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Forster, N.S.W.
April 19-22, 1993

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Conference Convener
NSW Agriculture
Tamworth

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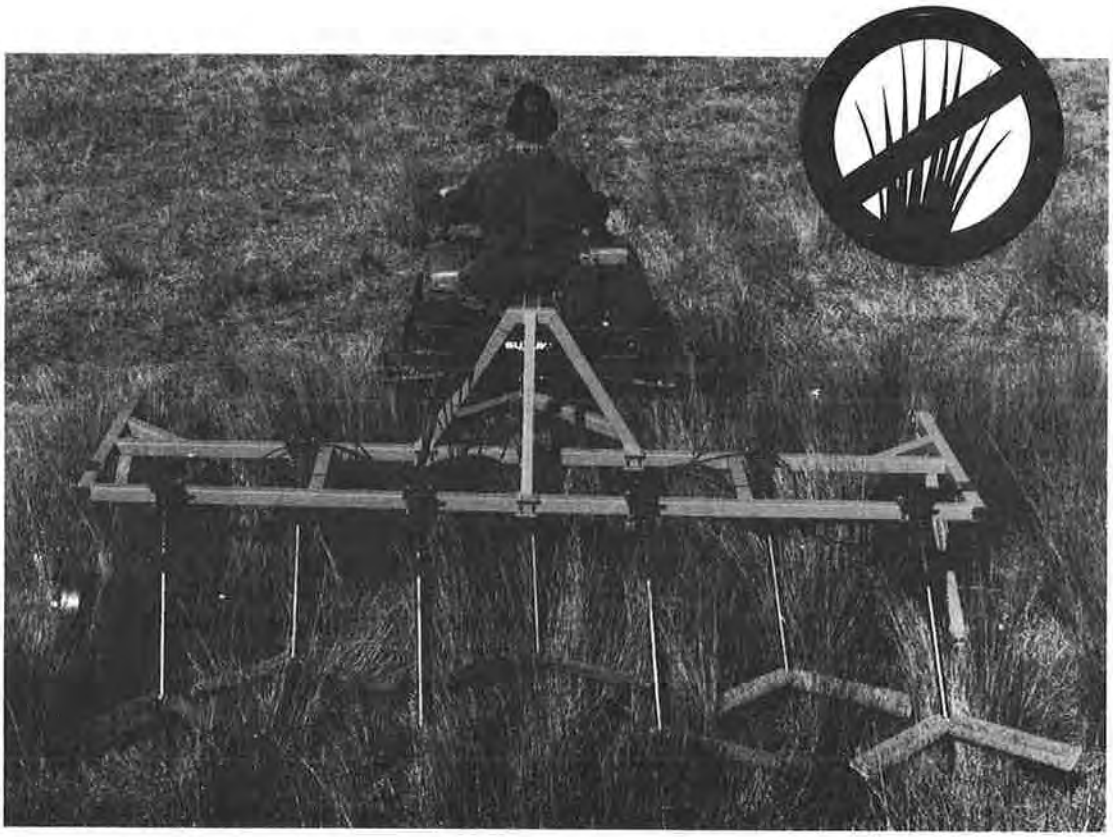

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CONTENTS

PROGRAM 9

NSW AGRICULTURE AND LANDCARE - D A Hayman 13

LANDCARE AND ITS ROLE IN NOXIOUS WEED MANAGEMENT
Stuart Bray 20

A CATCHMENT APPROACH TO WEED MANAGEMENT
W J Garrard 23

UNDERSTANDING SCIENCE AND YOUR ENVIRONMENT
Dr Roy Tasker and Mrs Ruth Dircks 29

URBAN BUSHLAND IN DECLINE - Judie Rawling 33

THE SENTINEL AND THE CARBO-FLO PROCESS 37
ENVIRONMENTAL CONCERNS WITH FARM CHEMICALS 41
Don Matthews

LAND STABILISATION AND ROADSIDE REVEGETATION - B.M. Sindel 47

COMPUTERISED WEED MAPPING - Ken Hayes 55

BIOLOGICAL CONTROL OF WEEDS IN NEW SOUTH WALES
J. R. Hosking and R. H. Holtkamp 58

BIOCONTROL OF WEEDS IN QUEENSLAND: RECENT DEVELOPMENTS
Rachel E C McFadyen 67

EXPECTATIONS OF BIOLOGICAL CONTROL - H J Milvain 72

WOODY WEED CONTROL - R Fagan 75

ALLIGATOR WEED UPDATE - Ken Bunn 81

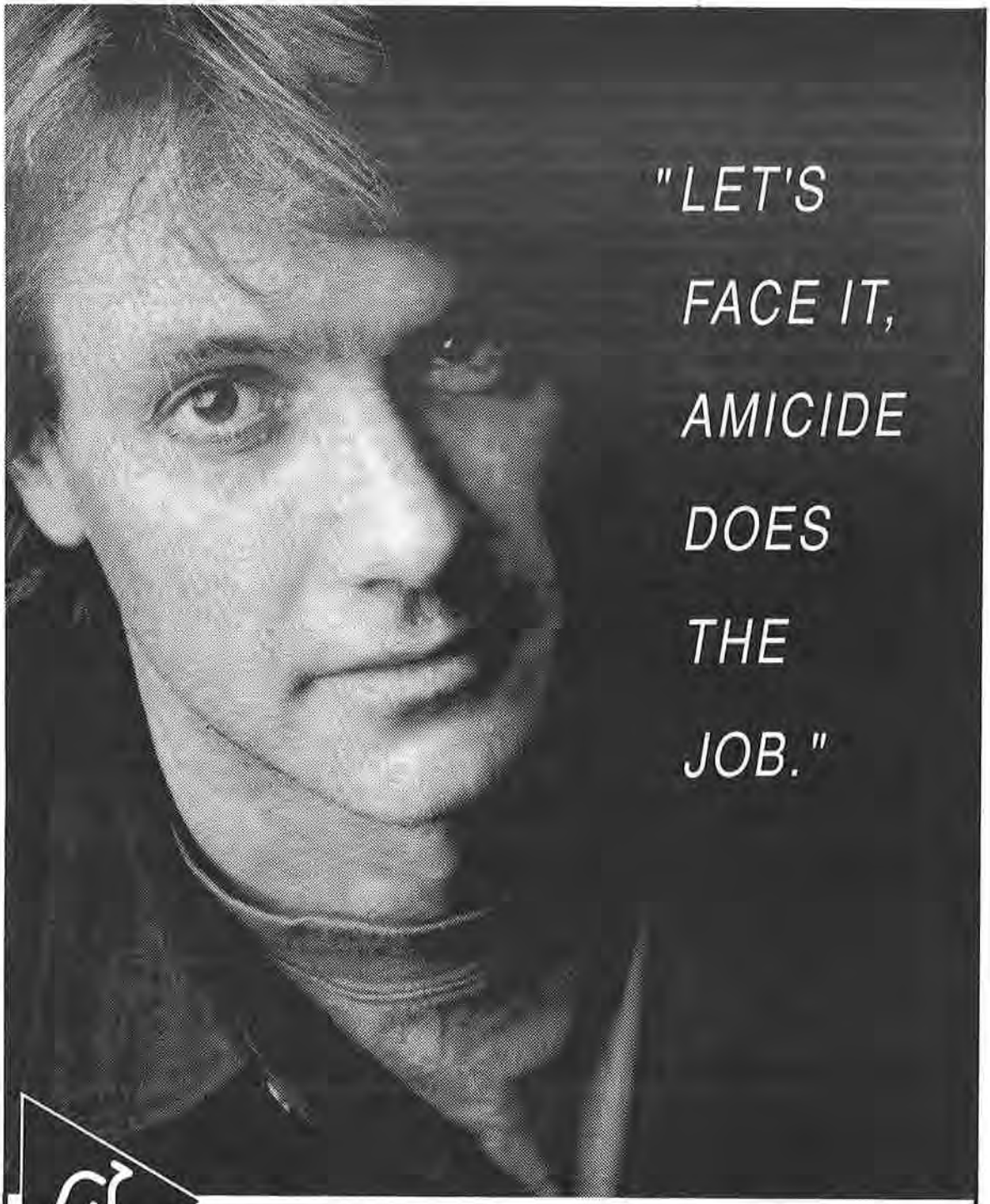
THE GRANULAR ADVANTAGE - Bernie Horsfield 84

HANDLING THE PRESS - Col Begg 89

CHEMICAL CONTROL OF ST. JOHN'S WORT - C.O. Love 101

JOHNSON GRASS CONTROL WITH "OUST" - Michael Brooks 105

LIST OF ALL DELEGATES 134



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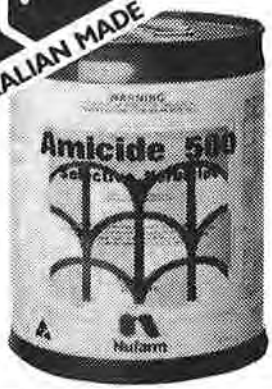

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Nufarm

PROGRAM

7th Biennial Noxious Plants Conference, Forster NSW.

Monday 19th April to Thursday 22nd April 1993.

Venue: **Forster-Tuncurry Memorial Services Club.**

Registration: From 2.00pm to 6.00pm Sunday 18th April, at the Forster - Tuncurry Memorial Services Club.

Program : Monday 19th April.

8.30 am. Registration.

A choice of three tours to set the scene for the next three days.

10.00 am. **Tour 1.**
Full day, taking in inspections of control, Blackberry bio control, Lantana herbicide demonstrations Giant Parramatta Grass control trials, and Rainforest regeneration at Wingham Brush,

10.00 am. **Tour 2.**
Full day, Bitou Bush bio control, Urban Weed impact on National Parks, Fireweed control and its impact on Deer Farming, Lantana herbicide demonstrations.

11.00 am. and 2.00 pm. **Tour 3.**
An inspection of the Pampas Grass problems associated with the dredging of Wallis Lake and foreshore weed problems. Pesticides and the Oyster Industry.This tour is by boat.

1.00 pm. **Alternate Activity.**
Turf and Woody Weeds inspection, lead by Bernie Horsfield.

Program : Tuesday 20th April.

8.30	Registration	
8.50	Housekeeping	G.Keech
9.00	Official Opening	Dr. Kevin Sheridan, Director General NSW Agriculture.
9.30	NSW Agriculture and Landcare.	Don Hayman, Executive Director Policy and Planning, NSW Agriculture.
10.00	**Morning Tea**	
10.30	Weed Control & Environmental Considerations	Harvey Baker, Environmental Director Australian Cotton Foundation Ltd.

11.00	Landcare & its Role in Noxious Plant Management	Stuart Bray, North West Director of Landcare, Department of Conservation and Land Management, Gunnedah.
11.30	A Catchment Approach To Weed Management.	Wayne Garrard, North West Total Catchment Management Coordinator, Dept. CALM. Tamworth.
12.00	Understanding Science & Your Environment	Dr. Roy Tasker and Mrs Ruth Dirks. Royal Australian Chemical Institute.
12.30	**Lunch**	
1.30	Understanding Science Continued.	Royal Australian Chemical Institute
2.00	Urban Weeds and & Bushland Management	Judie Rawling, Project Manager Urban Bushland Management.
2.30	Environmental Concerns With Farm Chemicals and The "Sentinel" Water Effluent Treatment Plant.	Mr.Don Matthews, Stewardship Manager ICI Crop Care.
3.00	**Afternoon Tea**	
3.30	The Clean Waters Act : Herbicide Application Near Waterways.	Mr. Simon Smith, Regional Coordinator Environmental Protection Agency.
4.00	Stabilisation & Roadside Revegetation With Native Grasses.	Dr. Brian Sindel Research Scientist, Division of Plant Industry, CSIRO.
4.30	Computerised Weed Mapping.	Ken Hayes Chief Weeds Officer, Coffs Harbour City Council.
5.00	End Day One Evening Free	

Program : Wednesday 21st

8.30	An update on Weed Biological control present and future.	Dr. David Briese CSIRO Deputy Section Head, Bio Control of Weeds.
9.00	Bio Control Research in NSW Agriculture.	Dr. John Hosking / Royce Holtkamp NSW Agriculture
9.30	Bio Control of Weeds in Queensland : Recent Developments.	Dr. Rachel McFadyen Qld.Lands Department

10.00	**Morning Tea**	
10.30	Realistic Expectations of Biological Control	Hugh Milvain NPAO NSW Agriculture
11.00	Woody Weed Control	Rob Fagan DuPont
11.30	Endangered Fauna Act	Russel Couch, Manager, Endangered Species Unit, National Parks And Wildlife Service.
12.00	Alligator Weed Update	Ken Bunn Port Stephens Shire Council.
12.30	**Lunch**	
1.30	Chemical Compatibilities & Spray Additives	Leyland Minter Organic Crop Protectants P/L
2.00	Weed Research Update	Jim Dellow, NSW Agriculture
2.30	Weed Research Update	Tony Cook NSW Agriculture
3.00	**Afternoon Tea**	
3.30	Noxious Plants Officers Association Annual General Meeting	
3.30	Elected Members Forum & Guest Speaker, Alan Russell, Chief Legal Officer, NSW Agriculture.	
3.30.	State Rail TVO meeting.	
5.00	End of day two	
Evening	B-B-Q Tea Catered by Apex.	

Program : Thursday 22nd

8.30	Spraying Without Water.	Bernie Horsfield, Macspread.
9.00	Aerial Inspections	Peter Gorham NPAO NSW Agriculture.
9.30	Nationally Declared & Prohibited Plants	Andrew Leys, Program Leader, Weeds. NSW Agriculture.
10.00	**Morning Tea**	
10.30	National Pesticide Registration and The NSW Pesticides Act	Roger Tofflon -Registrar of Pesticides NSW Agriculture

11.00	NSW Hazardous Substances Regulations.	Mr. Ted Safraniec, Scientific Officer Workcover Authority.
11.30	Impact of Legislation on Containers & Disposal	Greg Healey, Manager, Research and Development, Nufarm Ltd.
12.30	**Lunch**	
1.30	The Noxious Weeds Act & Legal training	Patrick Dodgson, Senior Legal Officer NSW Agriculture.
2.00	Handling The Press	Col Begg, NSW Agriculture
2.30	Monsanto New Chemistry	Brian Arnst, Monsanto
3.00	**Afternoon Tea**	
3.30	Chemical Control of St. Johns Wort.	Chris Love, DowElanco
4.00	Johnson Grass Control Using Oust ®.	Michael Brooks Narrabri Shire Council.
4.30	Conference Review	Doug Hocking, Peter Gorham.
5.00	Conference Ends.	
6.30 for 7.00	**Conference Dinner**. Dress - Semi Formal (Coat and Tie.)	

Please Have A Safe Trip Home!

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NSW AGRICULTURE AND LANDCARE

D A Hayman, NSW Agriculture
Executive Director (Policy, Planning and Technology)

Introduction

My talk today is going to outline briefly what the Department of Agriculture's role is, its commitment to promoting sustainable farming practices, and the important interdependence between Agriculture and the environment; to look at the Landcare movement, and to emphasise our commitment to and involvement in Landcare.

The Department's role is summed up in its Mission Statement:

> *"To enhance the competitiveness and environmental sustainability of the food and fibre industries to maximise their contribution to the economy and the community of NSW."*

What we're about is helping farmers to perform better, and earn more, but to do so in a sustainable way.

Our Mission Statement is fleshed out in a series of Corporate Goals:

- Develop efficient agricultural systems that provide competitive food and fibre products to meet the requirements of domestic and international markets.
- Promote the use of sustainable agricultural practices.
- Ensure consumer confidence in the quality of New South Wales food and fibre products.
- Communicate to the community the importance and role of agriculture to the economy of New South Wales.
- Manage the Department's corporate resources to enhance Departmental productivity and staff morale.

Sustainable Agriculture

I want to draw attention particularly to the second goal - to promote the use of sustainable agricultural practices.

Much has been said and written about what is meant by "sustainable agriculture", and I don't want to get too hung up on definitions at this juncture. I think we all understand the broad concept - that is, using our natural resources to produce agriculture products, in a way that ensures these resources are maintained, as far as possible, in a state which enables them to continue to be used for agriculture by both present and future generations; in other words, caring for our land so that it

will continue to be available for our children, and their children, to enjoy, use and pass on undamaged.

The land is certainly one of our greatest assets, its quantity and quality are finite, but it can do much for us - produce agricultural products, provide a haven for the full range of plant and animal species, be a source of minerals, provide a diversity of landscapes and vistas for recreation and tourism, as well as a host of other uses.

Before addressing the Department's role in promoting sustainable agriculture, I shall first briefly outline how the Department is structured. In order to achieve its Corporate Goals the Department is structured into a series of Programs, based principally around the various products of the agriculture sector. For example, we have a Cereal products Program, a Fibres, Oils and Specialty Products Program, a Fresh and Processed Horticultural Products Program, a Beef Products Program etc, all headed by a Program Manager. We also have Quality Assurance and Plant and Animal Health Protection Programs, as well as the usual Corporate Support Programs, but one of our key Programs is the Agricultural Resource Management Program, and I quote here its objective:

> *"To develop, promote and increase adoption of agricultural resource management policies, practices and technologies that are economically efficient and environmentally sustainable".*

The Manager and Staff of this Program area have particular responsibility for promoting the protection of prime agricultural land, for generating greater awareness of, understanding of, and commitment to the sustainable use of our natural resources - be they land, water or soil, and to ensuring that the Environmental Plans, and resource management policies of other agencies, be they local, State or Federal Government, are couched so as to preserve the natural resources used for agricultural production and fit land use more closely to land capability.

In this context, I now want to talk about our policies on land suitability and the protection of Agricultural Land.

Protection of Agricultural Land

Land is extremely variable in its capability and suitability for agriculture, as well as for all its other uses. The Department of Agriculture has recognised this, and has developed a system for classifying land according to its agricultural suitability. There are five basic classes, as follows:

Class 1: Arable land suitable for intensive cultivation where constraints to sustained high levels of agricultural production are minor or absent.

Class 2: Arable land suitable for regular cultivation for crops but not suited to continuous cultivation. It has moderate to high suitability for agriculture but edaphic

(soil factors) or environmental constraints reduce the overall level of production and may limit the cropping phase to a rotation with sown pastures.

Class 3: Grazing land or land well suited to pasture improvement. It may be cultivated or cropped in rotation with pasture. The overall production level is moderate because of edaphic or environmental constraints. Erosion hazard, soil structural breakdown and other factors including climate may limit the capacity for cultivation and soil conservation or drainage works may be required.

Class 4: Land suitable for grazing but not for cultivation. Agriculture is based on native pastures or improved pastures established using minimum tillage techniques. Production may be seasonally high but the overall production level is low as a result of severe constraints, including economic factors, which preclude land improvement.

Class 5: Land unsuitable for agriculture or at best suited only to light grazing. Agricultural production is very low to zero as a result of severe constraints, including economic factors, which preclude land improvement.

An additional class may be used occasionally where land has some special feature which allows a special crop to be grown.

Specialist Class: Land which, because of a combination of climate and soil, is well suited to intensive production or a crop or a narrow range of crops whose special requirements limit their successful culture to such land. This class may include some lands formerly described as 'unique'.

We have mapped significant areas of the State into one or other of these categories, and we generally use the term 'prime agricultural land' to describe land that falls into Classes, 1, 2 and 3. This is the land that is best suited for agriculture, and it is this land that we assign a priority to looking after and caring for, maintaining as far as possible the availability of this land to agriculture.

The accompanying graph (page 15) indicates the areas of land within NSW falling into these various categories and it can be seen that less than 19% of NSW is prime crop and pasture land, hence the responsibility our Department has taken on to care for this land.

The Department is currently reviewing and updating all its Environmental Policies, and some of you will recall our Director-General releasing in late 1991, the Department's draft Conservation Strategies, a suite of policies on a wide range of issues pertaining to agriculture and the environment - Soil Management, Trees on Farms, Weeds, Pesticides, Conflicts of Land Use in Rural Areas, and Organic Farming, to name just a few.

These draft policies were open for public comment during early 1992, and a wide range of comments were received. We are now completing the process of taking on board these comments, and these various policies should be released in final form about the middle of the year.

One of these policies is our Policy on the Protection of Agricultural Land, and because of its importance, it has already been released. The essence of this policy is to promote the preservation of prime agricultural land by discouraging inappropriate or ad hoc rural residential subdivision, and conflicting land uses, and encouraging local authorities to foster sympathetic and environmentally sound development, and to take account of the needs of agriculture in their Environmental Planning decisions.

The Agricultural Resource Management Program is not the only Program area within the Department responsible for promoting sustainable agriculture however. All of our product based Programs are charged with ensuring the environmentally sustainable development of their industries, and the remainder of our plant and animal industry programs also have an important role to play in promoting sustainable agriculture and landcare.

The control and eradication of noxious weeds is the particular responsibility of Doug Hocking's Quality Assurance and Plant Protection Program, and the theme for this Conference: "Working Together to Care for our Environment" shows clearly the recognition by Doug and all his team, of how important this Program area is in contributing to a better environment, both for agriculture, and the community generally. It is only by each of us doing our bit, and working together, that we can achieve a healthy and cared for environment.

Landcare

Our Department recognises that it shares this responsibility with many other agencies, hence our commitment to and involvement in Total Catchment Management (TCM) and Landcare. We work closely with the Departments of Conservation and Land Management, Water Resources, Planning, Fisheries, the Environment Protection Authority, and the National Parks and Wildlife Service, to name just some of the agencies involved, in seeking a holistic approach to caring for land and the environment.

Landcare is a community based program designed to achieve sustainable land use throughout Australia.

Landcare involves the whole community, including rural and urban dwellers and public as well as private land holders and managers. It operates principally through the formation of Landcare groups of landholders and other community members. The groups receive technical and administrative support and funding from government agencies but are not directed by government.

In New South Wales Landcare operates within the framework of Total Catchment Management, but at the local level of decision making and action. There are four main activity themes:

- community awareness and education
- community Landcare groups
- research and development for Landcare

- agency support.

Typically a community Landcare project is one that aims to control or prevent a land degradation problem of importance to the local community. It has clearly defined specific objectives and is designed and carried out by the Landcare group.

Commonwealth funding for Landcare has been provided through the National Soil Conservation Program, now part of the National Landcare Program. Some examples of projects that have been funded are:

- land assessment surveys and mapping
- demonstrations of sustainable soil and land management practices
- monitoring of groundwater
- promotional exercises
- technical support for whole farm planning.

The current decade has been declared the Decade of Landcare. The goal is to create an ethos of sustainable land use throughout the whole community by the year 2000. Decade of Landcare Plans have been developed for all States to identify the necessary objectives and actions to achieve this goal.

Role of NSW Agriculture

NSW Agriculture has a key role to play in the NSW Landcare program because the Department's primary client base consists of the 50,000 farmers who manage 75% of the state's land resource. The Department carries out research and provides advice to farmers on a wide range of Landcare related issues such as soil degradation and management, water management, optimum use of pesticides and fertilisers, sustainable farming systems, plant and animal pest management, utilisation of animal effluents, resource monitoring, organic farming, land use planning, property management planning, economics, engineering and non-agricultural vegetation management.

NSW Agriculture has been actively involved in the development of the NSW Decade of Landcare Plan through its representation on the NSW Landcare Working Group, as well as on the State Catchment Management Coordinating Committee, which has overall responsibility for coordinating and oversighting Landcare in NSW.

The Department also has a role in supporting Landcare groups, mainly through the provision of technical advice. The Department encourages its advisory officers to increase their efficiency through the use of group extension methods wherever feasible.

Some examples of the Department's support for Landcare groups include:

- Joint project with the Glenbawn Dam Landcare Group to promote no-till pasture sowing for the reduction of sheet erosion.
- Assistance to the Wakool Landcare Group in the development of a Land and Water Management Plan for the Wakool Irrigation District.

- Conduct of St John's Wort and grazing management trials with the Merriwa Landcare Group.

Recently NSW Agriculture has had discussions with the Department of Conservation and Land Management aimed at improving the coordination of programs of the two agencies that relate to Landcare. As a result procedures are being put in place to:

- regularly exchange lists of community groups operating and forming in rural communities, to prevent duplication;
- establish joint in-service training in sustainability and expand joint training in group extension;
- develop a joint approach to property management planning so that advice can be integrated to meet the demands of groups;
- enable groups sponsored by both organisations to attend group conferences, education and training opportunities;
- facilitate group communication through local and regional networks;
- encourage both organisations to use each other's newsletters and publications.

Landcare, however, will not work without the commitment of the farmer, and there are some brief comments I want to highlight, which Andrew Campbell, the former National Facilitator for Landcare has made, in a report he prepared following his period with Landcare, parts of which he also made in a series of addresses across the country.

There are four key ingredients for Landcare Groups to achieve sustainability:

- they must want to achieve sustainability
- they must have resources
- they must know the options
- there must be a process for effecting change.

Commitment alone, while necessary, is not sufficient.

All of us in the agencies must help Landcare Groups so that they end up with all these ingredients present. The National Landcare Program provides some resources, but we in Agriculture and the other agencies should help groups, particularly in developing the options, and in generating the desire to achieve sustainability.

Local Government has the ability to be a magnificent resource for Landcare Groups - in terms of the basics such as photocopying and clerical support, and also skills such as engineering and drafting. Farmers cannot afford to fund land degradation solutions from land earnings, hence the responsibility of the wider community and all our agencies to contribute.

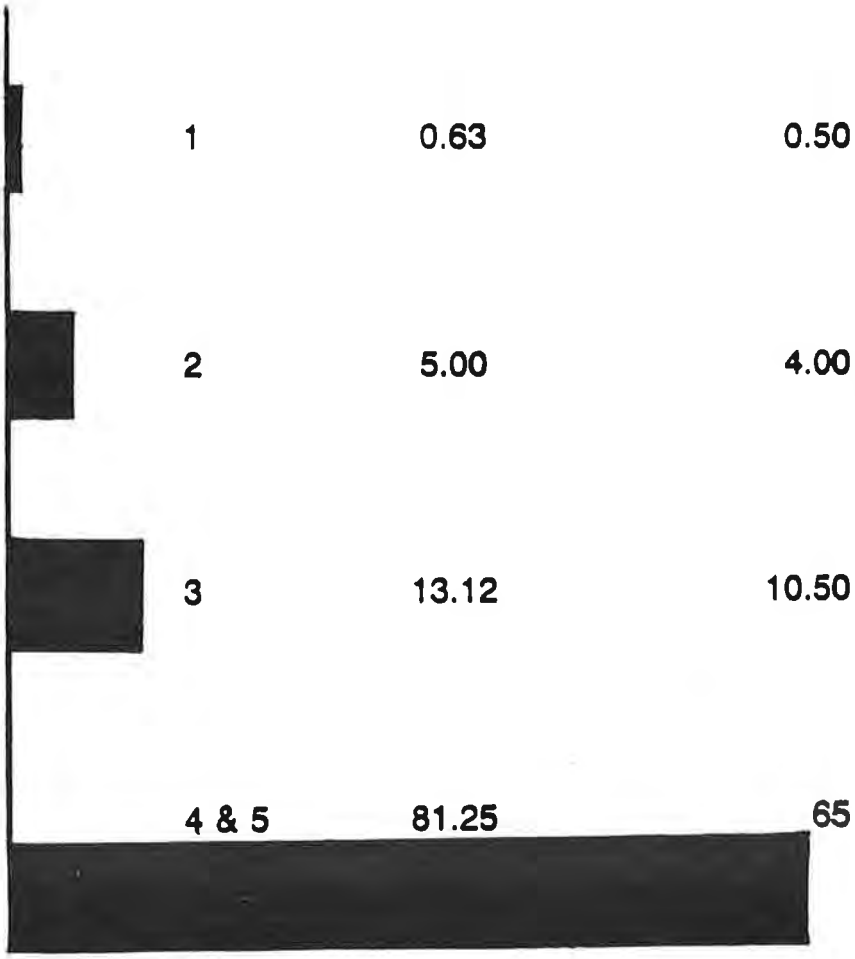
The 1990's are the Decade of Landcare, and the Commonwealth and State Governments all have Decade of Landcare Plans. Our Plan, which I have already

alluded to, was subject to extensive community consultation, and outlines what Landcare is about, the role of the individual, community and the Government, and a series of programs to achieve an improved Landcare environment.

Our Department is committed to this Plan, and in assisting to ensure that when we look back over the 90s, in the year 2000, we will be able to say that much of the Plan has been successfully achieved and implemented.

PRIME CROP & PASTURE LAND
NSW

LAND CLASS	%	AREA (ha 10^6)
1	0.63	0.50
2	5.00	4.00
3	13.12	10.50
4 & 5	81.25	65



LANDCARE AND ITS ROLE IN NOXIOUS WEED MANAGEMENT

Stuart Bray
North West Director of Landcare
Department of Conservation & Land Management
Gunnedah

Timing is important.

The Landcare Program was launched at just the right moment in time, hard on the heels of financial management as a mainstream political agenda in 1989.

The environment as an issue has slipped somewhat in terms of importance as the financial crisis in Australia deepens.

However the timing was right for the launch and it is now an entrenched policy in both political parties.

The numbers are there to prove that the program has been successful. I came to Gunnedah in 1990 and there were about 11 Landcare groups - for the first 18 months we all talked to interested groups. Both Soil Conservation staff and Department of Agriculture by 1992 had over 30 groups.

During the last year this number has more than doubled to 71.

Last year the groups spent over a million dollars on projects. Their catchments cover approximately 1.4 million hectares, and there are about 1,400 landowners in Landcare groups in the northwest.

This rapid development has occurred in most other regions in NSW and in other states . The national figure is around 1,800 Landcare groups but NSW has seen the most dramatic growth.

The issues are many and varied but without a doubt the issue that concerns most groups is Dryland Salinity. More than 50% of landcare groups are focused on how to manage this problem. Noxious weeds are the main focus of one group , but it's the exception. However when you look at the two issues there's not much difference between them and how they can bond landcare groups together.

When we are working on the formation of a landcare group we try and identify at the first meeting what problems are common or nearly common to all members of the group .

When 60% or more of the group share the same problem then there is usually no difficulty in forming a group. Obviously when everyone has a different issue or problem they want addressed it's difficult to get the group to work collectively on a issue and think much further than their own boundary gate.

Salinity as I mentioned is a large problem with many groups formed with it being the catalyst.

Now those groups are starting to work together collectively as a much larger body.

On the Liverpool Plains 6 landcare groups with salt last year now 14. With so many people working actively to one goal, their success will have a huge impact on the area.

I can see similarities with noxious weeds, as more groups form and realise they have the same problems, because this structure could be used to control a problem that is costing Australian farmers 3 billion dollars a year in lost agricultural production.

It makes land degradation issues pale into insignificance.

The MaciNtyre Development Unit 2000 are a landcare group at Inverell that are extremely concerned about the lack of specialists in the field of weed science and are in the process of trying to establish a Chair of Weed Science at the University of New England.

How can Landcare work in with County Councils

We've established that Landcare Groups are rapidly forming up throughout NSW.

These groups are formed on the basis of specific issues in their catchments. However, noxious weeds are rarely the reason they form.

However when the initial inventory of catchment issues are discussed with a group, noxious weeds are always one of the ancillary problems that everyone shares in a catchment.

It's a matter of where it fits in the list in terms of priority.

To many people especially in a newly formed group, telling your neighbours, and whoever else is at the meeting, that your place is overrun with St Johns Wort or Blue Heliotrope is not the war to endear yourself to the group.

Like footrot in sheep there is a certain stigma attached to having a large variety and extensive area of noxious weeds on your farm.

Landcare being run on a catchment, determining a large number of issues can overcome this problem of determining the extent and type of weeds in catchments by mapping areas of dryland salinity erosion, tree decline, cropping areas and noxious weeds. In a catchment it takes the personal quilt/responsibility away from the issue and puts it on a catchment perspective, which is less personal and more an overall problem.

So it becomes one of the many issues that the group has to prioritise and work out a strategy of management and control.

From the County Council approach this should start to make their job easier.

Like everyone else they are strapped for financial resources and manpower.

The Central Northern County Council has 24,000 landholders to service, 5 permanent staff, 7 vehicles and a budget of half a million dollars.

The task for these people is enormous - and when one looks at the spread of noxious weeds in the area such as St Johns Wort which has extended its territory from 10,000 ha in 197 to 64,000 ha in 1993, and Golden Dodder which has rapidly gone from 40 ha in 1979 to 7,000 ha in 1993, w all know its priority as a catchment problem has got to receive higher recognition by landcare groups.

Jim Cherry, Chief Weeds Officer with the Central Northern County Council, told me that at Windy Station, just out of Quirindi, during the depression years when that country was primarily grazing country for sheep, it had a lot of Bathurst burr across it and each year they would employ 500 burr cutters who would walk shoulder to shoulder across the country cutting the burr with hoes.

Sixty years on we have a much wider variety of noxious weeds so the old hoe won't work and there's not the labour in the bush to do the job. Fortunately, we have chemicals to help us.

Obviously we need to work in a more coordinated way to control the problem.

Landcare groups working in catchments in consultation with weeds officers working out strategies for 60,000 - 80,000 acres at a time will speed up the process. Groups buying chemicals in bulk through Councils should reduce costs to the landholders and as much more groups are formed, provide a focal point for weeds officers to run field days and workshops on eradication methods.

In addition the landcare groups are providing the councils with a network to introduce programs such as weedwatch as an early warning and monitoring system to check the spread and extent of existing noxious weeds as well as providing an early warning system for the appearance of new varieties such as Blue Heliotrope which is gaining a large foothold in several States in Australia.

Funding - National Landcare Program through NRMS provide funding details available through the National Landcare Program.

A CATCHMENT APPROACH TO WEED MANAGEMENT

W J Garrard
TCM Co-ordinator
North-West Catchment Management Committee
Tamworth

Background

The need for weed control was first recognised by legislation in the NSW Municipalities Act, 1867. The control of weeds at field level has remained with Local Government since that time.

The Local Government Act, 1919 allows for the establishment of Weeds County Councils. Groups of Local Councils may form a County Council whereby each council contributes funds for the operation of that County Council e.g. Quirindi, Nundle, Parry, Murrurundi and Manilla Shire Councils together with Tamworth City Council have formed the Central Northern Weeds County Council.

Weeds impose an enormous and increasing economic cost (estimated at $3 billion per year), social and productivity burden on rural Australia.

It is therefore imperative that an effective and efficient means of controlling weeds is put in place.

Why change from present system?

Currently, noxious weed control in NSW is under the direction of two Ministers - the Minister for Local Government and the Minister for Agriculture and Rural Affairs.

This has created the situation where in some instances neither Minister provides decisive leadership, which leads to uncertainty on the part of councils, and also extends the time taken for Ministerial approval such as in the case of grant allocations where the approval of both Ministers is required.

The current system allows councils to make decisions at the local level however generally there is no means of ensuring that all councils implement effective and uniform noxious weed control programs.

The new weeds legislation will overcome some of these problems, but it will not provide the substantial degree of co-ordination and co-operation necessary for noxious weed control to be effective.

The Draft National Weeds Strategy identified strong community concerns relating to the effectiveness of the current institutional mechanisms for weed control.

The strategy also recognises that, while successful weed control outcomes depend on action by land users and the community, a realignment of legislation and institutional effort is necessary. It also reflects a growing awareness that long-term

management of Australia's productivity and biodiversity is best served by an integrated approach to weed management.

Proposals for a Catchment Approach

Whilst it may be argued that not all weeds are spread by water, a significant proportion of noxious weeds and other problem weeds have water as a principal means of spread e.g. Johnsons Grass, Noogoora Burr, Dodder, etc.

Weed management needs to be tied in with other natural resource management strategies, including pasture and grazing management, feral animal management and management of public lands. It is therefore difficult for bodies formed primarily to control weeds, to relate this to an integrated approach.

Weed control on a catchment basis has the advantage that it can involve co-ordination across local government and other political and property boundaries. Management of weeds is particularly amenable to the catchment management approach.

The use of databases and monitoring of priority weed infestations on a catchment basis will allow allocation of resources to achieve the most cost-effective control strategies to be developed.

Catchment Management Committees, established under the NSW Catchment Management Act (1989), exist over all of inland NSW and a significant proportion of coastal catchments.

These committees would be most willing to assist in the development of integrated weed management strategies.

The community can also be a powerful force in managing weed problems.

Approximately 430 Landcare groups currently exist in NSW. While some of these groups are addressing weed problems, there is scope for greater involvement of Landcare groups in implementing integrated weed management strategies.

Case Study - Namoi River Catchment

The Namoi River Catchment covers an area of 43,000 km^2 ha rising in the northern tablelands and extending through the north-west cropping belt and joining the Barwon River at Walgett. See Fig. 1

Under the current institutional arrangements there are six weed control bodies with responsibility for weed control in the Namoi catchment, these being:

- *Central Northern Weeds County Council* (includes Shires of Manilla, Murrurundi, Nundle, Parry and Quirindi and the City of Tamworth)

- *New England Tablelands Noxious Plants County Council* (covers Uralla and Walcha Shires plus others)
- *Far North Western Slopes (Noxious Plants) County Council* (covers Barraba Shire and others)
- *Gunnedah Shire Council*
- *Narrabri Shire Council*
- *Castlereagh Macquarie County Council* (covers Walgett and Coonabarabran Shire and others)

The majority of the catchment is managed by Central Northern County Council and Gunnedah and Narrabri Shires. Table 1 shows estimates of expenditure for 1992 by these three bodies for control of weeds that are to a certain extent spread by water.

Table 1 Expenditure Estimates for Weed Control in the Namoi Catchment

	Organisations Expenditure Estimate			
Weed	**CNCC**	**Gunnedah Shire**	**Narrabri Shire**	**Total**
Johnsons Grass	81,100	43,500	22,720	147,320
Noogoora Burr	1,500	14,000	14,000	15,500
Dodder	1,000	1,600	-	2,600

If these bodies operated independently and maintained responsibility for weed management in their own defined area there would always be the possibility of resources being ineffectively allocated to weed control in down stream catchments.

Opportunities for a Catchment Approach to Weed Management

1 WITHOUT LEGISLATIVE CHANGE

Provisions already exist for the formation of Noxious Plants Advisory Committees and there is no reason for these not to be formed on a catchment basis.

The Namoi-Gwydir Noxious Plants Advisory Committee has operated for a number of years at what I consider to be a sub-standard level.

This committee's aim is to co-ordinate the control of noxious plants within the region and has adopted the following objectives:

1) To encourage co-operation and co-ordinate the resources and activities for noxious plant control.

2) To initiate and support the education of the general public in identification and control procedures.

3) To offer a mechanism for co-ordination of noxious plant control efforts so that control programs might be more effective and cost efficient.

4) To identify and monitor major and potential noxious plant and other weed problems.

5) To compile a register of weed control activities including trials using chemical, biological or alternative control methods.

6) To annually prepare a "short list" of weed problems which deserve special attention from the committee.

7) To identify control needs, establish priorities and support funding for research and control problems.

8) Review of noxious plant lists.

9) Presentation of a uniform approach for; legislation, funding and control of noxious plants.

While these objectives sound good it is their implementation, and the commitment of participants to the concept, which in my opinion, has prevented this body from reaching its full potential.

Several government agencies rarely attend meetings and there are a few groups that are not included.

It may be logical to consider having a separate committee for the Namoi Catchment and combining the Gwydir catchment with the Severn/Dumaresq/Macintyre river system.

In my opinion these advisory committees should be established in all catchments with representation from all weed control bodies, relevant government agencies, landholder representation and a representative from the relevant catchment management committee.

Cross-fertilisation between Advisory Committees may be able to be provided by NSW Agriculture Noxious Plant Advisory Officers and/or government agency representatives. This would negate the need for inter-advisory

committee meetings - although these may be useful on an infrequent basis (e.g. biennial).

2 *REQUIRING LEGISLATIVE CHANGE*

There are numerous pieces of legislation, or section of legislation, at Federal , State and Territory level that deal in some way with weeds.

There is an urgent need for review of legislation concerning weeds, especially at State and Territory level, to get consistency nation-wide.

I believe that catchment approach to weed management should be enshrined in Federal and State legislation. Legislation should be complementary between state and federal and between states.

This would allow everyone to be working to the same rules, no matter what catchment or state in which they are operating.

Suggested Administrative Structure

1 *At Federal level*, catchment management of weeds to be administered by the Dept. of Primary Industry.

2 *At State/Territory level* - relevant department is Dept of Agriculture

3 *At Catchment level* - control also maintained by relevant Agriculture department with direct linkage with Catchment Management Committee

4 *At Operational/Field Level*
A fresh start is required based on a completely new structure extending from a Catchment Advisory Committee as outlined previously. The North-West Catchment Management Committee has proposed that one body be established to take over the responsibilities of Weed Control, Rural Lands Protection Boards, and the Prickly Pear Commission.

Obviously this would involve some costs, but in the long-term there would be hugh savings in having noxious plants and feral pests under the control of one organisation.

