A Good Weed

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Glyphosate Resistance Discovered

Herbicide resistance in Australia is an increasing problem and, according to experts, we have more resistance than any other country in the world. It is perhaps not surprising then that the first case of glyphosate (Roundup) resistance worldwide was discovered recently in Australia. While its use patterns and mode of action suggested that the development of resistance to this non-selective knockdown herbicide was unlikely, history now shows that it was not impossible.

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Editor: Brian Sindel
Department of Agronomy and Soil Science, University of New England, Armidale 2351
Ph: (067) 733 747
Fax: (067) 733 238 Email: bsindel@metz.une.edu.au

Secretary: Leon Smith
8 Darwin Drive,
Lapstone 2773
Ph/fax: (047) 393 564

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.... Glyphosate Resistance Discovered

Although the likelihood of weeds developing resistance to glyphosate has been considered to be very low (see previous edition of *A Good Weed*), a case of glyphosate resistance has now been discovered in Australia. Thought to be a world first, a farmer in Echuca, northern Victoria, found annual ryegrass on his property that was not being controlled by glyphosate (Roundup). The farmer noticed that weeds in one paddock were no longer susceptible to the herbicide after 10 sprayings in the past 15 years.

Researchers at the Centre for Conservation Farming at Charles Sturt University at Wagga Wagga conducted studies that confirmed the weeds were resistant to glyphosate. Jim Pratley said that two sets of tests had been performed on the weeds to confirm resistance to the herbicide. Some of the ryegrass survived almost five times the recommended dose.

Monsanto Australia's technical director, Bill Blowes, said the company was working with the university to confirm the cause of the resistance in the trials conducted there. Earlier this year, Monsanto announced plans to invest nearly US$200 million over the next three years to expand manufacturing and formulation capacity for Roundup. Sales of the herbicide played a key role in the 11% increase in Monsanto's agrochemical sales in 1995.

Glyphosate is a broad-spectrum herbicide widely used to kill unwanted plants both in agriculture and in non-agricultural situations. It is viewed by some as a key component of conservation or "no-till" farming. In the United States, glyphosate is the eighth most commonly used herbicide in agriculture and the second most commonly used herbicide in non-agricultural situations.

According to Roger Cousens from Latrobe University, high-technology crop production systems which rely entirely on herbicides are "in danger of crashing down around our ears" because of the development of weeds resistant to herbicides. Australia is said to have more herbicide resistance than any other major crop producing region in the world. Ryegrass, the most commonly resistant weed in Australia, is resistant to various herbicides across 40% of the country's agricultural region.

The delay in the buildup of resistance to glyphosate relative to other herbicides is due in part to its use pattern. As a pre-sowing knockdown herbicide, its failure to control plants for any reason can be masked if complete soil disturbance is achieved during sowing. Survivors of the sowing process may subsequently be controlled by the application of a selective post-emergent herbicide. According to Jim Pratley, a resistant plant therefore needs to survive a three phase process before it can add seed to the soil for a new generation of resistant plants.

The discovery of resistance to glyphosate could also affect proposals to introduce genetically engineered glyphosate-resistant crops in Australia. Monsanto has genetically engineered glyphosate-resistant cotton and soybeans which have been approved for use in the US; the company is currently seeking US approval of glyphosate-resistant canola and is developing engineered glyphosate-resistant corn. In addition, five other genetically engineered glyphosate-resistant crops have been field tested in the US - wheat, sugar beets, lettuce, potato and poplar.

At this point, the discovery of glyphosate resistant ryegrass is not a disaster, but rather just one confirmed case out of hundreds of thousands of farms. The fact that glyphosate is effective on a wide spectrum of weeds and is considered relatively safe because it breaks down rapidly and is largely inactivated on contact with soil, underlines the need to retain it as an effective herbicide. Integrated weed management, which combines a variety of weed control techniques, is being promoted partly because of such cases of herbicide resistance. ❐

Gene Transfer from Herbicide Resistant Crops and Weeds

The development of transgenic crops with novel characteristics such as herbicide resistance has raised considerable debate in other parts of the world. The risk of herbicide resistance genes escaping to weedy relatives has been considered as one of the main threats.

The one crop for which a large number of weedy relatives is present is canola. Canola has been a target for transformation for both glufosinate and glyphosate resistance, and for ALS herbicides via metagenesis. Triazine tolerance has been introduced by inter-specific crossing from resistant wild relatives.

While interspecific crosses from canola and its wild relatives do occur under controlled conditions, the ability of the seeds to produce viable plants is low.

Crosses between canola and wild radish are not viable where canola is the pollen donor, but crosses where the wild radish is the pollen donor may be viable using embryo rescue techniques. Crosses from wild radish to male sterile canola may be more viable.

It is likely that, under some conditions, viable interspecific crosses will develop in the field and this could produce plants with herbicide resistant characteristics and weediness if seed was not captured at harvest.

