to replant pastures as the native species now survive through the cropping phase or regenerate from an extensive seed bank. Maintaining the perennial native groundcover through the cropping phase means the ground is never bare for weeds to invade.

Annual benefits of weed management

Benefits

55% increase in carrying capacity	
Reduced pasture maintenance costs	\$15,000
Reduced crop establishment costs by 20%	
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Annual net benefit	\$62,000

Keys to success

Achieving 100% groundcover by increasing the proportion of perennial pasture species, is Colin's central strategy for managing Paterson's curse.

Implementing a planned approach to grazing and retaining perennial pasture species through the cropping phase are the critical success factors behind this strategy.

Case Study 3 - Marombi

Dick and Anthony Ord, "Marombi", Coolah, New South Wales

Marombi is a 688 ha intensively run dryland property at Coolah in central west NSW. The Ord family purchased the original Marombi block in 1946, with subsequent acquisitions increasing the land area to its current size.



The production system

While not a large property by today's standards, Marombi ably supports two families through efficient management. The main enterprises include lucerne hay, Merino wethers for trading, wheat, subtropical grasses for grazing and seed production, and lucerne seed production.

Since the 1950s, most of the property has received over 3.7 t/ha of superphosphate. Soil phosphorus and sulfur has accumulated over this time, so fertiliser use is now much lower than previously and is applied according to soil test results.

The property is subdivided into 50 paddocks. Pastures are dominated by lucerne and flexible rotational grazing is used. There is no fixed stock-on/stock-off system. Grazing duration and rest periods are dependent on the available feed and the requirements for stock and pastures.

Paterson's curse

Paterson's curse first entered Marombi 20 years ago, via purchased seed. Infestations have also come from adjoining areas.

Six years ago, the weed reached levels where it began to threaten farm viability. It had infested most pastures, fence lines, laneways and areas around buildings, and some areas adjoining the farm were totally smothered by the weed.

For many years, Paterson's curse had been controlled routinely, as part of the weed control program for crops and lucerne hay paddocks. Then, six years ago, the Ords decided they needed to focus more on Paterson's curse.

They aimed to reduce the severity of its impact and, eventually, totally eradicate the weed from the whole property.

When left uncontrolled, Paterson's curse can smother improved and native pasture species such as perennial grasses. The native perennial grasses at Marombi are valued for their feed quality and ecological significance. They improve groundcover levels throughout the year, thereby reducing soil erosion.

The incentive to act

Marombi had always been a profitable and well-managed property but the Paterson's curse infestation was threatening that status. The Ords realised that if they did not implement a whole-of-farm approach, their livelihood as farmers would be threatened.

Left uncontrolled, Paterson's curse could ruin their pastures and dramatically cut livestock productivity. The increasing levels of infestation indicated that they would face a major downturn in production if they did not address the problem.

The hay and seed enterprise demands a high level of weed control to keep its products free from weeds like Paterson's curse.

Knowledge gained from sources like the NSW Department of Primary Industries and agribusiness also assisted the decision to act. The Ords learned that Paterson's curse could be successfully managed with an integrated program involving several control methods.

Deliberation

Six years ago, the Ords concluded that, despite routine weed control measures in cereal and hay paddocks, Paterson's curse had gradually increased across their property, which warranted a whole-of-farm control program.

Initial priority was given to preventing seeding in crops and lucerne hay areas but progressively all paddocks have been brought into the program, including laneways, roadways, fences and areas around sheds.

They knew that small areas left uncontrolled would present opportunities for reinfestation of clean areas. Seeds can be readily spread by water, wind and feral animals, and by livestock, which regularly move around the farm as part of the normal grazing management.

Assessing the extent of Paterson's curse at Marombi, which is largely arable and level-to-undulating, was straightforward. Most of the property is regularly monitored for pasture, crop and livestock condition.

Dick and Anthony's primary goal is to prevent Paterson's curse from seeding, although they recognised that this would be difficult in the initial years. Provided that new invasions could be prevented or dramatically reduced, total seed prevention would, over a number of years, dramatically reduce the population and impact of the weed.