Conclusion

The Draft National Weeds Strategy recognised that:

* weeds impose an enormous and increasing economic cost (estimated at $3 billion per year) and social and productivity burden in Australia;

* exotic plant species are among the most serious threat to the conservation of native species and habitats;

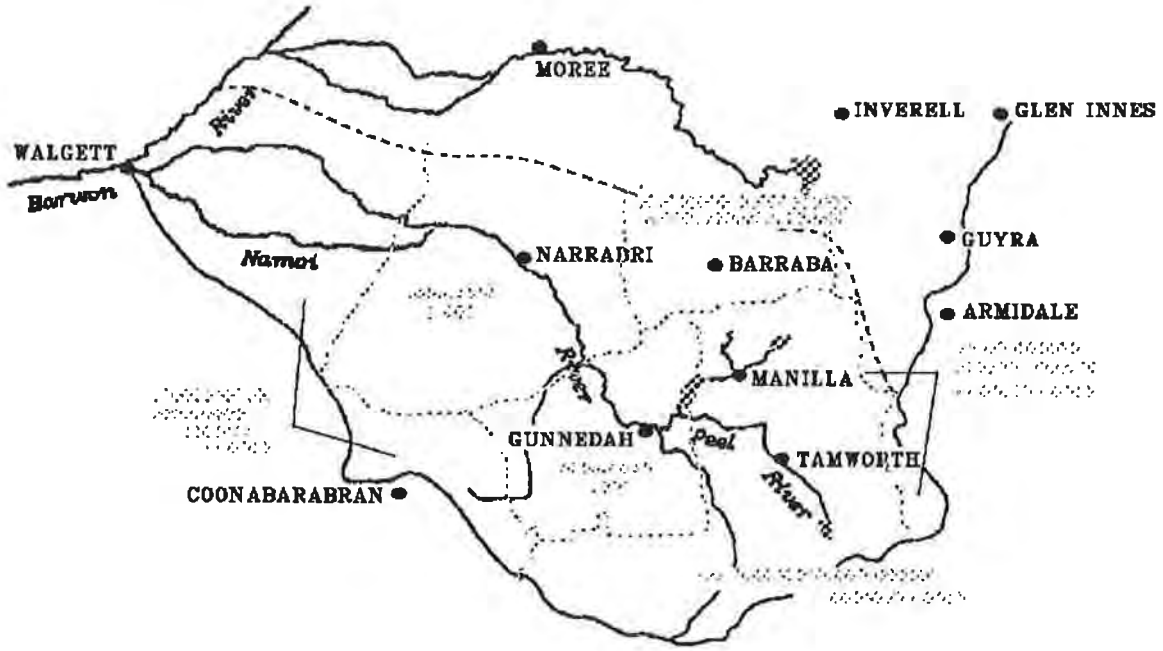
* sound land management and sustainable land use practices are integral to long-term weed management;

* many of the current social, legal and institutional mechanisms for handling weeds issues are outdated; and

* adequate appreciation of the serious social, economic and environmental implications of current weed invasion patterns is lacking.

A catchment approach to weed management will allow these issues to be addressed in an integrated approach resulting in more effective weed management.

Figure 1. NAMOI RIVER CATCHMENT WEED CONTROL BODIES



UNDERSTANDING SCIENCE AND YOUR ENVIRONMENT

A New Public Education Program
by
Dr Roy Tasker
Senior Lecturer in Chemistry
University of Western Sydney, Nepean
and
Mrs Ruth Dircks
Australian Academy of Science
on behalf of the

Understanding Science and Your Environment Program

ABSTRACT

Recent surveys have shown that the general public is more *interested* in science than sport! However, public *understanding* of science, both of its knowledge and its processes of inquiry, is cause for concern because there are so many issues that involve science and technology - the use and abuse of agricultural chemicals being one of them.

Society cannot be productive if its populace reacts to such issues relating to health, lifestyle, and the environment solely on an uninformed, emotional basis. The 'spectacular' science in the media cannot educate adults in 'ordinary' science, or help them to ask pertinent questions on everyday issues. How then can the adult public be exposed to 'ordinary' science in an impartial and entertaining way? The *Understanding Science and your Environment (USE)* program is designed to meet this challenge.

This paper describes the program and illustrates the approach by presenting a part of the pilot module entitled *Everyday Chemicals - Balancing Benefits and Risks* .

Understanding Science and your Environment

Need for Better Public Understanding of Science

The results of two large surveys[1] of public understanding of science revealed that only

* 34% of Britons, and 46% of Americans, appeared to know that the Earth goes around the Sun once a year;

* 28% of Britons, and 25% of Americans, knew that antibiotics are ineffective against viruses.

Although knowledge of our planet's movement around the Sun may not be considered vital for living, the overuse of antibiotics by people with viral ailments, like the flu, is an issue of concern. Of greater concern to public policy makers, interested in public debate on important issues, is that only

* 34% of Britons knew that nuclear power stations are not a source of acid rain;

* 23% of Britons recognised a link between the burning of fossil fuels in coal-fired power stations and the problem of global warming.

Interestingly, surveys[2,3] of public *interest* in science in Australia and UK show that television viewers rank news stories in science and medicine at the top of 15 categories, way ahead of sports, politics, and major disasters. journalists, on the other hand, ranked science and medicine sixth, behind politics and disasters in terms of their own interests, and 13th in terms of how they saw the viewer's interests.

Public *attitudes* to science are also quite positive. One survey showed that 56% of Australians believed science and technology did more good than harm, whilst only 10% believed the reverse.

So the interest and positive attitude are there, but a more scientifically literate public is needed, with a healthy, *informed* scepticism, to prevent knee-jerk reactions to predictions that the sky is falling!

However the only source of science for adults is the broadcast and print media which, understandably, focuses on 'spectacular' science - new discoveries, new technologies, and new controversies - usually in a superficial way. Although informative and entertaining, such material is rarely useful in everyday decision making in important issues-

Should our local council put fluoride in our water?

Are genetically - altered vegetables healthy?

Are the microwaves in a cooker dangerous"

Should PCBs be removed, at great cost, from light fittings in classrooms?

People tend to leave decisions on such issues to the 'experts', but feel frustrated when the experts disagree. The issue of health risks associated with food additives and pesticide residues is a good example. Society cannot make informed public policy decisions if its populace reacts to issues relating to health, lifestyle, and the environment solely on an emotional basis.

What is the USE?
The *Understanding Science and your Environment* (USE) program encourages people to

* learn to ask pertinent questions (rather than demand "quick fix" answers), obtain evidence, and use it as the basis for decision-making;

* understand the nature, advantages, and limitations of scientific inquiry.

The major aim of *USE* is to show the role of chemical and physical principles in informed decision-making by adult members (35-60 year old age group) of society. The idea is to provide the public with interactive experiences (role plays, 'hypotheticals', scientific demonstrations) that help them to relate these principles to their life and environment.

The *USE* program produces carefully prepared presentation kits dealing with important scientific topics of relevance to everyday life, such as everyday chemicals (like plastics), radiation, hazardous waste management, risk assessment and management, and others. These kits are used by trained presenters who can speak to adult audiences in Service Organisations (Rotary, CWA, etc.), Parents and Citizens Associations, Conferences (such as this one) and the workplace.

The program was an initiative of the Royal Australian Chemical Institute in 1991, and the present USE Advisory Board has members from the other science professions, the Institution of Engineers, CSIRO, and industry.

***USE* is not an advocacy program, and every attempt is made to provide balanced information without inbuilt conclusions.** Each presentation provides a framework of ideas to empower people to form their own reasonable assessments based on evidence, whilst recognising that subjective values are also involved in the decision-making process. The following excerpts from the pilot module on a chemistry topic illustrates the approach.

Everyday Chemicals - Balancing Benefits and Risks

The presentation begins with some introductory remarks about chemicals

- chemicals are everywhere, and that we are composed of chemicals - some of which are potentially toxic!

- that any chemical (even water) can damage health above a threshold dose, depending on the type and time of exposure;

- that it follows that chemicals of natural origin are not necessarily less harmful than manufactured chemicals.

The main point is that the benefits of any chemical to quality of life must be balanced against its risks to health and the environment. Since the concept of 'zero risk' is impossible, many situations require an objective assessment of the risk/benefit trade-off.

These points are illustrated in a hypothetical scenario involving water from a nearby lake contaminated with a red chemical of natural origin. To drink, or not to drink, that is the question!

During this discussion the need for information is highlighted, and concepts like concentration (in ppm, ppb), dilution, and threshold level are demonstrated. These concepts are used to explain how the toxicity of the red chemical is determined, and hence how the health risk can be assessed.

With this information the audience is asked to review their drinking decision in the light of new information. Comparing the toxicity of the red chemical to the toxicity of caffeine in coffee, illustrates the idea of comparing new risks with everyday risks.

The decision on the "safety" of the drinking water is left to the audience - as in many real life issues there is no *correct* answer!

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URBAN BUSHLAND IN DECLINE

Is it inevitable?

by
Judie Rawling
Managing Director
Urban Bushland Management Ltd.

1. Introduction

For the last two hundred years the Australian bushland has been under siege. Throughout the country, wherever man has settled, the native flora and fauna have been replaced with plants, animals and structures alien to the natural landscape.

Nowhere is this more apparent than in the remnant, often pocket- handkerchief sized bushland reserves around our towns and cities. Today, in the urban environment, only isolated pockets of natural bushland remain intact, and even the survival of these small remnants is threatened by encroaching development. If these remaining fragments are to survive, they must receive a high level of care and protection.

Urban bushland is not wilderness - by its very nature the term implies development, pressure and negative impacts. Management strategies developed for use in wilderness areas and national parks are generally inappropriate in small fragmented urban reserves. Yet with a few exceptions, very little work has been done to ascertain how to manage urban reserves, and how best to maintain, restore or promote their ecological viability, biodiversity, value to the community - or even to determine whether these stated goals are realistic ones.

In fact, some people seriously question whether it is possible to manage urban reserves effectively and economically given on-going development pressures, shrinking budgets, and in most cases, only cursory lip-service to addressing the persistent root causes of bushland degradation.

2. Current Levels of Funding - who is paying the bills?

The past five years have seen a plethora of State and Federal government-funded environmental programmes, all seeking to involve the community in practical "hands-on" projects and designed to foster a feeling of stewardship in the local environment. Programmes such as *Save the Bush, Landcare, Dunecare, One Billion Trees,* and the *Environmental Trusts* have made funds available to undertake a whole range of environmental projects. Political parties vie with each other to announce bigger and better grants, more and more "green" policies, and the Australian public is asked to vote for the party which "gives the environment the best deal".

Grants allocated to the community, state & local government agencies for environmental work through the NSW government-funded *Environmental Trusts* in

1992 totalled $2.2 million - Sydney Region $1.3 million (Environmental Protection Authority), with the Federal government spending $1.2 on community-grants through the *Save the Bush Programme* in 1991- 92, - Sydney Region $82,437 (Australian National Parks & Wildlife Service).

The Sydney Water Board alone spends $1.1 annum on its Special Environmental Programme, with 27 projects underway aimed at restoring urban bushland damaged in the course of laying sewers and watermains - projects which are funded by an $80/household/year levy (Mathias pers. comm. 1993). The SEL Programme will spend some $5.5 million over a five year period in Sydney bushland. This figure does not include money spent by other government agencies such as the RTA, City Rail or ElCom on the maintenance of their own properties - this was not canvassed.

At local government level spending is also evident - although with perhaps somewhat less "hype". In 1991 a special survey on aspects of public open space was distributed to local governments in the Sydney Region by the *Sydney Natural Resources Management Group.* Responses from 14 local government areas, which between them manage some 15,360 ha of public open space, of which 60% is SEPP-19 bushland, indicated a total open space budget of almost $53 million, of which $4.19 million was allocated to bushland management - and this was two years ago with responses representing only 14 out of a possible 40 local government areas (Bennett 1991).

Bushland management has matured and become respectable. Bush regeneration *(Bushland Weed Control)* is offered as a two-part certificate course in NSW TAFE colleges, and shorter courses are offered in community colleges and by local councils - many with their own bushland units. The Positions Vacant columns regularly carry advertisements for *Community Bushcare Officers.*

Sydney alone can offer some half-dozen professional bush regeneration companies - my own company for example, *Urban Bushland Management,* employs over 70 part-time workers and has an annual turnover of almost $1 million in contract income two years from establishment. Bushland management is well established in other states - Brisbane and Melbourne in particular have many active groups and firm state and local government backing.

Therefore, doing a little simple arithmetic, it is clear that an awful lot of public money is going into restoring/rehabilitating or otherwise managing urban bushland reserves - in Sydney's case about $6.7 million each year.

But - to put the cat among the pigeons - are we getting our money's worth? Are we being effective? Are we achieving our objectives? Are those objectives realistic? Is there a better way of doing things? Does it really matter what we do in the long term? It is these questions I want to address today, and perhaps, with some lively discussion after this session we may be able to come to grips with the question I posed in the title of this talk: *urban bushland in decline - is it inevitable?"*

3. Why is Urban Bushland so vulnerable - can we do anything about it?

Visit any urban reserve - no matter what size - in any village, town or city in Australia and you can find signs of degradation. Weeds - unwanted plants from a variety of sources (agriculture, gardens and wastelands) - polluted waterways, soil erosion and siltation, dumped garbage, and usually very little in the way of native wildlife.

Are these things inevitable? After all, they are the direct result of human settlement - our impacts on a natural system, no matter how unintentional. We have to live somewhere.

Table No. 1 lists a number of negative impacts or problems common to most urban bushland areas. Some of these impacts can be modified, others can be eliminated altogether. But you will see that I have included a column headed *Live With It!*, because it may be that some things just can't be changed - not if people continue to build their houses in or near a patch of bush.

You will also see that some of the items have been qualified; for example in older developments (old sites) the damage has already been done. Changes in the soil profile for example - structure, chemistry and water retaining ability - may be permanent. In newer developments we may be able to modify or even prevent the damage occurring. Yes, we do have the technology - but do we have the will to do something about it, or better yet, demand that our *masters* do the right thing?

Land degradation, whether it occurs in urban bushland, farmland or wilderness areas contained in national parks, has a number of root causes. Some problems have relatively simple solutions - like changing current management practices (e.g. mowing regimes, fire regimes). Others are not so simple (e.g. urban drainage, nutrient enrichment) and will require considerable research and expertise to address. In fact, some will require political solutions.

However, new methods, new technologies, are being developed and adopted all the time. Unfortunately many are being implemented in an *ad hoc* fashion and often the knowledge is not shared.

4. Changing Attitudes and Modifying Objectives

In the seven years or so that I have personally been involved in bushland management I have seen many changes in the bush regeneration fraternity, changes in community attitude and emphasis, and no one would deny that there have been radical changes in methodology, and a greatly improved success rate - if I can use the word "success", and if only we really knew how to measure our success!

Possibly less willing to change views and practices are some of the land managers: elements within local government and in large government agencies who resist changes on the grounds of "no time, no staff, no money, no authority" - they really mean - "no interest in rocking the boat, in learning new things".

Are our objectives realistic? Often when rehabilitation projects begin they are a little "pie in the sky", but they often soften with experience. Some changes in bushland ecology are inevitable - just by virtue of natural successional change, and few people really think we can preserve urban bushland in a pristine state or recreate a replica of something out of a wilderness calendar. But we may be able to re-create a "manageable ecosystem", something which lies within the *limits of acceptable change* - a term much used by the environmental consultants - and achieve a compromise that satisfies our basic need to have some form of relatively natural area on our doorsteps.

So how about all that public money being channelled into urban bushland - are current management practices effective and is all that public money being wasted?

Most bushland rehabilitation projects are relatively effective, at least to the extent that they remove weeds and encourage native plant regrowth, but possibly they are not half as effective as they could be if we thought the project through more carefully and came up with solutions which suited everybody - if we spent more time planning and working out what we really wanted to achieve.

Perhaps we should have fewer projects and do them better. Perhaps the government funding bodies should insist on a much greater level of strategic planning in their guidelines, with only projects demonstrating a good understanding of the overall local and regional picture receiving financial assistance. Should support be given only to those projects where the managing authority is willing to co-operate by treating the causes of the degradation - not just the symptoms - and where the land manager guarantees on-going commitment to the project?

Bushland management is a partnership involving the community and the land manager. If one of those partners is unwilling to listen to new ideas or unwilling to change tired old practices, or when there is conflict over who is "really in charge", the project will fail - no matter how much money is handed out.

I hope that some the issues discussed today will stimulate further discussion, and I would hope that with all the expertise represented at this conference, some new solutions will be suggested, or better yet, actually tried in practice.

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Problems and Impacts on Urban Bushland

Problem/Impact/Issues	Can be Eliminated/ Modified	Live With It!
1. Fire Regime		
*too frequent	x	
*not at all	x	
2. Urban Runoff		
*nutrient enrichment	x (new sites)	x (old sites)
*hydrological changes	x (new sites)	x (old sites)
*soil structure changes	x (new sites)	x (old sites)
*pollutants	x	
*imports weeds	x	x
*siltation/erosion	x	x
3. Vegetation Changes		
*weed invasion	x	x (some)
*loss of native species diversity	x	x (some)
*loss of vegetation structure (eg no understory)	x	
*rise of opportunistic native 'pioneer' species	x	?
*loss of habitat	x	?
4. Faunal Changes		
*loss of species	?	?
*invasion of exotics	x	

Problems and Impacts on Urban Bushland

Problem/Impact/Issues	Can be Eliminated/ Modified	Live With It!
*spread of weeds by native birds		x
*attack by predators (poor prognosis for restocking)	?	x
*no linking corridors	x	
*loss of habitat	?	x
5. Development Pressures		
*recreational demand	?	
*conflicting land uses	x	
*'green' lobby vs development	x	?
*disturbance from construction fire, runoff, service corridors etc	x	
6.Economic/Management conflicts		
*piecemeal acquisition policys	x	
*non-coordinated management approach	x	
*lack of funds		x
*un-coordinated use of available funds	x	
*political, sectional pressures & demands		x

THE SENTINEL AND THE CARBO-FLO PROCESS

Don Matthews

ICI CROP CARE

MELBOURNE

The Sentinel is a scaled down version of a water treatment facility used by ICI at many of its manufacturing sites around the world. One such can be found at our Villawood NSW plant.

The treatment principle is the Carbo-flo process which is an ICI development.

The main feature of the unit is its simplicity of operation requiring only one person to supervise the treatment. In the initial stages of use all the treatment chemicals are provided in pre-measured units for each 1000L batch of effluent.

When treating wash waters from empty containers, washdown of spray rigs and excess spray the cost of treatment is about 2¢ per litre. This allows for the replacement of the carbon filters after 20,000L.

In simple terms the process involves a flocculation or precipitation step then filtration through a sand filter and then two activated carbon filters. The precipitate is concentrated and dried and can be disposed of in an approved tip.

The unit is now in use in some 20 countries including Australia and New Zealand.

Some 120 active constituents have been put through the system. The details for some of these are set out in Table 1. Much of this work was done in Holland where 9 units were trialled by the Dutch Ministry of Agriculture on farms with different forms of agriculture over a two year period.

TABLE 1

TREATMENT OF A MIXED EFFLUENT

ACTIVE CONSTITUENT	CONCENTRATION (PPM) IN TANK AT START	AFTER FLOCCULATION	IN FINAL EFFLUENT
TRIAL 1 HARPENDEN LABORATORY - UK			
Pirimicarb	180	170.0	<0.02
Cypermethrin	25	1.0	<0.02
2,4-D	61	62.0	0.01
Paraquat	580	198.0	<0.5
Demeton-S-methyl	250	<0.5	<0.02
Propiconazole	100	19.0	<0.02
Gamma HCH (lindane)	530	17.0	<0.02
TRIAL 2 HARPENDEN LABORATORY - UK			
Pirimicarb	200	200.0	<0.02
Cypermethrin	24	<0.01	<0.01
2,4-D	66	62.0	0.01
Paraquat	535	207.0	<0.5
Demeton-S-methyl	320	<1.0	<0.02
Propiconazole	110	21.0	<0.05
TRIAL 3 ON-FARM TRIAL - UK			
Paraquat	180	12.0	<0.01
Trifluralin	20	0.1	<0.001
Triallate	700	300.0	<0.01
TRIAL 4 WAGENINGEN INSTITUTE - NETHERLANDS			
Atrazine	240	-	<0.00006
Organo-P compounds	0.08	-	<0.00005
Organo Cℓ compounds	0.1	-	<0.00001
TRIAL 5 OHIO STATE UNIVERSITY - USA			
Atrazine	5100	-	0.004
Permethrin	237	-	<0.004
Atrazine	92	-	0.004
Permethrin	1052	-	<0.004

TABLE 1 - Continued

TREATMENT OF A MIXED EFFLUENT

TRIAL 6 WESSEX REGION NATIONAL RIVERS AUTHORITY - UK

Pirimicarb	225		-	<0.00004
Cypermethrin		50	-	
<0.00004				
Paraquat	200		-	<0.00004

TRIAL 7 SOREX LED - UK

Permethrin	182	-	<0.01

Table 2 sets out the herbicides which have been put through the unit.

TABLE 2
HERBICIDES USED

AMITROLE	CYANAZINE	ETHOFUMESATE
ATRAZINE	DICAMBA	FENMIDIPHAM
BENTAZON	DICHLOBENIL	FLUAZIFOP-BUTYL
BROMOXYNIL	DIFENOXURON	GLUFOSINATE-AMMONIUM
CARBETANIDE	DINOSEB	GLYPHOSATE
CHLORPROPHAM	DIQUAT	ISOPROTURON
CHLORTOLURON	DIURON	LENACIL
LINURON	MONOLINURON	SETHOXYDIM
MCPA	PARAQUAT	SIMAZINE
MECOPROP	PENDIMETHALIN	TERBUTRYN
PROPHAM	TRIALLATE	METHABENZTHIAZURON
METOLACHLOR	PROMETRYN	
METOXURON	PROPACHLOR	
METRIBUZIN	PROPAZINE	

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Don Matthews B.Agr.Sc

STEWARDSHIP MANAGER

ICI CROP CARE

MELBOURNE

Firstly, may I thank the organisers of this Conference for inviting me to speak on this topic. They must think I know something about it.

I have been involved in the farm chemical business in many roles for the past thirty years. I have been in the field doing development trials, a salesperson, a market development officer with chemical manufacturers. I have been a regulator in the State of Victoria and am now back in the private sector in a unique role.

I believe that I am the only full-time person allocated the full-time role of stewardship in this or any other part of the chemical industry in Australia.

I had the good fortune to enter the industry at the time when new compounds were flooding onto the market in increasing numbers. I also had the good fortune to be involved with developing and marketing four of these compounds. Three are still in the marketplace.

When considering what to talk about on this topic I decided that rather than deal with specific issues, for example residual herbicides in ground water, it might be more appropriate to look at the wider picture. Much is written and said about specific issues but little is said about the whole picture and what the future holds for us.

I am aware that this Conference is about the control of noxious weeds but that is only part of the story. Much of that activity is seen by the urbanite as of little consequence and in most cases doesn't have much impact on his way of life. Therefore not only is the issue one of chemicals in the environment but also why are you messing around with nature.

Unfortunately there is a perception that nature is good and is benign. Haven't we got short memories. The 1983 fires in Victoria and South Australia are but a memory and in many cases there are people living in those same areas who say it won't happen again and have done little to make sure that it doesn't.

The technological tools we employ to combat the pests, weeds and diseases which afflict us, our food and fibre producers and the environment in which we live are

seen by some as evil. These social pressures are worthy of at least some comment as I believe they represent some of the most powerful influences which could prevent you from achieving your goals.

Ten thousands years ago life was short, nasty and brutish. Man fought with the rest of nature for food and shelter to survive. Man was a fringe species constantly facing extinction. For the first dozen millennia man survived and numbers had only reached a few hundred families inhabiting vast tracts of land at the time when the first farmers and metal workers arrived.

Then, whether by chance or divine intervention, we acquired the ability to accumulate and preserve knowledge for those that followed behind. We converted this knowledge into useful technology that has ensured, for many of us, longer, healthier, more comfortable and enriched lives.

We cut ourselves free from the clutches of the natural world and now assist those who still haven't achieved this kind of liberation to share in its benefits.

Thus, it is strange to find some powerful elements in our society, who enjoy its benefits, which seek not just to control the growth of technology but to abolish it.

Man often fears that which he does not understand. The fear of chemical technology is natural and runs deep and is synonymous with the fear of poison which is as old as man.

I believe the basis of the fear which has generated the current social pressure is simply that chemical technology has been presented as a silent, sinister and dangerous villain which surreptitiously poisons our environment and threatens our very existence - WHAT A HOAX!

The problem is double vision.

Natural chemistry is simply not being viewed with the same eyes and interpretive system as man-made chemistry.

Eggs yolks are coloured by, amongst other chemicals, xanthophylls and carotenes present in green feed such as lucerne.

Eggs yolks coloured yellow by man-made compounds are considered different.

No analytical chemist could distinguish which colour came from lucerne and which colour came from synthetic chemistry - they are exactly the same molecules.

From our earliest recollections of our parents I am sure all of you can recall being told "Don't eat that it might be poisonous!". In most cases it was not known to be poisonous, and so we hear from early times don't do this or that it might be dangerous. The "might be" or "may be" syndrome.

Currently the urban dweller, including our political leaders, are paranoid about chemicals. Fear of chemical poisoning and cancerophobia is rampant.

I believe these attitudes also result from ignorance and a loss of contact with our ancestral roots in the growing and production of food and fibre.

In just 50 years the number of people who can still claim to have a close relative involved in agriculture has rapidly fallen. Today, we have a population of 16 million and just 170,000 farm units.

Fifty years ago there were many more farms supporting a population of less than half that of today.

Ignorance. It is a legal maxim that ignorance is not a defence. It seems that it doesn't matter in the case of the detractors of modern agriculture when it is clearly the root cause of much of the public concern.

It is unfortunate that neither the news media nor our public agencies are caring enough to accurately inform the public on the distinction between toxicity and hazard and the proper perspective on risk relationships with respect to dose and exposure. Some people in the community are actively undermining the principles of toxicology with variations of the "maybe" syndrome.

A colleague of mine sought advice from seven members of a faculty of Psychology including the Dean on "what motivates people to become so fearful and emotional over simple issues surrounding the use of agricultural chemicals?". The reaction was fast and furious - "because they're terrible"; "because they're dangerous"; "because they shouldn't be allowed"; "they're unnecessary"; "they destroy the environment"; "they cause all types of horrible effects and defects"; "they upset the balance of nature"; "they are an invasion of privacy".

Here we have a group of highly intelligent, influential and articulate people releasing pent up feelings. How sad that they were so grossly misinformed.

While I was in Tasmania, sometime ago, I came across a lady who waved an opinion from Mr Justice Einfeld of the Human Rights Commission under my nose. She claimed it gave her child the right to a chemically free environment and guaranteed her privacy from invading chemicals.

An interesting exercise and it does show what a huge task confronts us all.

There is also no doubt that much of the pressure is generated from a psychological response to the issue. This has been demonstrated with the use of aircraft, in agriculture.

At this stage in the "debate" there is little doubt that the forces of environmental activism have public emotion as support on their side while the manufacturer of the chemicals and the food and fibre producers are supported by a vast array of data, logical argument and truth about the compounds being used.

There is a chasm preventing the development of tolerance and understanding between philosophy and social science and the natural sciences. This is neither productive nor healthy but since the former have greater impact on emotional and political thinking the dice are pretty heavily loaded against natural science its needs, deeds and aspirations.

The analytical chemist has added a contribution to the cause for concern. This branch of science has been the beneficiary of the remarkable advances in technology over the past twenty years. At that time crude techniques, by today's standards, that took several man days to complete enabled identification of a few compounds as residues on a limited number of substances. Results were in the parts per million range,

e.g.3 x 10^{-6} g/kg OR 3 mg/kg.

In today's world of highly sensitive gas-liquid chromatographs combined with mass spectrometry hardly a molecule can escape detection. Recently I saw a figure of 0.04 parts per trillion of TCDD quoted as a residue in milk from a cardboard carton, i.e. 4 x 10^{-14} g/kg OR 0.00000004 mg/kg.

This same article had the required dose of the "might be" syndrome. Professor Hardell, a Swedish medico, who has been working for years to prove a link between exposure to phenoxy-acid herbicides and soft tissue sarcoma, without a great deal of success, now warns women that the use of tampons, bleached with chlorine, may have a connection with "the most common forms of cancer of the uterus". He says "it is very disturbing that there are dioxins in products that enter the body". Scary hocus pocus.

The capacity of the analyst, who claims that he can find almost anything in everything, has fuelled the fire and aided and abetted those who promote the concept that exposure to one molecule of a potential carcinogen once in a lifetime has the portent of doom.

It is an unfortunate fact that scaring the public has become a growth industry. The motives of the initiators of the scare tactics are not always obvious. For example it was claimed that in particular area where there are numerous glasshouses some 15 people had died from cancer as a result of using farm chemicals in the glasshouses.

The newspapers carried the horrific details. Official investigations revealed there were no facts to support the claims and secondly, and more importantly, the claims were started by a group of land developers who wanted the land rezoned from 'special purposes - agriculture' to housing development. The closing down of the glasshouses would have netted them millions of dollars in easy profit.

The other aspect of the scare business is the growth of so called "public interest" or "consumer representative" groups. I have no doubt that some are genuine in their concerns but many are far from representative.

The recent 'ALAR' issue in the US is a classic example of 'scare the people' by the Natural Resources Defence Council. The report was titled "Intolerable Risk : Pesticides in Our Children's Food". The media reacted with almost religious fervour to this dire prediction.

The media failed to seek peer review of the data.

This has been done. It has been universally rejected. But the damage was done. When confronted with the results of scientific peer review the response from NRDC was - the ends justifies the means.

On the environmental side since DDT was removed from worldwide use in developed countries and 2,4,5-T was restricted so that marijuana crops would not be damaged in the forests of the US the issues have been primarily human health related. The contamination of underground water is both an environmental and a human health issue.

Some issues have apparently been to do with aerial application and subsequent environmental contamination but in truth the issue has been pine trees. Agricultural chemicals have the necessary characteristics to be a more effective stick than a poor old pine tree to stop such developments.

In general terms the application of agricultural chemicals in this country attracts little media attention. This, of course, does not condone those instances of fish kills and damage to non-target areas which have occurred.

Where do we go from here?

Some groups would hold that the farm chemical industry has raped the environment without regard for the future. I don't believe that that stance is a fair reflection of the real situation. These detractors have it easy. They do not have to produce data to support their claim. They just have to suggest there is an unknown level of risk.

I find it hard to believe that the greatest threat to our agricultural lands, salinity, is due to the use of farm chemicals. Nobody has suggested that it is but they could.

I am not aware of any form of agriculture which has ceased to be viable as a result of the use of farm chemicals.

I am not aware of the loss of a native animal or plant through the use of farm chemicals. I am aware of the loss of native fish from rivers and streams due to the effects of building hydro-electricity systems on the headwaters and thereby changing the thermal gradients in the water.

The nub of our story is that as soon as man began to harness nature to his will and for his well being it was the end of the balance of nature. It cannot be returned to its pristine state. Even the making of a decision about an area and

how it should be managed takes away the real element of letting nature determine its future.

Our forebears introduced plants and animals from their countries of origin to have a little bit of home in this desolate land. In fact you probably know that one of our worst weeds was spread by one of our most famous botanists on the basis of providing food for people lost in the bush.

The other side of the story is that the amount of arable land is finite but the population is still expanding. Even in our own backyard have we put the needs of housing people ahead of the value of the same land for food and fibre production. There in you can see the dilemma. We have changed our value systems.

There are many examples in our cities where some of the best agricultural land has been put under concrete and forced the producer to move to more distant places and not always onto land of equal quality. Nobody held rallies to prevent this happening.

In many cases the extra cost of cartage etc has been offset by more efficient production methods which has generally included the use of agricultural chemicals.

I have no argument with those who want agricultural chemicals regulated to ensure that proper use does not affect the environment beyond the target zone. This however does not mean that absolute safety can be guaranteed - it does not exist in nature so why do we expect it from our activities. A balance between benefit and risk must be struck.

As a final challenge let me pose this to you. You are an Irishman in 1840 with a field of potatoes and living with nature. Unfortunately nature that year forgot to live with you and sent you a large dose of Irish blight. Without any fungicide available, you and your family face death by starvation. In fact one million died and many emigrated to the USA. The Irish population, by the way, has never recovered to the pre 1840 levels. My question. What if you had access to a fungicide, would you use it to save your family or would you accept your fate. Would you use what is described as a nasty, polluting, probably carcinogenic or teratogenic compound or not?

If you do the latter, I respect your decision but of course could not support it.

If you decide to use the fungicide then remember there are many others around the world who also seek the right to survive. It is not our prerogative to dictate what is best for others who may not have reached the level of sophistication in society that we enjoy and which allows us certain luxuries not available to the whole world.

We have millions of lives to save and mouths to feed so please play quietly so that those in the business of food production, protection of public health and the environment can get on with our work.

LAND STABILISATION AND ROADSIDE REVEGETATION WITH NATIVE GRASSES

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Introduction

Weeds are often categorised according to the habitat in which they occur, for example, as pasture weeds, crop weeds, lawn weeds, environmental weeds or water weeds. One of the habitats where weeds are most obvious and where they pose the greatest threat to a wide range of plant communities is the roadside corridor. Roadsides generally have a large boundary to area ratio and, thus, have the potential for significant weed invasion (Panetta and Hopkins 1991). Whereas weeds on the property side of the fence may be controlled through grazing, herbicide application, vigorous competition or mowing, weeds on the less intensively managed roadside may go unchecked. The movement of vehicular traffic, livestock, agricultural produce and other goods along roads also leads to considerable spread of weed propagules (Lonsdale and Lane 1990). Hence, roadsides can be a major focus for both weed infestation and spread. When dealing with noxious plants it is particularly important to prevent weed movement along road corridors.

One of the factors most likely to prevent the infestation and spread of weeds along roadsides is a stable dense grass cover that prevents weed seed germination and seedling establishment through competition and shading. The maintenance of roadside vegetation cover provides soil stabilisation, weed control and an aesthetically pleasing landscape for motorists.

Natural grasslands comprised of Australian native grasses and other low-growing herbaceous species have been severely depleted in area in southern Australia since European settlement due to cropping and intensive grazing pressure. Intact remnants of the grasslands now survive only in areas such as roadsides and non-arable or non-grazed paddocks. These natural grasslands, when undisturbed, are strongly resistant to weed invasion. The construction of new roads creates the opportunity to restore many of the native grassland communities in areas where they were once much more widespread. Degraded roadsides with patchy vegetation cover or heavy weed burdens, that are not amenable to restoration by conventional management techniques, can also be rehabilitated with native grasses.

In this paper I discuss some of the potential benefits of and obstacles to the revegetation of roadsides with native grasses and review the research aimed at their domestication and the development of appropriate techniques for their use in revegetation programs.

Benefits of Revegetating with Native Grasses

Interest in the use of native grassland species for revegetation has increased greatly in recent years because of the rapid rise in management and maintenance costs for large areas of traditional European-type turf grasslands, and a growing appreciation of the aesthetic and ecological qualities of native grasses and their associated colourful flowering herbs. Many of the characteristics of native grasses which have led to their decline in grazing and agricultural situations in fact make them ideal for less costly low maintenance and management applications. These characteristics include their slow growth, their ability to establish without nutrient addition, and their comparative drought hardiness if mulched at the time of sowing. Hence they may require less mowing, fewer fertiliser applications and less watering than many of the introduced grasses which have often been developed for the vastly different climatic environments and high resource input systems of the northern hemisphere.

The conservation value of re-establishing the otherwise dwindling native grassland communities is also high. In a recent CSIRO survey of 500 motorists 86% said that they thought it was important that roadside plants be native and up to 63% wanted to see native grassland communities restored. Natural grassland species have aesthetic attributes such as form, colour, texture and line which are distinctly Australian. The infestation of native grassland communities by exotic weeds, therefore, reduces their conservation value.

Native grasses may also be preferable to introduced species for roadside use for a variety of other ecological reasons. Native grasses have been reputed to be deep-rooted and suitable for soil stabilisation and erosion control; they may provide habitats for a variety of indigenous animals and niches in which trees and shrubs may establish; they may be less prone to invasion by weeds; and they may also constitute less of a fire risk in summer. Because fire can promote weed invasion (Bridgewater and Zammit 1979), the growth of a less flammable, summer-green native species such as kangaroo grass, *Themeda triandra*, instead of a summer-dry exotic grass, may also reduce the effect of weed invasion due to fire, though this theory requires investigation.

Native grasses may not only fulfil the three basic requirements of roadside vegetation i.e. soil stabilisation, weed control and aesthetic quality, but they may also raise the conservation status of the roadside corridor.

Obstacles to Revegetation

There are two major obstacles which can restrict the widespread use of native grasses for revegetation. The first is incomplete establishment technology and the second is the lack of commercially available seed supplies. While many of the factors affecting the germination and establishment of species such as *T. triandra, Danthonia spp, Stipa bigeniculata and Bothriochloa macra* were elucidated in the 1970s (e.g. Hagon 1976; Hagon and Chan 1977; Hagon and Groves 1977), this establishment technology has only recently been practised (Jefferson *et al.* 1991) and refined (e.g. Sindel *et al.* 1993) as the time of seed availability approaches.

It can be argued that native grasses should only be domesticated to the extent of collecting and cultivating local accessions in order to maintain the indigenous population of a particular area (this is recommended in the vicinity of pristine native grasslands) (Sindel and Groves 1990), but for large scale roadside revegetation programs in southern Australia, local material may no longer exist or be accessible, nor be able to supply sufficient quantities of seed. Native grasses generally produce relatively few seeds which are easily and irregularly shed, making seed harvesting difficult and expensive. There is a need, therefore, for the multiplication of seed under agricultural conditions; and, to be successful, this necessarily involves selection pressure, particularly for high seed production (Sindel and Groves 1990).

In the CSIRO Division of Plant Industry our approach to this problem has been to begin a process of selection and breeding ('domestication') for one of the cool-season wallaby grasses, *Danthonia richardsonii*, and for the widespread warm-season kangaroo grass, *T. triandra*. The aim of this work is to select varieties that will (i) produce large quantities of seed and (ii) will be suitable for mechanical harvesting and eventual commercial production. We are also concurrently refining germination and establishment techniques for these two species and have established long-term roadside trials to investigate their usefulness in land stabilisation and revegetation. Regeneration and seed production studies of the third component of temperate natural grasslands, namely the colourful native herbs, have also begun.

Domestication

The first domestication project on *D. richardsonii* is nearing completion. CSIRO has now entered into a commercial agreement with Heritage Seeds, a Melbourne based seed company, for the multiplication and sale of 'Hume' Wallaby Grass. It is anticipated that seed will be released onto the market in 1994.

The second project on *T. triandra*, funded by the Roads and Traffic Authority of NSW, was begun in 1989. Although presumed to be of tropical origin, kangaroo grass is widespread throughout Australia and is very variable in terms of its morphology, colour, response to environmental factors and its method of reproduction. Its distinctive flowering stems and seasonal colour changes make it a most attractive feature of the Australian landscape. Plants from a subalpine population with low, prostrate foliage (suitable for roadside vegetation) have been selected and bred on the basis of high seed yield, erectness and height of flowering stems. It is anticipated that the first variety of kangaroo grass will be finalised by mid 1993. The timing of its release onto the market will depend on our obtaining Plant Variety Rights and having a prospective seed company agree to bulk up the seed supplies for sale.

A third project on the evaluation and development of the colourful native bluebell, *Wahlenbergia stricta*, was started in late 1992 with support from the Australia Flora Foundation. Seed and ecological data for this and several other *Wahlenbergia* species have been collected from over 70 sites throughout southeastern Australia over the 1992/93 summer period so that plants may be cultivated and evaluated on

the basis of morphology and seed production in 1993. This and other broadleaf herbs such as the 'everlasting' daisies (*Helichrysum* and *Helipterum*) are common components of natural grasslands and can add colour and interest to revegetated areas of native grasses. They are also thought to play an important role in filling inter-tussock spaces and, by virtue of their diversity, may confer more ecological stability to the natural grasslands.

Germination, Establishment, Growth and Seed Production

In association with the Roads and Traffic Authority of NSW, sowings of wallaby grass have been compared with standard seed mixes (recommended by the RTA and parkland authorities in Canberra) in a roadside trial near the NSW-ACT border (Jefferson *et al.* 1991). That trial, now in its fifth year, has demonstrated that given the right environmental conditions, *D. richardsonii* establishes well from seed and, that at optimum densities, it can provide excellent virtually weed-free long-term cover.

The object of long-term roadside trials recently initiated on the new Western Freeway on the outskirts of Sydney and on the new Yass by-pass is to determine the ability of wallaby grass and kangaroo grass to establish and survive in the distinctly different climatic regions of the Southern Tablelands and coastal NSW; to measure the success of the establishment process; and to identify the optimum proportion of the two species in mixtures which produces a stable roadside grassland. Early results from these trials are promising.

The results of other recent experiments on the establishment of kangaroo grass show that for surface-sowing of seeds (such as is needed on steep roadside batters with a slope greater than 1:5) the awn of the seed must remain intact and suitable seedbed disturbance must be carried out in order to obtain satisfactory lodgement of seeds in the soil and germination (Sindel *et al.* 1993). Because awned seeds of kangaroo grass in contact with one another become entangled, separation must be maintained by mixing seed in kangaroo grass chaff as a filler at the time of harvest. In contrast, when sowing seed with a conventional drill on flatter areas, the awns must first be removed and the seeds must be sown at 1 cm depth or less to maximise germination and establishment. The application of a mulch appears to be warranted when soil moisture is likely to be limiting, but bitumen-coating should not be used as it interferes with the movement of awned seeds into safe microsites, and so also reduces germination (Sindel *et al.* 1993).

Given that kangaroo grass produces few seeds and that many of them are infertile (Woodland 1964), we began several experiments in 1993 to look at a broad range of factors, such as genotypic differences, pollen availability, nutrient and moisture stress and insect attack which may account for such infertility, with the aim of identifying and developing management strategies or breeding lines which maximise seed fertility in this species. These experiments are continuing.