The development of triazine resistant hybrids might well occur under field conditions if seed shattering before or during harvest was to allow such seed from such crosses to be put back into the system. Characterisation of the canola/wild radish hybrids for weediness and herbicide tolerance still needs to be undertaken.

The recent publication in *Nature* of results on the transfer of genes amongst canola varieties and the distances of which viable hybrids might be found has some implications for the spread of ALS resistance genes in wild radish. The authors (Timmons *et al.*, 1996, *Nature* 380, 487) have shown that viable hybrids could be detected by DNA analysis up to 360m from a parental source and that modelling would suggest that even at 2km up to 0.1% of seed produced could be hybrids.

If wild radish has similar pollen dispersal characteristics, then the spread of ALS resistant pollen to susceptible paddocks, combined with continued ALS herbicide use, could be sufficient to spread ALS resistance amongst susceptible radish populations quite rapidly.

It is likely that, under some conditions, viable interspecific crosses will develop in the field and this could produce plants with herbicide resistant characteristics...

The collection of at least four ALS resistant wild radish samples from a number of sites in WA in the past 3 months means that sampling of paddocks up to 4km away from these resistant sites will need to be done if farmers are to better understand their risk from ALS resistant wild radish and put in place alternative strategies while the level of ALS resistance is still very low. ❐

(Reprinted from the Newsletter of the Plant Protection Society of WA, Vol 8 No.2.)

The Smith Report - 2nd International Weed Control Congress

About 350 people, from 50 countries attended the 2nd International Weed Control Congress at Copenhagen, Denmark from 25 - 28 June, 1996. This was mainly an academic conference with few people from industry. There were two concurrent sessions and because of conflicting topics this often made it difficult to decide which session to attend. There were 80 papers presented orally and 130 poster presentations. The proceedings are published in 4 volumes of 1400 pages (I have a copy if anyone is interested in seeing it).

In opening remarks it was stated that weeds cost Denmark US$400 million per annum. The importance of pests and weeds, and the need to reduce use of pesticides are recognised by the government as there is a $25 million dollar building program underway to house weeds, insects, pathology and cultural systems in new research and extension facilities at the Plant Protection Institute.

A biobed is a specially prepared grassed area where equipment is filled, washed and stored so that spillage, leakage, and contamination is confined to one area.

One of the highlights of the Danish program on weeds is the Danish Computer Assisted Decision Making System (PCPP) which helps farmers identify weeds and then assists them with choices of strategies to control the weeds in various situations. Use of this program has enabled substantial reductions in herbicide use to be obtained without jeopardising production.

The first session I attended was on **Herbicides in the Environment.** Dr Torstensson from Sweden gave an overview of the transport, degradation and effects of herbicides in the environment. He concluded that while knowledge of the persistence and effects of herbicides in the environment is extensive there are still areas where we need to know more, especially in transport mechanisms, influence of herbicides on organisms in the soil, and factors affecting the rate of decomposition.

One area of practical interest he mentioned, was the use of "biobeds" or degradation pits to minimise environmental contamination. A biobed is a specially prepared grassed area where equipment is filled, washed and stored so that spillage, leakage, and contamination is confined to one area. In this area a mixture of top soil, peat and straw, rich in humus, is used, where decomposition by micro-organisms is encouraged. This effectively confines pesticide spills/contamination on farms to one area where it is retained and degraded.

Other papers of interest in this session were given by Dr Steven Walker, Queensland who spoke about the restricted recropping options available for sulfonylurea herbicides in the soils of north-eastern Australia (4 to 24 months) and his work to correlate the herbicide concentrations in the root zone at sowing time and recropping interval, which seemed to allow improved flexibility (3 to 6 months) depending on the soils and climate of the region.

Dr Rahman, New Zealand, spoke about the persistence of flumetsulam in volcanic soils of New Zealand, where the persistence (half-life 5 to 6 weeks) was not as long as predicted from other regional research. Degradation was mainly microbial and strongly affected by temperature but not soil moisture.

An interesting paper on the movement of pesticides following application to golf courses by Dr A Smith from University of Georgia, USA, showed that leaching as measured by lysimeters accounted for only 0.5% of applied herbicides. Fifteen per cent of the water soluble pesticides were transported in run-off water and only 1% of non-water soluble materials. Pressure injection of pesticides into the canopy appeared to minimise run-off. Also, use of holding areas (storage ponds) where run-off water from pesticide treated areas is stored before reuse to allow breakdown is a management practice being recommended.

In general there is extensive knowledge available about the effects of herbicides in the environment, but leaching and run-off remain as the main concerns. Persistence of individual chemicals varies mainly with climate and soil type, and tests should be done worldwide on as many soils as possible before registration.

The next session I attended was on **Herbicide Resistance**. Dr Ian Morrison, Canada, gave a keynote address on "Herbicide Resistant Weeds: Mutation, Selection, Misconception". The major misconceptions about HR weeds are i) that low rates of herbicide use are indicative of a high risk of development of HR (low rates do not select in the field), and ii) frequency of mutation corresponds with the number of resistant weeds (population models have been of little use in predicting resistance).