The goal of total property control is feasible on such an intensively managed property, and the cost of this was not considered unreasonable when compared with the likely future losses if the problem was ignored.

Diversity in the approach

The Ords have adopted an integrated Paterson's curse control program involving herbicide use in crops and pastures; crop and pasture rotations; competitive pastures; slashing; grazing management; and biological control.

Herbicides

To reduce Paterson's curse in a three to four year crop cycle, crops are sprayed with a range of herbicides that in general, completely prevent seeding, eg, terbutryn, metsulfuron, chlorsulfuron and 2,4-D.

Lucerne pastures, and pastures with sub-tropical grasses with winter annual legume components, are sprayed on an annual basis if weed levels are greater than that which can be controlled by spot spraying. The choice of herbicide depends on pasture type, weed stage and weed density. There are less herbicide choices for legume pastures than for grass pastures, and sometimes a decision is made to sacrifice the winter annual legume as it generally regenerates well in the next year.

A spray-graze approach is used successfully in some areas but can't be used in every paddock every year due to the large number of livestock required.

Spot spraying is used to treat areas before they become widespread, or as a follow-up measure on small infestations that have remained after broadacre spray programs. Spot spraying is regularly used along laneways, fence lines and around sheds.

Pastures

Competitive pastures are, in the view of the Ords, essential for both profitability and improved competition against weeds, even if weeds have been sprayed. Pastures that will aggressively compete with weeds are established after cropping or with the last crop.

Sub-tropical grasses are widely grown and have added greatly to the pastures' ability to compete against Paterson's curse in the crucial autumn and spring period.

Dense, well-managed lucerne is also competitive, especially above 20 plants/m².

Slashing alone has not been very effective. However, when used at the early flowering stage on areas where the weed got away, or in combination with spray-grazing or spray-only controls, it has reduced seed set.

Biological control

While biological control agents have never been released at Marombi, they are present throughout the district and do contribute to control. Dick and Anthony stress that it is important not to depend on biological control agents but that fostering them makes good sense.

Diligence

Dick said that the key to success is continuous careful monitoring and timely action.

Correct timing of herbicide application and spray-grazing is especially important. Regrowth after herbicide treatment is regarded as the biggest threat to preventing seed set.

Paterson's curse can regenerate from "hard" seed so the Ords aim to totally prevent seeding in a given area for at least four years. Even then, they expect reinfestation, so continue to monitor these areas and treat as required.

They have observed that weed levels are starting to decline. As this continues, they will use less broadacre spraying and more spot spraying.

Keeping weeds out, once levels have been reduced or eliminated, is an ongoing challenge.

The Ords work closely with neighbours for a united approach and potential new infestations from public roads and visiting vehicles are also being

addressed. For example, the Ords only allow Marombi farm vehicles to travel around the property. Visiting vehicles are restricted to areas on the farm that can be easily monitored.

Reintroduction of Paterson's curse via seed with purchased livestock is also a risk. Wherever possible, newly acquired animals are quarantined in a designated paddock for the first two weeks.

Benefits and costs

When at its worst, Paterson's curse affected 70% of Marombi. Now, all infested areas across the property are being addressed through a combination of control measures and its impact on productivity is minimal; less than 5%.

While total prevention of weed seed set has not been achieved, most areas are being prevented from seeding.

Total eradication remains the Ords' ultimate aim. They believe that reducing the impact of the weed to negligible economic consequence is within their sights. They feel that in another four to five years, they should be able to say Paterson's curse is no longer an economic issue on their property, although spot spraying and containing new invasions will likely be ongoing for some time yet.

Dick and Anthony have seen properties where Paterson's curse has more than halved productivity, ruled out enterprises like hay and pasture seed production, and badly degraded the whole farm environment. The main benefit of their program is in avoiding this situation.

The cost of the program, above normal farm practice, is not as high as one would expect. For example, the introduction of more competitive pastures, such as Consol lovegrass, has combined better weed control with greater productivity. Well-run, dense lucerne stands are more productive, as well as more competitive against Paterson's curse and other weeds.