Kangaroo grass takes up less soil moisture than the native wallaby grass and the two introduced species, perennial ryegrass, *Lolium perenne*, and tall fescue, *Festuca arundinacea*, (Figure 1). This indicates a reduced requirement for

irrigation, greater avoidance of stress during prolonged drought and, perhaps, the advantages of using kangaroo grass for revegetating water catchments where runoff needs to be maximised (Davidson unpublished data). We are also finding huge variation in the tolerance of kangaroo grass to acid soils, and this suggests that varieties could be bred with the specific purpose of revegetating particularly acidic sites.

Several experiments carried out under artificial conditions have elucidated the germination requirements of many of the herb species and a field trial is currently underway in Canberra in which the effects of time of sowing, depth of sowing and mulching on germination of *Wahlenbergia stricta, Helichrysum apiculatum, Helipterum albicans* and *Bulbine bulbosa* are being investigated.

Roadside Revegetation Techniques and Weed Control

Several different revegetation techniques for native grasses have been proposed depending on the species concerned. For example, Stafford (1990) has devised a technique whereby seed-producing tillers of kangaroo grass are cut during summer when some seeds are mature and the kangaroo grass hay is immediately spread as a thatch over the area to be revegetated. In the following spring when non-dormant, viable seeds are released from the seed head and are buried in the soil by the action of the hygroscopic awn, all the herbaceous weed growth is sprayed with a mixture of glyphosate and atrazine and burned several weeks later, thus stimulating germination of the buried kangaroo grass seeds. In order to check the growth of winter dominant plants a selective herbicide may be applied in the following autumn. Mowing in the next spring before the new culms are produced will also assist the grass to gain dominance which it should maintain thereafter. While this technique gives good results for relatively small areas and has been investigated further by McDougall (1989), it is largely inflexible in terms of time of sowing and is labour intensive. For large scale operations the more flexible, reliable and less labour intensive method of sowing 'clean' seed into a prepared seed bed (Sindel *et al.* 1993) is likely to be more suitable.

For a cool season species such as wallaby grass, an autumn sowing is likely to give best results whereas a late spring sowing when soil temperatures are rising will lead to the best establishment of the summer-growing kangaroo grass.

Effective revegetation with Australian native grassland species is often limited by the generally slow early growth of native grasses when they are in competition with more vigorous and exotic grass and broadleaf weeds stimulated to germinate at the time of sowing. In 1993 an Honours student from the University of Canberra began to evaluate the potential of several ecological methods for suppressing weed growth during the germination and establishment of native grasses for revegetation, including the broadcasting of seeds (versus drilling them in rows), increasing the planting density above that which may normally be recommended for establishing a stable grassland community, and adding to the seed mix a vigorous but short-lived cover (or nurse) crop such as cereal rye, *Secale cereale*. It is hoped that the 'nurse' crop will give rapid early establishment yet allow the natives to dominate in the second growing season.

Because the growth potential of annual weeds in particular is strongly determined by soil fertility levels, no fertiliser should be applied at the time of sowing. In recent work we have shown that native grasses such as *T. triandra*, and to a lesser extent *D. richardsonii*, respond little to increasing phosphorus levels (Figure 2) and, therefore, are likely to be at a competitive disadvantage with vigorous annual weeds. Thompson (1983) has even suggested that top soil should not be spread over the clay subsoil prior to revegetation because it usually contains large quantities of agricultural weed seeds and will increase the fertility level of the soil. Where non-selective herbicides can be applied before sowing and selective herbicides after sowing (Morgan 1989) then these will give the native grasses a competitive edge.

Conclusions

There is considerable demand in the community and amongst public authorities for native grass seed for all kinds of revegetation work. The challenge for the future will be to further develop the technology of seed production, establishment, and management of native grasses, and to develop varieties suited for seed production and revegetation. Stable natural grasslands on roadsides should help prevent the movement and infestation of unwanted weeds.

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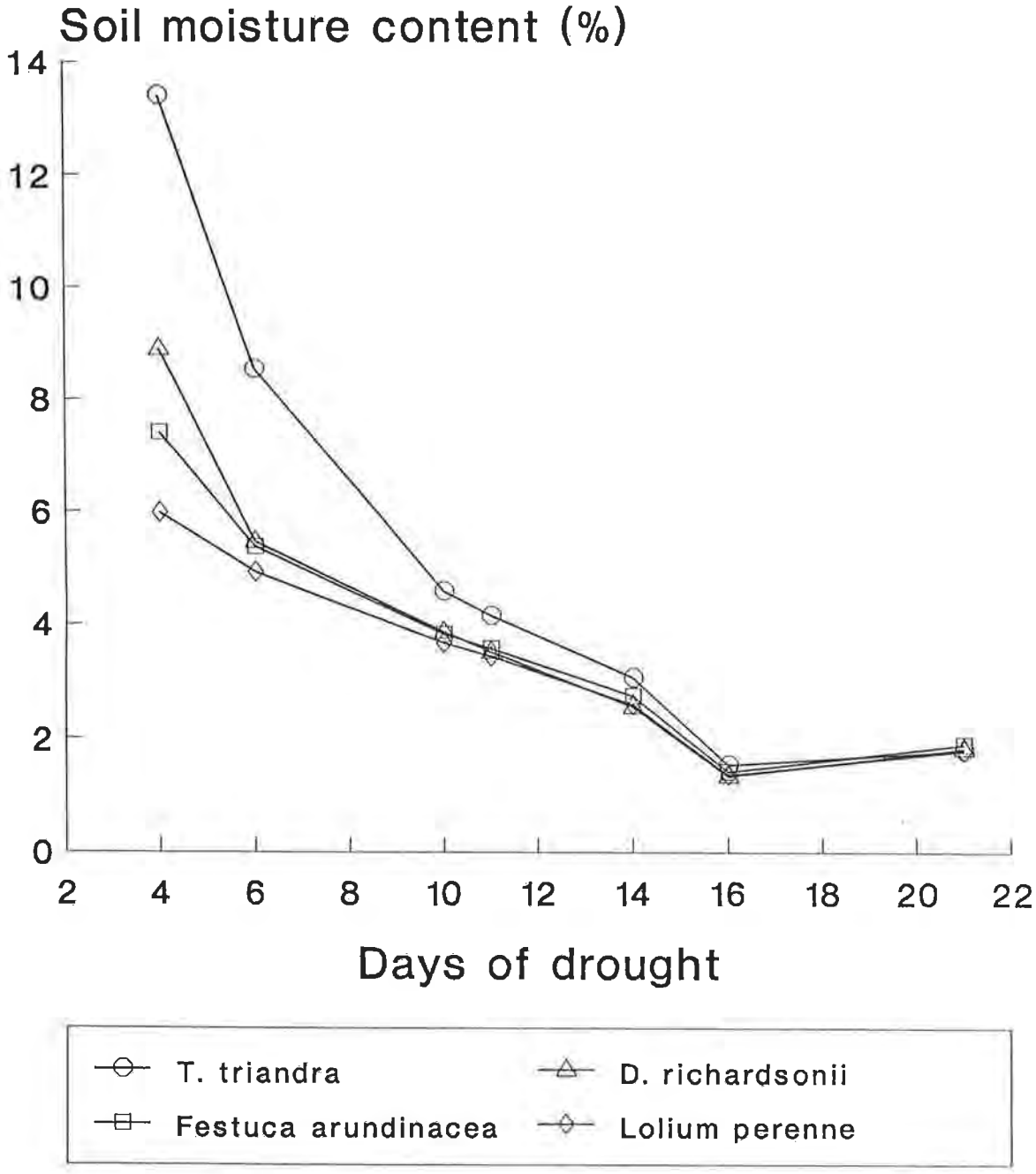

Figure 1 Soil moisture content after drought treatments to two native and two introduced grasses grown alone in pots (from Davidson, unpublished data).

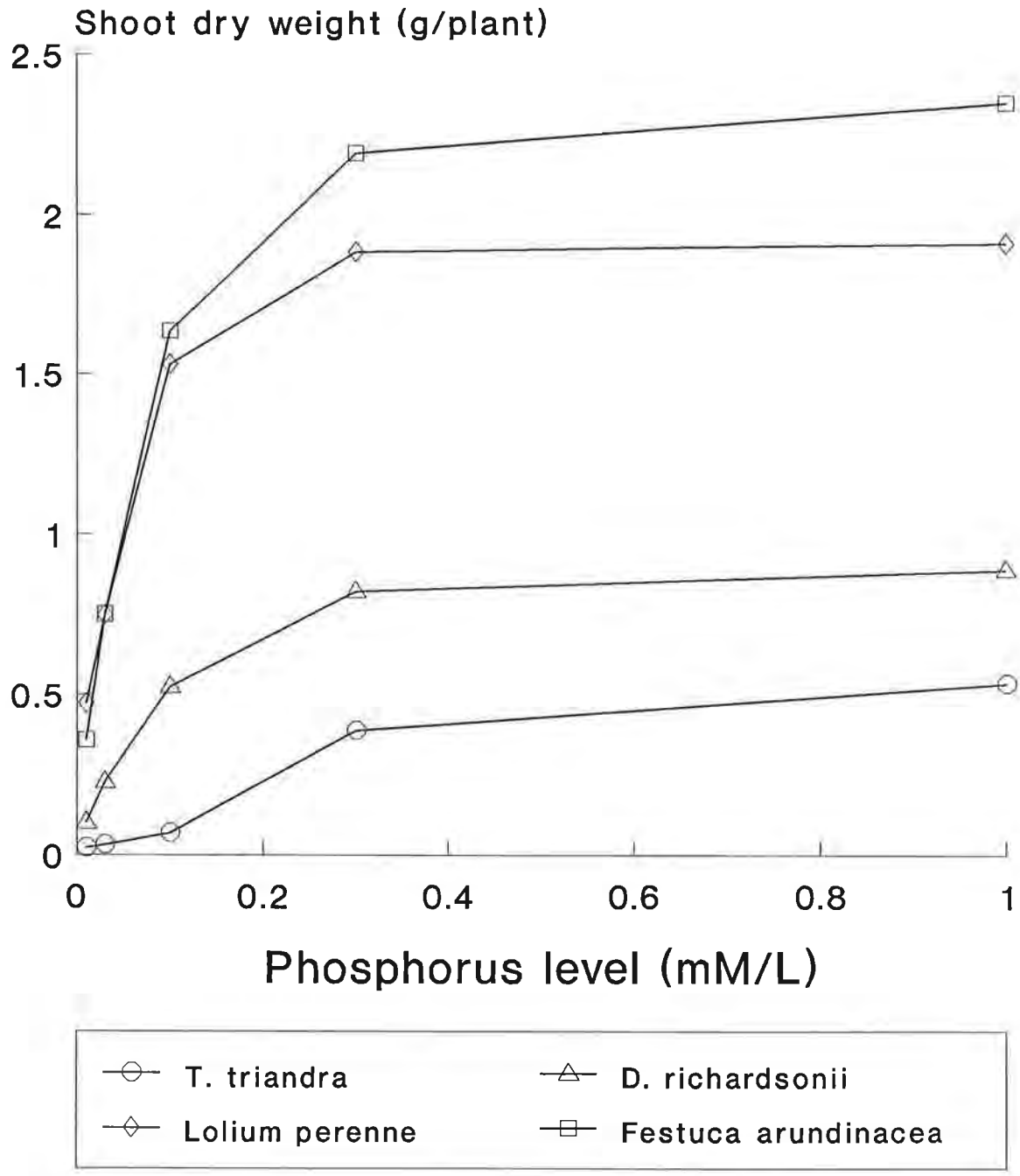

Figure 2 Effect of phosphorus applied in sand culture in pots on the dry weight of shoots of two native and two introduced grasses (from Reyenga, unpublished data).

COMPUTERISED WEED MAPPING

by Ken Hayes
Chief Weeds Officer
Coffs Harbour City Council

Since 1982, the Coffs Harbour City Council's Noxious Plants Section has been using a basic mapping system to record the location of the major noxious weed infestations throughout the Shire area.

The form of mapping used was to add lettratone symbols on stable based cronaflex to the Shire base map, with a different symbol for each noxious weed on various overlays.

These maps were then updated each year and noxious weed infestations were either added to or reduced.

These maps were of invaluable help in the preparation of the yearly noxious plants grant application.

Since the declaration of Giant Parramatta Grass however, a different form of mapping was required, as this noxious plant is endemic in almost every part of the Shire. The old mapping approach to this noxious weed was completely unsatisfactory because of the widespread infestations on almost every property in the City area, as well as adjoining Shires, and the varying densities of infestation on individual properties.

The first hurdle to overcome in this new mapping programme was to establish a density base, for which we could begin our mapping programme.

John Betts, our local District Agronomist, was asked to help. John and I decided to establish a five density classification for Giant Parramatta Grass - light, light to medium, medium, medium to heavy, and heavy.

Computerised Weed Mapping

We then spent a day or so going on to properties and putting this theory into practice, but also finding that individual properties could have 2 or 3 densities of Giant Parramatta Grass present over varying parts of the property.

Once the criteria had been established, then the whole Shire was surveyed and detailed information maps were formed. The information on these maps was then transferred to clean base maps, with the information density for each of the five levels colour washed in different colours onto these maps on almost every rural property in the Shire.

This work was completed in 1988.

At this stage it was becoming evident that the Giant Parramatta grass was taking up so much of my time - with inspections, mapping work, trial plot for various control measures, field days, plus other extension work, that if we were going to maintain this level of effort on one noxious weed, the level of effort on the other 15 noxious weeds found in the Shire would have to suffer.

After much consultation with Council and the Noxious Plants Advisory Officer, it was agreed to employ another inspector/spray operator for 7 months of each year to work solely on Giant Parramatta Grass, with the position to be self funding after several years from private works.

The temporary inspector/spray operator was appointed in September 1991. The new inspector's first task was to reinspect all Giant Parramatta Grass infested properties and reclassify the infestation density on each property using the original five classification criteria, as the information on the existing maps was now over two years old.

On completion of this phase of his duties, he then transferred the information to the colour washed base map information. We were then informed by Council's Information Services Department that they had just purchased the software and hardware for a geographic information system (G.I.S.) and they could transfer our existing infestation maps to the G.I.S.

Council's Information Service Department has been able to assist the Noxious Weeds Department with this new G.I.S. technology in the following ways.

They are able to produce from the G.I.S. plots of the City showing current properties, Lot numbers and their property ID numbers. Noxious weed staff are then able to more quickly and easily identify properties infested with noxious plants.

After identifying the properties, noxious weeds staff can then mark on these maps the extent of the noxious plant and the level of infestation. This information is then captured in the G.I.S. as a map layer. Once this information is captured as a map layer, there is the capability to do all sorts of things with this information, i.e. map layers can be interrogated to calculate the number of hectares infested for each noxious weed and even the number of hectares for each density of a particular noxious weed. Hard copy maps can be produced by either pen plotter or colour postscript printer to show areas of infestation.

Programmes can be used to notate the property records (held in the textual data base) to show that this property is infested by perhaps more than one noxious weed.

Once the property has been identified, the system can be programmed to automatically produce a standard letter of notification to the owner of the infested property.

With the capacity to store thousands of map layers in the G.I.S., a history record can be built of map layers year by year to show the changes taking place. You can then see at a glance whether you are winning or losing the battle.

Council's G.I.S. is call Geographic Data Management System (G.D.M.S.) and currently operates on a Wang VS (main frame). The data is accessed via P.C.s linked to the VS. All data is stored on the VS. The G.I.S. software was developed in the U.S.A. and is marketed and further developed by Datamation Software Systems in Sydney.

G.D.M.S. can store up to 65535 map layers and the geographic data base is fully integrated with the textual data base allowing flexibility in how data is captured and where it is stored.

Council currently has an investment of approximately $180,000 in the G.I.S. software, with 11 mapping capable P.C. workstations (includes 2 editing P.C.s with 20 inch monitors and 9 other P.C.s for general access of mapping data by staff), an AO digitizer and A1 plotter and A3 colour postscript printer.

One development that has enormous potential in the G.I.S. environment is the use of G.P.S. (global positioning system), in the accurate capture of data in the field and then download that data directly into a G.I.S., i.e. to be able to walk around the perimeter of a noxious weed infestation with a hand held G.P.S. and then to have this accurately recorded in the G.I.S.

With the development within the G.I.S, the amount of data and the interrogation of that data is only limited by the resources you have available.

22 March, 1993.

Onopordum thistles

Three *Onopordum* species are important pasture weeds in southern NSW, these are Scotch thistle, *O. acanthium* L., Illyrian thistle, *O. illyricum* L. and stemless thistle, *O. acualon* L. These thistles are native to Europe, Asia Minor as well as western and central Asia.

In July 1990 the first biological control agent for control of *Onopordum* thistles was introduced into quarantine at CSIRO, Canberra, for host specificity testing. The agent is a weevil, *Larinus latus* L., which destroys seeds of *Onopordum* spp. This agent proved to be host specific and was released in November 1992.

Fireweed, *Senecio madagascariensis* Poiret

Fireweed, *S. madagascariensis*, is a native of southern Africa and Madagascar. In NSW fireweed is now a major weed in pastures east of the Great Dividing Range. At present it covers hundreds of thousands of hectares and is estimated to cost the agricultural community in excess of $ 2 million dollars per annum. These losses are made up of decreased pasture production due to plant competition and reductions in the growth rates of cattle and horses caused by sub-clinical doses of the pyrrolizidine alkaloids naturally occurring in the plant. Studies are under way to determine the arthropod fauna of fireweed and native *Senecio* species in an effort to determine the suitability of fireweed as a candidate for biological control. The most common insects found on fireweed in NSW include a leaf feeding beetle, *Chalcolampra* sp. and two moths, magpie moth, *Nyctemera amica* (White) and blue stem borer, *Patagoniodes farinaria* (Turner). Two species of leaf and stem mining flies and two species of flower head feeding flies are also commonly found. Approximately 50 species of insects and two rusts have been recorded on *Senecio* spp. to date. This is a cooperative project between NSW Agriculture and the University of Sydney (Applied Plant Ecology Research Unit). The project is partially funded by the Dairy Research and Development Corporation.

Variegated thistle, *Silybum marianum* (L.) Gaertner

Variegated thistle is an important pasture weed in NSW. This thistle originated in the Mediterranean region, Asia Minor and the Soviet Union.

Two releases of a European strain of *R. conicus*, for control of *S. marianum*, were made in Victoria in 1988 and 1989 but did not establish.

Bathurst burr, *Xanthium spinosum* L.

Bathurst burr is a native of South America and is now a common weed throughout NSW. The burrs are a major contaminant of wool.

A naturally occurring pathogen, *Colletotrichum orbiculare* (Berk. et Mont.) v. Arx, is being developed as a mycoherbicide for control of Bathurst burr. The pathogen is being developed commercially by Sandoz in conjunction with NSW Agriculture.

In 1991 a feasibility study into possible biological control of Bathurst burr, conducted by CSIRO, showed that a number of potential agents were present in Argentina.

Noogoora burr, *Xanthium occidentale* L.

Noogoora burr is a native of North America and is now a common weed in NSW. The burrs are a major contaminant of wool and plants can be serious competitors in pasture and summer crops.

NSW Agriculture is looking at the use of a combination of pathogens for control of Noogoora burr.

Boraginaceae

Paterson's Curse, *Echium plantagineum* L. and related species

Paterson's curse is a common weed of degraded pastures, roadsides and neglected areas in winter rainfall districts. It is present in other areas as well but is usually less of a problem except in areas which are bare at the time of Paterson's curse seedling germination. This weed is often the dominant species in grazing land in southern Australia. Paterson's curse reduces the quality and quantity of useful fodder and the plant is toxic to stock.

A biological control program for *Echium* spp. began in 1972. Echium leaf-miner, *Dialectica scalariella*, was first released in winter 1980 but failed to establish, further releases being prevented by a High Court of Australia injunction (Delfosse 1985). Releases of the moth began again in 1988. The moth has now established throughout the Paterson's curse areas in NSW.

Two other biological control agents are at present being released for control of *Echium* spp. They are the root feeding Echium weevils, *Ceutorhynchus geographicus* (Goeze) and *C. larvatus* Schultze. According to Vayssières and Wapshere (1983) these insects are more damaging than other organisms found on *Echium*. Mass rearing for large scale releases is being carried out by CSIRO Canberra and at WBCU facilities located at Tamworth, Yanco, Orange and Mudgee. *C. larvatus* has proved difficult to rear and rearing of *C. geographicus* has only recently commenced. Only small scale releases of both weevils have been made to date.

Further biological control agents for Paterson's curse are being imported into CSIRO quarantine facilities in Canberra.

Blue heliotrope, *Heliotropium amplexicaule* Vahl

Blue heliotrope is a native of South America and in NSW it is a coloniser of roadsides, old cultivation areas and pastures. It is causing a lot of concern in the Coonabarabran area.

In 1992 a feasibility study into possible biological control of blue heliotrope showed that a number of potential agents were present in Argentina.

Common heliotrope, *Heliotropium europaeum* L.

Common heliotrope is a native of southern and central Europe, western Asia and northern Africa. In NSW it is mainly a problem in inland areas being most common in the south of the State. Common heliotrope is toxic to cattle, sheep and horses.

The heliotrope rust fungus, *Uromyces heliotropii* Sredinski, is a potential agent for control of common heliotrope. The first release of this rust was made at Jugiong, NSW, by CSIRO in January 1991. The rust has now been released at a number of sites and appears to cause some damage.

Clusiaceae

St John's wort, *Hypericum perforatum* L.

St John's wort is a native of Europe, western Asia and North Africa. In NSW it is mainly a problem of the Tablelands and Western Slopes. St John's wort causes photosensitisation and chemicals from the plant may also affect the central nervous system of animals causing loss of condition.

St John's wort aphid, *Aphis chloris* Koch, reared by CSIRO, have been distributed throughout most areas of St John's wort in NSW. Some of the distribution was carried out by the WBCU. This insect causes some damage but plants tend to recover. Many releases of the mite, *Aculus hyperici* (Liro), another biological control agent for St John's wort, have been made since its initial release in 1991. The mite appears to have caused significant damage at a number of the release sites.

Fabaceae

Scotch broom, *Cytisus scoparius* (L.) Link ssp. *scoparius*

The native range of Scotch broom extends western Europe to central Russia and possibly to the Azores. In Australia, Scotch broom is a serious competitor in bushland and pasture. In bushland it competes with native flora leading to loss of understorey plants. In pasture it can form thickets that prevent grazing by animals and restrict access to streams. Broom was introduced to the northern part of the Barrington Tops in the 1840s. It has now spread over 10,000 ha in this area making this the largest broom infestation in Australian. Other infestations occur on the Southern and Central Tablelands of NSW, and in high rainfall areas of Victoria, South Australia and Tasmania. This underrated weed is still spreading in Australia. Scotch broom is also a major weed, occupying hundreds of thousands of hectares, in New Zealand and eastern USA.

Herbicides, burning, physical removal and grazing using sheep or goats are techniques currently used in attempts to control Scotch broom. Grazing of broom

infested areas with sheep and goats can be used in most pasture situations except where wild dogs are a problem. These control techniques are not considered to be suitable for environmental areas and many are not suited to forested areas. Previous attempts at chemical control in the Barrington Tops have met with little success due to large reserves of long-lived seeds in the soil and the cost of herbicides, including associated application costs.

Attempts to biologically control Scotch broom began in 1990 (Hosking 1991). In December of that year the small twig mining moth, *Leucoptera spartifoliella*, was imported from New Zealand. The moth is actually of European origin and reached New Zealand accidentally. The main reason for using moths from New Zealand is that this insect has an annual life cycle and insects from New Zealand are already in phase with Australian seasons. Potential hosts for this insect were evaluated by WBCU staff based at the CSIRO quarantine facilities in Canberra. The moth was only able to complete development in Scotch broom and some ornamental broom hybrids. This moth was released in the Barrington Tops and Shoalhaven River areas in February 1993.

A second potential biological control agent, a psyllid, *Arytainilla spartifoliella* (Förster) was brought into quarantine in January 1993. Host specificity testing of this insect is being carried out at present.

The cost of this program has been met by NSW Agriculture, CSIRO, NPWS of NSW, Forestry Commission of NSW and Hunter Pastoral Company.

Lamiaceae

Horehound, *Marrubium vulgare* L.

Horehound' s native range extends from western Europe to central Asia and North Africa. In Australia, horehound commonly occurs along fence lines, roadsides, around buildings, on sheep camps, in degraded pasture and occasionally in cropping land.

A biological control program for horehound began in 1989 with European studies commencing in 1990. European studies are being carried out by CSIRO and quarantine studies in Australia by KTRI. A defoliating moth is at present in quarantine at KTRI. A number of other insects have been identified as potential biological control agents.

Polygonaceae

Docks (*Rumex* spp.)

Clustered dock, *Rumex conglomeratus* Murray, curled dock, *R. crispus* L., broadleaf dock, *R. obtusifolius* L. and *R. pulcher* L. are natives of Europe and Asia while swamp dock, *R. brownii* Campd. is a native of Australia. In NSW docks are common in wetter areas. Docks are weeds of arable, horticultural and pastoral

lands and may also be problems in recreational areas such as playing fields, lawns and gardens.

The clear wing moth, *Chamaesphecia doryliformis* (Ochsenheimer), was released in early 1991 at Yanco Agricultural Institute. This moth was supplied by WADA. *C. doryliformis* larvae bore into the roots of mature plants often killing them. This moth has been released at many sites in NSW and appears to have established at some of these.

Pontederiaceae

Water hyacinth, *Eichhornia crassipes* (Mart.) Solms

Water hyacinth originates in the Amazon River basin of South America. In NSW it is common in coastal rivers. Dense infestations prevent swimming and boating as well as removing much of the oxygen from the water and increasing water loss through plant transpiration.

A weevil, *Neochetina eichhorniae* Warner, has become an effective agent in some areas of Queensland but is less effective in NSW. A second weevil, *Neochetina bruchi* Hustache, is being reared in NSW by NSW Agriculture using material supplied by CSIRO. The first releases of this insect were made at Grafton and Maitland in December 1990. Many releases have been made since and the weevil appears to have established at a number of release sites. However, it is too early to estimate future levels of damage caused by *N. bruchi* as populations are still establishing.

Rosaceae

Blackberry (*Rubus* spp.)

In NSW blackberry is a major problem of pastures and forests on the tablelands and adjoining regions. Blackberry is a declared noxious plant throughout NSW and most of Victoria. In 1984 it was estimated that blackberry was causing an annual loss of $42 million due to reduced production and the cost of control.

There are 8 species and 1 hybrid which are referred to as blackberry in NSW. The most common blackberry species is *Rubus discolor* Weihe & Nees which is also referred to as *R. procerus* Muller. All species referred to as blackberry in NSW are of European origin. *R. discolor* is the species targeted by a strain of the rust, *Phragmidium violaceum* (Schultz) Winter, which has recently been released in NSW.

A strain of *P. violaceum* was found in Victoria in 1984 (Bruzzese and Field 1985). It had apparently been introduced illegally. The early strain of this rust was not very effective on the main blackberry species in NSW and Victoria. The rust was effective on some types of blackberry and these clumps decreased to scattered plants over a 4 to 5 year period.

A strain of *P. violaceum* selected for control of *R. discolor* was released early in 1992 at a few sites in NSW. This rust strain came from Europe via quarantine facilities at KTRI. The rust is the most damaging strain for *R. discolor* and was first released in Victoria in 1991. Further releases were made on the Northern Tablelands of NSW during 1992 and into 1993. A field day was held in the Hanging Rock area near Nundle in January 1993. At this field day landholders were encouraged to transfer rust infested blackberry cuttings to blackberry infestations near or on their properties. About 300 people attended the field day and spread rust infested blackberry from the Queensland border to the Blue Mountains and inland to the Warrumbungles. The rust is likely to be most effective in high rainfall areas so a number of the releases may cause little damage. Use of a field day to spread biological control agents is less expensive for those breeding and establishing the agents rather than delivery to all those requesting agents.

The new rust strain should assist landholders with control of blackberry but it is important they continue current control programs as there is no guarantee that the rust will work on all properties.

Zygophyllaceae

Caltrop, *Tribulus terrestris* L.

The native range of caltrop extends from the Mediterranean region through Asia and Africa. Caltrop is widespread in inland NSW and is an important weed infesting vineyards, irrigated cotton, overgrazed pastures and neglected areas.

The *Tribulus* group is at present being studied to determine if there is a possibility of the native species being sufficiently different from *T. terrestris* to warrant a biological control program for this species.

DISCUSSION

A number of weeds are at present targets, or may be targeted in the near future, for biological control. A number of agents have been released and damage caused by them has varied across the state.

Biological control will not eradicate target weeds but will reduce problems caused by those weeds.

Assessment of the impact of natural enemies and their role in the population dynamics of weed species should be a priority in weed biological control programs. This knowledge makes sure that the most damaging agents are brought into quarantine and tested for host specificity. It has been estimated that each untried agent takes at least 3 scientist years from selection through testing to establishment (Julien 1987) so it is desirable that the most damaging agents are selected. Although detailed overseas studies are expensive they are cheaper than testing and release of a number of agents which have little impact.

Weed biological control programs are expensive and would not be possible without continued support from State and Federal authorities and various rural industry and environmental funds. Unfortunately most programs are long term and often funding groups prefer to see results in the short term. The long term nature of biological control programs and the economic and social benefits of successful programs needs to be continually emphasised.

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BIOCONTROL OF WEEDS IN QUEENSLAND: RECENT DEVELOPMENTS

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Introduction

As you are all aware, biological control of weeds has a long and sometimes even successful history in Queensland. It is not my intention to re-capitulate this; there are many published reviews available. We have been fortunate that the current atmosphere of cut-backs has not so far affected us in the Land Protection Branch, and we have maintained our full quota of scientists, even gaining one contract entomologist.

The development of our Tropical Weeds Research Centre in Charters Towers since 1985, the increasing development in the north of Queensland, and increasing links with Asian countries, have all tended to strengthen the emphasis on northern problems, weeds of the true tropics rather than the sub-tropics and temperate zone. As a result, rather less of the work in Brisbane is relevant to NSW than previously. For example, CSIRO in Indooroopilly is working on *Mimosa pigra*, *Sida acuta* and *S. rhombifolia* for the Northern Territory. We have just started surveys for the biocontrol of *Cassia (Senna) obtusifolia* in Queensland and may be working together with the NT on biocontrol of *Jatropha gossypifolia* (Bellyache bush) if they get finance. We continue to work on *Mimosa invisa* and rubbervine *Cryptostegia grandiflora*. All these are purely tropical weeds, of concern only to the 3 northern states, and I will not discuss them here.

My talk today will be a brief summary of progress in the last few years and future prospects, concentrating on the weeds of interest to NSW.

NEW DEVELOPMENTS

The Cooperative Research Centre for Tropical Pest Management

A new development of great importance to us all has been the establishment of the Centre for Tropical Pest Management as one of the first of the Cooperative Research Centres set up by the Hawke government in 1991. The CTPM has 4 participating organisations, the Entomology Divisions or Departments of the Queensland Department of Primary Industries, CSIRO Long Pocket, and the University of Queensland, and the Alan Fletcher Research Station. The overall objective of the CTPM research program is to increase our understanding of insect/plant ecology and relationships, and then use this knowledge to devise improved pest management strategies, for both insect and plant pests. Within this broad aim, there is a strong section involved in biological control of weeds, and it is our hope that the CTPM will result in greater co-ordination and depth to our research as well as a better use of resources.

There is also a strong education component and scientists from both CSIRO and QDL will be increasingly involved in lecturing to university students, and supervising pre- and post-graduate projects and research degrees. A Graduate Diploma in Tropical Pest Management is being offered by the University, in which students can choose courses to suit their requirements, and could specialise in biocontrol of weeds if they wished. The CTPM is also offering a 2-week intensive course in Biocontrol of Tropical Weeds, aimed at experienced and qualified agricultural scientists who need practical training in this field. The first course for 7 to 10 participants mainly from overseas will take place in May this year, and the next is scheduled for March 1994.

CURRENT PROGRAMS AT THE AFRS

Fireweed *Senecio madagascariensis*

Fireweed continues to spread slowly north into Queensland, with occasional plants found in Brisbane. It is common in parts of Beaudesert shire, behind the dunes in South Stradbroke, and is turning up along roads south of Brisbane. It is still sprayed whenever found, except in the Beechmont area where it is beyond control. Interestingly, it can be reliably distinguished from the native *S.lautus* by the root system, as well as by features of the flowers and seed. *S.lautus* occurs in sand dunes and in the Lamington plateau in the south-east and is seasonally common and even weedy in central and western Queensland. Contrary to what one might expect, *S.madagascariensis* has **shallow** roots, while *S.lautus* has a deep tap-root system. This difference seems to hold true in all situations and soil types.

The biological control program is being funded by the MRC, under a contract which commenced in July 1990 and finishes in July 1994; so far we have not requested an extension. Two lepidopterous insects have been imported from Madagascar, a flower-feeder *Phycitoides sp.* and a stem and tip borer *Lobesia sp.* The former was going very well but the quarantine colony died out in January, apparently because it doesn't tolerate excessive heat or possibly because long summer days sent it into diapause. It appears to be specific to *Senecio* and probably to the *S.lautus* complex. At this stage we are not planning to re-import it, partly because if it can't tolerate Brisbane summer heat, it may not be much good to us. *Lobesia sp.* is currently being tested; so far, indications are that in large cages and therefore probably in the field, it will be restricted to the *Senecio lautus* complex of species. In small cages, however, eggs are laid and larvae develop on a range of related plants, and the situation is still not clear.

There are a number of insects from South Africa which could be imported and tested, but this work has been delayed by the drought in South Africa and the desire to complete testing on *Lobesia* first.

Parthenium

After a long period of little change, there have been some recent developments in parthenium biocontrol. The rust disease *Puccinia abrupta* was field-released in winter 1991 and again 1992, but in both years conditions were very dry with very

little parthenium around. The rust established and spread locally where there was some moisture, but did not survive the summer. In irrigated parthenium at Brisbane, the rust re-appeared the following spring, and there seems no doubt that it can survive and increase if weather conditions are suitable, ie with substantial rain falling in late summer or in winter. Because of the very dry conditions in central Queensland over the last 2 years, it is impossible to predict the likely overall effect the rust may have.

Two new insects are also being released or about to be released. The Argentine stem-boring moth *Platphalonidia mystica* has a life cycle very similar to the Mexican moth *Epiblema strenuana*, but bores in the stem at the axils rather than forming galls. It is the same size but light grey, almost white in colour. The Argentine moth lays many fewer eggs than *Epiblema*, but survives drought better and comes out of winter diapause in response to rain rather than temperature, and it is hoped might be present when *Epiblema* is absent. Field releases of the moth started this spring and are continuing, but it is too soon to know if establishment has occurred.

The other new insect is a stem-galling weevil from Argentina, *Conotrachelus sp.* Adults are small, nocturnal and feed on the leaves, and the larvae form stem-galls. Again, it is very similar to the Brazilian weevil *Listronotus setosipennis*, which is established in very limited areas of central Queensland. Permission for field releases of the Argentine weevil is expected soon, and releases will begin immediately.

Another new development is the re-appearance of the Mexican ladybird beetle *Zygogramma bicolorata*. This black and white beetle is a familiar sight on annual ragweed from Brisbane to Lismore, with both adults and larvae feeding on the leaves. The beetle can leave plants completely defoliated over small areas, but more usually the beetles are not abundant enough to cause significant damage.

It is less known that the beetle originally came from parthenium, and from 1980 to 1983 was released on parthenium in central Queensland in very large numbers. There were no signs of establishment except at one site in the south of the parthenium area, where larvae and adults were found over several hectares 12 months after release. After that, no more were seen until in 1990, 7 years later, some adults were found in the same area. Adults continued to be seen with increasing frequency, until in January this year there was a massive outbreak in the area, with millions of beetles leaving the plants completely stripped and dying in patches of 2 to 3 ha. The beetle is now found over a radius of 50km or more, and we are waiting with interest to see what will happen next year. Adult beetles collected in the outbreak have been released in other parthenium areas. Laboratory studies are planned to see if the beetles have changed over the 10 years, to become better adapted to central Queensland conditions.

Lantana

The QDL continues an active program of biocontrol for lantana. A review of the insects established in Queensland as a whole, together with a detailed study of the

impact of the insects in south-east Queensland, has been started as a PhD project by one of our entomologists.

New insects continue to be imported from Brazil and from Mexico. A leaf-webbing moth *Pyramidobela sp.* from Brazil, which feeds on creeping lantana as well, has just been cleared for release. A leaf-feeding beetle from Brazil *Charidotis pygmalea*, also feeding on creeping lantana, is still waiting for release clearance. Host-testing is about to begin on 3 new insects from Mexico. These are a membracid *Aconophora compressa*, a mirid *Adfalconia sp.*, and a stem-boring cerambycid *Aerenicopsis championi.* This latter is very damaging and, if it can be successfully reared, offers more promise of control than the others.

At our request, the IIBC in the UK undertook a survey of pathogens attacking Lantana in South and Central America, and found many potentially useful agents. Unfortunately, further work on these is expensive, about $200,000 per agent tested, and we cannot obtain finance. Lantana has been a major weed for so long that the rural community no longer complains about it, yet there is scandalously little real information on the economic cost of the weed, and it is hard to get support or hard data when applying for finance. Approaches have been made to the NSW Department of Agriculture and the ANPWS for finance.

Bitou Bush

Within Queensland, Bitou bush is being eradicated using sprays, so our biocontrol program is limited to support of the program in the southern States. Importation and testing of new insects is undertaken by the KTRI, and QDL is responsible for rearing and releasing the insects for the coastline from the NSW border to the Clarence River. There has been successful establishment of *Comostolopsis germana* at all sites, but little spread between sites except at Fingal. At this site the moth is found up to 5 to 6 km from the release site and is spreading fast, with about 70 larvae per sq m. It seems that exposed sites are better, as there are fewer predators, chiefly ants and spiders, and the plants are drought-stressed which seems to favour the insect. The mass-rearing and releasing will continue until the money runs out in Dec 1993. Seed production has been reduced by 50 to 70% at Wooyung and Fingal.

John Cronin who is doing the work intends to import the flower-feeding tephritid *Mesoclanis polana*, a specialist on *C.monilifera* ssp *rotundata* rather than ssp *monilifera*, for testing at AFRS; we have the permit but no insects, and are waiting to hear from KTRI.

Groundsel bush *Baccharis halimifolia*

There has been no new activity with insects for this weed, and none is planned in the near future. The gall midge *Rhopalomyia californica* is ineffective in most situations, and studies have shown this to be due to parasitism. In cool conditions, the parasite is least effective and the midge may reach damaging numbers. The stem-boring moth *Oidaematophorus balanotes* is now widespread and increasing,

and is causing significant damage in some areas. Ants remove the young larvae and this can restrict it.

Our biocontrol effort for this weed is now concentrating on pathogens, a number of damaging ones having been found in Florida where the weed is native. Dr Charudattan of the University of Florida is currently testing a rust *Puccinia evadens* which is both specific and damaging, and trying to establish the life cycle of another fungus which is much more damaging but whose biology and life-cycle is not well understood.

FUTURE DIRECTIONS

Funding

Funding becomes more and more difficult each year. Project budgeting and Performance Planning means that costs cannot be "carried" by other work; in particular, supervision by senior staff has to be costed in, and so does the use of glasshouses and quarantine insectary. These latter are very expensive, about $100,000 per year per project. Previously, outside funding agencies had been asked to pay for extras only, such as extra staff, materials, travel etc. All other costs - facilities, maintenance, supervision, project management, and so on - were carried by QDL. Now that funding agencies are being asked to pay the real costs of projects, $3-400,000 a year for a biocontrol program, they are refusing funding. Yet if a weed such as lantana is costing the community millions per year in lost revenue as well as control costs, the cost of a biocontrol program is trivial, and is far outweighed by the potential benefits.

However, in order to support funding requests, we do need good data on the cost of weeds to the community. Too often, the rural community lobbies for control programs against particular weeds, but fails to obtain or record hard economic data on the cost of the weeds. This data may need to be paid for, by hiring consultant economists, but this is a necessary expense in order to obtain funds for further research. For example, we need $60,000 immediately in order to continue the work on lantana pathogens, which offer the best chance of permanent control of this weed. Lantana has been a major weed in Queensland and NSW for over 90 years, yet there is no proper economic analysis of the cost of lantana to the grazing or dairy industry, let alone to the environment. I would urge rural industry and local government to assist us in our efforts by obtaining and supplying this kind of supporting economic information.

EXPECTATIONS OF BIOLOGICAL CONTROL

H J Milvain
Noxious Plants Advisory Officer
NSW Agriculture
Yanco

Biological control has been practiced since primitive man first turned to agriculture and has its origins in early study of natural history.

In New South Wales with the exception of Galvanised burr and Sifton bush all of the problem weeds which are noxious have been introduced from overseas. Areas which have contributed to the noxious weed flora are Europe, North and South America and Africa.

Most of today's problem plants were introduced as garden plants by the early settlers without their natural enemies because of the long duration of the sea journey to Australia.

Early weed control was the traditional hand pulling, hoeing or other physical means. Early spraying used chemicals such as arsenic pentoxide, sulphuric acid and salt which were highly toxic to the plants, humans and animals.

The earliest development of biological control was recorded in the late 1770's, with the Chinese utilising insects to control other insect pests prior to this.

The first natural enemy to be established by moving from one country to another was the mynah bird, from India to Mauritius to control locust. The cochineal insect *Dactylopius Ceylonicus* was introduced to India from Brazil in 1795 on the belief that it was the commercial strain which is used to produce red dye. The insect spread and was found to control Smooth Tree Pear over a large area.