Dr Morrison said the selection intensity (frequency of application) rather than herbicide efficacy is the most important factor influencing evolution of HR weeds. Seed dispersal is the major method of spread of HR and much more work is needed on this aspect for practical control.

The *Kochia scoparia* resistance story was presented by Dr D Till, USA. This is an ALS inhibitor resistant weed, which is very widespread in the USA and must be treated as a "new weed" and effective IWM strategies for its control need to be developed.

...the selection intensity (frequency of application) rather than herbicide efficacy is the most important factor influencing evolution of HR weeds.

Dr Steve Powles, University of Adelaide, gave a very elegant presentation about IWM for control of HR annual ryegrass including crop species manipulation, delayed seeding time, crop topping, harvester modifications to collect seed etc.

The discovery of a glyphosate resistant *Lolium rigidum* in southern Australia was noted after many years use of glyphosate with direct drilling (see feature article in this edition).

Dr Dale Shaner, Cyanamid, USA, spoke about the use of herbicide resistant crops. HR crop varieties are now available for canola, soybean, sugar beet, maize, cotton and wheat.

Concerns about HR genes spreading to weeds, as well as HR crops becoming weeds is still widespread. Dr S Linscombe, Louisiana State University, gave details about insertion of a bar gene into rice varieties (*Oryza sativa)*, which conferred resistance to glufosinate so that the weed, red rice (*Oryza sativa*) can be controlled in rice crops.

It is evident that substantial progress has been made to understand herbicide resistance. HR is generally controlled by a single gene and HR weeds are not less fit than susceptible ones. There are many practical extension strategies for avoidance of HR, but effort needs to be concentrated

on management practices to reduce selection intensity (frequency of application). The advent of HR crops has several advantages (expanded rotations, increased flexibility of herbicide use) and disadvantages (potential transfer of genes to weed relatives, management of HR volunteer crops) for control of weeds.

The session on **Current Options** was overviewed by Dr P Zwerger from Germany. Today 50 - 100% of arable land in developed countries is treated with herbicides, but this has lead to i) contamination and public pressure to reduce use, ii) evolution of HR, and iii) increased costs. IWM is widely touted for use, but many farmers are loath to adopt this system, especially if they have to count weeds. "They do not like to get down on their knees before the weeds".

Patch spraying of weeds in cereals is being advocated...

Dr A Blair, England, presented an elegant paper, which outlined using pot trials to investigate cutting and burial treatments on 4 weeds. Cutting below the soil surface was very effective for poppy and chickweed, but less effective on *Poa annua* and *P. trivialis*.

Patch spraying of weeds in cereals is being advocated as it is environmentally sound, reduces herbicide use and cost, and reduces herbicide loading to surrounding areas. However, it requires good weed maps and a computer model. An example of how this can be done using a model was presented by P Christensen, Denmark. The cost of herbicide was reduced by 48% in the example using a 3 or 4 dose system.

Peter Dowling, Orange, gave an excellent presentation of the *Vulpia* spp. problem in Australia and the work he is doing to reduce seed set and remove seeds so that availability of seed is reduced.

In general, herbicides still provide the main method or key to weed management, but they must be integrated with other methods as widely as possible. There is a need for more precise application such as patch spraying and improved extension and knowledge services on IWM, especially in developing countries. It is felt that commercial people need to change their attitude to use of other techniques and IWM in general.

In the Symposium on the **"Environmental Impact of Weed Management"**, Prof H Coble, USA, presented information about the positive and negative impacts of weed management tools.

Dr R Fawcett, USA, talked about the impact of weed management systems on the biotic component of the environment. Tillage is no longer essential in modern agricultural systems and herbicides can replace it with little adverse effects on the biotic component. In fact, it has been shown that effects on earthworms are less in hand weeded areas and herbicide treated areas than in unweeded areas.

Prof K Hurle, Germany, spoke on the effects of weed management systems on the abiotic environment, especially air and water quality. Only a few compounds show up in this environment and they are the materials which have a high dose rate, high frequency of use, high persistence and have been in use a long time, e.g. atrazine has been used too widely and is now banned in Denmark and Germany.

George Cussans, UK, spoke about the need for biodiversity of organisms in agricultural systems and the level of weed management input we should be operating at to obtain the economic optimum output at least impact on the environment.

Overall, the symposium highlighted the fact, that careful selection and use of herbicides and other methods will allow attainment of weed control aims and at the same time alleviate environmental concerns.

In the session on **Control Options for the Future**, Prof Coble spoke both as a practising farmer and weed scientist about the options available. He said we need to recognise that weed populations change as we change our farming systems, we need to be able to predict what will happen in future, and we must educate all people (voters and politicians) about the need for weed control.

Five questions to be answered before using an option are i) is the option efficacious? ii) is the option economical? iii) are natural resources harmed? iv) is food/feed quality affected? and v) is it compatible with other options?

Dr Gressel, Israel, spoke about lowering chemical dependency by use of synergists (mixtures of chemicals).