Annual costs and benefits of weed management

Costs

Pasture herbicide (200 ha @ \$30/ha)	\$6,000
Spot spraying herbicide	\$3,000
Labour for monitoring and spraying	\$6,000

Benefits

Avoided 50% loss in livestock returns	\$45,000
Avoided loss of pasture seed and hay enterprises	\$100,000
Annual net benefit	\$130,000

Keys to success

It is too early for Dick and Anthony to call their program a total success but they believe they are making good progress. They think the key factors include:

- Realistically assessing costs/losses if the control is not undertaken.
- Formulating a realistic control weed control program.
- Timely and thorough adherence to the program.
- Fully understanding the weed.
- Remaining on the look-out for missed areas and new weed invasions.

Summary

Dick and Anthony Ord are effectively managing Paterson's curse at Marombi by:

- ✓ Using a combination of control strategies including herbicides, spray-graze, crop and pasture rotations, biological control, competitive perennial pastures, slashing and short periods of heavy grazing.
- ✓ Carefully monitoring potential weed entry points and treating new infestations quickly.
- ✓ Ensuring all operations, such as spraying, are done on time and correctly.

They believe that if they did not adopt an aggressive control program, Paterson's curse would put them out of business.

While they haven't eradicated it, their program has reduced the impact of the weed on farm production to less than 5%, and has helped them avoid a potential loss of \$145,000 a year.

Top tips ✓

Dick and Anthony's recommendations to other farmers with Paterson's curse are:

- ✓ Eradicate the weed before it gets a grip on your property.
- ✓ Focus a control strategy around prevention of flowering.
- ✓ Use as many control options in combination, as are applicable to your situation.
- ✓ Do careful and regular property surveillance to quickly detect and treat new infestations.
- ✓ Timely control is very important.
- ✓ A good control strategy is compatible with greater profitability.

Case Study 4 - Mill Beck

Di and Michael Griffin, "Mill Beck", Dederang, Victoria

Di and Michael Griffin moved to their 16 ha farm at Dederang, in Victoria's Kiewa Valley, in September 1995. The Griffins are committed to managing their land organically. Di currently works off farm while Michael is building their new house.



The production system

Di and Michael have a 10 year plan to earn their living from the farm. They want to prove that they can make a living from 16 ha and do it organically.

The couple has planted 60 olive trees, 20 of which currently produce fruit. They run 40 Cashmere x Boer goats to control blackberries and graze pastures, against bobby calves for a local dairy and have some horses.

With high annual rainfall and the steep hills in the valley, they try to ensure that there is adequate groundcover to prevent erosion. Increased groundcover with suitable pasture species helps to reduce sediment run-off into the creek. This, combined with avoiding chemical use, helps to improve the water quality of the creek that flows through the farm.

Paterson's curse

Soon after moving to Mill Beck, Di and Michael discovered that they owned 16 ha of weeds.

About 15% of the Griffins' property is highly infested and 30% moderately infested with Paterson's curse. The infestation is thought to have come from hay that was brought in to feed the horses and dairy cattle that were run on the farm before they purchased it.

They have tried various measures over the past 10 years and feel that they are now having good success with managing Paterson's curse.

The incentive to act

Paterson's curse has reduced Mill Beck's livestock carrying capacity, a farm that has poor soil fertility and a pasture base that is struggling to compete with weeds. The balance of the whole farm system has been disturbed by overgrazing and the incursion of weeds.

Di and Michael were also under constant pressure from weed inspectors to control the Paterson's curse on their farm.

They also felt they were "the talk of the valley" for having hills covered in Paterson's curse during spring. There was high community and peer pressure for them to control it.

Deliberation

Di completed an organic farm course at Riverina TAFE, which gave her the skills to develop a whole farm plan for Mill Beck.

Di and Michael then plotted the Paterson's curse locations onto an aerial photo of the farm, which helped them to monitor weed changes and to form a weed management plan.