In Australia effective biological control has been used since 1925 when *Cactoblastis* was first liberated to control prickly pear (*Opuntia spp.*), it is this successful program that today's society uses as a yardstick to measure the success of any new program.

But it took more than 6 years before the Cactoblastis made any significant reduction of the Prickly Pear infestation and even today is still containing the Prickly Pear at an economical control level.

Today's biological control programs undergo a very rigorous procedure to ensure that the agent is effective on the nominated target species before being released.

To be considered as a control agent in any bioprogram the target plant species must be first studied in the country of origin to ascertain if there are any natural enemies which are having a controlling effect on it. Once an agent is identified it then must undergo stringent host specificity testing to ensure that the target species only is attacked and not other commercial or native plant species.

This work could take up to 10 years before a field release is made.

Any of the possible control agents which could become a pest itself, is unsuitable and would be discarded from the program. Only those organisms being studied in a program then would continue to be researched as to their suitability for release as a control means.

One area of a biological control program that most people do not take into consideration or disregard as being important when condemning a program as being a failure is the length of time the weed has been flowering and seeding in any given location.

Plants like St Johns Wort, Paterson's curse and Dock are prolific seeders and any program that would reduce seed set would not cause any significant plant number reduction because of the soil's seed population, but the agents that have been released are not likely to cause any plant number reduction under 5 years in any of the current biological control programs.

With most of the current programs one has to explain not only the biology of the target plant but also that of the organism so that the perception of control can be understood.

It is our duty as weed control agents firstly to understand the biology of both the target plant and organism that is being used as a control means and secondly be able to inform our clients of what can be expected and achieved from any biological control release.

This process is very similar to what is currently known that has made the use of herbicide easier because if you apply herbicides at the target plants wrong stage of growth it is likely to fail and also be uneconomical.

In other words, the use of herbicides as a short term control means which is causing unknown damage to the environment whereas biological control is environmentally friendly and is a long term approach to control in those areas and locations where the chemical means is uneconomical.

In conclusion, since the first release in 1795, worldwide there has been 174 projects to control 101 weed species. Of the 174 projects, 68 were a success and led to some level of control of 48 weeds.

Finally, know your target plants biology and be able to know what and how the organisms effect the target plant enable a better understanding of what biological control is all about.

References

1990 Agnote DP1/2 Biological weed control, R Dyson L Smith
1980 The Prickly Pear Pest in NSW
1992 Biological Control of Weeds, A handbook for practitioners and students, K L S Harley and I W Forno.

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WOODY WEED CONTROL

R Fagan

Du Pont (Australia) Limited
168 Walker Street, North Sydney 2060, Australia

INTRODUCTION

1 Woody Weeds

A weed is plant that is not wanted where it happens to grow. Weeds can include

1 Weeds of productive crops, pastures and forests. These may reduce the quality or the value of production.

2 Weeds or ornamental, amenity and sporting areas. These may reduce the recreational value, beauty or useful access, and usefulness of these areas.

3 Weeds of roadsides, rights of way, industrial situations, water ways and other areas. These weeds can interfere with the use and may create fire and other hazardous risks in these areas.

Often these weeds which may be noxious weeds, woody weeds or others, were introduced from European or other environments. For example in 1803, just 15 years after the first fleet arrived Governor King listed 292 introduced plants. Of these at least nine subsequently became important noxious weeds including Gorse, Scotch Broom and Sweet Briar. Thistles had also been noted to cause 'great injury and loss ...' by Government gazettes written in 1850 in both NSW and South Australia.

Woody weed control

Good weed control in any situation will always depend on the following factors.

- Good management, including the improvement of crop or pasture vigour.
- Good hygiene, which can ensure seeding or other infestation methods are suppressed.
- Crop or pasture rotation.
- Reduced soil disturbance and weed seed germination.
- Management by grazing, competition, improved soil fertility or pH, improved soil drainage.

Cultivation can help to control weeds in some situations, or help spread weeds in others via seed dispersal, soil damage and erosion. Other

Gorse, Lantana, Blackberry (coastal) and St Johns Wort and several other species.

- For specific weed requests on registration or permits we are always pleased to assist.

- Pasture selectivity trials are used to update labelled tolerant and susceptible species.

(c) **Weed wiping of key weeds using carpet wipers (unregistered in NSW)**

Using Victorian research on bracken fern, a carpet wiping mixture has been developed per 25 litre container which is the normal container used on small carpet wipers. This includes:

22 litres of water
3 litres of mineral oil (e.g. Caltex Sprayplus)
60 grams Brush-Off

Benefits of the carpet wiper technique includes:

1 **Substantially reduced costs** and rates of herbicide used per hectare. For example the boom spray rate of Brush-Off per hectare is 60 grams per hectare. Weed wiping tests on dense bracken indicate 30 grams per hectare of product is used. On moderate to light bracken infestations 15 grams per hectare or less may be applied.

2 **Greatly reduced pasture effects**, as almost all product applied is to the target weed.

3 **Improved flexibility,** and timing as control can be obtained much closer to the timing for pasture improvement and increased pasture competition.

4 **Product is applied to the target weed only**, giving reduced rates of active ingredient per hectare and less opportunity for off target effects or drift. A submission to apply for this use is currently being compiled.

(d) **Weeds of pastures**

Du Pont is also attempting to improve their focus on weeds, their habitat and market segments. Du Pont is looking to develop a new product specifically for use in improved pastures.

(i) **Situation**, includes tolerant grass species or pasture renovation or for noxious weed control.

(ii) **Target broadleaf weeds proposed include**:

Onion grass; Cape tulip; Wild garlic; Dock spp; Sorrel; Soursob; Patterson's Curse/Salvation Jane; Ragwort; Erodium/Geranium/Storksbill; Clover; Doublegee/Spiney Emex/Three Cornered Jacks; Medics;

The product may be used alone at rates from 5-15 g/ha or in combination with Roundup CT as a spray topping mixture. Further weeds may be added to this list as research continues.

(e) **Velpar ULW**

These have been developed specifically for aerial application for Noxious Weed Control in Queensland and the Northern Territory.

Proposed Use Situation

For the control of woody weeds in pastures and rangelands and in rights of way.

Proposed weeds

Parkinsonia	Brigalow Regrowth
Rubber Vine	Eucalyptus
Acacia Nilotica	Regrowth
(Prickly Acacia)	Buddah Bush
Acacia Farenssia	Hop Bush
(Mimosa Bush)	Punty Bush
Mesquite	Turpentine

It will be essential with this product's use to combine a pasture improvement program which addresses soil fertility and pasture density to improve pasture competition against weeds seeding or reinfesting.

(f) **Velpar Incitec Gridball, for use by ground distribution**

Situation - for the control of woody weeds in rights of way around agricultural buildings in pasture and rangelands.

Weeds controlled

Eucalyptus Spp., Greybox/Gum Topped Box, Parkinsonia, Budda/False Sandlewood, Narrowleaf Hopbush, Turpentine, Punty Bush, Poplar Box/Bimble Box, Yapanyah, Coolabah.

- The product is designed to be placed at the base of target bushes on either an individual tree application or a grid pattern application basis.
- The main target for this product is the Western Lands Commission and the Western Range Lands of NSW and Queensland.
- It may be possible to add other noxious weed species such as African Box Thorn and Mesquite as further research proves results.

3 CONCLUSION

These varied product uses and techniques are being used to further combat the encroachment of weeds in the three main areas listed in the introduction. These were:

Weeds of productive crops, pastures and forests
Weeds of ornamental, amenity and sporting areas
Weeds of roadsides, rights of way, industrial situations, waterways and other areas.

As you can see it is important to apply the correct products, techniques and uses as appropriate to both the areas of use and weeds targeted.

Good management by including responsible recommendations and incorporating integrated weed management strategies by people such as the weeds officers present will assist us to ensure continued viability of these products, improved weed control and management and a better acceptance by the public of the work objectives of the NSW Noxious Weeds Officers Association.

ALLIGATOR WEED UPDATE

Ken Bunn
Chief Weeds Officer
Port Stephens Shire Council

Alligator Weed (*Alternanthera philoxeroides*) is an introduced species from South America, believed to have arrived in Australia in the mid 1940's in ship's ballast. It now infests some 2500 hectare of land along the coastal strip from Sydney to Port Stephens.

It is a stoloniferous summer growing perennial herb. It has hollow stems with nodes regularly spaced along the stem, leaves are normally 2-7 cm long and 1-2 cm wide and form as opposite pairs at the nodes. White flowers form as a compact inflorescence on a short stem arising from a leaf axil. The plant will produce seed, however these are not viable, reproduction is by vegetative means.

Since 1964 Alligator Weed has been the subject of an extensive research programme. Now in 1993 nearly 30 years later, it is with some satisfaction that I can say that this research has paid off and we now have the means to control/eradicate most infestations.

Over this period of time many people and organisations have contributed to this research. The latest contribution which has culminated in permits to use two herbicides for Alligator Weed control has been carried out by Dr Kath Bowmer and her research team from CSIRO at Griffith.

This programme was carried out over a four year time span starting in 1987. The studies included applying and evaluation of various herbicides and combinations. One trial area contained 127 plots. The use of carbon 14 radiolabelled glyphosate, to trace herbicide translocation through the plant, the effect of extended daylight hours, and the comparison between uncultivated and cultivated and reseeded plots.

The results of this work revealed that two herbicides gave consistently good results, firstly in small plot trials and later in larger plot trials, and now in field application. This has led to approval for permits for use of:

A. In pastures, right-of-way, commercial and industrial areas.

   The application of Brushoff® at the rate of 50 gms per hectare (Boom application) or mix at the rate of 10 gms produce per 100 litres water for hand gun application. Note that the general label data i.e. safety directions still apply.

   In areas of dense infestation it may be necessary to cultivate and seed with suitable competitive species. Two or more treatments may be required.

B. In right-of-way, commercial and industrial areas, non crop situations.

   Application of Casoron, granules - apply at a rate of 222 kg of produce per hectare.

   In areas of dense infestations cultivation and seed with a suitable competitive species.

   As with Brushoff, label requirements in relation to safety requirements etc still apply.

The Alligator Weed infestations within Port Stephens Shire area encompasses all of the situations that the plant can grow in. This ranges from Aquatic situations - drains, creeks, rivers and swamps, to terrestrial situations where it is growing in pastures, roadsides, even ovals.

With the availability to use the two herbicides we have initiated a control programme, treating both council controlled land and private properties. Results of this work is encouraging with minor infestations being eradicated and reduction in some of the larger areas. Realistically, complete eradication is not a feasible concept, if however we can contain and control existing infestations and treat new infestations before they can become established. I feel that a good job has been done.

---

* CSIRO Research Team - Dr Kath Bowmer, Team Leader
'Geoff McCorkelle, Senior Technical Officer
Dr P L Eberbach, Experimental Scientist

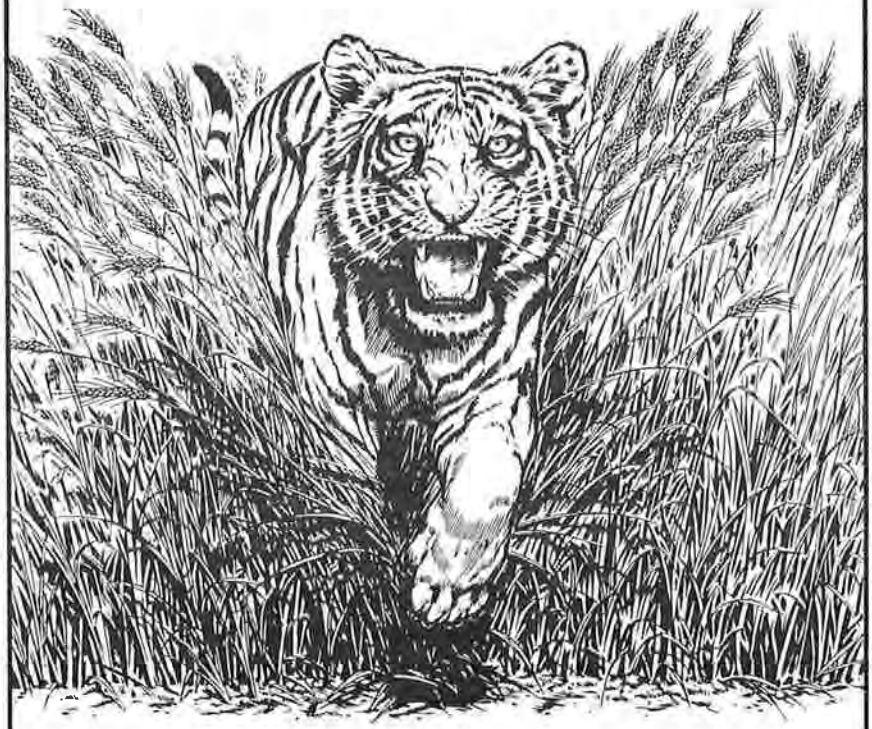
CSIRO
Division of Water Resources
Private Bag No. 3
Griffith

Further Information:

Alligator Weed Control Project 86/85 CSIRO - Division of Water Resources.

NSW Agriculture Agfact 647 (Agdex)

This year it won't cost much to hunt down broadleaf weeds.



Tigrex*

Savages broadleaf weeds.

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THE GRANULAR ADVANTAGE

By Bernie Horsfield
Director of Macspred Pty. Ltd.

"Spraying" Without Water

The current trend of chemical manufacturers is to switch from wettable powder and liquid herbicide formulations to either a dry flowable or granule formulation.

Macspred now have their own formulation plant in Melbourne where we are continuously looking at granular herbicide formulations to meet the needs of the industrial (general weed control) and forestry markets.

We are an independent Australian Company which was formed in May, 1990, to specialise in supplying and servicing all Government, and semi-Government departments with their herbicide requirements.

Macspred could see the benefits of using granular herbicides, and commenced with the initial formulations of residual herbicides such as Velpar G and Dybar*G for the industrial markets.

Application of Macspread herbicide granules using the Seymour Spreader.

Traditionally, controlling weeds has meant either getting out the boomspray or knap-sack and appropriate safety gear, filling with water, adding herbicides and wetting agents and then spraying those troublesome weeds. Now that you are ready to spray, you often have to compete with difficult environmental variables such as wind and rain. Once spraying is completed you are faced with that boring job of flushing and cleaning your equipment. There must be an easier way.

Macspred granular herbicides such as Velpar G, Dybar G and Oust G have the appearance of small prills of granules and are about the size of hundreds and thousands. These are applied directly to the ground, in a similar manner to applying fertiliser. Once on the ground, moisture activates the release of the active ingredient to the soil where it controls weeds.

In contrast to the Macspread granule there are other formulations on the market which are referred to as water dispersible or dry flowable granules which are in fact mixed with water before they can be applied using a boomspray.

Macspread granules completely eliminate the need for application using water which offers many advantages, some of which are outlined below:

- No need to cart water to the application unit, therefore there are reduced vehicle and labour costs associated with application.
- Granule application is far less affected by wind than boomspraying liquids.
- Simple, low bulk container disposal (no multiple flushing).
- Macspread granules are of low toxicity.
- Workers are not handling liquid herbicide concentrates, and so avoid "splash" contamination.
- Granule application is less likely to attract negative public attention.

In addition to these advantages associated with handling and application, Macspred granules have also shown in trials to provide longer control compared to their equivalent liquid formulations. This mainly results from the fact that all of the granules eventually reach the soil, compared with liquids where some chemical is lost through spray drift, and some bound up with surface organic matter (e.g. leaves, weed foliage), much of which does not reach the soil.

In 1991, many customers tried Macspred granules on a small scale e.g. Weed-A-Metre spot application or through the hire of one of our tractor mounted units. The success of this method was extremely encouraging and this year, many have opted to use granules on a commercial basis. The key benefits listed by most of those trying granules last year were:

- Ease/flexibility of application in damp/windy conditions.
- Excellent, broad spectrum weed control.
- Inexpensive application equipment that is almost maintenance free.
- Longer period of weed control compared to conventional liquid treatments.

In addition to visualising the need for granules, Macspred could also see the requirements for specialised application equipment for both small quantities and large volume applications.

To meet these needs Macspred have designed, manufactured and made available the equipment as shown on the following page.

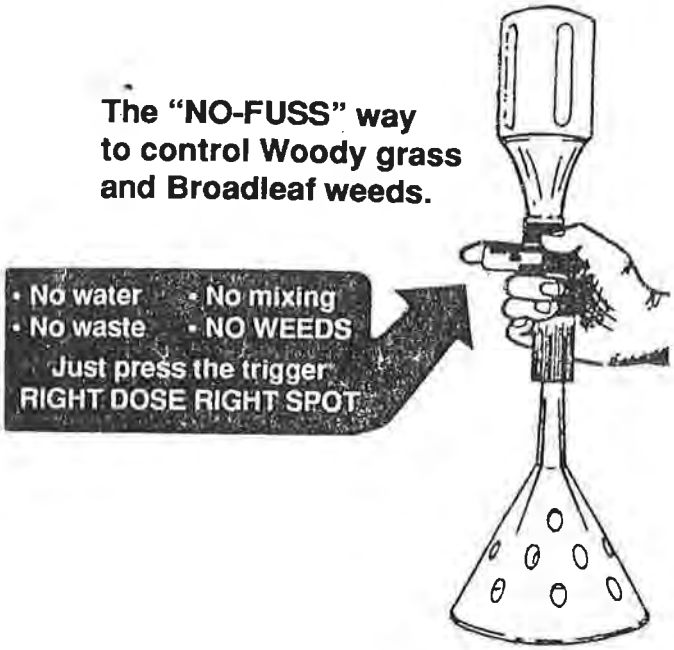
Equipment Update

New 1 Kilo Disposable Shaker Pack

Ideal for small areas - simple and easy to use.

Examples of where to use the Shaker Pack.

* Around buildings
* Industrial storage areas
* Airport runway lights



WEED-A-METRE
THE NEW GRANULAR HERBICIDE APPLICATOR

The Weed-A-Metre was designed to place a precise dose of granular herbicide within a 1.2m diameter circle. This is ideal for treating around guide posts, signs, car parks etc.

The Weed-A-Metre is held above the area to be treated and the trigger pressed. Granules fall onto the cone, and spread in a precise pattern over the weeds. For a more concentrated application, the cone can be replaced by a length of poly pipe which will deposit the granules right into the heart of a single weed.

Weed-A-Metres sell for $85 each and are available from Macspred Pty Ltd.

SEYMOUR SPREADER

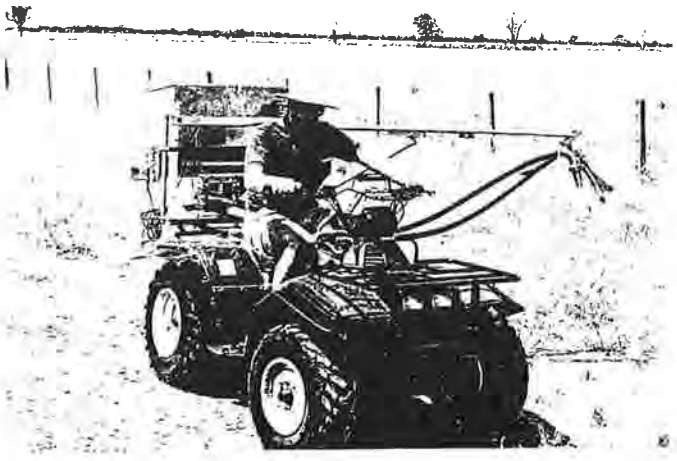
Suitable for larger areas, inexpensive and easy to calibrate.

Ideal for use in the following situations:

* Fence lines (including electric)
* Firebreaks
* Under pipelines
* Railway yards

"BIKE-PACK" GRANULE APPLICATOR

Macspred has just released the new compact "Bike-Pack" granule applicator for applying granules in a variety of situations.



The economical, motor bike mounted unit can be set up to treat:-

a) Narrow strips (0.5 - 2m) e.g. fence lines, road verges

b) Broadcast (up to 8m) - e.g. fire breaks, access tracks etc.

c) Twin strips - e.g. tree plantation weed control

d) Spot treatment - e.g. guide posts

Variations of this machine are available for 3 point linkage mounting for use on tractors.

Like all of the recently developed pneumatic Macspred granule applicators, this unit can continue to be operated in unfavourable windy and damp conditions, long after the boomspray has been retired to the equipment shed.

Macspread have expanded their product range as follows:

ATRAMAC*G 200G/KG ATRAZINE

For the residual control of a wide range of grass and broadleaf weeds in commercial and industrial areas, railway lines, rights of way and around agricultural buildings.

KROVAR*G	100G/Kg Bromacil
	100G/Kg Diuron
DYBAR*G	100G/kg Hexazinone
	50G/Kg Bromacil
	50G/Kg Diuron
VELPAR*G	200G/Kg Hexazinone

For the control of a wide range of annual and perennial grasses and broadleaf weeds in commercial and industrial areas, rights of way and around agricultural buildings. These products are not to be applied on or near desirable trees or other plants or on areas where their roots may extend.

FOREST MIX*G	50G/Kg Hexazinone
	170G/Kg Atrazine

For the control of a wide range of annual and perennial weeds in Pinus Radiata Plantations

OUST*G 20G/Kg Sulfometuron Methyl

For the control of certain annual and perennial grasses and broadleaf weeds in commercial and industrial areas around agricultural building and rights of way.

HANDLING THE PRESS

BACKGROUND BRIEFING NOTES PREPARED
FOR SEVENTH BIENNIAL NOXIOUS PLANTS CONFERENCE
AND MEDIA SKILLS WORKSHOPS
BY

Col Begg - Media Officer
NSW Agriculture- Gunnedah

31 March 1993 #

THE IMPORTANCE OF MEDIA TRAINING:

Throughout life, in one way or another, most of us are required to adopt a teaching role. Many research programs show that the most effective method of imparting one's wisdom is in a "one-to-one" situation. Financial constraints might prevent this form of contact.

These notes have been prepared for people who might consider the media as a suitable means of imparting their knowledge to their audience. It should be emphasised however **there is a direct trade off. Media cannot be used in the same manner as one-to-one contact.** It will not work as effectively. The media message must be "compromised" to a degree so that it satisfies the editor's requirements, while informing or educating the audience at the same time.

In order to do this there are some rules to follow which will help **you** get **your** message onto the editor's desk and perhaps into publication, while the less informed contributor's message will go straight into the great repository for the "world's greatest scoops"... the wastepaper bin!

IN THE BEGINNING:

Let's remember, editors (and that includes newspaper editors, magazine editors, television news editors, radio news editors, journalists and feature writers/ photographers/ illustrators and so on) are human.

They all have a limited amount of time to devote to a day's work. They are required to fill a newspaper or radio news broadcast with a specific number of stories or amount of editorial copy.

If they come across a story which, firstly is interesting and secondly, is easily "bashed into shape" for their audience, it will be used before a story which isn't interesting or which required a heavy re-write to get it into shape.

Broadly speaking, editors can be assumed to be basically lazy. Having been one, in a number of publishing houses, I can speak this way about my contemporaries.

No one expects you to be able to present to an editor a word-perfect story that can go straight into print. That is the hallmark of a trained journalist. Only by completing a three year cadetship and many years of practical writing experience, would you stand a chance of arriving at that level of proficiency. But by gaining an understanding of the journalists' basic craft, you can get your stories into print when and where you require.

PUBLIC RELATIONS VALUE:

Many people first experience writing for the media by being elected to the position of publicity officer for a sporting organisation. This can be a good starting point for many, if their copy is presented, as required. It can also be a disaster for you and the organisation, if the basic rules are not followed.

First and foremost, I advise all publicity officers who wish to present regular items to say their local newspaper or radio stations, to contact the editor, or the sporting editor if one exists. This is the most important step in any on-going publicity program. If the editor gets to know you, you are not just another faceless person on the end of a phone line. This is the first step in establishing good public relations with the media.

When you meet the editor, take along a pen and notebook so that you can write down the directions given on the presentation of copy and the deadlines you will have to meet. If you approach both the newspaper and the radio station, use your discretion on advertising the fact to each medium. There is a lot of professional jealousy between editors in the same location. Each likes to think he is going to receive the story first. Some even say "if you give it to me, I'll use it but don't give it to the opposition."

Obviously, you can't tell a lie by promising sports results to one outlet, excluding the other, so perhaps you'll have to give the newspaper editor an exclusive report with all the details as early as possible after the event, while giving the radio station an abbreviated version of the same report. (I'll deal with style altering in more detail later.)

SELECTING THE CORRECT MEDIUM:

For the purpose of these notes, I'll use the New England agricultural area as my example, quoting from experience and facts about the various media outlets. The same general rules apply across all areas and regions.

In this region we are currently served by one commercial television outlet Prime Tamworth. In mid 1991, NBN Newcastle will begin transmitting into the region and six to 12 months later NRN Coffs Harbour will also begin to beam into the region. Each of the commercial networks is affiliated with a large Sydney-based network and pressure of aggregation will force much local content programs from locally-run stations. ABC television will continue to operate its services as it currently exists with no local content.

Radio in the region remains largely an independent AM service, however there are a number of low-powered FM stations operating and increasing in popularity.

Local newspapers are mostly owned by city-based media empires with only a few independently owned papers still publishing.

Every one of these outlets has a distinct role to play in the dissemination of information. However one rule that is of vital importance to all of them (with perhaps the exception of the ABC):-

they must make money for their owner

We can talk glibly about "the role of the press". It's all a lot of hooey! If the newspaper doesn't sell, the owner goes broke and the newspaper folds. So remember, in all your stories, you have to help the editor sell more papers, or attract more listeners to radio or have more people watching television sets.

This does not mean you have to rush out and hire a "page three dolly bird in a brief bikini" to help publicise the local Presbyterian Church debating team's win.

What it means is simply .... **YOU HAVE TO ENTERTAIN THE AUDIENCE WHICH IS GOING TO READ/LISTEN TO THE STORY.**

And this brings us to the second major rule of media training:-

KNOW YOUR AUDIENCE:

Before embarking on any story writing, it is important to see the editor's view. You need to establish from the editor, who his audience is .... what is the age breakdown of the readership ..... what is their level of education ..... what is the socio-economic climate ..... more men or women .... do families read the paper ..... how long is the paper retained in the house.

All these answers along with some good, old fashioned common sense, will help you when you begin to put words on paper. You MUST know the composition of your audience if you are to write copy in a style which will entertain.

However, you must also be aware of changing audiences. Obviously in the electronic media, the audience changes as the day progresses.

Early morning radio programming is usually devoted to news/current affairs. Mid morning becomes kindergarten/ school time and late morning and early afternoon is devoted to the housewife, with a general audience around lunchtime.

Late afternoon is for the teenagers, while early evening is again children's time, then news, current affairs and light entertainment.

Newspapers and magazines are somewhat similar .... if you write a story for the children's section, it simply won't fit into the hard news section on pages one, two and three. Similarly, a radio news script will rarely be used in the time span devoted to women's serials or kindergarten of the air.

..... it's really very simple - all you need to do is think a little before beginning your story!

TYPE OF MEDIA:

Everyone knows that there exists a number of different types of media. Each is designed to fill a specific role in the transmission of information to its audience. However, to better understand the industry's requirements (from the contributor's point of view), let's review some of the basic background to publishing.

In the public arena there exists television (both commercial and ABC), radio (commercial, community, AM, FM, and ABC), newspapers and special interest magazines. Perhaps newsletters could also be included in this area.

Very obviously, no ONE medium can do that which others do .... television can't give a "lasting" message like a newspaper .... radio can't show pictures like television and papers.

So each type of media has a distinct place in the industry. Most, if not all, compete with each other for patronage .... for the consumer dollar. And it takes more than a handful of those consumer dollars to cover all the (non-productive) overheads associated with large media organisations.

After paying the switch girls, lunch boys, clerks and associated general dogsbodies, phone/electricity/rent etc., the actual cost of producing a newspaper might be 20 or 30 cents more, than its cover price. But it has advertising to bridge the gap.

In order to sell advertising space, the paper must have a good circulation figure and to have a good circulation - the paper must "entertain" its readers.

Solid news is largely supported with "giveaways" - bingo competitions and other gimmicks - in order to increase circulation. Measure the hard news content in a newspaper and you'll find it makes up only 35-40% of the total.

Radio is a fascinating (and perhaps the most professionally difficult) medium in which to work. Not everyone can handle writing for radio and even fewer can handle broadcasting live to air. (More on this subject later but for now let's look at writing for radio).

When writing for radio it is important to go back to basics and mentally examine the purpose of radio.

Radio gives *the first news of the day*. Radio is almost instantaneous communication with the general public. It can always beat a newspaper to break a story because of the flexibility of programming and lack of deadlines.

Radio can make a story sound more interesting because RADIO PAINTS A MENTAL PICTURE OF EACH EVENT. In a newspaper story about a car smash in some remote area, the writer must use a lot of words to describe the scene and details of the smash. Whereas a radio report of the same incident will probably not have as much hard, factual detail but it will be much more descriptive about the scene. And if the radio reporter is phoning in his report, this helps to make the story sound as though it has just happened.

Radio news is instantaneous! And it can be "dramatised" by the use of ascending music fanfares to introduce a newsflash - which you've all no doubt, heard from time to time.

Television on the other hand can be dramatic in its presentation of news but the medium lacks the flexibility of radio due to its set programming. Most stations cannot simply run a newsflash at the drop of a hat. It disrupts totally the airing of programs and advertisements, links with networks and satellite hook-ups.

Most television stations have time commitments specified to the split second for two weeks ahead at any one time. All their programs, advertisements, community service announcements and other material is scheduled.

Television news requires one important factor ..... pictures!

The time factor of obtaining those pictures makes television news less timely than radio. But the pictures can (when edited in a special way) make the story even more dramatic than it originally appeared. By showing the shape of a body under a crisp white sheet, with a mangled car in the background and police and rescue vehicles' rotating lights flashing in the top corner of the frame, the whole story is visually dramatised.

Generally speaking, it is much more difficult to get stories onto television news than onto radio news.

Newspapers (especially local ones) are much more inclined to pick up local stories than are radio stations. So you can rate your efforts accordingly.

And it's important to remember the "circulation" figures of the various mediums.

In this region, the Northern Daily Leader circulates around 13,000 copies, Prime TV News has about 250,000 viewers, 2TM/MO/AD radio news has about 100,000 listeners and ABC radio news has about 80,000.

Again, the amount of effort put into an editorial item must take into consideration the potential to make contact with the target audience.

As I said earlier, each medium requires a particular style. When writing for a newspaper or a magazine, two distinct styles must be adopted. However the television and radio scripts can be quite similar.

Let me illustrate this important factor this way .... a script or story for a rural interest magazine should never be submitted to a radio or television news editor. Nine times out of ten, the story will be thrown out.

Similarly, if you send a 200 word radio script to a special interest magazine (which is looking for a 2,000 word feature), the editor won't even give the story a second look.

This leads on to one of the other major points I wish to discuss.

WHAT IS NEWS?

All news stories set out to say WHO, WHAT, WHERE, WHEN, WHY and HOW. All news and features stories have a heading, a lead and a body.

Assuming that you are all beginners in this field of writing, may I respectfully suggest you write down a rough plan for all your stories.

News and features stories follow the plan of the inverted pyramid. Firstly you have the headline, followed by the lead and then the body of the story. If you write down these words in the left hand margin, then complete a rough of the story beside the prompts, you'll see it much clearer.

The heading tells the reader what has happened .... **MAN BITES DOG !**

The lead (the first paragraph or two) tells the reader the story in a nutshell .... **A bigtown truck driver today sank his teeth into a dog's back to make it release his arm from its jaws.**

The body (or the rest of the story) relates to the circumstances, place, time, consequence and who was involved.

At the completion of the body of the story, you must ask yourself if the story says WHO, WHAT WHERE, WHEN, WHY and HOW.

Modern radio and television techniques demand brief interviews. Seldom does an interview last for more than two or two and a half minutes, unless it is a "talk show".

To avoid the problem of arriving at the message you wish to get across in the last 15 seconds of the interview you've got to plan it. If you don't, you'll be wasting your time and the time of the station. Planning a radio interview only takes a few minutes and is divided into three parts:-

1 An Opening: Keep it concise (15-30 words) to avoid "waffle". The best opening alerts the listener to the fact that someone interesting has something to say about a particular subject, and he's about to say it right now!

2 Key Questions: Decide what the main questions are to be and arrange them in logical order. Keep the answers brief so that the interviewer can ask another question if necessary. Avoid the one question/one long answer type interview. These are not interesting. Short, pointed questions demand short (but not curt) answers. Never answer a question with a simple yes or no. The interviewer will scream!

If you have to answer yes or no .... expand your answer with ".... yes, I'll have to agree with that point of view."

3 The Tail: You need a tail to a radio interview which in essence, sums up the point(s) you wish to make. Keep it brief (no more than 20-40 words).

Remember, the journalist interviewing you may not know a thing about your particular area of expertise, so if you provide him with a precis and a list of questions, you won't be insulting his intelligence.

The same rules apply as for successful press writing. Write down your plan and ask yourself if the "who, what, where, why and how" plan tells the complete story.

OVERCOMING NERVES:

Everyone who has been interviewed has suffered to some degree, from an attack of nerves. I suggest that only practice makes perfect.

You MUST know your subject thoroughly. You must anticipate any questions the interviewer may ask you, that may not have been planned. And to appear less nervous, you must try to breathe deeply, using all your lung capacity to answer, before drawing breath again.

Just before the tapes start to roll, take a few long, deep breaths and drop the shoulders. It has a marvellous, relaxing effect.

When the interview starts, concentrate on what the interviewer is saying. **LOOK THE INTERVIEWER IN THE EYES AT ALL TIMES.** This will help to create a warm feeling of interest between you and the interviewer, which is transmitted to the audience.

Don't be afraid to laugh or smile and use your hands during the interview (as long as you don't knock the microphone). These actions help to give your interview credibility.

As with newspaper writing, don't use slang or bad language. Don't drop off the "h" or "g" from words.

You should speak naturally, using abbreviations such as "I'll see to it .... no, we don't do it .... yes we've got to plan it."

Try to divorce from your mind, once the interview has begun, the recording equipment and the time. The interviewer is a professional ..... he'll look after that end of it. And if the interview is planned, the timing of the interview will take care of itself.

If you are going live to air and you make a mistake during the interview - correct it there and then.

If the interview is being taped ask the interviewer if you can stop the tape for a second or two while you re-gather your thoughts, so that you can give him the correct answer.

Again ..... planning usually overcomes these problems before you begin the interview.

Super-aggressive interviews usually only involve politicians, policemen and criminal matters. If these subjects don't interest or involve you .... AVOID THEM LIKE POISON.

Good interviewers are professionals - they have the training and skills to make you look silly if they wish. And they have the ultimate power of editing an interview after you have left the studio.

Another point I like to make in advising beginners about voice delivery is NEVER READ FROM PREPARED NOTES. It takes a real professional to make a prepared script sound like "ad-lib" thoughts from the mind. And never make a conscious effort to sound sincere - you'll more likely bomb it! Be natural with your voice presentation.

The television interview can be planned in the same manner as the radio interview.

Take along a little synopsis of the subject, and a few suggested questions for the interviewer. Discuss the length of the interview before the tape begins rolling. Discuss the audience and the involvement of others in the interview.

Remember, they might be setting you up against someone with an opposing point of view. In this case you may need to be more assertive in your answers.

Another important aspect of the television interview is the provision of "overlay" material.

Overlay is footage of the subject matter being discussed in the interview. Two talking heads are not terribly interesting, so when the interview is completed, the television crew will usually shoot a number of scenes of subjects that can be over-layed on the vision of the talking heads, yet leaving the audio tracks.

This overlay could take the form of graphs, diagrams, photos or actual footage of the subject.

The more overlay you can provide, the better the interview will be at broadcast.

Appearance in the television interview is not paramount but it is important. You should always be neat and tidy. As a rule, have a look at what the interviewer is wearing and try to wear similar clothes.

Always have your hair done and be clean shaven. Don't be afraid to use a little hair spray. If it's summer and the bush flies are bad, use a little aeroguard around the face too. Check to see that your tie knot is centred on your collar. Don't wear clothes with small checks. Avoid clothes in the mid blue range and fast, fiery reds. Some cheap video cameras cannot handle these colour renditions well.

Ladies should not use too much make up but should remain distinctly feminine. Television tends to emphasise weight problems. If you are overweight, wear loose, flattering clothes/vertical stripes etc.

The best advice with television interviews is "be natural". If a woman is interviewed in the paddock, she would look silly in a dress. A man would look silly in a collar and tie, giving advice in a dairy.

If seated for the interview, try to maintain a straight back during the interview. Nothing looks worse than someone lounging down in a chair like a real slob.

If you're standing, stand still! Otherwise you might move out of frame and the interview cannot be used. Position your weight evenly on both feet, BEFORE the cameraman frames you. Then hold that position until the end.

Unless you make it to the Prime Ministership, never, NEVER, look directly into the camera lens when answering a question. It is totally presumptuous and smack of a presidential address or sermon.

Ignore the camera, cameraman, sound recordist and other members of the crew. Concentrate on the interviewer - maintain eye contact at all times and relate to his questions - the interview will be much warmer and you'll be able to see him draw breath for the next question.

DEVELOPING CONTACTS:

For those who seriously see a role for media contact in their future careers, there is probably no greater advice I can impart than GET TO KNOW YOUR LOCAL PRESS.

Newspaper reporters/journalists, radio journalists and presenters, television news, current affairs reporters and chat show hosts are all very approachable people.

If you make an effort to contact them and find out about their programs, you may be able to help them with stories/story ideas, which will in the long run, help you. Buy them a drink. Tell them what you have to offer. Don't take one knock-back as a personal affront. If a story gets "spiked" ask the editor to point out to you what's wrong with it.

Be a little humble and you might find it will pay off handsomely in the long run.

Journalists are proud craftsmen and women. It is not unknown for them to make a mistake or to perhaps emphasise a particular issue for sensationalism's sake. However, one thing they love to hate is the old saying "you misquoted me".

Very, very rarely are people misquoted. I suggest strongly a lack of preparation for the interview is the blame in these cases. Ill-prepared people tend to "shoot off their mouth" without paying too much attention to their brain. If you are ill-prepared, you may get a roasting from some elements of the press.

If you know your subject and you are fully prepared for the interview situation, you could have a very strong ally in the press.

...O..

SUMMARY:

PRESS - GOOD FOR REPORTING LOCAL, DISTRICT ISSUES, DETAILED REMEDIES TO PROBLEMS, SPECIFIC RECOMMENDATIONS, BEING QUOTED AS "EXPERT" SOURCE OF INFORMATION. NEED MORE B&W PIX FEATURING DEPARTMENTAL EXPERTS WITH LOCAL PRODUCER. COPY CAN'T BE TOO TECHNICAL! STORIES MUST APPEAL TO GENERAL PUBLIC, UNLESS A SPECIAL INTEREST RURAL PAPER! STORIES CAN BE RE-RELEASED TO OTHER MEDIA OUTLETS.

RADIO - GOOD FOR "INSTANT" AWARENESS NEWS, AD HOC WORK, "BUSHFIRE" MESSAGES. NO AUDIENCE RETENTION OF DETAIL! KNOWLEDGE OF LOCAL NEWS DEADLINES IMPORTANT. EXPERIENCE WITH PHONE INTERVIEWS FOR NEWS INSERTS NEEDED.

TV - GREAT FOR MASS AUDIENCE CONTACT/CORPORATE IMAGE ENHANCEMENT. RURAL MESSAGES NEEDS TO HAVE SOME APPEAL TO REGIONAL OR CITY AUDIENCE. NEEDS EXPERIENCE! "CONTENTIOUS ISSUES" BEST TAPED BY DEPARTMENTAL STAFF RATHER THAN TV STATION STAFF. LITTLE AUDIENCE RETENTION OF DETAIL!

VIDEO - CAN BE GOOD, IF MESSAGE, AUDIENCE, VIEWING OF COMPLETED PROGRAM, PLANNED PROFESSIONALLY AND WELL IN ADVANCE OF NEEDS. IF DONE PROPERLY, OPPORTUNITIES FOR SHOWING SEGMENTS OF PROGRAM IN TV NEWS AND FEATURES. TIME-CONSUMING TO PRODUCE.

NEWSLETTERS - LOSING FAVOUR AS A MEANS OF CONTACT, UNLESS VERY SPECIFIC IN THE SUBJECT MATTER (IE: DROUGHT FEEDING, PLAGUE LOCUSTS). FARMERS BOMBARDED WITH JUNK MAIL THESE DAYS. THEY DON'T HAVE TIME TO READ!

DIRECT MAIL - DITTO ABOVE - UNLESS VERY SPECIFIC (IE: FIELD DAY INVITATION PERSONALLY SIGNED). MUST HAVE SOME FORM OF "GIMMICK" IN ORDER TO BE PUT ON FRIDGE.

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Landcare Aware

CHEMICAL CONTROL OF ST. JOHN'S WORT

C.O. LOVE
DowElanco Australia Ltd, Tamworth NSW 2340.

Summary. In 1991, two replicated herbicide trials were conducted in steep grazing country heavily infested with St John's wort, *Hypericum perforatum* var. *angustifolium,* at Rouchel (1991) and Bundella (late 1991). The trials evaluated a range of herbicide products and rates using the high volume application technique. A proprietary formulation of triclopyr (butoxyethyl ester) and picloram (hexoxy propylamine sale) @ 150g + 50g/100L water was applied as a high volume application (3000L/ha) and produced the highest control of St John's wort, 21 months after application at Rouchel and 14 months at Bundella.