Other speakers talked about use of plant pathogens, competitive varieties of crops, stubble tillage, limitations of development of mycoherbicides, nutgrass control with growth regulators applied prior to herbicides and allelopathic effects of rice cultivars.

The main features of this session were that chemical control remains as the main option for weed control; there are significant barriers to the broad application of biocontrol, bioherbicide and allelopathic approaches; and changed agronomic practices can lead to increased costs.

A brief summary of the sessions I did not attend is as follows: **Biology for Weed Control** - this subject has enormous complexity and progress is slow, but it is of basic importance in understanding weed control. **Discovery, Registration and Herbicide Use** - new molecules with herbicidal activity are continually being discovered as well as new natural products - approximately 3 - 5 per year. Many opportunities for new products exist.

Selectivity can be manipulated by additives and mixes (5 way mixes now available). Regulation/registration requirements need to be balanced so that they don't delay innovation and stifle development of new products and new uses for old products. Biological control will never replace chemical control.

Herbicides in the Environment - IWM promises to increase biodiversity, energy efficiency and self regulation. Computer simulation can be very useful to help with decision making. Changes in tillage practices can have widespread effects on off-site effects of herbicides, water movement etc.

...we need to recognise that weed populations change as we change our farming systems...

Developing Countries - parasitic weeds such as *Striga* and *Orobanche* are the main weed problems. Research has tended to outstrip extension and better advisory/extension services and practices are urgently needed. Awareness by officials and farmers of economic importance of weeds is needed. Use of herbicides is likely to become more important.

Conclusions

1. Weed control must be reliable and sustainable.
2. IWM is the only way to go, but industry must be involved with its application (lack of senior industry people at conference).
3. Herbicides continue to be a fundamental component of weed control methods/options.
4. Increased attention to information and technology transfer (communications) is needed. Public concerns need to be considered and addressed.
5. Urgent action is required in developing countries to put effective extension services in place.

The next IWCC will be held in Foz do Iguaca, Brazil, in the year 2000. Foz do Iguaca is located near the famous Iguaca Falls and Iguaca National Park at the border with Paraguay and Argentina. Brazil is the fourth largest pesticide consumer in the world.

The Brazilian Weed Science Society hosts a weed conference every two years with attendance near 1000 scientists. Hope to see you in Brazil in the year 2000! ❐

(Leon Smith is Secretary of the Weed Society of New South Wales and was formerly Principal Agronomist (Weeds) with New South Wales Agriculture - now retired.)

Weeds and the Law

Over the centuries, noxious weeds have received a lot of bad press. According to Christian faith, they were inflicted on humankind to punish us for the commission of sin in the Garden of Eden. Adding insult to injury, John Wyndham, in his well known novel, *The Day of the Triffids,* portrays weeds as conspiratorial walking-talking evildoers, and to top it off, they are called derogatory names such as 'pernicious' and 'injurious'.

However, at the foundation of this concern is the legitimate belief that weeds must be controlled. In modern society, that means that laws must be made to specify what must be controlled, by whom and by what means.

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The purpose of this article is to outline the various legal provisions which govern the control of noxious weeds, with particular attention to recent developments.[1]

[1] This article is not intended as legal advice for potential litigants but instead, seeks to provide a brief outline of the relevant provisions. Persons requiring thorough legal advice should contact a qualified legal practitioner.

The Noxious Weeds Act 1993 (NSW)

Most people in the industry are familiar with the provisions of the Noxious Weeds Act (NSW) which was enacted in 1993, and replaced provisions contained in the Local Government Act (NSW) 1919. Unlike some other legislation, the Act is easy to understand and avoids unnecessary legal jargon.

The basic effect of the legislation is to impose a duty to control noxious weeds on private and public authorities, including local control authorities. Weeds may be declared 'noxious' by the Minister, and when declared, must be assigned to a category, which in turn dictates what action must be taken by the land holder to fulfil their duty to control.

However, public authorities are required to perform to a lesser standard. They must prevent the weeds from spreading to adjoining land. The categories which apply to local authorities and private landholders are as follows:

- 'W1': the presence of the weed on land must be notified to the local control authority and the weed must be fully and continuously suppressed and destroyed;
- 'W2': the weed must be fully and continuously suppressed and destroyed;

- 'W3': the weed must be prevented from spreading and its numbers and distribution reduced; and

- 'W4: the declaration may specify special measures which must be taken.

The Act also provides a process by which the duty to control noxious weeds can be enforced. The regime can be distilled into three basic stages. First, the failure to fulfil the duty to control imposed by the relevant category renders private landholders guilty of an offence and therefore susceptible to prosecution.

Second, the Act contains a mechanism whereby a 'weed control notice' can be issued which, in effect, provides the landholder with a second chance to perform control. Thirdly, as a last resort, the local control authority can enter the land and perform the control work, at the expense of the defaulting landholder.