Based on laboratory soil test results, the Griffins undertook a soil improvement program using organically-approved additives such as dolomite, rock phosphate and trace elements.

Di and Michael worked out which method of control was most appropriate for different areas. For example, in areas that were too rocky for slashing, hand pulling or pine oil applications were used to control the Paterson's curse.

They wanted to minimise the spread of Paterson's curse on their farm and reduce the risk of it spreading to neighbouring properties. They aimed to utilise Paterson's curse as a green manure crop, until they could reduce the infestation to a manageable level.

Their local Landcare Coordinator provided very helpful information about Paterson's curse and put them in contact with the Victorian Department of Primary Industries research centre, the Keith Turnbull Research Institute, to discuss biological control.

Diversity in the approach

Di and Michael have learned through research and trial and error that there is no simple, quick fix solution to controlling Paterson's curse. They feel the best results are achieved using a combination of control methods.



Crops and pastures

Suitable cropping and grazing areas have been fenced off and different crops and pastures are planted in rotation. Oats and peas are grown together for a couple of years both as a green manure crop and to compete with the Paterson's curse.

Biological control

The Griffins have been introducing biological control agents since 1996. They have been released into fenced off "nursery" sites and have spread as their numbers have increased. They have introduced five different agents to attack the Paterson's curse as part of a regional biological control approach.

Grazing management

When the Paterson's curse rosettes have emerged and grown tall, but before they go to seed, the Griffins use their goats to intensively graze the weed. Sheep and goats eat the new growth and they will eat the centre of the rosettes.

Livestock are moved before paddocks become overgrazed and the overall management aims to protect the soil so that pasture species can compete against Paterson's curse.

Mulching

Mulching or brush cutting is used when the plant has flowered but not yet produced viable seed.

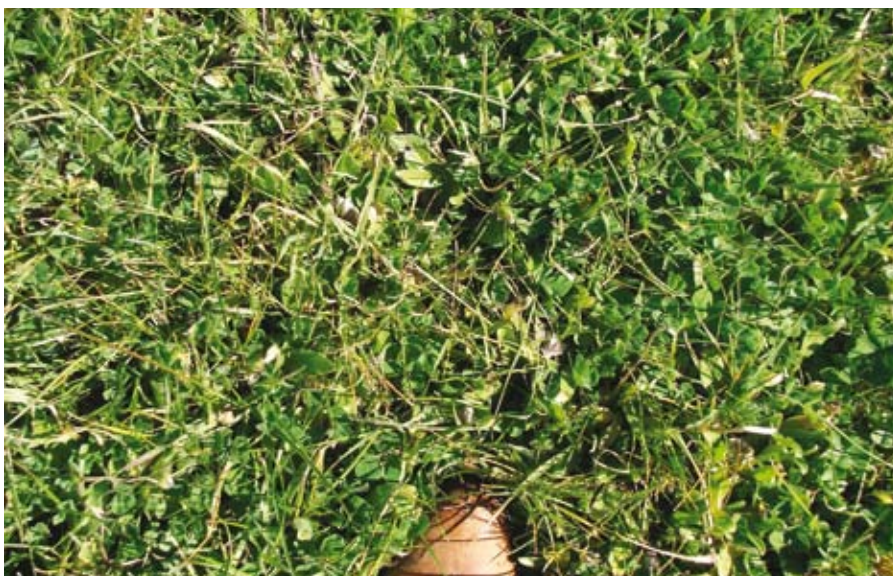
Mulching usually takes place during late spring and summer, depending on the seasonal conditions.

The Griffins have learnt to resist cutting Paterson's curse too early, as if they do, it produces more lateral flower stalks, which grow thicker and closer to the ground.

Hand pulling

Spot weeding to remove plants that have gone to seed is done by hand pulling. The pulled plants are burned. Di and Michael have also collected the seed by slashing with a mower and collecting seed in the catcher, which is also burned.