INTRODUCTION

St John's wort, *Hypericum perfortatum* var. *angustifolium,* brought into Australia in 1875 as a garden plant, is now a widespread weed of pastures. It causes photosensitisation in sheep, cattle, horses and goats, resulting in loss of condition, lower productivity and, in extreme cases, death. It also spoils fleece quality by adding vegetable fault to wool, and excludes useful plants pastures (2).

St. John's wort is spreading at an alarming rate in grazing hill country in the slopes and tablelands areas of NSW. Today over 250,000 hectares in NSW are estimated to be infested with St John's wort.

METHODS

Trial 1 was located at Upper Rouchel, Hunter Valley, NSW and trial 2 was located at Bundella, Liverpool Plains, NSW. A randomised complete block design with three replicates was used.

Trial 1 had an even dense stand of St John's wort, 75-90 cm high with 65% brown pods when sprayed at the late flowering stage on 23 January 1991. Plot size was 5x10 m and treatments were applied with a Solo knapsack sprayer fitted with a variable spray nozzle.

Trial 2 also had an even stand of wort, with growth stages shown in table 3. Plot size was 5x10 m and treatments were applied with a power operated sprayer using a handgun fitted with a D6 tip and operating at a pressure of 500 kPa. The fine droplets produced were applied in successive vertical sweeping motions up and down each plant, wetting both leaves and stems.

Formulations tested included Grazon DS# (300 g/L triclopyr as butoxyethyl ester & 100 g/L picloram as hexoxy propylamine salt), Garlon 600# (600 g/L tricopyr as butoxyethyl ester) and Tordon 50-D# (200 g/L 2,4-D & 50 g/L picloram, both present as the tri-isopropolamine salt). Ulvapron* @ 0.1% v/v was added to some treatments.

Plots were visually rated for brown-out and regrowth the following season.
Registered trademark of DowElanco.
* Registered trademark of BP Australia Ltd.

RESULTS AND DISCUSSION

In both trials, Grazon DS provided good control of St John's wort when applied under good growing conditions, between October and January (Tables 1 & 3).

Table 1 Percent control of St John's wort using high volume application technique @ 300 L water/ha, with and without the addition of Ulvapron spray oil @ 0.1% v/v.

Treatment	Rate (mL/100L)	Rate (L/ha)	Without oil		With oil	
			12 MAA	21MAA	12MAA	21MAA
Grazon DS	125	3.75	67	68	69	73
Grazon DS	250	7.5	81	87	83	93
Grazon DS	500	15	100	99	100	100
Garlon 600	170	5.1	53	53	46	40
Tordon 50-D	500	15	81	82	88	87
Tordon 50-D	1000	30	92	97	94	99

MAA = months after application

The addition of Ulvapron crop oil @ 0.1% v/v to the treatments in table 1 did not significantly improve the control of St John's wort, however the level of control with Garlon 600 was reduced by the addition of Ulvapron.

Application volume did not significantly affect control of St John's wort with Grazon DS, when applied at equivalent rates/ha. This is shown by the results in table 2.

Table 2 Percent control of St John's wort following high volume application of Grazon DS at different application volumes, Upper Rouchel 12 & 21 MAA (months after application)

Treatment	Rate (L/ha)	Application volume: 3000 L/ha		1500 L/ha	
		12 MAA	21 MAA	12 MAA	21 MAA
Grazon DS	3.75	67	68	66	70
Grazon DS	7.5	87	87	77	80

Even though there was no significant difference between control of St John's wort with Grazon DS at different application volumes, it was much easier to calibrate your application technique to apply 3000 L/ha compared to 1500 L/ha. There was less likelihood of application errors applying 3000 L/ha, as it was essential to obtain complete coverage of the whole plant to obtain acceptable results

Table 3 shows lower control of St John's wort after application of Grazon DS and Tordon 50-D under poor soil moisture conditions, when plants were stressed. From these results, best control of St John's wort was achieved with Grazon DS @ 500 mL/100L water at an

application volume of 3000 L/ha, applied when good soil moisture was present and plants were actively growing from a growth stage from pre-flowering to flowering or November to January.

Table 3 The effect of dry conditions on the control of St John's wort with Grazon DS and Tordon 50-D high volume application at "Ardgour", Bundella, 1991/92 - trial 2.

		Time 1 Application: 4,10,91 Stage: pre-flower Soil moisture: good Plants active growth	Time 2 Application: 3,12,91 Stage: flowering Soil moisture: poor Plants stressed
Treatment	Rate (mL/100L	% control 14 MAA	% control 12 MAA
Grazon DS	500	92	82
Grazon DS	350	-	67
Grazon DS	250	78	47
Tordon 50-D	1000	93	80
Tordon 50-D	500	80	40

From these results and those obtained by Ross Watson, District Agronomist, Scone (3), a pesticide order was issued on 18 March 1992 for the use of Grazon DS @ 500 mL/100L water for the control of St John's wort, with the following critical comments:-

Apply during late spring to early summer (Nov-Jan) to coincide with flowering to early seed set. Do not apply during the autumn or winter as inferior levels of control will occur.

High Volume: apply through well calibrated hand gun equipment. Adjust hand gun spray equipment to apply the equivalent of 3000 L/ha (i.e. 3L/10 square m, - an area of 5x2 m). Check your application rate over a measured area of St John's wort infestation before spraying large areas. Adjust hand spraying speed or nozzle size to change application rate. Always ensure thorough coverage.

Hand gun equipment should be fitted with a D5 (2 mm) nozzle plated and operated at 400-500 kPa (60-70 psi) as a broad spray pattern. Apply to thoroughly wet all leaves and stems, avoiding excess run-off. Do not apply to plants showing obvious signs of stress. If applied as directed, one application will provide a high degree of control. Some minor regrowth and seedlings may need retreatment the following summer. Grasses are largely unaffected, pasture legumes are severely damaged or killed by this herbicide. Clover regeneration will be significantly reduced for 12-18 months after application. However, good regeneration from seed should be observed 18-24 months after application (1).

ACKNOWLEDGMENTS

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JOHNSON GRASS CONTROL WITH "OUST"

Michael Brooks
Senior Noxious Plants Inspector.

NARRABRI SHIRE COUNCIL.

INTRODUCTION

In the Narrabri Shire we have had a problem with Johnson Grass and its related species for many years.

We started with at least 200 kilometres of heavily infested roadsides, that have needed an intensive control programs over the last 25 years to obtain the results we have today.

In fact, a survey conducted during 1993 would show Johnson Grass restricted to 50 kms. of heavy infestations along State Highway No.17 {Narrabri - Moree road) and some minor infestations on other shire roads that only require routine maintenance.

These results have been obtained over many years by using an integrated control programme using Glyphosate initially, then pasture re-establishment by a variety of methods;

1. Slashing to help establish pasture.

2. Sod seeding desirable pasture or broadcasting seed.

The main seed used has been Rhodes Grass mixed with Lucerne, Woolly Pod Vetch and Buffel Grass.

These programs have been effective in the past, although time intensive and expensive.

PROBLEM

The problem we have today is we are not receiving the effective results from Glyphosate as we did in the past.

We believe this problem may be attributed to some kind of Glyphosate resistance being developed in the Johnson Grass of today which seems to have a stronger Rhizome system and has experienced noted changes from the Johnson Grass of the 1970's, (with the cross breeding ability of Johnson Grass any number of Hybrids could be present today.)

"OUST" TRIALS

To challenge this resistance we have been trialing the soil residual herbicide, Oust, from Dupont.

Some trial work was carried out during Jan.1988, with the Monsanto area representative.

The trials were done at the rates of 27 grams and 54 grams of oust to 100 litres of water with 1 Litre of Roundup.

These Trials were done on a small scale and where not followed up till Feb.1991. when we started more intensive oust trials. We concentrated on our worst area, which is State Highway 17, and our aim was to knockdown the Johnson Grass with Glyphosate and effect the vigorous rhizomes and prolific seed bed with Oust, but still allow pasture to re-establish to prevent soil erosion and be competitive against Johnson Grass in the future.

To seek this objective we varied the Oust rate from **40** to **80** grams with 100 litres of water and 1 litre of Glyphosate.

Our results showed that the lowest rate we could use and still retain satisfactory residual control was 50 grams of Oust to 100 litres of water.

Some of the desirable pastures we have noticed naturally re-appearing are Lucerne, Couch and Common Blow Away Grass.

But unfortunately there are undesirables that invade the Oust plots, examples are Patterson's Curse and the Thistles.

At this stage we have not tried any heavy re-pasturing with machinery on the trial sites although the small amount of hand casting we have done is having some success.

METHOD OF APPLICATION

The majority of Oust trials we did were conducted during 1991 from 19th of February to the 29th of May. We used a hand gun application, which we found to be convenient because of its spotting ability over boom or side sprays.

The benefits of the hand gun are:

1. Its ability to change treatment aim,
2. Adjustments because of wind direction,
3. Obstructions like guide posts etc.
4. And weed density.

As we all know soil moisture does play an important part when chemically treating weeds but with Narrabri Shire's hot and usually dry weather, good application timing is very restricted. So the majority of our Oust trial work was carried out when there was some soil moisture evident and the temperature was in the high 30's.

I support the recommendation on the label requiring good soil moisture. We applied the mixture at normal rate that is, wetting the leaf area up to the point of run off.

Other benefits we found when using Oust were;

1. Handling a concentrate granular form,
2. Its low toxicity,
3. Its minimal soil leaching.

COSTING

Costs are estimated and can vary considerably due to the changing conditions. For example the distance to water.

Area the costing is estimated on.
1 kilometre x 10 metres (5m each side of road) = 1 Hectare.

Charge.

Oust	= 28 cents per Gram.
Glyphosate	= $10.00 per Litre.
Labour + On costs	= $14.00 per Hour.
Plant	= $ 1.67 per Hour.
	= 25 cents per Kilometre.

Heavy Infestation.

Water	= 800 Litres.	
Oust	= 400 Grams	= $112.00
Glyphosate	= 8 Litres	= $ 80.00
Labour	= 3 Hours	= $ 42.00
Plant	= 3 Hours	= $ 5.00
	= 10 Kms.	= $ 2.50
	Total	= $241.00 approx.

Medium Infestation.

Water	= 400 Litres.	
Oust	= 200 Grams	= $ 56.00
Glyphosate	= 4 Litres	= $ 40.00
Labour	= 2 Hours	= $ 28.00
Plant	= 2 Hours	= $ 3.34
	= 10 Kms.	= $ 2.50
Total		= $129.84 approx.

Light Infestation.

Water	= 200 Litres.	
Oust	= 100 Grams	= $ 28.00
Glyphosate	= 2 Litres	= $ 20.00
Labour	= 1 Hour	= $ 14.00
Plant	= 1 Hour	= $ 1.67
	= 10 Kms.	= $ 2.50
Total		= $ 66.17 approx.

Routine Maintenance.

Water	= 20 Litres.	
Oust	= 10 Grams	= $ 2.80
Glyphosate	= 200 mls.	= $ 2.00
Labour	= 12 mins.	= $ 2.80
Plant	= 12 mins.	= $ 0.32
	= 10 kms.	= $ 2.50
Total		= $ 10.42 approx.

CONCLUSION

I believe our results have shown that Oust can be used in an integrated program to help prevent Johnson Grass regrowth and allow desirable pasture establishment and even though adding Oust to a control program can increase the initial costs by approximately **50%** the all up expense is greatly lower because of the savings on follow up treatment. Therefore I believe Oust has contributed considerably towards our fight against Johnson Grass.

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Thats right! By ***Investing*** *in the* **QUIK SPRAY** *Remote Control Retractable Hose Reel System, (initial cost approx. $2000 more than "conventional" systems), you* ***immediately*** *start* ***increasing your productivity*** *and make* ***substantial labour savings****. Many* **QUIK SPRAY** *owners agree a* ***minimum*** *of* ***$10 000 per year*** *is saved. ($50 000 over a 5 year period).*

A **QUIK SPRAY** *system is not a luxury, it is a* ***sound business investment****. In many spraying applications it would be* ***financially negligant*** *not to update to the latest* **QUIK SPRAY** *technology.*

ASK COUNCILS "IN THE KNOW"

New England Tablelands Noxious Plants County Council
Coffs Harbour City Council
Great Lakes Shire Council
Belligen Shire Council
ACT Parks and Conservation Service
Tenterfield Shire Council
Nambucca Shire Council
Port Stephens Shire Council
Cowra Shire Council
Severn Shire Council
Crookwell Shire Council
Boorowa Shire Council
NSW Dept. of Water Resources
Greater Taree City Council
Upper Hunter Weeds Authority
Caloundra City Council
NSW State Rail Authority
Victorian Dept. Conservation and Environment
Upper Macquarie County Council
Johnstone Shire Council
Banana Shire Council
Kempsey Shire Council
Wellington Shire Council
Culcain Shire Council
Jenolan Shire Council
Ulmarra Shire Council
Goulburn Shire Council
VIC. Rural Water Corporation
Snowy River Shire Council
Eurobodalla Shire Council
Dubbo City Council
Castlereagh-Macquarie County Council

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representing the final stage of South American weed incursion at Wingham Brush.

Treatment Methods

Prior to implementing a rehabilitation program, a plan of management should be compiled with a complete list of all plant species, exotic and native. Fauna surveys should also be undertaken and site-dependent animals identified. Where possible, technical information should be obtained from wildlife authorities regarding the impact of the proposed regeneration activities upon vulnerable site fauna.

It is recommended that valued natives be manually isolated 20cm. from their stems and foliage before any spraying is undertaken, to ensure selective application of herbicides.

Macfadyena unguis-cati

Vines are cut with loppers or secateurs, about 1.5 metres from the ground. The vines are then pulled away from the host tree, bundled and tied with a flexible section of vine. Roundup® (undiluted concentration), is applied immediately after recutting the bundled vines. Subsequent regrowth is coiled and sprayed with Roundup® (1:50 concentration).

Anredera cordifolia

Vine cutting causes an increase in aerial tuber proliferation. Where the numbers of vines are few, or large vines are encountered, the recommended treatment is to carefully scrape a 20cm. length of stem to expose the cambium like a half-peeled potato, and then immediately apply Roundup® (undiluted concentration). Alternatively, the vines can be injected with a pressurized syringe for injecting cattle, with 2-3cc of Roundup® (1:1 concentration). This will allow translocation of herbicide into the aerial tubers.

Where large numbers of vines makes this individual treatment impractical, or where the entire vine can be removed from the canopy, (e.g. understorey infestation) the vines are cut and allowed to reshoot. The reshooting vines, together with the sprouting tuberlings, are sprayed as required with Roundup® (1:50 concentration) until the tubers are exhausted. Aerial tubers have shown an amazing capacity to survive for 5 years in the canopy after vine severance, and still be viable upon falling to the ground. The use of aluminium extension poles with hooks is recommended to bring down stems and aerial tubers suspended in the canopy. Masses of *Anredera* on the forest floor can be raked into piles to facilitate the spray program.

Cardiospermum grandiflorum

Large individual vines can be cut and painted with Roundup® (undiluted concentration). The recommended treatment for curtain infestations is to sever the vines and then wait for them to reshoot and then spray with Roundup® (1:50 concentration). Other edge vines, e.g. *Passiflora ssp.*, Moth vine, *Araugia hortorum*, Cape Ivy, *Senecio mikanioides*, Lantana, and *Ipomoea spp.*, can be treated in a like manner.

Cardiospermum produces large quantities of seed, but seedlings are readily removed manually even if several metres long due to the weak root system. Alternatively, these seedlings can be sprayed.

Tradescantia albiflora

Tradescantia is a living 'weed mat', completely restricting seedling emergence. *Tradescantia* thickness varies from 6cm. in areas of intact canopy to 60cm. where light levels are high. *Tradescantia* is removed after the canopy has been restored. This prevents the emergence of weed species in the high light levels which temporarily exist while the canopy is reforming. Tradescantia can be removed manually or by spraying with Roundup® (1:50 concentration) during the winter months. Subsequent regrowth can be resprayed or removed manually.

After the removal of the *Tradescantia* blanket, seedlings will emerge. In more exposed areas Privets *Ligustrum spp.*, and Camphor laurel, *Cinnamomum camphora*, will predominate. These will need to be manually removed from the native regeneration.

Ligustrum spp. and *Cinnamonum camphora*

Invasive plants in more open situations are ideally felled by chainsaw where possible and the stumps painted with Roundup® (undiluted concentration). Where this is not possible, frilling with a chainsaw and application of Roundup® (undiluted concentration) is effective. Where dense infestations occur, the use of tomahawk and Tordon® TCH (1:1.5 concentration) may be considered, by injection method. A 15cm. diameter tree would require two cuts with a tomahawk close to ground level and 2 ml. per cut of herbicide solution applicated.

Solanum mauritianum

This exotic species colonizes areas devoid of forest cover after spray treatment, providing essential canopy cover for native rainforest species. Tobacco Bush, *S. mauritianum* is short-lived and unable to persist in shade, and little disturbance results after its death and collapse due to its pulpy structure.

The shade, mulching, and perhaps allelopathy under sloping canopies inhibit rampant annual weed growth, which would otherwise overwhelm rainforest seedlings. The shade produced, however, is not dense enough to inhibit early successional species, e.g. Stinging trees *Dendrocnide* spp., Native Peach *Trema aspera*, Bleeding heart *Omalanthus populifolius*, White cedar *Melia azaderach* var. *australasica*, Red cedar *Toona australis* and Creek sandpaper fig *Ficus coronata*, and these species readily establish along with Privets and Camphor Laurels. Furthermore, the slower growing species comprising the mature canopy also establish under *Solanum*. Seedling establishment is encouraged because *Solanum* is a heavy fruiter and an attractive food source for a variety of frugivorous rainforest birds, which serve to vector desired species from the surrounding forest. *Solanum* is therefore considered a beneficial species in the regeneration cycle.

Flying-Foxes

Both the Little Red Flying-fox *Pteropus scapulatus*, and the Grey-headed Flying-fox *Pteropus poliocephalus*, occur at Wingham Brush, and much discussion has centred upon their impact on the canopy. Although previous reports have defined fruit bats as primary causes of remnant rainforest degradation, the authors observation during the past 8 years at Wingham does not support this view.

Flying-foxes are attracted to roost in areas of depauperate canopy where the remaining trees are isolated from their fellows, allowing free access for alighting and departing, in addition to good visibility. Although the depauperate condition may have resulted from logging, storm damage, senescence, weed invasion, or a combination of these factors, the association of flying-foxes and degraded rainforest has apparently led to the conclusion that flying-foxes have initiated the degradation.

P. scapulatus visits Wingham irregularly, usually from 2-4 weeks during most summers. During the summers of 1985 and 1986, areas heavily infested with *Macfadyena* were treated by cut stump technique. As the vines withered, the spindly, nearly leafless branches of the smothered trees became apparent. These areas attracted large congregations of *P. scapulatus*, resulting in heavy damage to the weakened canopy. Subsequently, tree recovery was vigorous, with dense crowns reformed at a lower, more uniform height. *P. scapulatus* has not revisited the areas to date and the conditions would not now be attractive to them.

It would seem that flying-foxes merely prune canopy tree species rather than producing overall detrimental effects. *Pteropus poliocephalus* populations vary year to year, according to the available local food supply. Although some flying-fox are present all year, the population is greatest October to April. Moreton Bay fig *Ficus macrophylla*, is a popular roosting tree and supports heavy populations without damage. Canopy disturbance occurs primarily to Giant Stinging tree *Dendrocnide excelsa*, where such trees stand in isolation. Flying-foxes strip leaves and branchlets, but the trees recover during the May-September period.

Previously unobserved changes in flying-fox behaviour have been noted during last summer, including roosting within the denser canopy layer below the emergents, and large numbers of flying-foxes remaining at night to feed within the Brush. As the restoration proceeds and a more typical rainforest environment is provided, the behaviour of flying-foxes is likely to continue to change.

History would indicate that the control of flying-fox is unrealistic and discussions on flying-fox damage are therefore academic and probably irrelevant in a practical sense. However, the presence of large numbers of flying-foxes have not impeded the restoration programme at Wingham. The author understands their role as seed distributors and nitrate producers outweigh such disturbance to the canopy as results from their evolutionarily determined activity.

Conclusion

Only remnants of lowland subtropical rainforest remain in NSW. Some of these, like Wingham Brush, are controlled by local councils, others by the Lands Department and some are NPWS Nature Reserves. The universal presence of aggressive weeds within and adjacent to these small reserves dictates that the natural succession will be interrupted as gaps occur. These gaps will require monitoring and weed control strategies as they occur, on a continuing basis, if these relic forests are to survive.

I believe the management of remnant rainforests should be regularly assessed by an independent authority, such as the National Trust of Australia (NSW).

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DO YOU GET THE DRIFT?

If you are involved in spraying, drift is a fact of life. As much as 30% of the total volume from a typical hydraulic sprayer consists of droplets so small that they are prone to drift even in the most favourable spraying conditions.

To the sprayer drift represents not only waste, but a hazard to himself, neighbouring properties, crops and the enviroment.

Furthermore, a recent report by the Health and Safety Executive shows that spray drift is still a major concern to the general public.

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Do you get the drift?

Data from International Pest Control Journal Vol 34 (3) published January, 1993).

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April 19-22, 1993

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Conference Convener
NSW Agriculture
Tamworth

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A Message From The Chairman.

Dear attendee,

Well the conference is over, and by the time you receive this volume of the proceedings, so will 1993. It seems that the older you get the faster time flies, or is it the slower you think? By the time next Christmas arrives I might be ready for last Christmas.

Back to business, many thanks to all of you who wrote, phoned or gave your personal thanks for the organisation of the conference, the success was due to a lot of hard work by a lot of people. I would like to thank the organising committee for the assistance they gave and Les Tanner who ably edited both sets of proceedings. Others like Peter Hughan, the catering manager at the club, Apex and the Bush Fire Brigade all cotributed to a very enjoyable time. A very special thanks to Bruce Carter, my field assistant who helped with the construction of the dais, screen and did a lot of fetching and carrying (especially the cold wet stuff for the bar-b-que).

A personal thanks to all the speakers, without whose efforts all would have been in vain. The content and quality of all papers was exceptional and I hope thought provoking. Even those who sang long and loud claimed to have gained a great deal from attending.

I wish all the best to Peter Gorham and his team in the organisation of the 8th Biennial, and to all of you good health, happiness and fortune for the times ahead. I look foward to meeting you all again (in a much more relaxed atmosphere for me) in Goulburn in 1995.

Best Wishes

Geoff Keech

CONTENTS

Volume 1

PROGRAM 9

NSW AGRICULTURE AND LANDCARE - D A Hayman 13

LANDCARE AND ITS ROLE IN NOXIOUS WEED MANAGEMENT - Stuart Bray 20

A CATCHMENT APPROACH TO WEED MANAGEMENT - W J Garrard 23

UNDERSTANDING SCIENCE AND YOUR ENVIRONMENT -
Dr Roy Tasker and Mrs Ruth Dircks 29

URBAN BUSHLAND IN DECLINE - Judie Rawling 33

THE SENTINEL AND THE CARBO-FLO PROCESS 37

ENVIRONMENTAL CONCERNS WITH FARM CHEMICALS 41
Don Matthews

LAND STABILISATION AND ROADSIDE REVEGETATION - B.M. Sindel 47

COMPUTERISED WEED MAPPING - Ken Hayes 55

BIOLOGICAL CONTROL OF WEEDS IN NEW SOUTH WALES
J. R. Hosking and R. H. Holtkamp 58

BIOCONTROL OF WEEDS IN QUEENSLAND: RECENT DEVELOPMENTS
Rachel E C McFadyen 67

EXPECTATIONS OF BIOLOGICAL CONTROL - H J Milvain 72

WOODY WEED CONTROL - R Fagan 75

ALLIGATOR WEED UPDATE - Ken Bunn 81

THE GRANULAR ADVANTAGE - Bernie Horsfield 84

HANDLING THE PRESS - Col Begg 89

CHEMICAL CONTROL OF ST. JOHN'S WORT - C.O. Love 101

JOHNSON GRASS CONTROL WITH "OUST" - Michael Brooks 105

CONTENTS

Volume 2

PROGRAM 125

BIOLOGICAL CONTROL OF TEMPERATE WEEDS IN CSIRO 129
D.T. Briese

UPDATE ON WEEDS RESEARCH AND DEVELOPMENTS 137
J.J. Dellow

WEED RESEARCH UPDATE 143
Tony Cook and Max McMillan

PROPERTY INSPECTIONS - GROUND VERSUS AIR 151
Peter Gorham

NATIONALLY DECLARED AND PROHIBITED PLANTS 157
Andrew Leys

NATIONAL REGISTRATION OF AGRICULTURAL AND VETERINARY CHEMICALS 163
Roger Toffolon

NEW SOUTH WALES HAZARDOUS SUBSTANCES REGULATION 169
Ted Szafraniec

NEW TECHNOLOGIES FOR OLD PRODUCTS 177
Matthew Gallagher

CONFERENCE POST MORTEM 185

LIST OF DELEGATES 197

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PROGRAM

7th Biennial Noxious Plants Conference, Forster NSW.

Monday 19th April to Thursday 22nd April 1993.

Venue: **Forster-Tuncurry Memorial Services Club.**

Registration: From 2.00pm to 6.00pm Sunday 18th April, at the Forster - Tuncurry Memorial Services Club.

Program : Monday 19th April.

8.30 am. Registration.

A choice of three tours to set the scene for the next three days.

10.00 am. **Tour 1.**
Full day, taking in inspections of control, Blackberry bio control, Lantana herbicide demonstrations, Giant Parramatta Grass control trials, and Rainforest regeneration at Wingham Brush,

10.00 am. **Tour 2.**
Full day, Bitou Bush bio control, Urban Weed impact on National Parks, Fireweed control and its impact on Deer Farming, Lantana herbicide demonstrations.

11.00 am and 2.00 pm. **Tour 3.**
An inspection of the Pampas Grass problems associated with the dredging of Wallis Lake and foreshore weed problems. Pesticides and the Oyster Industry. This tour is by boat.

1.00 pm. **Alternate Activity.**
Turf and Woody Weeds inspection, lead by Bernie Horsfield.

Program : Tuesday 20th April.

8.30	Registration	
8.50	Housekeeping	Geoff Keech, Conference Convenor
9.00	Official Opening	Dr. Kevin Sheridan, Director General NSW Agriculture.
9.30	NSW Agriculture and Landcare.	Don Hayman, Executive Director Policy and Planning, NSW Agriculture.
10.00	**Morning Tea**	
10.30	Weed Control & Environmental Considerations	Harvey Baker, Environmental Director Australian Cotton Foundation Ltd.

11.00	Landcare & its Role in Noxious Plant Management	Stuart Bray, North West Director of Landcare, Department of Conservation and Land Management, Gunnedah.
11.30	A Catchment Approach To Weed Management.	Wayne Garrard, North West Total Catchment Management Coordinator, Dept. CALM. Tamworth.
12.00	Understanding Science & Your Environment	Dr. Roy Tasker and Mrs Ruth Dirks. Royal Australian Chemical Institute.
12.30	**Lunch**	
1.30	Understanding Science Continued.	Royal Australian Chemical Institute
2.00	Urban Weeds and & Bushland Management	Judie Rawling, Project Manager Urban Bushland Management.
2.30	Environmental Concerns With Farm Chemicals and The "Sentinel" Water Effluent Treatment Plant.	Mr.Don Matthews, Stewardship Manager ICI Crop Care.
3.00	**Afternoon Tea**	
3.30	The Clean Waters Act : Herbicide Application Near Waterways.	Mr. Simon Smith, Regional Coordinator Environmental Protection Agency.
4.00	Stabilisation & Roadside Revegetation With Native Grasses.	Dr. Brian Sindel Research Scientist, Division of Plant Industry, CSIRO.
4.30	Computerised Weed Mapping.	Ken Hayes Chief Weeds Officer, Coffs Harbour City Council.
5.00	End Day One Evening Free	

Program : Wednesday 21st

8.30	An update on Weed Biological control present and future.	Dr. David Briese, CSIRO Deputy Section Head, Bio Control of Weeds.
9.00	Bio Control Research in NSW Agriculture.	Dr. John Hosking / Royce Holtkamp, NSW Agriculture
9.30	Bio Control of Weeds in Queensland : Recent Developments.	Dr. Rachel McFadyen Qld. Lands Department

10.00	**Morning Tea**	
10.30	Realistic Expectations of Biological Control	Hugh Milvain, NPAO NSW Agriculture
11.00	Woody Weed Control	Rob Fagan, DuPont
11.30	Endangered Fauna Act	Russel Couch, Manager, Endangered Species Unit, National Parks And Wildlife Service.
12.00	Alligator Weed Update	Ken Bunn, Port Stephens Shire Council.
12.30	**Lunch**	
1.30	Chemical Compatibilities & Spray Additives	Leyland Minter Organic Crop Protectants P/L
2.00	Weed Research Update	Jim Dellow, NSW Agriculture
2.30	Weed Research Update	Tony Cook, NSW Agriculture
3.00	**Afternoon Tea**	
3.30	Noxious Plants Officers Association Annual General Meeting	
3.30	Elected Members Forum & Guest Speaker, Alan Russell, Chief Legal Officer, NSW Agriculture.	
3.30.	State Rail TVO meeting.	
5.00	End of day two	
Evening	B-B-Q Tea Catered by Apex.	

Program : Thursday 22nd

8.30	Spraying Without Water.	Bernie Horsfield, Macspread.
9.00	Aerial Inspections	Peter Gorham, NPAO NSW Agriculture.
9.30	Nationally Declared & Prohibited Plants	Andrew Leys, Program Leader, Weeds. NSW Agriculture.
10.00	**Morning Tea**	
10.30	National Pesticide Registration and The NSW Pesticides Act	Roger Tofflon, Registrar of Pesticides, NSW Agriculture

11.00	NSW Hazardous Substances Regulations.	Mr. Ted Szafraniec, Scientific Officer, Workcover Authority.
11.30	Impact of Legislation on Containers & Disposal	Greg Healey, Manager, Research and Development, Nufarm Ltd.
12.30	**Lunch**	
1.30	The Noxious Weeds Act & Legal training	Patrick Dodgson, Senior Legal Officer NSW Agriculture.
2.00	Handling The Press	Col Begg, NSW Agriculture
2.30	Monsanto New Chemistry	Brian Arnst, Monsanto
3.00	**Afternoon Tea**	
3.30	Chemical Control of St. Johns Wort.	Chris Love, DowElanco
4.00	Johnson Grass Control Using Oust ®.	Michael Brooks, Narrabri Shire Council.
4.30	Conference Review	Doug Hocking, Peter Gorham.
5.00	Conference Ends.	
6.30 for 7.00	**Conference Dinner**. Dress - semi formal (coat and tie.)	

****

BIOLOGICAL CONTROL OF TEMPERATE WEEDS IN CSIRO CURRENT ACTIVITIES

D.T. Briese, P. Chaboudez, P. Jupp,
A.W. Sheppard, A.J. Wapshere and T. L. Woodburn
CSIRO Division of Entomology,
GPO Box 1700,
Canberra, ACT 2601

Introduction

The period since the 6th Biennial Noxious Plants Conference has been quite eventful for the Biological Control of Weeds group at CSIRO for several reasons. Firstly, there has been considerable activity on current projects with a number of new agent releases and in this paper we would like to discuss those projects of interest to NSW. Secondly, the new research facility for the CSIRO Biological Control Unit at Montpellier, France, is due to be completed in June 1993 and should greatly improve operations involving the search and evaluation of potential control agents. Finally, the downturn in the rural economy has meant that our principal funding sources, the Rural Industry Research Funds, have less money available for research. This has led to the cessation of some projects and reduced funding for others. The implications of this for control in the longer term will be discussed.

Scotch and Illyrian Thistles

The project against Scotch (*Onopordum acanthium*) and Illyrian (*O. illyricum*) thistles started in 1988 and has, until the last two years, been based in Europe, where studies were undertaken to find and evaluate potential biological control agents. Of 130 species found throughout the Mediterranean region, 6 were identified as candidate agents following detailed studies of their impact on the population dynamics of *Onopordum* spp. These are the seed weevils, *Larinus latus* and *L. cynarae*, the seed fly, *Tephritis postica*, the stem-boring weevil, *Lixus cardui*, the sap-sucking plant hopper, *Tettigometra sulfurea*, the rosette weevil, *Trichosirocalus horridus* and the crown fly, *Botanophila spinosa*.

The first agent to be introduced into Australia was the weevil, *L. latus*, which was found to attack up to 100% of thistle heads in its native range in Greece and destroy most of the seed before it fell to the ground. A single larva of this large weevil (10-20 cm long) can destroy all the seed in a head up to 3 cm in diameter, and multiple attack is common on larger heads. As the enormous soil seed banks are a large contributing factor to the thistle problem in Australia, introduction of such a pre-dispersal seed predator was given priority. Approval to release the weevil was given, after safety testing, in October 1992 and the first releases made in November and December 1992. Enough insects had been reared in quarantine to make 5 releases of 2-300 adult weevils; at Galong, Harden, Bungendore (all on *O. illyricum*), Tharwa and Cooma (on *O. acanthium*) respectively. The weevils laid well on the thistles and second generation adults emerged in February 1993. These adults have now "disappeared" to find hibernation sites for the winter period and we will need to await their re-emergence in Spring before we can claim successful establishment. Once the early releases have built up in numbers we hope to organise an active program of re-distribution in co-operation with State and local government officers.

Host-specificity testing of the stem-borer, *L. cardui*, has just successfully terminated in quarantine at Canberra, and, if the current application for release is successful, releases of

this weevil will be made in Spring 1993. Experiments in France showed that heavy attack by this weevil could reduce plant size by up to half and lead to smaller flower heads and an increase in the abortion rate of these flower heads. As with all programs, successful biological control will depend on the complementary activity of several agents. Thus, it is planned to introduce another of the agents listed above every one or two years, with the seed fly, *T. postica*, to be introduced into quarantine for host-testing in July 1993.

Nodding Thistles

The first agent released against nodding thistle, *Carduus nutans*, (in 1988) was the receptacle weevil, *Rhinocyllus conicus*, which is now well established in the tableland areas of NSW. The first egg-laying of the weevil coincides with the appearance of the primary flower heads. Usually all the seeds are destroyed in these first heads and survival of the weevil from egg to adult is usually very low, given that large numbers of weevils are laying on a small number of heads. The secondary heads, which are more numerous than the primary heads, have fewer eggs laid on them, but usually sufficient to destroy most seeds, and egg to adult survival is as high as 60%. By the time the numerous tertiary flowers (which produce about half of the total seed set) are formed, the weevil has ceased egg laying and hence these heads escape attack and mature all their seed. The best effect to date of the weevil has been a 36% reduction in seed set at Glencoe. However, due to the prolonged flowering period that far exceeds the activity of the weevil, it appears most unlikely that *R. conicus*, on its own, will control nodding thistle in Australia.

Another agent that limits seed production was therefore introduced to complement the effects of the weevil. The seed fly, *Urophora solstitialis*, was released from quarantine in December 1991 and has since become well established on the tablelands. The larvae induce the plant to form a woody gall in the capitulum. These galls, which act as metabolic sinks, invariably fuse together and can occupy the entire head. This agent also becomes active early in the season, but due to the presence of a second generation, it attacks heads formed over the majority of flowering period. Preliminary analyses indicate that from 6 to 9 seed fail to mature per larva, and seed reduction at one site so far this year has been reduced by 60%. Results from Europe indicate that although *U. solstitialis* avoids heads already attacked by *R. conicus*, survival is similar in heads with and without the weevil, and other research indicates that the weevil survival is also unaffected by the presence of the fly. Research sites have recently been established this year where the effects of both agents will be monitored.

Application has been made for the release of a third agent, the rosette weevil, *Trichosirocalus horridus.* This weevil lays its eggs on the rosette leaves from autumn to spring. The larvae burrow down through the petioles and into the crown tissue, where they feed and destroy the apical meristem, forcing the plant to become multi-crowned. If a succession of eggs are laid on the plant these new crowns are in turn destroyed. Heavy attack can lead to rosette death while lighter attack results in a plant with reduced vigour.

Slender Thistles

A joint project has been undertaken with CSIRO Division of Plant Industry to find strains of the rust fungus, *Puccinia cardui-pycnocephali*, that were virulent against the slender thistles, *Carduus pycnocephalus* and *C. tenuiflorus.* This rust is already present in Australia, but is not particularly damaging. Surveys in southern Europe identified 38 rust strains and their effect on Australian plants was compared to two Australian isolates of the rust. As a result, two of these strains were selected for introduction into Australia. Strain

FR3 from southern France is more virulent against *C. tenuiflorus*, while strain IT2 from Italy is more virulent against *C. pycnocephalus*.

Field experiments in France have shown that the strains of *P. cardui-pycnocephali* could significantly reduce plant biomass and the production of viable seed. However, the two thistle species responded differently to each isolate of the rust. This confirms the importance of introducing and releasing initially at least two rust strains. These have been imported into Australia, where they are currently undergoing host specificity testing. It is hoped that this will be completed in time for field release in Spring 1993.

Paterson's Curse

Following the successful co-operative release project between CSIRO and the various State Departments responsible for agriculture, the *Echium* leaf miner, *Dialectica scalariella*, is now found throughout the range of *Echium plantagineum* (except parts of Victoria and Tasmania) and is causing observable damage in the field. Evaluation of the impact of this moth on the survival, flowering and seed production of Paterson's curse is continuing under this scheme. Release work, however, has since concentrated on the other control agents needed to augment the herbivore pressure being placed on the weed by this moth. Techniques for mass-rearing the two crown weevils, *Ceutorhynchus larvatus* and *C. geographicus* have been successfully developed, and starter colonies of these sent to the collaborating organisations. In 1992/93 *C. larvatus* was released by CSIRO at three sites (Braidwood, Jugiong and Finley) where it has established and in 1993 was released at a further two sites by the New South Department of Agriculture (Yanco and Cowra) Despite some problems in maintaining cultures over summer, releases of *C. geographicus* in field-cages are planned for autumn 1993.

By contrast, mass-rearing of the flea-beetle, *Longitarsus aeneus*, whose larvae feed on the fine root hairs, proved too difficult on potted plants under quarantine conditions. Consequently, approval has been obtained from the Australian Quarantine Inspection Service to directly release imported insects into nursery sites in 1993, following a period in quarantine to ensure that the stock is healthy. Host-specificity testing of another potential agent, the bud moth *Ethmia bipunctella*, was completed, but it was found to feed on a wide range of native Boraginaceae. Hence, no application is to be made for its release.

A comparison of the population dynamics of *E. plantagineum* in Europe and Australia indicated that, where infestations are light and the soil seed bank is low (as in Europe), the population is largely seed-limited, whereas in dense infestations in Australia *Echium* is limited by the number of germination sites. Thus, light infestations may be controlled by grazing to reduce seed production, whereas heavy grazing in a denser infestation will only open up more germination sites and lead to re-infestation from the large soil seed bank. A mathematical model developed from the European studies suggests that Australian seed banks must decline by over 80% to reduce germination. An experiment is currently underway to monitor seed longevity in the soil, with and without soil-borne predators. Ultimately, these ecological studies will help integrate biological control into an overall management package for *Echium* spp.

Common Heliotrope

Recent work on common heliotrope, *Heliotropium europaeum*, has concentrated on the use of pathogens as control agents, in particular the rust fungus, *Uromyces heliotropii*, which was approved for release in 1991. Five sites in South Australia, Western Australia

and NSW (Trangie and Jugiong), were inoculated in 1992 and rust spread was measured at 2-500 m from the points of inoculation. Natural reinfection from overwintering spores was observed at the two South Australian sites, confirming establishment, but not at Trangie despite an abundance of common heliotrope. Efforts are to be directed at understanding the environmental factors favouring rust infection. In January 1993 a further eight sites (including Barham, Parkes, Temora and Young in NSW) were inoculated, mainly in irrigated paddocks to facilitate establishment and initial spread. These were made using a dust spray technique which reduced application time and increased the area that could be inoculated.

The infection at Parkes in NSW never had the opportunity to spread, largely because of an outbreak by a native leaf-blotch fungus, *Cercospora* sp. A second, seemingly more virulent fungus of this genus, *C. heliotropii-bocconii*, is presently being studied in Europe as a possible complementary agent to the rust fungus. While it is not as efficient at killing seedlings as the rust it can infect the seed and reduce germination. This species can also be grown on artificial media, raising the possibility of its use as mycoherbicide.

Work on the root weevil, *Pachycerus cordiger*, and the flower-bud moth, *Ethmia distigmatella*, has ceased, as the former was found to reproduce on some native Boraginaceae and the second was considered to have too little impact on the weed to warrant extensive study and tests. The flea-beetle, *Longitarsus albineus*, however has been rediscovered in the field at Young. Mathoura, Trangie and Jugiong, showing that initial releases in 1987 were, in fact, successful. The agent has not, however, dispersed and numbers have built-up very slowly. It has yet to show any significant impact on the weed.

Blue Heliotrope

Preliminary surveys for agents of blue heliotrope, *Heliotropium amplexicaule,* were carried out in parts of its home range in Argentina. Although only four host-restricted insect species were found, one of these, the chrysomelid *Deuterocampta quadrijuga,* was observed to produce massive defoliating infestations on the plant. Although the chrysomelid only occurs in a restricted region of Argentina, a comparison of the climate of that region with the climates of the regions infested by the weed in Australia showed that it would be pre-adapted to the most of the area infested here. The other insects have broader climatic ranges in Argentina. There is therefore some possibility for the biological control of this weed.

The other important result from the preliminary survey was that, unlike the situation in Australia, the aerial vegetation of this perennial plant declined sharply over the summer in Argentina to levels where it was very difficult to find. Thus the ecology of blue heliotrope in its home range appears to differ considerably from its ecology here where leafed stems persist over summer and this difference could explain why it has become weedy in Australia.