Common law provisions

Perhaps a less well known area of law governing the control of noxious weeds is that made by judges over the last hundred years or so. In summary, the developments in this area establish that an adjoining land owner can sue their neighbour if weeds are allowed to cross from one property to the other and thereby cause damage.

In one of the first reported cases in the area, a landowner sued his neighbour for allowing thistles to grow, and to spread seeds onto the adjoining owner's land. The seeds had grown and done damage to the land. The judges hearing the case immediately rejected the assertion that liability could arise from such an action.

In what was an unusually abrupt judgement, the Chief Justice said, 'I have never heard of such an action as this. There can be no duty as between adjoining occupiers to cut the thistles, which are the natural growth of the soil'.[2]

[2] Giles v Walker [1890] QB 656 at 657

Some subsequent cases, however, have taken a different approach. They indicate that in fact a landowner *will* be liable for the spread of weeds to adjoining land. The current position can be best summarised as follows. A general duty is owed to a neighbouring occupier in relation to a hazard occurring on the land, whether the hazard is natural or man-made.[3]

To fulfil this duty, the landholder must take reasonable steps in the circumstances to render the hazard harmless to the neighbouring occupier.[4] Failing to take 'reasonable steps' means failing to render the hazard harmless when the risk of injury is reasonably foreseeable and the capacity of the landowner to abate the hazard including age, physical condition and finance is adequate to enable abatement.[5]

The Act also provides a process by which the duty to control noxious weeds can be enforced...

A recent case in New Zealand demonstrates the application of the principle. In *French v Auckland City Corporation*[6], French occupied land adjoining a property of the City Corporation. French had attempted to control the variegated thistle infesting his land. The Corporation had not made such intensive efforts. French sued the Corporation for the damage caused by the infestation, given that had the Corporation controlled the weeds, French would have had the thistles on his land under control. The judge held in favour of French, saying that:

[3] Goldman v Hargrave [1967] 1 AC 645 at 661-662

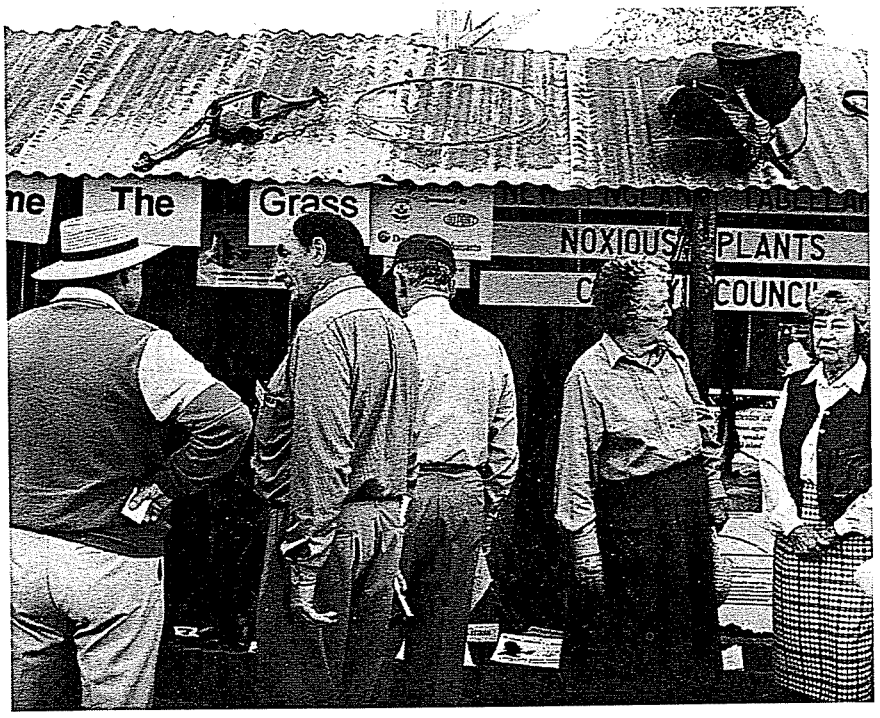
[4] Goldman v Hargrave [1967] 1 AC 645 at 663.

[5] Goldman v Hargrave [1967] 1 AC 645 at 663; Leakey v National Trust [1980] QB 485 at 526; Solloway v Hampshire C.C. (1980) 79 LGR 449 at 461.

[6] [1974] 1 NZLR 340

'...an action may now lie...for the spread of weeds through natural agencies on to neighbouring properties. Whether in an individual case an action will lie will depend on the surrounding circumstances, some of which will be the extent of the spread of weeds, the damage likely to result, the cost and practicability of preventing the spread, and the location of the properties concerned.'

It appears in recent years that the law relating to noxious weeds is once again moving towards change.



The exact requirements for a successful action against landholders who allow weeds to spread are not yet settled, given that very few cases in the area actually reach the courts. However, as the action becomes more widely known, it will be the subject of further judicial scrutiny, and this in turn is likely to have the effect that landholders will be more careful in allowing weeds to spread to neighbouring properties.