Pine oil is used as a foliar spray in areas of high infestation, such as along fence lines. Pine oil is the only organically approved herbicide that the Griffins are aware of. Compared to other non-organic herbicides, pine oil is more expensive, but it is effective, killing the plant by dehydration. It has proven a great tool in Di and Michael's strategy for managing Paterson's curse.



Summary

Di and Michael Griffin have effectively used an organic weed control strategy to manage Paterson's curse at Mill Beck, with a combination of:

- ✓ Releasing five biological control agents to destroy Paterson's curse.
- ✓ Mulching/brush cutting when Paterson's curse is flowering but before the seeds are viable.
- ✓ Spot weeding by hand when Paterson's curse has set seed, and destroying pulled plants by burning.
- ✓ Crash grazing by goats to help pastures compete against Paterson's curse.
- ✓ Planting vegetative boundaries to prevent and reduce seed spreading between neighbours.
- ✓ Cultivating and establishing crops or pastures to compete against Paterson's curse.
- ✓ Spot spraying with pine oil, an organically approved herbicide, in difficult to treat places.
- ✓ Balancing soil nutrients to increase soil health.

Top tips ✓

Di and Michael's advice for managing Paterson's curse is:

- ✓ Don't give up! This is particularly the case if using biological control agents, as it will take some time for them to build up sufficient numbers to be effective.
- ✓ Keep accurate records of your weed management.
- ✓ Take before and after photos so that you can measure what you have achieved.
- ✓ Use a combination of methods.
- ✓ Monitor regularly, particularly in clean areas, and quickly remove new weeds by spot spraying or hand pulling them.

Diligence

The Griffins have kept weed-free areas clean by patrolling the whole farm regularly and eliminating stray plants by hand. If a new patch of multiple rosettes appears, they spray it with pine oil or hand pull the plants.

In order to prevent Paterson's curse from spreading to neighbouring farms, Di and Michael have made creek banks and boundaries a priority for eradication and they try to maintain a weed-free buffer of at least 12 m along boundaries and creek lines. Shelterbelts planted along these buffers reduce the risk of weed spread by providing a vegetative barrier. Shelterbelts also provide habitat for wildlife, shelter for livestock and reduce wind erosion.

Benefits and costs

The area of Mill Beck that originally had the worst infestation of Paterson's curse is now a weed-free olive grove.

On the remaining area, the Griffins have found that their Paterson's curse management strategy has increased biodiversity within their pastures; increased pasture growth due to less competition for nutrients and moisture; and increased soil fertility.

As a result of these benefits, the number of livestock that they can sustainably carry on the farm has increased.

The Griffins feel that the greatest benefits of managing Paterson's curse are that their whole farm system is becoming more balanced and they have increased the value of the land. They believe that by reducing Paterson's Curse to a manageable level, they will increase the value of their farm by as much as \$2,500/hectare - an increase in capital value of \$40,000 across the whole farm.

The initial stages of implementing their strategy took considerable time to set up. Despite this, the Griffins believe that their organic weed management strategy offers a number of benefits over conventional control measures. It is self sustaining, puts the environment back in balance, has less inputs than many conventional strategies, and is not as costly as using chemicals and other equipment to manage Paterson's curse.

For example, their greatest expense is the pine oil treatment, which costs less than \$2,000 per annum.

Now, more than 10 years on, although Di and Michael Griffin still have Paterson's curse, the weed is at manageable levels and the biological control agents are spreading to neighbouring farms.

Keys to success

Careful management of the biological control agents has been critical to the success of the Griffin's management strategy. Biological control agents need:

- ➔ To be carefully monitored.
- ➔ A well-maintained nursery site.
- ➔ A farm owner committed to biological control in the long-term.

Persistence was also a key to their organic control program, as the couple faced considerable peer and community pressure to use chemicals to control Paterson's curse.

Staying motivated was perhaps the biggest challenge that Di and Michael faced. However, the couple feel it was worth it and now a number of people are asking their advice on how to achieve the same results.

Other publications from AWI and MLA:

3D Weed Management: Paterson's curse

**Tips & Tools: Weed removers, pasture improvers
– Effective weed control**

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