Future work on blue heliotrope, when funds become available, would be centred in Argentina and would include further surveys there and in adjacent countries to the immediate north for other agents and initial determination of the host specificity of the insects already discovered. Studies aimed at understanding the different ecology of the plant in South America and Australia in the hope of discovering the cause of the summer decline in aerial vegetation would also be important.

St John's Wort

The most significant feature of the St John's wort program over the past two years has been the co-operative rearing and release program for the mite, *Aculus hyperici*, between CSIRO, the NSW Department of Agriculture and the Victorian Department of Conservation, Fisheries and Lands. This resulted in 170 releases since May 1991, of which 115 sites have been monitored and 82 sites confirmed as having established colonies of *A. hyperici*. Analyses of these showed that establishment was unaffected by shade, which is encouraging in view of the aversion of the principal existing control agent, *Chrysolina quadrigemina*, to shaded situations. Establishment was favoured when releases were made under fine weather conditions, on plants in good condition and growing in dense infestations. There was a trend toward better establishment if the *H. perforatum* infestation had a northerly aspect, while early Spring releases were more likely to establish than those made at other times. While too early to observe a general trend, in some individual sites (e.g. Burrendong), the mite caused sufficient damage to prevent flowering.

Detailed studies of mite population build-up and dispersal are being carried out at a site near Canberra where *A. hyperici* was first released in May 1991. These show a steady increase in numbers and dispersal up to 850 m in the first year. Individual *H. perforatum* plants showing mite damage were first observed in November 1992, though no impact on overall plant demography has yet been noted. In view of the importance of these studies they will be continued despite the cessation of external support for the program in 1992.

Further introductions of the root-borer, *Agrilus hyperici*, were made in 1992 to supplement the small colony established at Tuena NSW in 1990. However, this insect has a low potential for increase and numbers remain low. The other insect released in recent years, *Aphis chloris*, is now well distributed across New South Wales, again through the co-operation of the above agencies. Dispersal is ongoing with moves of 100 km per season not uncommon, though few colonies appear to reach densities able to inflict observable damage on the weed. Detailed studies at Adaminaby and six minor sites indicated that, while it can reduce plant vigour and seed output to some extent, it may not be a reliable control agent due to its inconsistent colonisation patterns. Hope for improving biological control of St John's wort in south-eastern Australia thus rests with *Aculus hyperici*.

Skeleton weed

Recent work on the skeleton weed project had concentrated on establishing experimental plots in Western Turkey, planted with Australian forms of *Chondrilla juncea*. The purpose of this was to trap strains of the rust, *Puccinia chondrillinae*, effective against the intermediate- and broad-leafed forms of the weed that are becoming increasing problems in Australia. This approach was suggested by studies of the population genetic of skeleton weed conducted at the CSIRO laboratory in France, which showed that the region of greatest genetic diversity and hence the likely centre of evolution of the *C. juncea* was in Western Turkey. This region was also found to contain sexually reproducing diploids of the weed and these have been implicated in the production of new forms in this region. With a greater diversity of the host and the regular occurrence of sexual cycles in the rust, a greater diversity of strains of the pathogen would also be expected, as it too would be continually evolving. Exposure of Australian forms of skeleton weed to these would increase the prospects of finding rust strains virulent against them.

Infected plants were recovered in the garden in 1991 and 1992, showing that the system of trap plants could work. Two strains of the rust highly virulent against the intermediate-leaf form were recovered, but none showing severe attack on the broad-leaf form.

However, funding for the project was terminated in June 1992, and the future of the work is uncertain. A new application has been submitted to GRDC and may lead to completion of this phase of work.

Despite the funding cut, work was continued on the host-specificity testing of one of the new strains from Turkey, virulent against the intermediate-leaf form of *C. juncea*. Testing will be completed in June 1993 and it is hoped to introduce this into Australia should further funding be obtained.

Bathurst burr

Preliminary surveys for agents of Bathurst burr, *Xanthium spinosum,* were carried out in Chile and Argentina in 1991. These showed that very few organisms occurred on the plant in Chile but that a wide range of damaging insects and fungi occurred on the plant in Argentina This result indicated that the origin of this plant was not in Chile, as previously supposed, but somewhere in South America east of the Andes.

Although a considerable number (30+) of insects infesting all parts of the plants were causing damage to Bathurst burr in Argentina, various fungi were the only organisms actually observed to destroy plants. Plants whose stems were bored by various insect larvae were clearly unthrifty and tingid bugs and moth larvae defoliated plants.

Bathurst burr occurs over a wide range of very different climates in eastern Australia. Another result of the survey in South America was the observation that different organisms were causing damage to Bathurst burr in different climatic regions. As would be expected, the most destructive fungal infestations, including root blights and anthracnoses, occurred in the higher rainfall regions but also different insect species were more common and more damaging in some climatic zones than in others. This was particularly the case for stem boring/mining insects. In the summer rainfall regions of Argentina, a cerambycid larva was the most important in the higher rainfall areas, mordellid, curculionid and lepidopteran larvae in the moderate rainfall regions and in the driest regions only mordellids mined the stems. In the winter rainfall regions of Chile there was only one large agromyzid mining the stems. Thus, given the wide climatic range of Bathurst burr in Australia, different organisms are likely to be effective as agents in different regions. The mordellids were the most damaging insects in climates similar to the dry regions were control is most needed in Australia.

Future work, should funds become available, would include further surveys for agents in eastern South America and initial determination there of the host specificity of the most important potential agents. Allozyme studies of the mordellids to determine whether or not they are nonspecific, as morphology indicates, with those infesting related Helianthinae would be necessary, plus investigations of the virulence and specificity of the very damaging fungi observed on Bathurst burr.

Doublegee and Lesser jack

During 1990/92 a study was carried out on the potential of the fungus, *Phomopsis emecis*, a damaging natural enemy of the doublegee, *Emex australis*, in its native range in southern Africa, to control the weed in Australia. Unfortunately, it was found that a strain of this pathogen already exists in Australia and that it contains the mammalian toxin, phomopsin. As a result, investigations of this potential control agent were terminated.

A new project based at CSIRO in Perth was started in 1992, however, to examine the potential of insects from the lesser jack, *E. spinosa*, in Israel and north Africa to control both *E. spinosa* and *E. australis* in Australia. Preliminary studies in Israel suggest that the insect fauna of the former species, crown weevils, *Apion miniatum*, root weevils, *Coniocleonus excoriatus*, the stem weevils, *Perapion* spp., root aphids, *Dysaphis emici* and sawfly, *Kokujewia ectrapela*, have the potential to attack earlier in the plant's growth and are thus better prospects than those previously studied from *E. australis* in South Africa.

Studies have also been carried out on the effect of the accidentally introduced aphid, *Brachycaudus rumexicalens*, which has recently had a quite damaging effect on *Emex* spp. in Western Australia.

The New Montpellier Laboratory

The construction of a new biological control facility for CSIRO at Montpellier, France, is now well underway and the laboratory should be operational in July 1993. This facility has been funded jointly by CSIRO and the Rural Industry Research Funds (WRDC, MRC, GRDC), with subsidies from French local government, and will replace the inadequate, rented buildings currently being used. Proper facilities for plant propagation, insect rearing and pathogen culture, testing, sorting and identifying field material and for running long term ecological field assessment programs, are vital to conduct rigorous programs on weed and invertebrate pest programs. Already use of the land attached to the site has been made use of in the evaluation of potential agents for *Onopordum* thistles and the screening of wheat cultivars resistant to Russian wheat aphid.

As well as assuring a secure base for current and future projects against European weeds and improving the efficiency of these classical biological control programs, the laboratory has the potential to serve as a base for other projects, e.g. collection and screening of genetic material, collaboration with European scientists in fields of interest to CSIRO, and for the development of research and commercial opportunities in Europe.

Funding of Control Programs

One of the major problems facing biological control of weeds projects at present is the reduced potential for funding due to the downturn in the rural economy. Currently the CSIRO Biological Control of Weeds Section receives over 50% of its funding from external sources, and, in the case of temperate terrestrial weeds, this involves mainly grants from the Wool Research and Development Corporation, the Meat Research Corporation and the Grains Research and Development Corporation. All of these organisations (WRDC in particular) have fewer funds available to distribute, which has led to the cessation of some projects over the past 12 months and some shift in emphasis on continuing projects. This involves a more concerted effort on the release and distribution of agents already selected as potential control agents, and a reduced effort on the search for and evaluation of potential new agents in Europe. This will probably see greater emphasis on collaborative work with State and local government agencies, such as has occurred with the *Echium* project, and this can only be beneficial. However, it would be counter-productive in the longer term if funding did not include a component for follow-up evaluation studies once agents were established.

One consequence of having less money available is that the funding bodies need to ensure that available funds go to projects most likely to contribute to the industries concerned. Economic justification of new projects will be an even more critical step. For example, MRC now requires a cost/benefit analysis as part of its consideration of new

grant applications. For weeds projects such an exercise needs data on areas of infestation, losses in production at different levels of infestation, areas treated with herbicides and frequency of such treatments etc. It is accepted that, at the present time, it is difficult to do more than estimate some of the input required. While much of the information is available at the local level, it is very difficult to obtain a global picture of the cost of a pasture weed. To do this, effort needs to be directed into collating this information, locally available, for all the serious weed problems. An evaluation is also needed of the most appropriate procedures for estimating the long-term benefit of self-perpetuating activities such as biological control. Such economic justification should form part of any new proposal regardless of whether it is required by funding bodies or not.

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UPDATE ON WEEDS RESEARCH AND DEVELOPMENTS

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In this paper I would like to briefly touch on some aspects of weed control developments and also research being conducted by NSW Agriculture.

New Herbicide Formulations

There is a very pleasing trend towards the development of and promotion of water soluble granular (WSG) herbicides in place of the current emulsifiable concentrates. Also there is a increased recognition of the odour problems posed by many herbicides, especially the phenoxy herbicides (eg 2,4-D and MCPA).

Many of the WSG herbicides are merely new formulations of old and currently registered and widely used products. Some examples of the "old" products which are being newly formulated are:

- Pacer (Monsanto) 850g/kg glyphosate
- Amisol (Nufarm) 800g/kg 2.4-D Amine Salt
- Tornado (Nufarm) 700g/kg 2,4-D Sodium Salt

It must be pointed out that WSG formulations have been around for a long time. The herbicide Glean (Dupont) registered on the early 1980's was one of the leaders in this new chemistry and marketing.

There are major benefits and environmental advantages with the WSG formulations.

Advantages:
- Less volume - cheaper transport and storage.
- No drum disposal and easier package disposal.
- Safer for
  - operator
  - transport
  - ease of clean up in case of spillage
  - easier to retrieve

Silverleaf Nightshade

Silverleaf Nightshade is a major "intractable" noxious weed of south eastern Australia (Victoria, South Australia and New South Wales). In New South Wales it is estimated to currently infest 140,000 ha of the wheat belt (Dellow 1993).

Currently NSW Agriculture through its Weeds Research and Demonstrations Unit at Orange is undertaking intensive research at Gulgong and Parkes to extend and integrate a control package to include herbicide applications, cultural practices and pasture improvement.

The Grain Research and Development Corporation have just recently funded a three year program to assist NSW Agriculture to promote the before mentioned aims. A major part of the program is a State wide awareness campaign to ensure the community can identify the weed. This is most important, particularly while the weed is not widespread but usually in

concentrated localities. Following early identification, the next most important phase of the program is the control and eradication of the isolated and small infestations. Along with these high priority aims, research into the control of large and consolidated infestations will continue.

A lot more will be heard of Silverleaf Nightshade in the immediate future.

Herbicide Resistance

Herbicide resistance is now a fact of life for the winter cereal grower of the southern wheat belt of Australia.

A recent survey of NSW indicated that at least 4% of farms in the State's southern wheat belt has herbicide resistance with possibly another 4% imminent. The survey also brought to light another serious statistic: Only 40% of producers in this area were aware of herbicide resistance.

The current species exhibiting herbicide resistance are annual crop weed species:

- annual ryegrass
- wild oat
- indian hedge mustard
- sow thistle
- rice weeds

The resistance in Australia is unique in the fact that for instance the herbicide resistant ryegrass is cross or multiple resistant. This means it is often resistant to both related and unrelated herbicide groups although it often has only been exposed to the one herbicide for a number of years (usually in excess of 4 consecutive years).

Plants which are candidates for resistance are usually annual plants and luckily most noxious weeds are perennials and consequently less likely to develop resistance. Annual ryegrass is an excellent candidate for herbicide resistance because of its:

- self pollination
- high seed production
- highly variable species
- autumn and spring germination
- short seed longevity

NSW Agriculture along with Agriculture Departments from Victoria, South Australia and Western Australia have just established an extension campaign funded by the Grains Research and Development Corporation to mount an awareness campaign of the problem and its causes.

The major messages will be:

- awareness of problems and causes.
- that continued and intensive use of herbicides, particularly from the same group to be avoided.
- careful paddock observations and results.

In regard to the development of herbicide resistance in noxious weeds the eventuality should not be discounted. With an understanding of the causes of herbicide resistance it is less likely to occur unless you are dealing with an annual crop or pasture weed which is continually targeted with herbicides

Serrated Tussock

Recent continued research by Dr Malcolm Campbell (Research Agronomist Orange) has shown excellent control for Serrated Tussock is being achieve with the registered herbicide Frenock®. This has also been confirmed by large commercial aerial and ground applications both in the Central and Southern Tablelands.

The reason for discussing this topic is due to the fact that failures using Frenock® have been reported in these same areas over several proceeding seasons.

No conclusions have been made in regard to this failure (possibly application in difficult terrain). However, following the trial result of Dr Campbell's research and the unsuccessful commercial application, NSW Agriculture is confident of Frenock's® efficacy.

Current Integrated Weed Management Research by NSW Agriculture

a) Grass weed control in pasture lays prior to cropping - by reducing the grass control in pastures prior to cropping greatly increases grain yields due to
- weed control - moisture and nutrients
- cereal disease control

However there is an increase in herbicide resistance pressure.

b) Reduced dependence on herbicide - integration of perennial and annual Vulpia spp. An effort is being made to integrate this with herbicide and grazing management inputs.

c) Crop Weed Competition
A project base at Wagga is investigating crop competitiveness through
- competitive cultivars
- sowing rates
- time of sowing
- fertiliser

This places less dependence on herbicides and also lessens weed seed production.

d) Reduction of Weed Seed Bank
Research at Orange is investigating the use of pathogens (fungi) for reducing the soils weed seed pool. Naturally occurring pathogens are being investigated (no introduction).

The weed species being investigated are
- wild oat
- annual ryegrass
- wire weed

e) Herbicide Resistance

As well as the GRDC funded national extension campaign, the northern wheat belt is looking at winter/summer crop and herbicide rotations. This will hopefully reduce the likelihood of herbicide resistance and also reduce the weed seed bank.

f) Cotton Weeds

Nut grain is a major target. Weed control in cotton is undergoing a re-think due to the high labour and herbicide costs.

Integrated approach looking at combinations of

- cultivation
- rotations
- herbicides

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POWERED AIR PURIFYING RESPIRATORS

Comfortable, effective protection against the damaging health effects of:

- ✓ Chemicals
- ✓ Dust
- ✓ Pollens
- ✓ Spores

"The Air You Wear"

DO YOU GET THE DRIFT?

If you are involved in spraying, drift is a fact of life. As much as 30% of the total volume from a typical hydraulic sprayer consists of droplets so small that they are prone to drift even in the most favourable spraying conditions.

To the sprayer drift represents not only waste, but a hazard to himself, neighbouring properties, crops and the enviroment.

Furthermore, a recent report by the Health and Safety Executive shows that spray drift is still a major concern to the general public.

Small droplets (those under 100 microns in diameter) are a source of drift in two different ways. Firstly, they may be directly carried away from the target in air currents during application .

Secondly, if the small droplets evaporate before reaching the target, any involatile chemical fraction remaining behaves like a smoke particle and is very highly drift prone. It is estimated that a 50 micron droplet has a life of only 12 seconds at 20° C and 80% relative humidity.

However, help is at hand. Recent research at Imperial College, London has shown that spraying agro chemicals with Codacide Oil can substantially reduce the risk of spray drift.

Codacide is no ordinary surfactant. It contains emulsifiers which enable the vegetable oil to envelope pesticide molecules in capsules of approximately equal size, which when added to the spray tank with water, form a controlled emulsion. The resulting spray consists of pesticide carrying oil droplets evenly distributed in the water, the great majority of which are much less susceptible to drift.

In the Imperial College study, the light energy diffraction pattern produced when a spray cloud was passed through a laser beam was used to determine the percentage volume of spray droplets under 100 microns in diameter.

When sprayed through a range of flat fan nozzles at a pressure of 3 bar, at 2.0% Codacide oil-in-water emulsion produced an average of 79% less drift prone droplets then water alone.

Given all the other benefits of Codacide ie:- increased deposition and uptake on target, reducing chemical odour and rainfastness within minutes. Farmers, spray contractors, councils etc will find that minimum recommended rates work very well, and less water is required to wet the target.

The cost savings are in time - money and the environment.
Do you get the drift?

Data from International Pest Control Journal Vol 34 (3) published January, 1993).

WEED RESEARCH UPDATE

NSW Agriculture
Weed Research & Development Unit

Tony Cook and Max McMillan
NSW Agriculture, Glen Innes

Horehound *(Marrubium vulgare)*

Six experiments were conducted to evaluate optimal rates and times of application of herbicides. Trial sites were located at Armidale (1), Glen Innes (2), Walcha (2) and Emmaville (1) and were sprayed between late spring 1987 to winter 1989.

In the first trial, installed in spring 1987, the outstanding treatments were MCPA and 2,4-D ester, however regrowth occurred in all treatments.

In autumn 1988, two trials were installed at Walcha and one at Glen Innes. Autumn trials gave more effective control. 2,4-D and MCPA were again outstanding and at rates of 3 L/ha killed mature horehound. Long term control was reduced by seedling reinvasion. All assessments showed no significant differences between both herbicides at the same rate of active ingredient. Control of horehound peaked about 6 MAT in autumn trials and began to decline afterwards due mainly to reinvasion by seedlings.

2,4-D amine/ester or MCPA should be used at the lower rates tested e.g. MCPA (1.5-2.0 L/ha), 2,4-D amine (1.5-2.0 L/ha) and 2,4-D ester (0.9-1.25 L/ha). This will reduce costs and pasture damage so that horehound seedling reinvasion can be minimised by competing pasture.

A spring experiment at Emmaville investigated horehound control in 8-10cm lucerne regrowth. MCPA was the most effective herbicide tested and gave a good brownout, but most plants regrew, and lucerne damage was excessive. MCPA was mixed with either diuron 900 at 1.67 kg/ha or Brush-off 10 g/ha with the objective of controlling seedlings. This tactic was unsuccessful.

In the final trial at Glen Innes, MCPA was applied at three rates (1, 2, and 3 L/ha) and on three different timings. (Summer, early Autumn and late Autumn). Late autumn was clearly the most effective, confirming previous observations. Application time had a greater effect than a three fold increase in application rate.

To help reduce seedling numbers, the sprayed area should be rested for at least 2 months when seedling emergence is likely (autumn and spring). Establishment of a strong competitive pasture is also recommended..

Prairie Groundcherry *(Physalis viscosa)*

Glen Innes Weeds Research & Demonstration Unit conducted two trials on this weed near Gunnedah. Trials were sprayed in fallow in autumn 1990 and 1991.

Herbicides tested in 1990 were Tordon 50-D, 10 L/ha, Amitrole, 11 L/ha, Starane 30%, 1 and 2 L/ha, and Roundup, 5, 7.5 and 10 L/ha. Starane at 2 L/ha gave 78% control and Roundup at 5, 7.5 and 10 L/ha produced 80%, 90% and 90% control respectively 11 MAT. The 1991 trial produced better results: Starane at 2 L/ha (86% control), Tordon 50-D at 5

and 10 L/ha (91% and 99%), Amitrole at 11 L/ha (97%) and Roundup at 5 to 10 L/ha (96% to 99%) 10 MAT.

The cost of these treatments is high. In fallow situations, the introduction of the Detect-Spray (W.A.S.P. - Weed Activated Spray Process) has great potential for reducing the cost of treating patchy weeds such as prairie groundcherry.

Roundup at 5 L/ha was the most cost-effective treatment. It is likely that two applications will be needed to control seedling and rhizome regrowth. Autumn is the best treatment time for most summer growing perennials. Grazing prairie groundcherry with sheep will give temporary control, prolonged grazing may weaken the underground reserves of the weed.

Nodding thistle (*Carduus nutans*)

A problem with thistle control is late detection and treatment. Quite often advice needs to be given for control of bolting/flowering thistles. Control at this stage requires higher rates of chemical per unit of area. A single trial was implemented for spot spraying of Nodding thistle when 50% were rosettes and the remainder were bolting or in flower.

The herbicides were applied at various concentrations through a D4 or D8 nozzle plate. Application volumes averaged 1500 L/ha for the D4 and 3900 L/ha for the D8 nozzle plate. Only the highest concentrations of MCPA 50% amine (500mL per 100 L) and 24-D 80% ester (312ml per 100 L) gave good control when sprayed through D8 nozzles. This trial was moisture stressed and better results could have been obtained by lower concentrations or smaller nozzles in unstressed conditions.

Two boom spray trials investigated various control options for rosette nodders. The first trial was hampered by insufficient rainfall before herbicide application (22 mm of rain in 2 months before spraying). Lontrel L at 100 and 150 mL ha were the only acceptable treatments (77% and 90% control respectively). Other treatments such as MCPA at 1 to 3 L/ha and Dicamba at 0.7 and 1.4 L/ha will give good control under normal conditions, but the best control recorded was 55% (56 DAT).

In a later trial sprayed under good conditions, MCPA and dicamba gave good control as expected. MCPA 50% amine at 1,2 and 3 L/ha, Dicamba at 0.7 and 1.4 L/ha and lastly MCPA + Lontrel L at 1.0L + 50 mL and 2.0 L + 50 mL/ha all gave at least 99% control 3 MAT. Lontrel L at rates of 50,75,100 and 150 mL/ha were very effective treatments (82, 86, 97 and 99% control respectively).

Lontrel L is cheaper than the other treatments and has the added benefit of better control under moisture stressed conditions. Excessive clover damage will result if Lontrel L is applied at rates above 100 mL/ha. White clover recovers reasonably well within 2-3 months of treatment at 75 mL/ha. Sub clover is more sensitive to Lontrel L than white clover.

The optimal rate appears to be 100 mL/ha and a Pesticide Order is in force for the use of Lontrel L on nodding thistles at this rate. This should be applied to rosettes less than 20 cm in diameter.

St. Barnaby's thistle *(Centaurea solstitialis)*

Efficacies of a range of herbicides for St. Barnaby's thistle control have been tested in five experiments. Two trials recorded lucerne phytotoxicity and one measured white clover and medic tolerance.

In early trials 2,4-D ester gave excellent results at 625 mL/ha and doubling this rate resulted in only a minor increase in control. Lontrel L was tank mixed with 2,4-D amine (500 mL and 1 L/ha) at rates of either 50 or 70 mL/ha. Improved control was seen for the small additional cost of the Lontrel L.

Under good conditions, Lontrel L alone gave satisfactory control at rates above 50 mL/ha. Rates of 100 ML/ha or more can cause severe lucerne damage. This may result in invasion of other weed species. A tank mix of Lontrel L + Gramoxone (50 mL + 1.5 L per ha) controlled St. Barnaby's slightly less than Lontrel L by itself, however lucerne foliar damage was reduced in one trial and the gramoxone killed or suppressed other weeds.

At another trial which investigated white clover and lucerne phytotoxicity, the optimum rate of Lontrel L was 75 mL/ha. This trial was affected by extremely dry conditions and treatments containing Lontrel L gave good results. 2,4-D ester at 600 mL/ha didn't control St. Barnaby's to desired levels and appears more susceptible to dry conditions as noted also for nodding thistle. Dicamba at 0.7 L and 1.4 L were examined but as expected white clover and lucerne damage were excessive. A tankmix of 2,4-D amine + Lontrel L (1 L + 50 mL/ha) gave (at least) 90% control of St. Barnaby's. Lucerne is sensitive to MCPA, 2,4-D ester and amine at rates that give control of St. Barnaby's.

Parramatta grass *(Sporobolus indicus var. major)*

In 1989 two experiments south of Grafton tested the efficacies of Frenock and Dalapon at two times of application (Spring and Autumn). They confirmed that Dalapon had greater activity against Parramatta grass in autumn compared to Frenock. This situation was reversed in spring applications.

Dalapon gave 95% control 20 MAT, with 10 kg/ha but at 5 kg/ha control was not acceptable. Split applications of Dalapon with 5 kg/ha applied at both autumn and spring was slightly less effective than one spray in autumn of 10 kg/ha.

Frenock controlled Parramatta grass well at rates above or equal to 1.5 L/ha in spring. Control at 2 L/ha was similar to that obtained from Dalapon 10 kg/ha in autumn. Applying Frenock at 1 L/ha in spring and again in autumn was less effective than a once over spray at 2 L/ha.

Gramoxone was added to Frenock (1.5 L/ha) as a spray marker. Antagonism between the two herbicides was seen when Gramoxone was mixed at 1.0 L/ha . Little or no antagonism was observed for Gramoxone at the low rate of 100 mL/ha, but this rate was ineffective as a marker.

Parramatta grass will need to be resprayed within 2-4 years from the previous spray. Good control is achieved by:

- selecting the correct time of application for the type of herbicide.
- choosing a rate which does not produce sub commercial results.
- having moderate rains after spraying, to enable good herbicide uptake.

(Excessively wet conditions leach Frenock past the root zone and reduce control).
- light grazing of the sprayed paddock to encourage good pasture.

Saffron thistle *(Carthamus lanatus)*

In the first trial, saffron thistle was controlled easily by a wide range of herbicides. This was due to good moisture conditions before and after spraying and the competitive effect of other species resulting from the exclusion of livestock after spraying. A list of treatments that gave excellent control whilst showing little foliar damage to sub clover were: 2,4-D amine at 750 mL and 1.5 L/ha, 2,4-DB at 3.5 L/ha, and MCPA at 750 mL and 1.5 L/ha. Sub clover was moderately damaged by diuron at 500 mL - 1 L/ha and Lontrel L at 50-70 mL/ha.

Another trial conducted in much drier conditions only measured saffron thistle control. Results in this trial were diminished by the lack of a competitive pasture. Lontrel L was sprayed from 25 mL to 150 mL/ha and only the top rate gave acceptable results. Although this treatment is cheap, it would severely damage pasture legumes. Dicamba at 1.4 L/ha gave excellent control but kills clover and 2,4-D amine was disappointing in the dry conditions with the highest rate of 1.5 L/ha giving sub commercial results. MCPA at 1.5 L/ha gave 89% control 20 WAT and 3.0 L/ha was not much different. Control with 750 mL/ha of MCPA dropped away dramatically to 40%.

A tankmix of Lontrel+MCPA (50mL + 750mL/ha) gave about 95% control and is expected to give some damage to legumes. 2,4-DB at 2.5 L/ha gave poor control. A spray top treatment of gramoxone at 500 ml/ha was applied at 10% flowering but grass damage opened the pasture sward for summer growing weeds. Flowering reduction was similar to the better treatments applied earlier (95%).

Fireweed *(Senecio madagascariensis)*

One trial by the WRDU investigated this relative new entry to the list of noxious plants. The trial tested a wide range of herbicides commonly used in pastures. Bromoxynil 20% at rates of 700 mL to 2.1 L/ha produced 94% to 99% control respectively (47 DAT). The 700 mL/ha rate mixed with 2,4-DB (1.4 L/ha) was inferior to straight bromoxynil. The other effective herbicide was Ally (7 g/ha). Control of fireweed 3 MAT was maintained with all bromoxynil treatments. White clover phytotoxicity was nil for bromoxynil treatments. Some plants that were large and flowering at spraying survived. Ally was still controlling fireweed 3 MAT but had an easier job controlling white clover.

The registered herbicide for use on fireweed is bromoxynil (1.4 to 2.8 L/ha). The other options are cultivation, grazing management and competitive pastures.

Field Bindweed *(Convolvulus arvensis)*

Recently a single trial tested rates of Roundup and dicamba. Control was generally poor with only a few of treatments giving moderate control.

Roundup was applied at 2,4 and 8 L/ha. This four-fold increase in rate did not improve control. All rates of Roundup gave approximately 60-70% control (3 MAT). Control varied from 68% to 84% when 2 to 10 L/ha of dicamba was applied. The registered rate of dicamba is 10 L/ha but in this experiment, 5 L/ha gave a similar result.

Several wetters and herbicides were mixed with Roundup. A minor improvement in control resulted for a Roundup/Ally (2L + 20 g/ha) tankmix and a reduction in control with Roundup 2 L/ha + Pulse penetrant at 0.25% v/v. Addition of Pulse (0.25% v/v) or codacide oil (2 L/ha) to dicamba 2 L/ha improved control by 10%.

The WRDU has done five experiments on field bindweed using very high rates of a wide range of herbicides. In none of these has good long term control been achieved with a single herbicide application.

Green Cestrum *(Cestrum parqui)*

A trial was installed in January this year and to date one assessment of brownout was completed. Results from brownout assessments cannot be considered as serious indicators for herbicide performance because it is common to observe heavy regrowth from previously well browned out plants.

Considering the above information, most promising brownouts were obtained from:

* Grazon DS, 3 mL/m^3 and 6 mL/m^3 (60 mL/L) through an Ag-murf® gas gun.
* Tordon 50-D, 5 mL/m^3 and 10 mL/m^3 (100 mL/L) through a gas gun.
* Starane 20%, 4 mL/m^3 and 8 mL/m^3 (80 mL/L) through a gas gun.
* Garlon 480, 4 mL/m^3 (800 mL/100 L) using a high volume sprayer.

Lantana *(Lantana camara)*

To coincide with this biennial conference, a demonstration trial was conducted at Forster. This demonstration has treatments such as Grazon DS, Tordon 50-D, Brush-off, Roundup, Roundup/Brush-off mixtures and combinations of Brush-off with various adjuvants. These treatments should show good control. However, Starane 20% and Lantana DP 600 should give less than acceptable results.

A more detailed experiment was implemented in May 1990 between Lismore and Kyogle. The principle aim of this experiment was to compare three adjuvants and two rates of Brush-off using a gas gun. Additionally, Brush-off was applied at two equivalent rates through a high volume spray gun and was also applied to the soil only at the high rate to test the levels of soil uptake. Touchdown, a herbicide closely related to Roundup, and Roundup were compared at similar rates using a gas gun. Starane 20% and DP 600 were also sprayed to show other forms of herbicide control.

Control scores 10.5 MAT produced interesting comparisons, such as:

* Brush-off at 20 and 40 mg/m^3 with BS1000® non-ionic surfactant 0.1% v/v through high volume spraying was better than the same rate through a gas gun.

* Pulse penetrant 0.2% v/v was superior to BS-1000 (0.1% v/v) and Ethokem (0.5% v/v) as an adjuvant for Brush-off.

* There was little difference between treating lantana with Roundup or Touchdown at equivalent rates. These treatments were slightly more effective than Brush-off but have the disadvantage of pasture damage.

* Starane 20% and Lantana DP 600 produced good results that were on a par with the low rate of Brush-off 20 mg/m^3 with BS-1000 or Ethokem. The Starane treatment was about twice the cost of Brush-off 20 g/m^3.

* Overall costs which include respraying with Roundup (50 mL/L) + Pulse 0.2% v/v, put Roundup (gas gun) as the cheapest form of control. Costs were low due to effectiveness of the first spray and thus the small respray volume required. Roundup was applied at 1.4 mL/m^3 of bush (100 mL/2L) through the gas gun.

* The next most cost-effective treatment was Brush-off at 20 mg/m^3 (0.75 g/L) sprayed by gas gun with the addition of 0.2% v/v Pulse penetrant.

* Brush-off applied to the soil was taken up by lantana to a small degree with variable symptoms recorded, i.e. one plant dead and 5 others showing minor symptoms. Foliar applied Brush-off was vastly superior to soil applied Brush-off at equivalent rates, but the trial demonstrated a significant amount of soil activity.

Groundsel Bush *(Baccharis halimifolia)*

Two non-residual herbicides, Roundup and Krenite, were tested on bushes ranging from 20 cm to 1 metre tall.

Spray treatments were applied with an Ag-murf® gas gun set to deliver a 10 mL shot. Bushes received from ½ to four 10 mL shots according to size, as below.

Bush diameter		shots per m height
≤	20 cm	0.5
	30 cm	1.0
	40 cm	2.0
	50 cm	4.0

Cut stump treatments were slashed with a machete and herbicide applied through a Phillips vaccinator at one ½ mL shot for stem < 1 cm in diameter and 2 x ½ mL shots for stems ≥ 1 cm. All treatments (spray and cut stump) contained approximately 50 bushes in each plot. A treatment where bushes were only slashed was also included.

Roundup sprayed at 5% and 10% produced complete brownout 34 DAT. Krenite through a gas gun at 5% and 10% was giving less than acceptable brownouts. Cut stump treated bushes with 50% Roundup gave 100% initial kill. A couple of bushes survived at the 25% dilution, however this level of control was still very good. All bushes were regrowing from "slash-only" treatments 34 DAT and would have regrown fully if it wasn't for a fire that swept through the trial before the second assessment date.

The next assessment was 8.5 MAT and the approximate death rate of untreated groundsel bushes due to fire was 52%. The fire interfered with results and all treatments showed excellent results, including the "slash only" treatments, which were expected to regrow fully. The trial demonstrated that slashing followed by fire during early regrowth may be a useful means of non-chemical control.

Blackberry *(Rubus fruticosus)*

This experiment was aimed at determining rate response curves for Brush-off and Grazon when controlling blackberry. High volume rates of Grazon sprayed were 800, 400, 200 and 100 mL per 100 L of water or equivalent to 2, 1, 0.5 and 0.25 mL of Grazon per m^3 of blackberry. A gas gun treatment was put in as a comparison to the second highest rate used for high volume, i.e. 1 mL Grazon per m^3. Similarly Brush-off was sprayed through high volume equipment at 80, 40, 20 and 10 mg of Brush-off per m^3 of bush or this corresponds to 32, 16, 8 and 4 g per 100 L of water. Another gas gun treatment was implemented to compare Brush-off at 40 mg/m^3 of bush.

Assessments 13 months after treatment were indicating a rise in control with higher concentrations of Grazon up to 400 mL of product/100 L water. The strongest rate somehow was lower than the next weakest mixture and this result is probably due to human error whilst mixing. Commercial control was almost achieved by the best Grazon treatment which suggests that blackberries might have to be resprayed 1 year after the first application. This rate was below the commercially recommended rate.

Brush-off produced a good rate response with steady increases in control with a doubling of concentration. Commercial control was exceeded with 16 and 32 g Brush-off/100 L water 13 MAT. For an increase of 16 to 32 g/100 L of water, the slight additional control of blackberry was not enough to pay for the additional cost. Blackberries might have to be resprayed after 1 year for the two lowest rates, whereas the 2 highest rates would be best resprayed after the second year.

Both gas gun treatments gave less efficacy than the high volume treatments. Poor results through gas guns might be due to inadequate coverage of large/taller bushes and insufficient canopy penetration of herbicides. Blackberry had been stressed during the spring but had received good rain approximately 10 days before spraying. Pre-spraying stress might have reduced the levels of control from Grazon treatments.

Sifton Bush *(Cassinia laevis)*

Sifton bush was sprayed in Autumn of 1989 when the plant was at the late fruiting stage. Since sifton bush grows close together, treatments consisted of large clumps of bushes ranging from 11 to 54 m^2. Roundup, Velpar L and Grazon DS were sprayed by low volume (gas gun) and high volume techniques. Two clumps of sifton bush were sprayed for each high and low volume treatment and also two high volume treatments of Garlon were applied.

Last assessment was 23 MAT, with Garlon 480 and Roundup giving inadequate control even at high costs per hectare. Velpar L (1:300) high volume resulted in very good control compared to Velpar L (1:30) through a gas gun, which produced fair control but was applied at slightly higher rates. Sifton bush control was excellent (little regrowth) when Grazon DS was mixed at a rate of 350 mL per 100 L water and applied at high volumes. Low volume control with Grazon was inferior to that of high volume but lower rates of herbicide per hectare were used through a gas gun.

Cost of chemical control is extremely high if good control is needed. The most effective treatment, Grazon DS high volume (35:100), would cost over $500 per treated hectare. Velpar L (1:300) sprayed high volume would cost approximately $260 per treated hectare which is still extremely expensive considering the low value of the land and the potential pasture damage.

Herbicide control would be an option for perimeters of infestations where sifton bush is beginning to invade more valuable land. High volume spraying is preferred since it offers better spray penetration of clumps and performs better with herbicides such as Velpar L and Grazon DS.

If marginal country is heavily infested with sifton bush then other options of control should be implemented e.g. bulldozer or fire.

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PROPERTY INSPECTIONS - GROUND VERSUS AIR

A COST BENEFIT COMPARISON

Peter Gorham
Noxious Plants Advisory Officer
NSW Agriculture
Cowra

Introduction

The cost of controlling noxious weeds by councils in NSW over the past 10 years has risen from $7 million to $12 million per annum. This is a conservative estimate. As these costs will escalate further over the next decade, and with the uncertainty of regular increases in government grants, it is time to take a critical look at current methods of enforcing noxious weed control and how to achieve better productivity from current funds available.

In 1991-93 seven councils took part in a program to inspect properties for noxious weeds by helicopter. The aim was to compare savings in time and cost as compared to the same operation carried out by the traditional ground inspection.

Results have shown that significant savings can be made by adopting this alternative method of inspecting properties. For example, a total of 3,432 properties were inspected by ground in 1991 by the seven councils at a cost of $227,403. This compares to 3,138 properties inspected by helicopter in one week at a cost of $30,920.

Materials and methods

For the inspections a *Hughes 500* ($660/hour) and a *Hughes 300* ($330/hour) were used. Highland Helicopters, Canberra, were chosen because of the firm's vast experience in aerial spraying of noxious plants in this region. An added bonus was that the pilot, Jim Satrap, who has a knowledge of noxious plants, could also act as an observer.

Preflight planning is critical to the success of this sort of operation. Meetings between weeds officers and pilot to discuss matters such as area to be covered, height and speed, noxious weeds to be monitored and method of inspection, all contributed to the success of the operation. Time taken to make decisions, once in flight, wastes time and costs money.

Recording was done by placing plastic overlays on topographic maps and marking weed infestations accordingly. For the first inspections a 1:25,000 scale was used. However, some participants felt that a 1:50,000 scale was better suited and easier to follow. Aerial colour photographs and property information maps were preferred by some councils.

For the first part of the program it was decided to inspect by flying on a grid pattern over the area but experience showed that accuracy could be improved by flying property boundaries. The choice depends on the individual and how well you know your property boundaries.

Comparisons

Table 1 shows the number of rural properties in each council, the number of properties inspected in one year and the percentage this represents for ground inspections, compared to the percentage inspected by helicopter.

Table 1 - Percentage of district inspected

Council	Ground			Helicopter
	No. Property Insp. in 1 Year	No. Rural Properties in Shire	% Inspected in 1 Year	% Inspected in 1 Day by Helicopter
Crookwell	171	1790	10	7
Mulwaree	318	3,285	10	5
Shoalhaven	109	992	11	31
Snowy River #1	489	2,178	23	2 (½ Day)
Snowy River #2 different helicopter				3 (2½ Days)
Yarrowlumla	301	1,492	20	12
Tallaganda	378	1,500	25	80
Wingecarribee	567	1,600	35	67

Table 2 shows the number of ground inspections for 1991, total cost, cost per inspection based on wages only and total inspection costs including on costs and plant costs. This is compared to an inspection cost by helicopter.

Table 2 - Cost comparison per inspection

Council	1991 Insp/s	Cost $	Cost per Insp. (Wages)	Total Cost per Insp. $	Cost per Insp. (Air) $
Crookwell	234	33,644	87	144	40
Mulwaree	585	45,667	40	78	13
Shoalhaven	175	18,541	68	106	11
Snowy River	556	60,256	71	108	48
Yarrowlumla	358	22,434	44	63	11
Tallaganda	397	20,702	32	52	3
Wingecarribee	1,127	26,159	27	23	3

Table 3 gives the area inspected by helicopter, the percentage of total area covered, the number of inspections, time taken and the total helicopter cost. To this add an average cost of $500 for pre- planning and post analysis by an inspector.

Table 3 - Helicopter costs

Council	Area (ha) Inspected	% of Total Area	No. of Insp/s	Time Taken	Helicopter Cost $
Crookwell	75,507	22	114	1 Day	4,500
Mulwaree	47,400	9	169	1 Day	2,180
Shoalhaven	32,100	7	307	1 Day	3,240
Snowy River #1	4,000	1	42	½ Day	2,000
Snowy River #2	24,000	4	56	2½ Days	7,000
Yarrowlumla	45,000	15	180	1 Day	2,000
Tallaganda	268,080	80	1,200	1 Day	3,000
Wingecarribee	180,000	67	1,072	1 Day	3,000

Table 4 - Summary of ground inspection costs -v- helicopter inspection costs

Council	Ground			Helicopter		
	Number Insp/s 1991	Man Days	Total Cost $	Number Insp/s	Number Days	Heli-copter Cost $
Crookwell	234	163	33,644	114	1	4,500
Mulwaree	585	185	45,667	169	1	2,180
Shoalhaven	175	95	18,541	307	1	3,240
Snowy River #1	556	278	60,256	42	½	2,000
Snowy River #2	..	..	..	56	2½	7,000
Yarrowlumla	358	107	22,434	180	1	2,000
Tallaganda	397	97	20,702	1,200	1	3,000
Wingecarribee	1,127	122	26,159	1,072	1	3,000

Comments

From Table 1 it can be seen that the percentage of properties inspected in one year by ground, can almost be achieved in one day by helicopter, with the exception of Shoalhaven, Tallaganda and Wingecarribee Councils where the percentage of properties inspected in one day by helicopter surpassed the ground inspections.