This brief overview of the legislation and the common law principles gives an indication of the various ways which the law has recognised the harm which noxious weeds can cause. The statutory system involves a monitoring and control process, while common law is concerned with actions between private litigants for injury suffered.

It appears in recent years that the law relating to noxious weeds is once again moving towards change. The last few years have seen completely new legislation enacted in Victoria and Tasmania, which focuses more on land management and less on the straightforward imposition of duties on landholders. While this trend is in line with the rise in environmental consciousness, the imposition of heftier fines may not be greeted with great enthusiasm by those who are required to pay up.

What the legal developments *do* show, however, is that noxious weeds are being taken more seriously. ❐

In additional to its control and enforcement operations, the Local Control Authority on the Northern Tablelands of NSW, The New England Tablelands Noxious Plants County Council, involves itself in an active awareness compaign about noxious plants, which includes a display at a local wool industry exposition.

(Jonathan Horton is a member of the Society and is currently studying law at the University of Sydney.)

Sheep in the Crop

The need for farmers to practise integrated weed management has been widely espoused and is now being increasingly practised by industry. Most of these practices are directed towards bringing weeds under control prior to sowing, with some emphasis also placed on handling weed seed at harvest.

There are few alternatives to chemical control of weeds in crops. However, the preferential grazing habits of sheep to graze weeds from within a crop can be exploited. The unpalatable nature of chickpeas to sheep has long been recognised by farmers, facilitating a reduction in weed competition and seed set through grazing the crop at light stocking rates. There was, however, a dearth of information regarding the palatability of other broadleaf crops to sheep.

In a replicated field trial, the palatability to sheep of 13 crop species was compared; canola (*Brassica napus*), safflower (*Carthamus tinctorius*), fenugreek (*Trigonella foenum-graecum*), lupins (*Lupinus angustifolius* cv. gungurru), chickpea (*Cicer arietinum* cv. semsen), faba bean (*Vicia faba* cv. fiord), field pea (*Pisum sativum* cv. alma), lathyrus (*Lathyrus sativus* and *L. cicera*), mustard (*Brassica juncea*), coriander (*Coriandrum sativum*), narbon bean (*Vicia narbonensis*) and lentil (*Lens culinaris* cv. aldinga). Wheat (cv. trident) was also grown to provide a common palatable crop species.

The trial was grazed by Merino wether hoggets at 12 d.s.e. (dry sheep equivalents) per hectare on two separate occasions (nine weeks and thirteen weeks post sowing) to determine whether crop palatability altered with its phenological development.

...narbon beans, faba beans and coriander may be grazed by sheep to reduce weed competition with little damage to the growing crop...

Preliminary results (see table below) suggest narbon beans, faba beans and coriander may be grazed by sheep to reduce weed competition with little damage to the growing crop. Chickpea and mustard may also have this potential. All other crops grown were shown to be as palatable as the weeds to the grazing sheep. ❐

(Adapted from an article by C.M. Penfold and M.S. Miyan, University of Adelaide, Roseworthy, SA 5371, that appeared in Crop Science Society of SA Newsletter No. 145, 1996.)

	Early Graze	Late Graze
HIGH PALATABILITY	Field pea, Lathyrus, Fenugreek, Lentils, Canola, Safflower, Lupins, Wheat	Lathyrus Field pea Canola
MODERATE PALATABILITY	Chickpea, Mustard	Lupins, Lentils, Safflower, Mustard
LOW PALATABILITY	Coriander, Faba bean, Narbon bean	Coriander, Faba bean, Narbon bean, Wheat, Chickpea, Fenugreek

Moratorium on Willow Imports

The Australian Quarantine and Inspection Service (AQIS) has placed a year-long moratorium on the importation of willows while the weed risk status of these plants is considered by a working group.

The moratorium was largely inspired by concern over the importation of new varieties that could exacerbate the weed potential of hybrids already in Australia. The moratorium will be on all *Salix* species, including those species already in Australia, because there is poor taxonomic knowledge of the species and hybrids already in Australia and their breeding relationship with any new material.

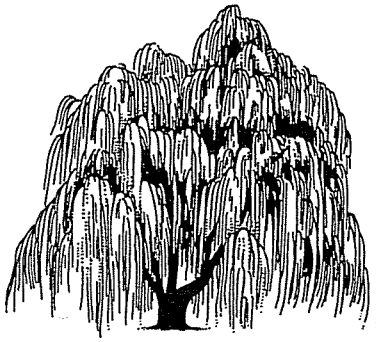
Willows (*Salix* spp.) used to be regarded as valuable plants for use in stream bank maintenance and restoration but have, over recent years, come under scrutiny as potential weeds.

Each willow plant is either male or female and it was thought that only one gender of each species had been introduced into Australia - leading to the assumption that all willow species in this country were sterile and could be propagated only by cuttings.

However, a number of varieties have begun to set seed, with reported increases in seed set resulting from either the importation of both genders of some species or hybridisation between fertile members of co-occurring species.