This increase in aerial inspections can be attributed to factors such as terrain. In the case of Shoalhaven much of the country inspected by helicopter could not be inspected by ground effectively. The type of inspection carried out is also indicative of what is achievable, e.g. to survey just for noxious plants as opposed to a thorough property inspection will allow for a much larger area to be covered. As can be seen in Table 2 the savings to inspect a property by helicopter are substantial and indicate a definite cost benefit.

In comparison to Table 1, Table 3 gives a clear indication of what can be achieved in one day by helicopter. Table 4 gives a direct comparison on inspection achievements by both methods.

In a second program Forbes Council inspected the Lachlan River for dodder infestation. In 4½ hours flying, approximately 450 km of river was inspected, it was estimated to inspect the same area by ground would take at least one month.

Advantages of aerial inspections

1. Allows councils to eliminate weedfree properties from time consuming ground inspections. This in turn allows councils to focus on problem properties.
2. Eliminates problems of organising ground inspections suitable to all parties, particularly with absentee landowners.
3. No locked gates to contend with.
4. Better access to areas of rough terrain.
5. More accurate assessment of total area can be carried out from a desirable vantage point.
6. No bogged vehicles.
7. Large areas covered in a short time for minimal cost.
8. More time available to follow up on administration aspects.
9. Dramatically increases number of inspections without additional staff.

Disadvantages

1. Limits initial contact with owner.
2. Restricted to certain time of year for some weeds.
3. May still require follow up ground inspections (but these will be briefer and fewer).

Highlights

To quote specific highlights, in Yarralumla Council a property of 7,400 ha was inspected from the air in about one hour, whilst two men would be required with two vehicles for at least one week to inspect the same property by ground. In Tallaganda Council one area was inspected in 30 minutes. To inspect the same area by ground would be practically impossible because of the rough terrain. If inspection by ground had been possible, travelling time alone would exceed four hours. Similar comments were made by all councils, land that cannot be inspected by ground was covered in minutes.

Conclusion

Aerial inspection of individual properties has an advantage over grid flying, as it allows for more accurate location of infestations. It does, however, involve more preflight preparation.

Whatever mapping system is used, it is an advantage to mark property boundaries beforehand. A small tape recorder helped in recording information as it can be difficult to record and carry out inspections at the same time if only one inspector is involved. An advantage in using the larger helicopter is that it allows for a recorder and one or two observers. The smaller machine has room only for the pilot plus one other with maps.

There were no major problems identifying weeds from the air. If there were uncertainties it was just a case of flying lower or landing to confirm the identification.

Inspections for large numbers of plants can be carried out an any time of the year. However, for certain species, the time of year when they are most evident will be the deciding factor.

Publicity in the local media alerting landowners that inspections were being made from the air was well received and seen as a positive step by councils at cutting overall costs.

The benefits in both time and cost savings have been highlighted by the participating councils and all have indicated that aerial inspection will now become a part of their inspection programs, particularly in harsh terrain. As stated at the beginning of this report, councils will need to look critically at current practices and implement techniques that give better productivity.

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Ken Neville, Forbes Council

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NATIONALLY DECLARED AND PROHIBITED PLANTS

Andrew Leys
Program Leader (Weeds)
NSW Agriculture
Orange

I have divided my talk into two parts. Firstly, I will discuss prohibited plants, which include all plants covered by drug legislation, and all those plants which are prohibited by quarantine legislation from entry into Australia.

There are no nationally declared noxious weeds, because noxious weeds legislation is the responsibility of the states. However, in the second part of my talk I have decided to briefly discuss plants which are on the declared lists in all states. I will then discuss two of these in more detail, common horsetail (*Equisetum arvense*) and kochia (*Kochia scoparia*), using slides and a video.

Prohibited plants

1. Drug Plants

a. Coca leaf

Coca leaf (*Erythroxylum coca*) is a small tree or shrub which grows to approximately 2 m tall. It has yellow bell shaped flowers grouped in clusters (6 to 12 per cluster) in the leaf axils.

Coca leaf is the source of the drug cocaine, which acts as a stimulant in small doses, but is an addictive drug.

Coca leaf is a native of the Andes Mountain areas of Peru and Bolivia. It has been introduced into, and is widespread in, Africa, Sri Lanka, Indonesia and Taiwan, but is not present in Australia.

b. Opium poppy

Opium poppy (*Papaver somniferum*) is bluish-green winter-growing annual herb which contains a milky sap. Leaves are alternate, sessile, and the margins sharply toothed. Flowers are pale violet to mauve with a darker spot at the base, 4-5 cm diameter, borne singly on long erect stiffly bristled stem.

Opium poppy is a source of morphine and codeine as well as the drugs opium and heroin.

Opium poppy is a mixture of two sub-species which commonly grow together and are widely distributed throughout all Australian states.

c. Indian hemp

Indian hemp (*Cannabis sativa*) is a bushy erect annual herb which can grow to excess of 2 m tall. Male and female flowers grow on separate plants. Leaves are alternate near the base of the plant, but become alternate towards the tip. They are palmately divided into 5

to 9 sharply toothed leaflets (5-10 cm long). Both surfaces of the leaf, but particularly the lower surface, are covered in short stiff hairs.

Cultivation and possession of Indian hemp is prohibited in all states under drug legislation.

Indian hemp is widely adapted to most parts of New South Wales and naturalised populations occur along the Hunter River near Singleton.

2. Plants excluded by quarantine legislation

Approximately 1,900 plants species have been introduced into Australia since 1770. Of these, 850 are now considered weeds in some form (Auld and Medd 1992), and over 200 have been declared noxious in at least one state. Of the 200 declared noxious, approximately half have been intentionally introduced into Australia.

There are two Federal Acts which control the importation of plants into Australia:

- The Wildlife Protection Act 1982 empowers the Commonwealth to regulate the importation of plants which could have an adverse effect on native Australian animals or plants.

- The Federal Quarantine Act 1908 contains schedules under Proclamation 86P which lists species which are prohibited from entry into Australia. The Act is administered by the Australian Quarantine Inspection Service (AQIS). If an importer wishes to import a species not on this list, it is up to AQIS to provide evidence to prove why the species should be excluded.

This system is obviously inadequate, as there are a number of weeds which have been introduced into Australia simply because they were not on Schedule 86P. The most recent example of such an introduction was kochia, which was purposely introduced into Western Australia in 1990 (see later discussion).

The Australian Weeds Committee has presented arguments for a list of species which are approved for importation, instead of the current system of a list of species which are prohibited from entry. Under this proposal the importer will be required to provide all necessary information to permit evaluation prior to importation. All costs required for the valuation will have to be met by the importer.

Several systems have been proposed to evaluate plants prior to their entry into Australia, but the most comprehensive and practical system is that shown in Figure 1.

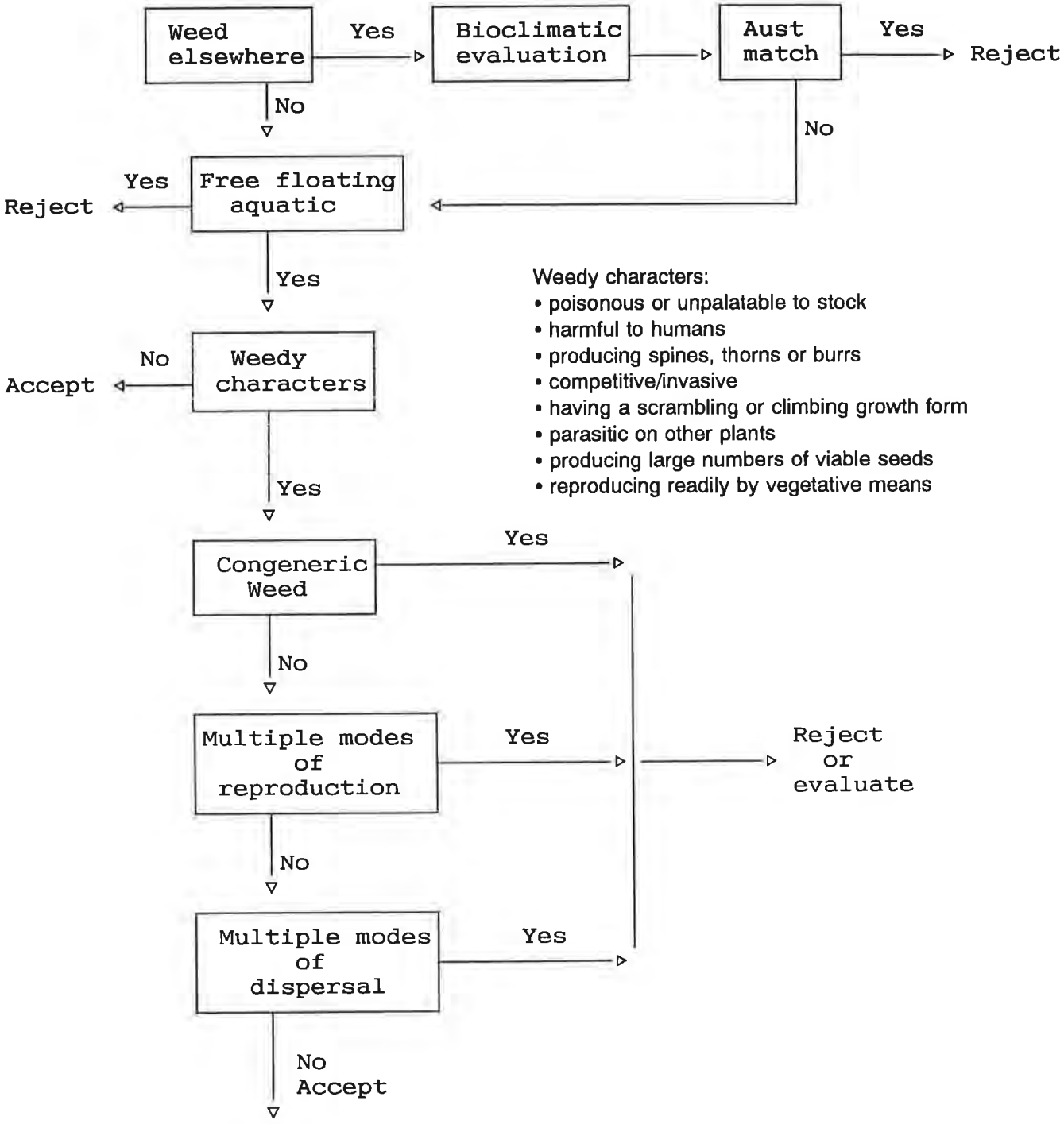

Figure 1 ***Screening system to evaluate proposed introduction of plants not listed under Proclamation 86P of the Federal Quarantine Act 1982***

Noxious weeds declared nationally

As mentioned earlier, there are no nationally declared noxious weeds, but what I shall do is discuss the plants declared noxious throughout NSW, and also of importance in other states.

1. Aquatic weeds

Alligator weed	*Alternanthera philoxeroides*
Lagarosiphon	*Lagarosiphon major*
Salvinia	*Salvinia molesta*
Senegal tea plant	*Gymnocoronis spilanthoides*
Water hyacinth	*Eichornia crassipes*
Water lettuce	*Pistia stratiotes*

2. Terrestrial plants

African boxthorn	*Lycium ferocissimum*
Blackberry	*Rubus fruticosus* agg.
Burrs	*Xanthium* spp.
Common horsetail	*Equisetum arvense*
Dodder	*Cuscuta* spp.
Kochia	*Kochia scoparia*
Mesquite	*Prosopis* spp.
Nodding thistle	*Carduus nutans*
Parthenium weed	*Parthenium hysterophorus*
Prickly acacia	*Acacia nilotica*
Prickly pear	*Opuntia* spp.
Scotch broom	*Cytisus scoparius*
Serrated tussock	*Nassella trichotoma*
Silverleaf nightshade	*Solanum elaeagnifolium*
Spiny burr-grass	*Cenchrus* spp.
St John's wort	*Hypericum perforatum*

3. Weeds declared in other states but not occurring in NSW

Giant sensitive plant	*Mimosa pigra*
Poison ivy	*Toxicodendron radicans*
Pond apple	*Annona glabra*
Rubber vine	*Cryptostegia grandiflora*
Spiny broom	*Calycotone spinosa*

I will now concentrate on two of these weeds with which you may not be familiar.

Common horsetail

Common horsetail (*Equisetum arvense*) belongs to the family Equisetaceae which are spore producing plants (as distinct from seed producing plants). Bracken fern and salvinia, although not belonging to Equisetaceae, are other spore producing plants.

Horsetail is an erect, non-flowering perennial herb reproducing by spores and tuber-bearing rhizomes. It grows during summer months and prefers moist areas, but can also occur on arable land.

It occurs widely overseas: from Alaska to Texas in North America, and from Norway to India and Japan, in Europe and Asia. It is also found in Argentina, Brazil, Chile and Indonesia.

In Australia it is only found in the Sydney region. There are three fairly small and discreet infestations at Belrose. Movement of plants and root pieces on machinery, or movement of contaminated soil allows horsetail to spread from one location to the next. New plants develop from buds on the rhizomes and this allows new infestations of horsetail to spread and increase in density.

Spores can be spread by wind, but they have a short life and must germinate soon after production.

Overseas, horsetail is an important weed of many crops and pastures and in horticultural areas. In Japan it is one of the most widespread perennial weeds of agricultural areas, and its spread has been enhanced by the expansion of reduced tillage practices. Dense infestations compete readily with crops and pastures. Common horsetail contains an enzyme, thiaminase, which causes vitamin B deficiency in animals.

Because of its extensive rhizome system, and deeply buried tubers, common horsetail is extremely difficult to control. No herbicides are registered for its control in Australia, although diclobenil is registered in some countries.

Preliminary results of experiments currently being undertaken by Bob Trounce, Weeds Agronomist with NSW Agriculture, suggest metsulfuron-methyl may also be useful. If either of these products prove successful, a permit will be obtained to allow the infestations in Sydney to be controlled.

Kochia

Kochia (*Kochia scoparia*) is a summer-growing annual weed belonging to the Chenopodiaceae, or salt bush, family. Well grown plants are dense multi-stemmed, spherical bushes that may reach 1.5 m in height and diameter. The young shoots are often hairy.

The leaves are flat and elongated, up to 50 mm long and 8 mm wide, with three longitudinal veins on the underside. The small indistinct flowers are borne along the upper portions of the shoots. As the plant ages, its colour often changes to pale yellow, pink and dull brown.

It is an important weed in a number of countries, especially in most of Europe, parts of temperate Asia, Canada, USA and Argentina. Kochia is an important weed in these countries because:

- it is a prolific seeder - it can produce thousands of seeds per plant, with resulting seedling densities of several thousand/m^2
- it has a tumbleweed habit which allows it to spread rapidly (in Western Australia seedlings have been found up to 3 km from parent plants)
- it is toxic to livestock (contains oxalates, alkaloids, and nitrates)

- it is very competitive (yield losses of up to 50% have been recorded in wheat and sunflowers in North America)
- it contains allelopathic chemicals
- it has developed resistance to triazine and sulfonylurea herbicides.

In 1990, seed of kochia was introduced into Australia by a seed company and promoted as a forage crop for salt affected land. (There is debate over its value as a forage species). The initial planting was on 750 ha over 68 farms. By the 1992/93 summer, it had spread over 6000 ha.

Prediction of its spread based on climatic data in Australia and overseas suggest it has potential to spread throughout the Australian wheat belt. If this occurred, it is estimated that it could cost Australian farmers in excess of $30 million.

For this reason, a national eradication program, funded by the Commonwealth and the States, is now underway.

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NATIONAL REGISTRATION OF AGRICULTURAL AND VETERINARY CHEMICALS

Prepared by

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Introduction

In August 1991, the Australian Agricultural Council announced the establishment of the National Registration Scheme for agricultural and veterinary chemicals. Under these arrangements the Commonwealth will be responsible for the regulation of agricultural and veterinary chemicals up to the point of sale, while the States will be responsible for ensuring that the chemical products are used only for the purposes for which they were registered.

The Council also announced that the full cost of the National Registration Scheme would be recovered from the agricultural and veterinary chemicals industry.

What is Registration?

The registration of agricultural and veterinary chemicals is an essential protection for all involved in their manufacture, distribution, sale and use. Prior to registration all products are evaluated by State and Commonwealth agencies to ensure that they will have no harmful effects on the environment, public health or the health of workers who use them. Registration also ensures that all agricultural and veterinary chemical products are correctly labelled with all the necessary information to ensure safe and effective use.

Why national registration?

A single national authority, under Commonwealth administration to evaluate and register for sale and use all agricultural and veterinary chemicals will eliminate unnecessary duplication and inconsistencies between States. As well, national registration will improve efficiency and strengthen existing regulatory controls while at the same time demonstrating to both domestic and overseas consumers that strict control over farm chemical products in Australia is a high priority.

However, national registration will not mean that all products will be available in all States. During the transition from State to Commonwealth registration, all products will retain their existing labels including any State differences. Additionally, products which are restricted to crops which occur only in certain States will continue to be restricted to those States under national registration. For example, products which are used exclusively for control of insects in cotton will continue to be registered only in Queensland and New South Wales because there is no legitimate use in any other State.

Nevertheless, there is considerable scope for eliminating artificial differences between States and as a result, considerably simplify the label of registered products.

How will national registration operate?

The Commonwealth has recently established the National Registration Authority for Agricultural and Veterinary Chemicals based in Canberra. The National Registration Authority is now fully staffed and is developing operational guidelines which will allow it to utilise the expertise of other Commonwealth agencies such as the National Health and Medical Research Council, the Commonwealth Environment Protection Agency, Worksafe Australia and the National Food Authority.

Legislation which will give the necessary powers to the National Registration Authority to register chemicals is still in preparation. In the interim the Commonwealth and States have established an administrative arrangement that allows the National Registration Authority to evaluate and approve new agricultural and veterinary chemical products. However, at this stage, formal registration is still required in each State.

What will the National Registration Authority be responsible for?

In addition to the evaluation and registration of new agricultural and veterinary chemical products, the National Registration Authority will also be responsible for the following:

- **Compliance Program**

  All agricultural and veterinary chemicals must adhere strictly to their stated formulations and must comply with any quality standards which apply to any component of the formulation.

  Under the compliance program, registered agricultural and veterinary chemicals will be sampled in the market place and analysed to ensure that they comply with registered formulations and standards.

- **Surveillance Program**

  Wholesalers, distributors and retail outlets selling agricultural and veterinary chemical products will be checked systematically for the presence of unregistered products or incorrectly labelled or packaged products.

- **Off Label Approvals**

  Situations arise where it is necessary to use agricultural and veterinary chemical products on crops or animals, or for diseases and pests, which have not been approved and which do not appear on a registered label. These situations include the use of agricultural and veterinary chemicals for:

  - field trials and experimental trials which are designed to generate efficacy, residue or other data in support of registration;
  - emergencies where a particular product is required for the control of an exotic pest or disease or where it may be used in a manner which has not previously been approved;
  - minor uses where the new use is not sufficient to justify the cost associated with registration and includes new and emerging agricultural crops or stock.

The National Registration Authority will be responsible for issuing permits or approvals for major variations in the use of agricultural and veterinary chemical products. All applications for off label approval must still satisfy minimum health and environmental standards. The off label approval process should not be seen as a means of circumventing the registration process.

- **Good Manufacturing Practice**

  All manufacturers of agricultural and veterinary chemicals will be required to meet minimum standards in the production of their products. The standards will be enforced by inspection and will be consistent with international quality control standards.

Will the States be involved in National Registration?

Once the National Registration Authority is fully operational, the States will no longer register agricultural and veterinary chemicals. However the States will continue to have a role in assisting the National Registration Authority in carrying out its responsibilities by contributing to:

- **Efficacy Reviews**

  An important component of the registration process is to determine whether the product will work for its stated purpose. These efficacy reviews are usually carried out by Departmental experts and are based on evidence provided by the company as well as other relevant information.

  The National Registration Authority does not have the necessary field expertise to carry out these efficacy reviews and has therefore contracted States to provide expert reviews on their behalf.

- **Compliance and Surveillance**

  The National Registration Authority will not have any field staff to carry out its compliance and surveillance program. It has therefore contracted State departments of agriculture, through their field inspectors, to carry out the necessary inspections and sampling for the Commonwealth on a fee for service basis.

- **Off Label Approvals**

  The Commonwealth has recognised that the need for off label approvals or permits often arises because of particular local requirements for agricultural and veterinary chemical products. As a result the National Registration Authority has agreed that all applications for off label approvals in NSW will require endorsement by NSW Agriculture before they will be considered by the authority.

- **Registration Liaison Committee**

  The Registration Liaison Committee (RLC) provides a forum where all States can raise issues with the National Registration Authority regarding the registration, sale and use of agricultural and veterinary chemicals. The RLC also seeks to develop national codes and guidelines which will lead to more uniform regulation of agricultural and veterinary chemical controls.

What about the Pesticides Act?

As well as assisting the Commonwealth in the tasks listed above, the States will continue to be responsible for what is referred to as control of use. Control of use includes all those restrictions which apply to what a user can or cannot do with an agricultural or veterinary chemical.

In NSW, the Pesticides Act defines what a user can or cannot do with a pesticide. Those sections of the Pesticides Act which relate to control of use will continue to apply even after the introduction of national registration. The main Sections can be summarised as follows:

* you must only use a registered pesticide
* you must read the label before using a pesticide
* you must follow the directions on the label
* you must not do anything with a pesticide that could injure your health or the health of others
* you must not do anything with a pesticide that could damage the property of another
* you must not make any claim about a pesticide which contradicts information on the registered label

Any person using a pesticide should be fully aware of all their responsibilities under the Pesticides Act and take all necessary steps to ensure that they use these chemicals responsibly.

NSW Agriculture will continue to issue permits and approvals in circumstances which involve the use of pesticides and which do not involve variations to the registered label.

If you have any questions about the use of pesticides or you obligations under the Pesticides Act, you should contact your nearest AgVet chemicals Inspector.

Do I need training in the use of pesticides?

NSW Agriculture strongly supports the National Farm Chemical User Training Program which has been introduced by the National Farmers Federation and the Rural Training Council of Australia. The program is aimed principally at primary producers but applies equally well to other chemical users.

The objectives of this program are to:

- provide users with the knowledge and skills to use farm chemicals competently; and,
- allay community concerns regarding the personal and environmental safety aspects of the use of farm chemicals

The Farm Chemical User Training Program is being offered by a number of providers including TAFE colleges around the State. The course usually requires at least 2 days full time training.

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NEW SOUTH WALES HAZARDOUS SUBSTANCES REGULATION

Presented by

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Summary

The WorkCover Authority of NSW is responsible for occupational health and safety legislation in NSW. In 1991 WorkCover released for public comment its Draft Occupational Health and Safety (Hazardous Substances) Regulation 1991 and supporting Code of Practice.

This NSW Draft Regulation contained general provisions for the control of hazardous substances in the workplace and were closely based on the National Occupational Health and Safety Commission's National Model Regulations and Code of Practice for Control of Workplace Hazardous Substances which was published in June 1991. Furthermore the NSW Draft Regulation contained additional but specific provisions to control certain hazardous substances. With the exception of controlling hazardous substances in high risk quantities, these are currently regulated under a variety of Acts and Regulations.

Public comment on the NSW Draft Regulation was received and assessed but national uniformity considerations overtook the process with the intention that national standards on hazardous substances were to be in place by the end of 1993. The National Uniformity Taskforce has redrafted the National Model Regulations following national discussions. The National Occupational Health and Safety Commission is yet to endorse the latest draft of the National Model Regulations pending further national discussion on the labelling of non-hazardous substances, ingredient confidentiality, workplace assessments and record keeping.

The National Model Regulations are supported by a number of codes of practice namely the National Code of Practice for Control of Workplace Hazardous Substances, Labelling of Workplace Substances and for Preparation of Material Safety Data Sheets, as well as, Standards on Approved Criteria for Classifying Hazardous Substances and a List of Designated Hazardous Substances.

While the latest draft of the National Model Regulations generally reflects the concepts of previous drafts changes have been made to the classification of hazardous substances. Also appropriate labelling and Material Safety Data Sheets are now acceptable and disclosure of hazardous substances is still required. But the requirements for placarding, manifests and detailed emergency provisions have been removed.

New South Wales Hazardous Substances Regulation

The WorkCover Authority of New South Wales is responsible for the administration of occupational health and safety, rehabilitation and workers compensation in New South Wales. Indeed two of its corporate objectives are: to improve health and safety in workplaces and, to reduce the social and economic impact of work related injury or illness.

The Occupational Health and Safety Act 1983 signalled a change in philosophy in occupational health and safety legislation from a rigid, prescriptive approach to a more flexible and self-regulatory one. This has enabled a more general approach to promulgating legislation and appears to be a practical way of dealing more effectively and with wider control in such areas as exposure to toxic and dangerous chemicals (broadly known as hazardous chemicals) in workplaces.

It is evident that any hazardous substances regulation in NSW will be introduced under the NSW Occupational Health and Safety Act. Consequently it will also reflect certain features of the Act such as the requirements for provision of information, the responsibility of the employer (ie general "duty of care" provisions), greater consultation in the workplace by both employers and employees and the use of Industry Codes of Practice.

NSW Draft Occupational Health and Safety (Hazardous Substances) Regulation 1991

In December 1991 WorkCover released for public comment its Draft Occupational Health and Safety (Hazardous Substances) Regulation 1991 and supporting Code of Practice for Control of Workplace Hazardous Substances.

The Regulation and Code of Practice were closely based on the National Occupational Health and Safety Commission's National Model Regulations and Code of Practice for Control of Workplace Hazardous Substances which was released in June 1991.

The NSW Draft Regulation also reflected some important features of the NSW Occupational Health and Safety Act namely, the provision of information and the responsibility of the employer to provide a safe workplace. The Draft Regulation applied to all workplaces in NSW other than mines.

In addition to the general provisions of the National Model Regulations the NSW Draft Regulation also proposed specific Regulations on: abrasives; hazardous substances produced by plating; asbestos; pesticides; hazardous substances produced by spray painting; and hazardous substances in high risk quantities. With the exception of the Regulation on Hazardous Substances in High Risk Quantities these specific regulations were not new requirements as similar Regulations already existed under Acts such as the Factories, Shops and Industries Act 1962 and the Public Health Act 1902.

Public comment on the NSW Draft Regulation was assessed but in early 1992 national uniformity considerations overtook this process in NSW. National Uniformity has since dominated the national debate on hazardous substances.

National Uniformity of Hazardous Substances Regulations

The National Uniformity Taskforce was established following the Special Premier's Conference in November 1991. The Taskforce comprises representatives from the Australian Chamber of Commerce and Industry (ACCI), the Australian Council of Trade Unions (ACTU), and New South Wales, Victoria and South Australia Government representatives, with other States and Territory Government representatives attending as necessary.

The role of the National Uniformity Taskforce is to achieve national uniformity in occupational health and safety standards by the end of 1993. Workplace substances is one of six priority areas.

The National Uniformity Taskforce proposed redrafted National Model Regulations and Code of Practice for endorsement by the National Occupational Health and Safety Commission (Worksafe) at the end of March 1993. The Commission endorsed the National Model Regulations in principle but with further consultation between the ACCI and the ACTU recommended in relation to the labelling of non-hazardous substances, ingredient confidentiality, workplace assessments and record keeping.

Control of Workplace Hazardous Substances: National Model Regulations and National Code of Practice

Following is a discussion of the National Uniformity Taskforce's proposed redrafted National Model Regulations.

The general requirements of the National Model Regulations involve the provision of information, consultation between employers and employees, and the assessment and control of hazardous substances.

The Regulations are supported by a number of National Codes of Practice outlining recommendations for control of workplace hazardous substances, labelling of workplace substances and the preparation of Material Safety Data Sheets, as well as, Standards recommending approved criteria for classifying hazardous substances and a list of designated hazardous substances.

Important specific provisions of the National Model Regulations include the classification of hazardous substances, provisions for information, disclosure of ingredients of hazardous substances, induction and training, assessment and control of hazardous substances and record keeping.

Major changes to the previous draft National Model Regulations include the classification of hazardous substances; provision of appropriate material safety data sheets and labels; the disclosure of ingredients of hazardous substances and the removal of requirements for placarding, manifests and emergency provisions.

Some of the more important specific provisions of the National Model Regulations are briefly discussed below.

Classification of a Hazardous Substance

The previous generic definition of a hazardous substance has been replaced. A "Hazardous Substance" now means a substance which:

(a) is listed on the National Occupational Health and Safety Commission's List of Designated Hazardous Substances, or

(b) has been classified as a hazardous substance by the manufacturer or importer, in accordance with the National Occupational Health and Safety Commission's Approved Criteria for Classifying Hazardous Substances.

The Approved Criteria for Classifying Hazardous Substances establishes cut-off concentration limits for pure substances and mixtures and the classification is largely health effect based. Consequently the criteria include such affects as toxicity, skin or respiratory sensitisation, carcinogenicity, mutagenicity and reproductive effects. This classification does not automatically include Dangerous Goods, which are classified mainly

on physico-chemical properties, as hazardous substances. It should be noted that asphyxiants such as nitrogen, hydrogen and the inert gases are also not considered to be hazardous substances based on the current criteria.

To aid in identifying the more commonly encountered hazardous substances a List of Designated Hazardous Substances also has been produced.

The National Model Regulation also covers hazardous substances which are produced or generated at a workplace and for this reason discriminates between a hazardous substance and an article. For example, while a welding rod (considered to be an article) is in itself not a hazardous substance the fumes generated when using a welding rod may be considered a hazardous substance.

Exemptions to the National Model Regulations

The National Model Regulations will not apply to all substances in the workplace and the following substances are exempt where their use will not be related to a work activity: food and beverages within the meaning of the food standards; therapeutic agents; cosmetics; tobacco or products made of tobacco; toiletries and toilet products; radioactive substances; and infectious substances.

There are also certain exemptions to suppliers, retailers and retail warehouse operators. For example, suppliers are exempt from providing Material Safety Data Sheets for hazardous substances which are supplied to retailers or retail warehouse operators in consumer packages which are intended for retail sale, will not be opened on the retailers' or retail warehouse operators' premises and hold less than 30 kilograms or 30 litres.

Similarly, retailers and retail warehouse operators are exempt from providing Material Safety Data Sheets or keeping a register for consumer packages which are not opened on their premises, which hold less than 30 kilograms or 30 litres and which are for retail sale.

Disclosure of Ingredients of Hazardous Substances

In relation to the disclosure of ingredients of hazardous substances required for labels and Material Safety Data Sheets three types of ingredients have been identified in the National Model Regulations. These are Type I, Type II and Type III Ingredients which are defined.

Provision of Information

Provision of workplace information includes having adequate labels, providing Material Safety Data Sheets of appropriate standard, maintaining a register of hazardous substances and training workers about workplace hazardous substances.

Further details about labelling and Material Safety Data Sheet recommendations are outlined in the respective National Code of Practice for the Labelling of Workplace Substances and the National Code of Practice for the Preparation of Material Safety Data Sheets which are called up by the National Model Regulations.

Some key information required on labels includes: recommended use of the signal word "HAZARDOUS" if the substance is classified as hazardous; the identification of the hazardous ingredients; use of risk phrases and safety phrases; directions for use and safety information, first aid and emergency procedures. The labelling of non-hazardous substances is still under discussion.

It should be noted that there are now a number of labelling options for hazardous substances. These include existing labelling requirements recommended by the Standard for Uniform Scheduling of Drugs and Poisons published by the National Health and Medical Research Council (NHMRC) or for Dangerous Goods the Australian Code for the Transport of Dangerous Goods by Road and Rail or the appropriate hazardous substances labelling.

Some important requirements of Material Safety Data Sheets include: appropriate identification of ingredients; health hazard information such as acute and chronic effects; precautions for use such as exposure standards, engineering controls and use of personal protective equipment; and safe handling information such as spills, transport and storage. The preferred Worksafe format outlined in the National Code of Practice for the Preparation of Material Safety Data Sheets will not be mandatory and therefore some European and International Labour Organisation (ILO) recommended formats will be acceptable.

Disclosure of commercially confidential information in relation to labelling and Material Safety Data Sheets is still under discussion at the national level.

Assessment and Control of Hazardous Substances

The assessment and control of hazardous substances are important requirements of the National Model Regulations.

An employer requires to carry out an assessment of the risks to health from exposure to hazardous substances at their workplace. Moreover where an assessment is required the employer must ensure that such exposure is controlled.

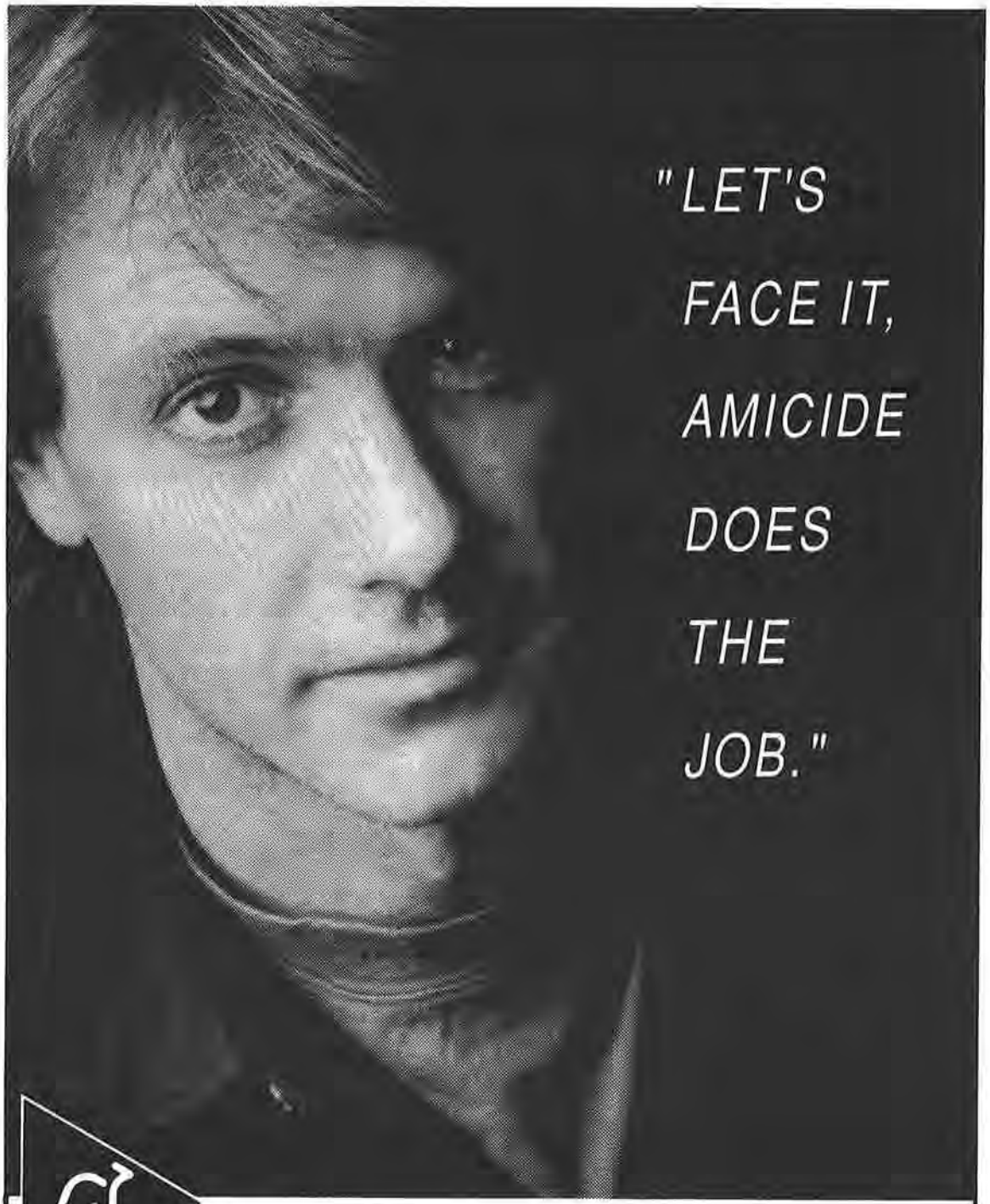
The hierarchy of control measures is a list of control measures, in priority order, that can be used to eliminate or reduce exposure to hazardous substances: **elimination** of hazardous substances; **substitution** by less hazardous substances; **isolation** of the process; **engineering controls** to contain the process or minimise exposure; adoption of **safe work practices**; and use of suitable **personal protective equipment**.

Where an assessment indicates that atmospheric monitoring is needed, the employer must undertake appropriate monitoring at the workplace. There is also a provision for prohibition of scheduled substances for specified uses.

The employer also must provide health surveillance for an employee who has been identified in the assessment process as being exposed to a hazardous substance and where it is warranted. A schedule of hazardous substances requiring health surveillance will be developed.

Future Considerations for NSW of the Hazardous Substances Regulations

Finally some of the perceived issues which are likely to be associated with the implementation of the National Model Regulations in NSW will now be briefly raised. However there will be no discussion of cost-benefit affects of the National Model Regulations since such analysis is beyond the scope of this paper.



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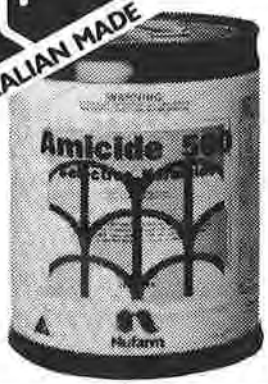

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Nufarm

NEW TECHNOLOGIES FOR OLD PRODUCTS

Matthew Gallagher
Research & Development
NUFARM

"AGE SHALL NOT WEARY THEM"

My apologies to the R.S.L. for this quotation, but it exemplifies the basic thrust of this presentation.

Noxious weed control has for many years been dependent upon one of a combination of herbicides from the phenoxy family of chemistry.

This family of chemistry is now fifty years old and in fact marked the birth of the synthetic agchemical industry as we know it today. This group of chemicals transformed agriculture and we are considered to be among the greatest scientific advances of this century. Previously vicious potions like sulphuric acid and the arsenic compounds had been in use for many years as weed killers, but the discovery of the phenoxy herbicides were the first chemicals to kill weeds without harming the crop plants around them.

They provided for the first time during the twelve thousand years in which man has been growing his own food, the ability to control safely, selectively, cheaply and without disturbing the soil, broadleaved weeds in graminaceous crops in pasture land forests and other situations.

These chemicals were discovered at about the same time in England and the U.S.A. - quite independently. They were the result of research by plant pathologists and chemists which was not aimed at weed control but at discovering the mechanisms which regulate the growth and development of plants. Where their work had a practical objective it was the attainment of higher yield in crops.

If these chemicals were so important, why then is the history of their discovery not better known? The reason is that they were discovered when World War 2 was at its height: a 'security clamp-down" was imposed when the existence of such potent agents of plant growth control became known.

In both Britain and the United States the phenoxy herbicides were seen as potential agents for crop destruction on an enormous scale by aerial application. Thus publication through normal channels of the scientific work which led to their discovery was impossible until the war was over.

However, none of these stories should detract from the magnitude of the impetus on modern farming of phenoxy herbicides. All are agreed that without these chemicals food production on the scale achieved in North America and Europe would not have been possible. Weed species vary widely in their susceptibility to herbicides but even the most vulnerable are still found in typical farm locations. The fact remains that some forty years after their first commercial formulation the chemicals still have the biggest share of the herbicide market.

In the fifty years since the discovery of the first two commercial types, the list of active ingredients available worldwide has grown enormously. However, during that time, new issues have arisen for the Chemical Industry.

ISSUES FACING THE AGCHEM INDUSTRY

1 Environmental

Residues:
Residues are of public concern and may also be used as an artificial trade barrier. Many of the public believe that a zero residue is the only acceptable level.

Off target damage:
This is of concern primarily to producers and in its own right can create problems for the industry, particularly if the off target damage occurs to such crops as grape-vines, cotton or horticultural crops.

2. Packaging

Disposability:
The Australian Agricultural Chemical Industry produces some twelve million containers per annum. These are a mixture of metal and plastic drums. How are disposed of now and how will they be disposed of in the future? Container disposal is potentially one of the greatest problems facing the Agchemical industry as well as users of agricultural chemicals.

3 Inert Ingredients

Often the inerts are more dangerous that the active ingredient they are mixed with. e.g. hydrocarbon solvents used emulsifiable concentrate formulation. Inerts are now under more severe regulatory scrutiny and we expect to see quite a number of them removed from formulations over the short term.

4. Development Costs

It now takes forty to sixty million dollars to develop a new active ingredient and can run up to eight years before any sales occur. This situation is acting as a deterrent to some companies to make new molecules. It has been estimated that an agchem company needs a turnover of $1,000M to $1,500M per annum to be able to afford the luxury of developing new molecules.

5. Costing of Ongoing Support

Toxicological reviews are never completely finished for any compound. Even 2,4-D which is fifty years old and has had more scientific review than any other product still requires a heavy cash commitment to ongoing studies.

6. Market Pressures

The off patent chemicals such as 2,4-D and MCPA are subject to severe market pressure on pricing. The continual cutting of margins makes if difficult to achieve reasonable levels of profitability for producers.