Seed production has resulted in a rapid spread in wetland areas, with researchers finding willows spreading along stream banks, in swamps and in moist forests in NSW, Victoria, Tasmania and the ACT. In each area the spread is adversely affecting the local environment by altering farm water flows.

At least 10 species have been found to have fertile female trees, the major threats appearing to be the New Zealand hybrid willow (*S. matsudana x alba*) and the upright golden willow (*S. alba* var. *vitellina*). The weeping willow (*Salix babylonica*) (see diagram), the most common willow in Australia, has fortunately not yet been found to spread by seed set.



(Reprinted from the AQIS Bulletin, Vol 9 No.3, May 1996).

Not so Glorious

The gloriosa lily (*Gloriosa superba*) is a relatively new weed in several national parks and other areas on the NSW North Coast. This plant, which originates in Africa and Asia, is recorded as being naturalised in north-eastern NSW and south-eastern Queensland.

The National Parks & Wildlife Service (NPWS) is concerned about the potential threat to conservation values that this plant poses in coastal environments. It is becoming increasingly common, with the ability to spread rapidly, and it has poisonous properties.

The National Parks & Wildlife Service is interested in developing control techniques for gloriosa lily. The limited control attempted so far has proved unreliable and ineffective.

The Service intends to conduct field trials, testing various control techniques. To enable this to be done efficiently, the Service would like to obtain as much information as possible about this plant. Information is required on distribution, abundance, biology, impact and control.

If you have any information on this plant and would like to assist in its control, the NPWS has a questionnaire available which they would like you to complete. The NPWS undertakes to provide all respondents with the results of this project.

The contact officer is Jeff Thomas, NPWS, Grafton District, PO Box 361, Grafton 2460.

Weedvertising

As from June 1996, the Society is offering advertising space within *A Good Weed* to help offset newsletter costs and to assist with other communications activities of the Society. Current distribution is around 250 people in NSW, most of whom are focussed on some aspect of weed management and/or research.

The rates for advertising in *A Good Weed* are:

(No. of editions in which advertisement is placed)

	1	2	3	4
¼ pg	$100	180	250	310
½ pg	$175	325	450	550
1 pg	$300	550	750	900

Insertion costs for a folded single A4 brochure are:

	$200	400	550	700

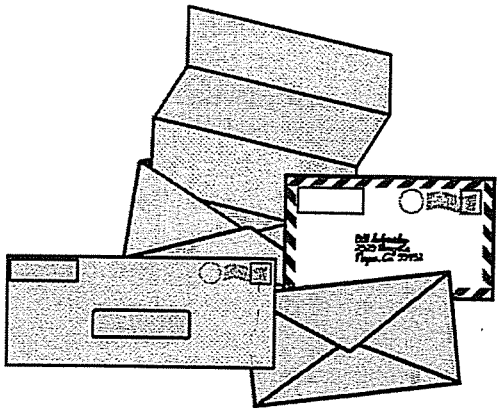
Please contact either John Cameron (02) 9489 2755 or Brian Sindel (067) 73 3747 for further details.

Members Matter

• Welcome to new members of the Society who have joined recently.

Trevor Cochrane of Buxton;
David Hawkey of Warren;
Vernon Keighley of St Ives;
Deborah Knoke of Wollondilly Shire Council, Picton; and
Jim Quinn of NSW Agriculture, Gosford.

• Congratulations to David Hawkey (University of New England) and David Langfield (Charles Sturt University) for each winning the undergraduate Weed Society of NSW prize for 1995.



Letters to the Editor

Sir, I read with interest the inquiry by Mrs Ruth Graddon of Sutherland for information on the control of *Anredera cordifolia* (Madeira vine). I belong to a group of volunteer bush regenerators which has received a grant from the NSW Environmental Restoration and Rehabilitation Trust to eradicate an infestation of Madeira vine in Anzac Avenue Reserve, Collaroy, on the northern beaches of Sydney.

Our project has the aim of preserving the reserve and to demonstrate the effectiveness of hand weeding techniques over glyphosate techniques. Prior to the project, we had limited success with glyphosate. The problem has mainly to do with the abundance and resilience of tubers. We are probably thinking along similar lines to Mrs Graddon in this regard. Another problem is the lack of spray contact with loose tubers on and in the ground.

We initially cleared a 100m^2 area of *Anredera cordifolia* by hand. We placed leaves, stems and tubers in a 44 gallon metal drum and in compost bins with form-ply bases. We added worms to these containers. Tubers in the metal drum broke down after 18 months. They did not break down in the compost bins. The bins allowed water to drain out so this could have been a factor. This material was buried deeply at the tip.

The aim is now to replicate this method over a 600m^2 area. During the project we have also used an excavator

to scalp an embankment that consisted of building rubble on top of Madeira vine. This appears to have removed 75% of tubers in this area.

The project is due for completion in October 1996. While the problem is under control at the moment, we expect to be digging out tubers as volunteers for the next 3 years.

Since the excavation, we now find tubers coming up as individuals scattered around the area. Ones that have dark green, sharp leaves seem to have a large tuber deep down in the earth, while tiny tubers close to the surface have an abundance of bright green leaves. Our large tubers are often as big as a decent sized sweet potato.

Although it is too early to reach definite conclusions, it would appear that the hand weeding may not be financially viable. We have been using large amounts of volunteer labour in this process and will make some calculations at the end of the project.

I have heard of a chemical called Starane that is used in Queensland for *Anredera* in the sugar cane industry.

Roger Moss
PO Box 385, Collaroy, NSW 2097

Sir, I refer to the recent request by Mrs Ruth Graddon of Sutherland for information relating to the control of Madeira vine (*Anredera cordifolia*).

The following techniques may prove effective if adopted as part of an integrated approach to the control of this particular weed.

Carefully scrape a 20cm length of stem to expose the cambium, and immediately apply glyphosate (100%). Vines may be injected using a pressurised syringe with a few millilitres of glyphosate at 50%. This allows for transfer of herbicide into the aerial tubers.

Where large numbers of vines make this individual treatment impractical, or where the entire vine can be removed from the canopy, the vines are cut and allowed to reshoot. The reshooting vines, together with the sprouting tubers are sprayed as required with glyphosate plus surfactant until the tubers are exhausted. One to three months is required between sprayings to ensure sufficient healthy growth. Glyphosate works best on healthy weeds.

Madeira vine requires high light levels, being unable to thrive in heavy shade, so it is important to mulch and replant with native shrubs to inhibit the vigorous growth.

If manually removing Madeira vine, all parts of the plant should be placed in plastic bags, sealed and disposed of at the dump - not into any mulching or recycling system, as it can regrow from even tiny parts of the plant.

I hope this information proves beneficial, if not already tried.

David Pomery
Illawarra District (Noxious) Weeds Authority, PO Box 148, Kiama, NSW 2533.

(Editor's note - Before using any herbicides, always read and follow the directions carefully.)

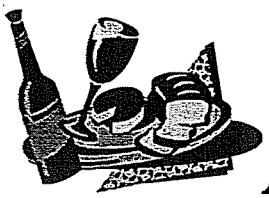
Field Day and Seminar - Herbicide Resistance

Professor Jim Kells, Michigan State University, USA, will speak at a field day on Herbicide Resistance to be held at Cowra on Tuesday 8 October.

Professor Kells will also give a seminar at the Agricultural Research and Veterinary Centre, NSW Agriculture, Forest Road, Orange.

Date: 9 October 1996
Time: 10.30am

Please contact Jim Dellow, phone (063) 913 889 or fax (063) 913 883 for further details.



Annual Dinner

You are warmly invited to the Annual Dinner of the Society to be held on Thursday, 10th October at the Parramatta Leagues Club.

Time: 7 for 7.30pm

Cost: $30 for Gourmet meal

It is anticipated that Dr Steve Dukes, President Elect of the Weed Science Society of America and/or Prof Jim Kells, Michigan State University, will be after dinner speakers at this function.

RSVP - Please let Alan Murphy or his secretary know before Tuesday, 8 October if you will be attending the dinner. Phone (02) 9975 0138; Fax (02) 9975 0242.

Weed Management in a Wetland Environment

All members of the Society should have received by now a notice about this 2 day seminar and workshop on weed management in a wetland environment on 28 and 29 October 1996.

Who should attend? Weed control officers of councils or land management authorities, environmental managers and anyone interested in the management of weeds in sensitive wetland environments.

Where? The Lakes Golf Club, King Street, Mascot.

Program? Day 1 starts at 9.30 am and goes through until 4.45 pm. Day 1 is the seminar component with speakers giving presentations on the introduction of weeds into a wetland environment, vegetation management and replacement strategies, biocontrol strategies, the use of herbicides in and around wetlands, legal obligations in using herbicides and the influence of water quality on weed growth.

Day 2 starts at 8.30 am and goes through until just after lunch. It will be a workshop focussing on the practical aspects of implementing a weed management plan in a wetland environment. Participants are advised to bring wet weather gear and to wear serviceable clothes for outdoor activities.

Registration fees? Society members - $55 (one day) or $90 (both days). Non members - $80 (one day) or $120 (both days).

Further information? Contact John Cameron 0419 209 709 or Dan Austin 018 258 423.

Register now? Mail your registration details (name, address, organisation, position, phone, fax, attendance details) and cheque to the Weed Society of New South Wales (Wetlands Seminar), PO Box 438, Wahroonga NSW 2076.

Annual General Meeting

The Annual General Meeting of the Weed Society of NSW will happen at the end of the first day of the seminar and workshop on Weed Management in a Wetland Environment at 5pm on Monday 28 October 1996. All members, whether you have attended the Wetland workshop or not are welcome and encouraged to attend!

Australian Weeds Conference

If you haven't yet booked your air ticket then heavily discounted (40% off) fares are available through Ansett (1800 632654) by quoting the conference number WSS01.

A Good Weed

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