7. Public Image

Both the chemical industry and chemical users do not have a good public image. Currently industry organisations such as AVCA and equivalent bodies in other

countries are taking pro-active steps towards improving the image of the chemical industry and users as well as attacking such questions as the issue of residues in food.

8. Legislative Influences

The people who legislate and administer the use of agricultural chemicals are in the main located in the large cities of Australia and are subject to the influences of various pressure groups. As users of agchems to control noxious weeds, this problem is particularly evident in certain areas, e.g. coastal regions of NSW and Queensland and on public lands anywhere in either State.

PROBLEMS FACING OLDER PRODUCTS

1. Volatility/Spray Drift:

Off target damage is of great concern in many areas of Australia, especially where sensitive plants grow, e.g. cotton, horticultural crops and home gardens. To further understand the causes of off target damage we need to understand the differences between spray drift and vapour drift.

VAPOUR DRIFT - is the airborne movement of evaporated chemical which occurs more readily with some chemical formulations than with others. Some 2,4-D Esters evaporate or vaporise easily. This is accentuated in warmer climates. Vapour rises from spray droplets on leaves or on the soil and may be carried in the air for some distance.

SPRAY DRIFT - is the airborne movement of droplets of the actual chemical solution from the target area in its liquid form as it leaves the sprayer.

In most instances, people blame the volatility of 2,4-D for causing the off target problem, when in most cases it is due to poor application which leads to spray drift.

The Amine salt formulations of 2,4-D (e.g. Amicide) are non volatile in the field, will remain on the target after application, and will not volatilise to cause off target damage. However, the ester formulations of herbicides do readily move through vapour drift.

DROPLET SIZE: Table 1. Distance travelled by droplets of various sizes.

Droplet Size (Microns)	Type of Droplet	Time required to fall 3m in still air	Distance droplet will travel in falling 3m with 5kmh crosswind
5	Fog	66min	5km
100	Mist	10sec	134m
200	Drizzle	3.8sec	5.2m
400	Fine Rain	2.0sec	2.7m
500	Heavy Rain	1.0sec	1.3m

Table 1 shows some startling results. If a spray rig is producing five micron droplets then in a relatively light breeze they can travel up to five kilometres. The hundred micron droplet may survive for ten seconds in cool humid conditions and then it may travel up to one hundred and thirty four metres. As droplets fall, evaporation may occur leaving extremely small particles. This data reinforces the fact that many incidences of alleged vapour drift from amine forms of 2,4-D are in fact spray drift from poor and inadequate application.

NON VOLATILITY OF AMINE FORMULATIONS - 2,4-D Amine formulations exhibit very low vapour pressure which is translated in the field to non volatility. Much research has been undertaken using susceptible crops such as tomatoes, beans and cotton to ascertain the non volatility of amine formulations.

Mullison (1949A) studied the effect of vapours from ester, amine and sodium salt formulations on tomatoes, beans and cotton in large glass jars. He placed small petri dishes full of the various 2,4-D formulation being tested beside pots containing young tomato and bean plants and enclosed plants to any 2,4-D vapours for sixty-five hours at room temperature. The summary of results is listed in Table 2.

PLANT RESPONSE - Table 2 - Responses of Tomato and Bean Plants exposed 65 hours to different 2,4-D formulations at room temperature.

	Plant response at End of Treatment		Plant Response 24 Days After Treatment	
2,4-D Formulation	Tomato	Bean	Tomato	Bean
Acid Amine Sodium Salt Ester	None None None Epinosty Stem	None None None Epinosty Stem	None None None Dead	None None None Dead
	Curvature		Curvature	
Untreated	None	None	None	None

Mullison found no vapour damage with the amine, sodium salt or acid formulations of 2,4-D. The ester showed effects on the test plants after five hours of treatment. Mullison also used the same procedure with cotton seedlings and found similar results.

Table 3. "Hormone" response of cotton exposed for 24 hours at room temperature to various 2,4-D formulations.

2,4-D Formulation	Plant Response at end of treatment	Plant Response 55 days after treatment
Sodium Salt	Nil	Nil
Amine	Nil	Nil
Ester	Response	Response
Untreated control	Nil	Nil

Table 3. shows that the amine and sodium salt formulation of 2,4-D did not cause vapour damage to the cotton plants. There were no visual differences between plant height or plant figure between the untreated control and the plants exposed to the amine and sodium salt formulations of 2,4-D.

It was concluded that "amine salts and the sodium salt of 2,4-D were non volatile as determined by the responses of tomato,bean and cotton plants."

He also added "the results of these experiments strongly indicate that unsprayed plants adjacent to or in the vicinity of plants treated for weed control will not be effected due to volatilisation of 2,4-D Acid, its amine or sodium salts."

Nufarm Limited (1993) studied the effects on tomato when enclosed in the container with a punnet of sprayed wheat plants. After 24 hours exposure to the 2,4-D formulations at 30 deg.C, no epinastic or growth regulating effects were observed when sealed with either 2,4-D amine or sodium salt. The ester caused varying effects over a period of time.

2. Odour:

Most people notice various odours when using phenoxy herbicide products. Measuring odour is a difficult process as the sense of smell is subjective and individuals exhibit varying sensitivity to these odours. 2,4-D Amine has a low vapour pressure and the odour associated with this product is mainly due to the level of dimethyl amine which is added to give the formulation stability at varying temperatures. This amine is what can be smelt from 2,4-D Amine (not the 2,4-D molecule itself) and has a characteristic "fishy " smell. The free amine will be the majority of the odour in the air, both during and after application.

In the case of ester formulations, these are dissolved in solvents and after application the majority of the odour will be the solvents. Depending the relative volatilities, the ester molecules of 2,4-D will volatilise, and can be smelt with the esters of higher volatility having a higher odour.

NEW TECHNOLOGIES:

WHAT ARE THE NEW TECHNOLOGIES BEING APPLIED TO OLD COMPOUNDS?

DRIVING FORCES:

* Container Disposal Problems
* Storage & Transport Issues
* Operator Exposure
* Odour

MECHANISMS OF CHANGE:
Conversion of formulations from liquid to dry
e.g. Simazine, Diuron & Atrazine
These are currently available in non liquid formulations and were the original products to be converted from flowable to water dispersible granule. In the future we expect other products such as 2,4-D, MCPA, Glyphosate, Triflurin and Dicamba to become available in similar formulation types.

The benefits of doing this are:
* No drums to dispose of
* No triple rinsing
* Reduced odour
* No operator exposure

Water soluble packaging.
This is probably one of the most significant packaging breakthroughs to occur in the agchemical industry. It involves packing the product in water soluble polyvinyl acetate. These packages are placed into the spray tank and dissolve within two to three minutes. The contents of the package are then released into the spray solution.

Improvements in polymer technology over the past five years has been so significant that this technology is available now, and provided simple instructions are followed, is available without any attendant problems.

SUMMARY

The phenoxy herbicides still play a vital part in the management of noxious weeds.

They are the oldest family of chemistry and actually signalled the birth of the synthetic agrichemical industry as we know it today.

On a volume basis they account for the largest single group in the herbicide market.

Over the past 12 months, modern technologies have been used to overcome some of the problems associated with phenoxy products:

* Volatility
* Odour
* Packaging
* Drum Disposal

References:
1. Mullison, W.R. (1949a). Volatility of several salts of 2,4-D as determined by tomato and bean seedlings. Proc.Amer.Soc.Hort.Sci. 53:281:290.
2. Mullison, W.R. (1949b.) Effects of 2,4-D on various field crops and vegetable seeds. Botanical Gazette 111:77-85.

INVEST $2000 • SAVE $50 000 OR MORE

*Thats right! By **Investing** in the QUIK SPRAY Remote Control Retractable Hose Reel System, (initial cost approx. $2000 more than "conventional" systems), you **immediately** start **increasing your productivity** and make **substantial labour savings**. Many QUIK SPRAY owners agree a **minimum** of **$10 000 per year** is saved. ($50 000 over a 5 year period).*

*A QUIK SPRAY system is not a luxury, it is a **sound business investment.** In many spraying applications it would be **financially negligant** not to update to the latest QUIK SPRAY technology.*

ASK COUNCILS "IN THE KNOW"

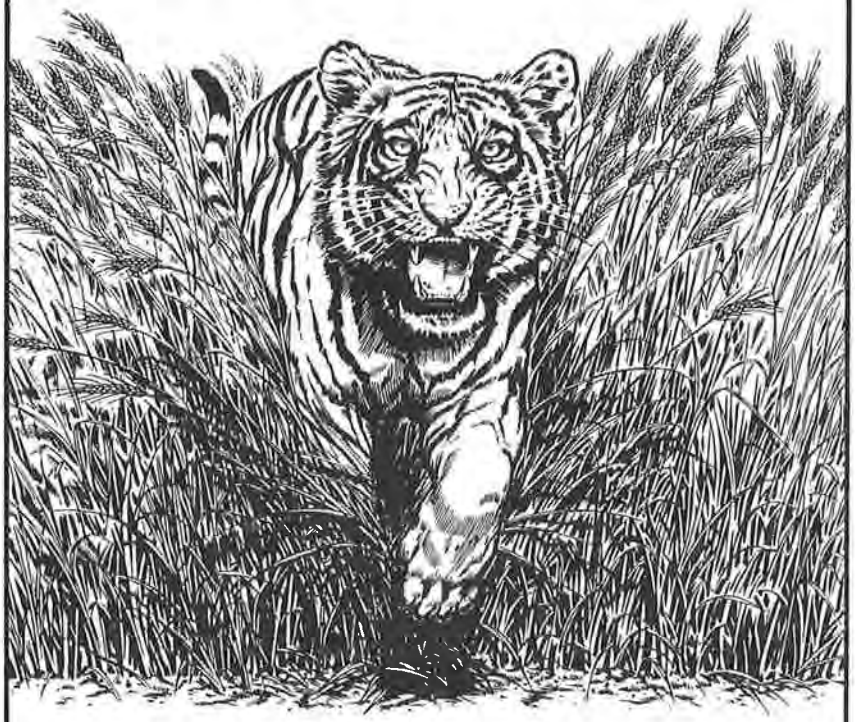
New England Tablelands Noxious Plants County Council
Coffs Harbour City Council
Great Lakes Shire Council
Belligen Shire Council
ACT Parks and Conservation Service
Tenterfield Shire Council
Nambucca Shire Council
Port Stephens Shire Council
Cowra Shire Council
Severn Shire Council
Crookwell Shire Council
Boorowa Shire Council
NSW Dept. of Water Resources
Greater Taree City Council
Upper Hunter Weeds Authority
Caloundra City Council
NSW State Rail Authority
Victorian Dept. Conservation and Environment
Upper Macquarie County Council
Johnstone Shire Council
Banana Shire Council
Kempsey Shire Council
Wellington Shire Council
Culcain Shire Council
Jenolan Shire Council
Ulmarra Shire Council
Goulburn Shire Council
VIC. Rural Water Corporation
Snowy River Shire Council
Eurobodalla Shire Council
Dubbo City Council
Castlereagh-Macquarie County Council

QUIK SPRAY

REMOTE CONTROL RETRACTABLE HOSE REELS

Manufacturer Adrian Anderson: PO Box 62 Uralla 2358 Telephone (067) 78 4499 Facsinile (067) 78 4751
Sales Enquiries Grant Mitchell: 126 Morialta Street, Mansfield Qld. 4122. Phone and Fax (07) 849 7130

This year it won't cost much to hunt down broadleaf weeds.



Tigrex*

Savages broadleaf weeds.

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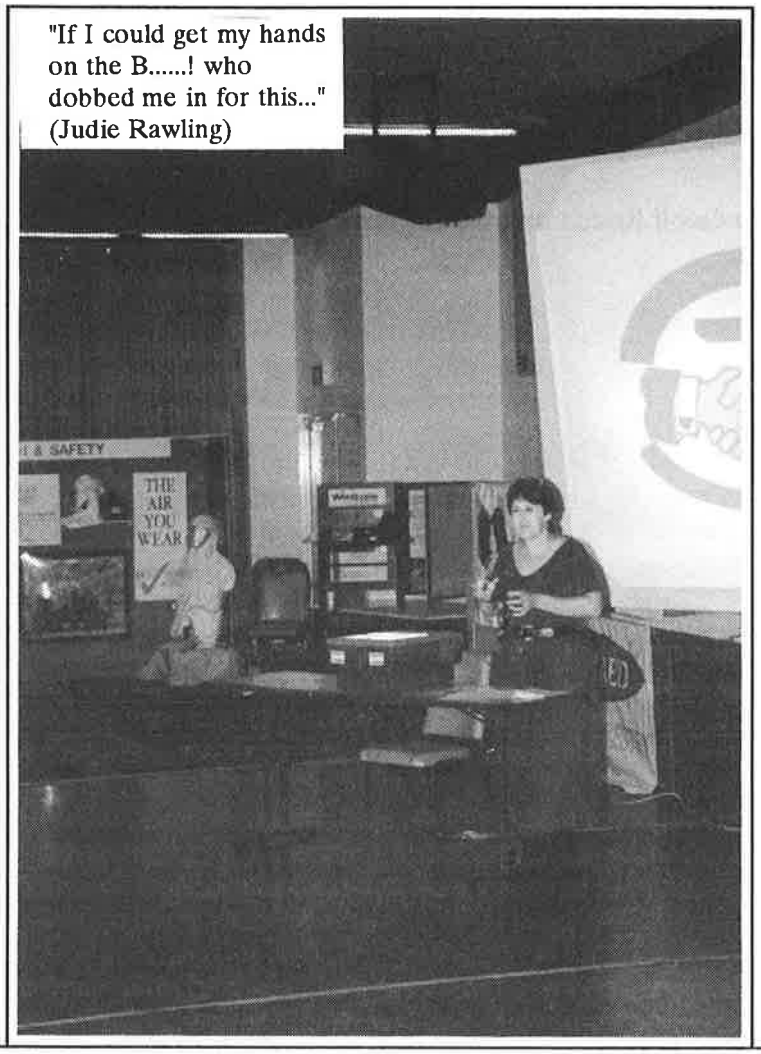
RHÔNE-POULENC

THE CONFERENCE POST MORTEM!

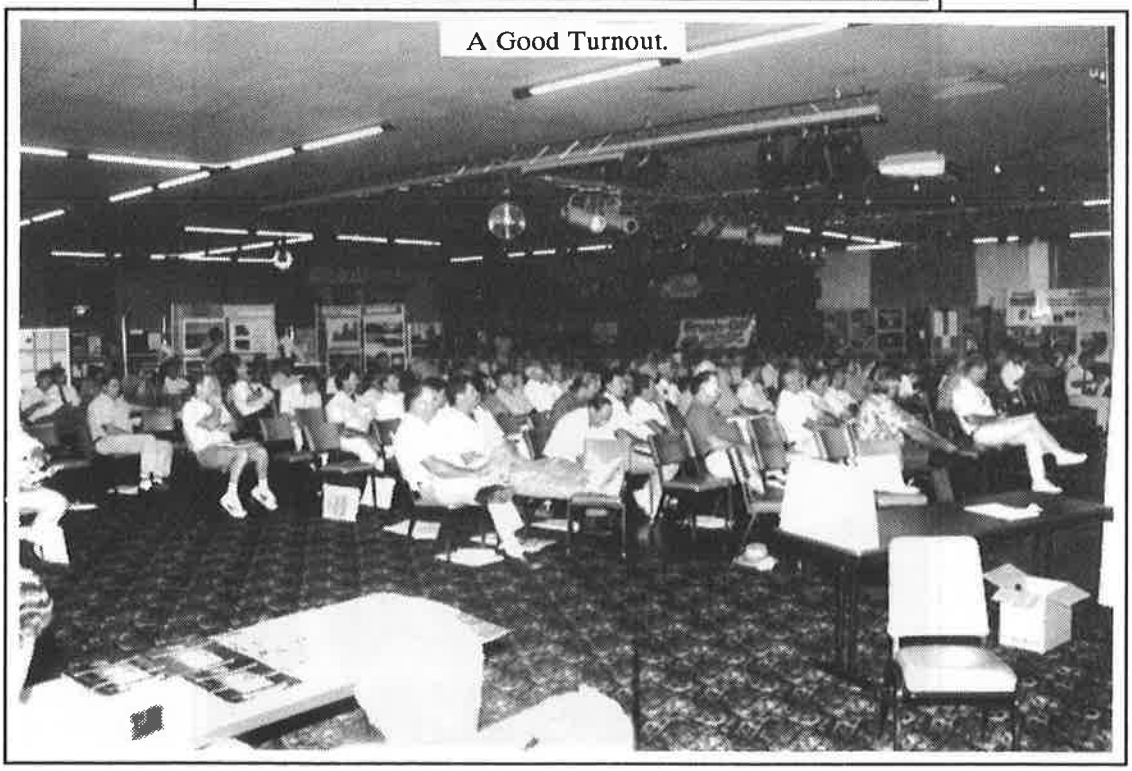
A very successful week, and the photographs and letters appearing on the following several pages are an indication of how well the Conference was received by the many delegates.

Congratulations to Geoff Keech and his Organising Committee!

The Official Opening.
Dr. Kevin Sheridan
Director General
NSW Agriculture

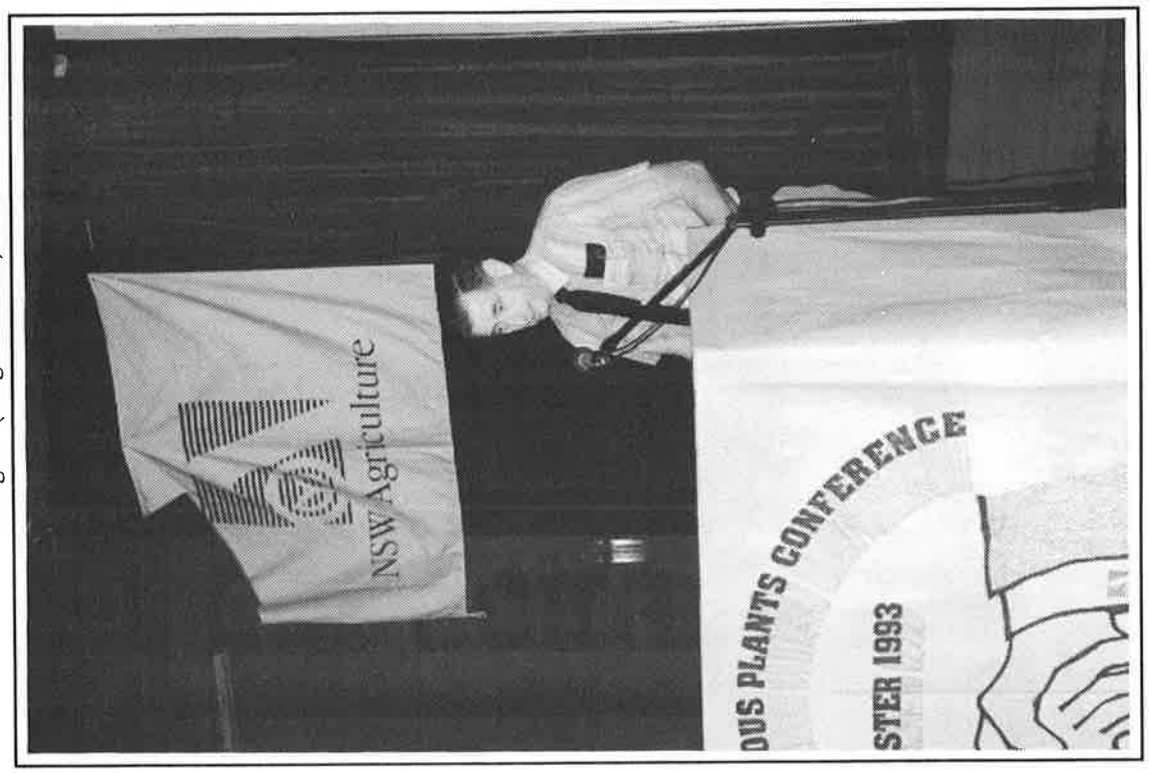


"If I could get my hands on the B.....! who dobbed me in for this..." (Judie Rawling)

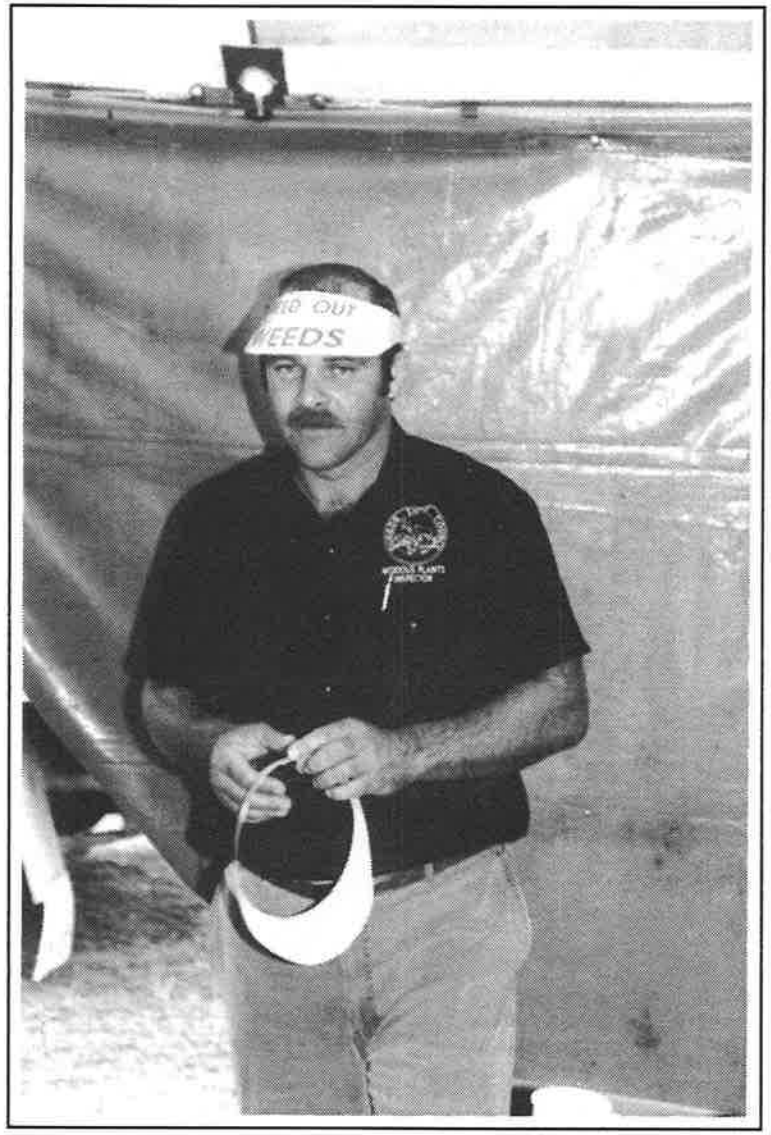


A Good Turnout.

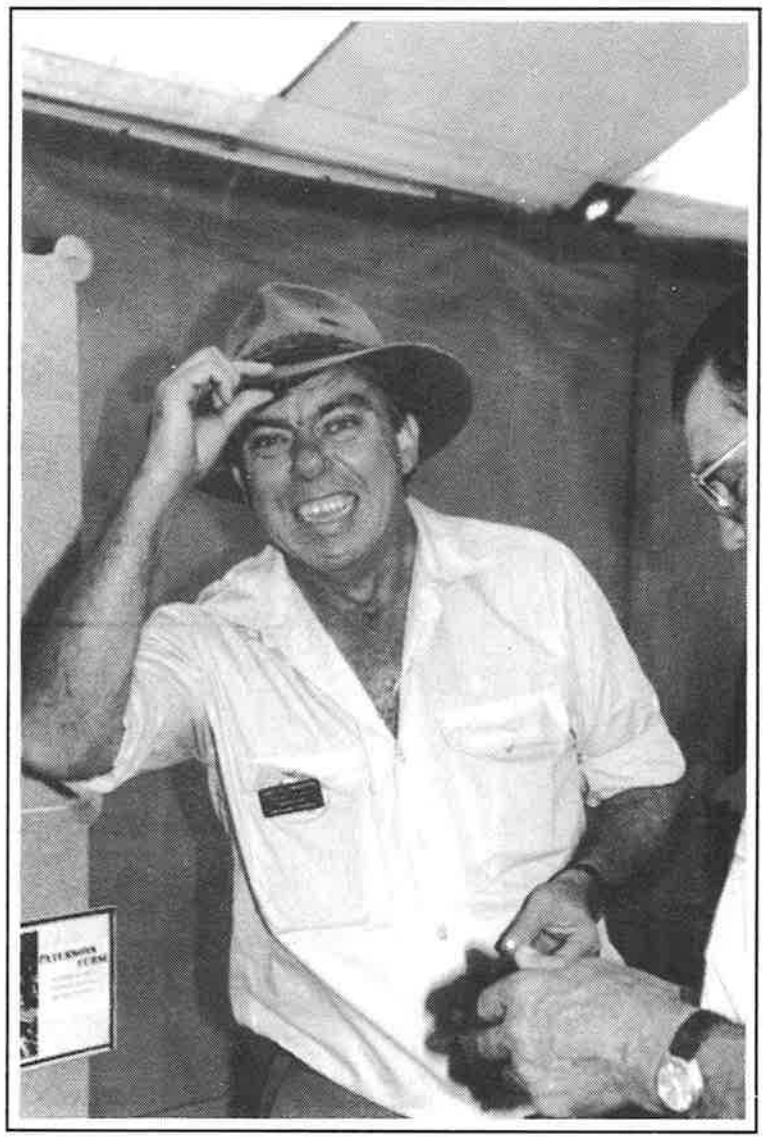
"Choir practice will **NOT** be outside my room tonight." (Hugh Milvain)



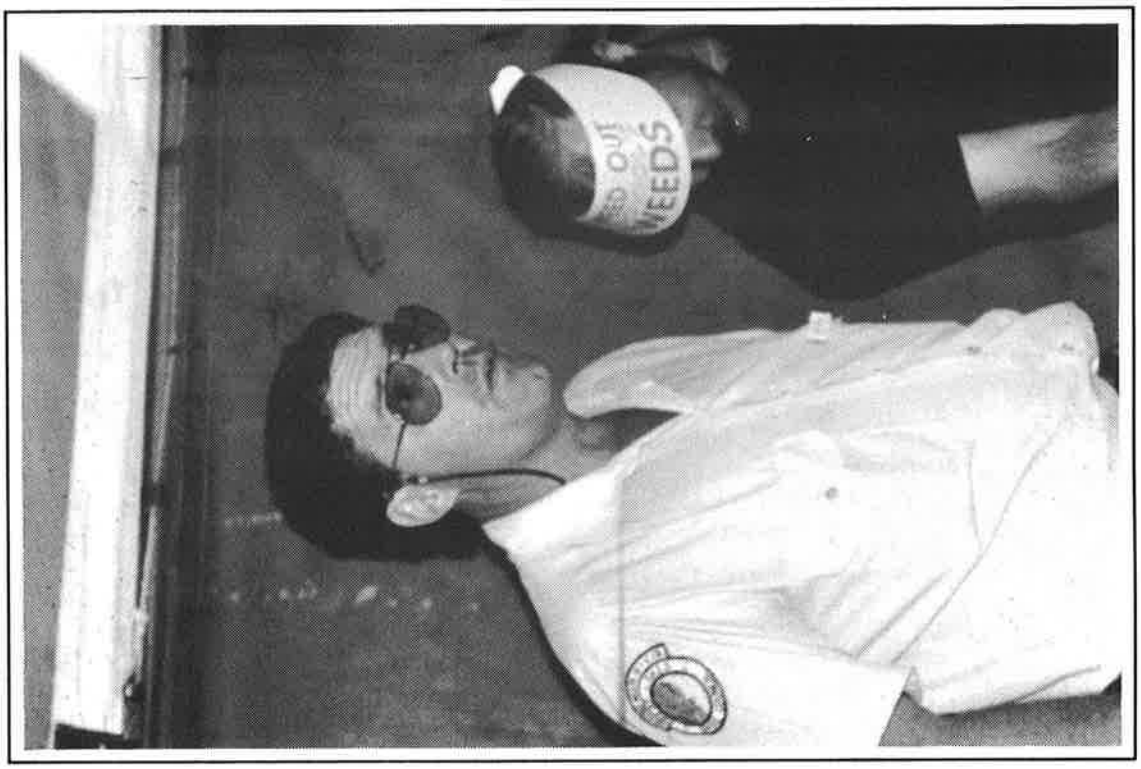
The Executive. L to R Ian Kelly, Terry Schmitzer, Val O'Brien, Eddie Lanting, Dave Richards, Dominic Lane.



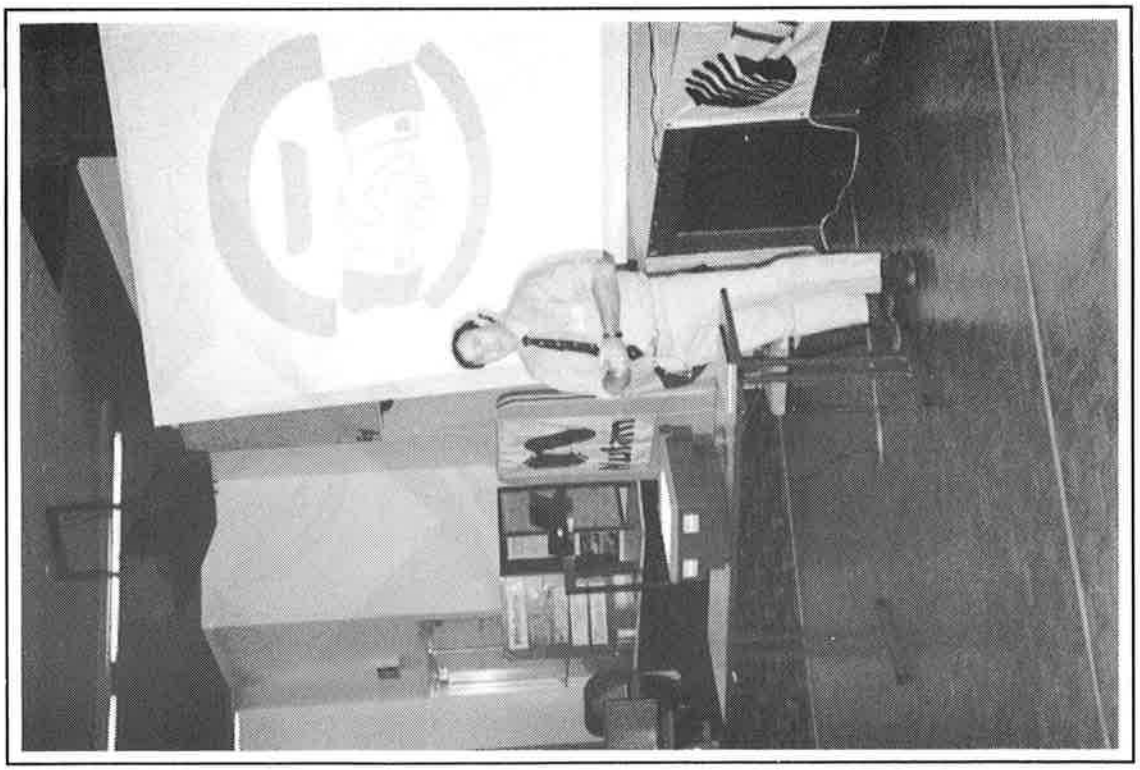
"I wonder what these hats are worth?" (Eric Pasenow)



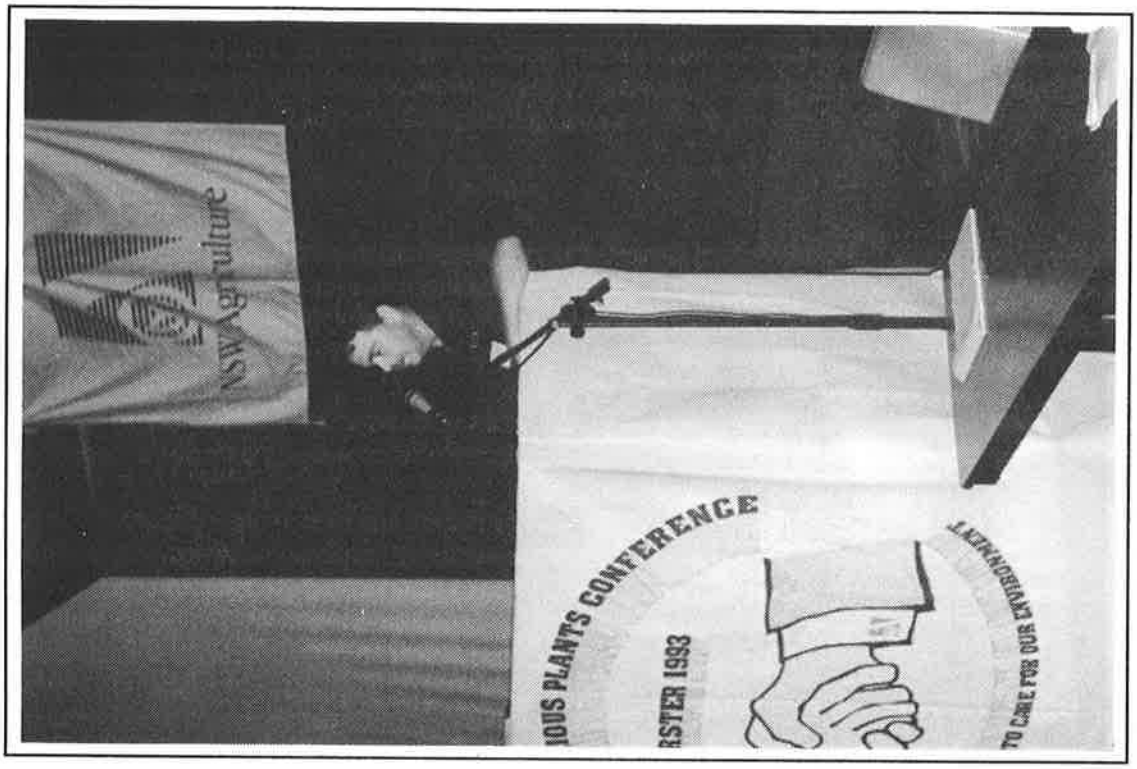
"Who said its time for a beer?" (Tony Featherstone)



"Now what else is there for me to worry about?" (Chris Hopton)

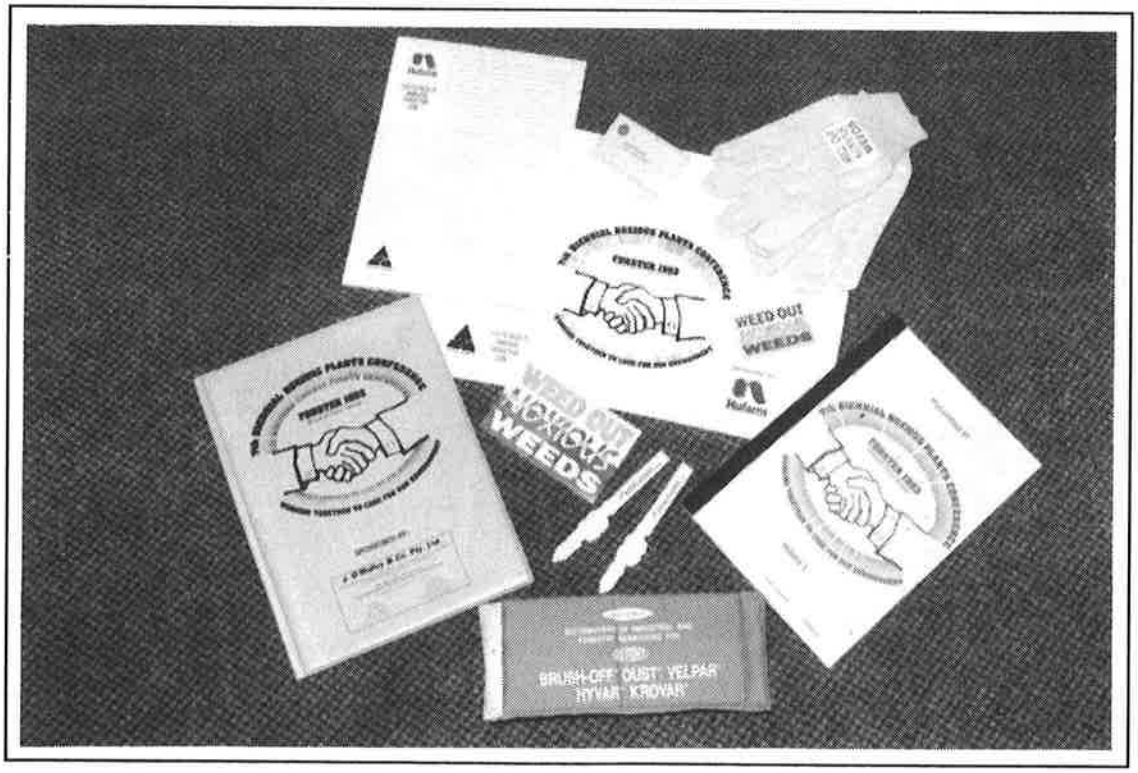


"Now how did they draw that logo?" (Stuart Bray)



"I can speak a lot better without this tobacco in my mouth".
(Ken Hayes)

Many Thanks To Our Sponsors!



NSW Agriculture

8 JUN 1993

P20/0125

Mr Geoff Keech
NSW Agriculture
PO Box 547
Tamworth NSW 2340

Dear Geoff

I wish to congratulate you and your committee on the organisation of the 7th Biennial Noxious Plants Conference at Forster from 19–22 April. I have been told you put an enormous amount of work into making this conference an educational and financial success.

The large number of delegates in attendance indicates a tremendous desire for information on the management of noxious weeds and the legislation affecting their control. The Conference obviously plays an important role in communicating this information, and allows interaction between Local Government Weeds Inspectors, elected members, NSW Agriculture, and other Government Departments. The introduction of the new Noxious Weeds Act will increase the need for this interaction.

Thank you for inviting me to open the Conference and please convey my congratulations to the other members of your Organising Committee.

Yours sincerely

K P Sheridan
Director–General

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23rd April 1993

Mr K Keech
NSW Department of Agriculture
TAMWORTH NSW 2340

Dear Ken

7th Biennial Noxious Plants Conference

I would like to take this opportunity to thank you for giving me and Macspred the opportunity of participating in you excellently run conference.

I was most impressed with "spot on" organisation of speakers/delegates etc,

I can say that I learnt far more from the speakers and delegates than I had expected and to win the lobster raffle just topped off a very helpful and [illegible] conference.

Once again, thanks for the invitation.

Yours sincerely,

Leyland Minter.

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Queensland Australia 4211
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Facsimile: (075) 960 616

27th April, 1993

NSW Agriculture
PO Box 647
TAMWORTH NSW 2340

Attention: Geoff Keech

Dear Geoff,

RE: 7th Biennial Noxious Plants Conference

It is a pleasure to congratulate you and your committee on an excellent Conference. Definitely one of the better conferences I have attended.

The overall friendly co-operation and assistance was much appreciated.

Yours sincerely
SPRAY TECH AUSTRALASIA PTY.LTD.

Geoff Modra.

G.Modra
Managing Director

7 Rex Place

Rangiora
19th May

Dear Geoff

Having completed an extensive study tour of N.S.W. and parts of Victoria. I wish to thank you for your hospitality and consideration extended to me during the N.S.W.Weeds Association conference. Thank you for meeting the motel costs outside the conference duration. You will be pleased to know that sea sickness was not a problem once on Ken Hayes yacht. The trip up the coast non stop was a great experience.
If you have the opportunity to come to the South Island of New Zealand feel free to contact me. Once again thanks Geoff for your hospitality.

Regards
David Rossiter

78 Coreen St
Frailderie 2716
27/4/93.

Mr Geoff Keech
NSW Agriculture
P.O. Box 547
TAMWORTH,

Dear Geoff, Please find enclosed copy of "Hand in Hand, Forster 1993." as requested. Please feel free to use it as you see fit

On behalf of Geoff Parbery & myself I offer thanks and congratulations to you and your committee on a most enjoyable & informative Conference. It should be a template for Conferences for some years to come.

Our carload and most others in this area arrived safely home, without making any contributions to the Police superfund and are now settling down once again to Weed Control.

Thanks again

Kind Regards

Dick Harrison

HAND IN HAND
FORSTER 1993

By A. Sprayer

The word went out in 92 " It's conference time again,
It is at Forster Servies Club, be there by half past ten."
And so we gathered at the site, we came by car or bus
It was said as we arrived, "There's a bloody lot of us".

In our ports we packed the things that we would need ,we brought our ties and coat
Kenny Hayes had greater need, He brought his brand new boat.

And so we started off, to see the sights that were around,
Some went by boat to see the fish, others went by bus, to keep their feet upon the ground,
Some also went further East to help Bernie play around (ie play a/ round)
We saw the Bitou Bush and Pampas Grass, and the mighty Parramatta Grass,
Whose mighty leaves and sweeping stems reach right up to your(AXXX) arms.

And then we started on the talks, the things for which we came,
We heard about the things that made it hard, to win our little game,
For tho' we'd hoped and prayed for many years, and often used no tact,
We only wanted for ourselves, our precious little act,

But 'ere this gift was granted, on Wednesday at half three,
We learnt that other acts that did control us, numbered twenty three.
And so in desperation we drank and played, far into the night,
We argued back and forth, about which was wrong and which was right.

And there are many ways to earn a Round Up jacket, as everybody knows,
But it is a desperate one I think, to let him suck your toes.

In years gone by, to improve their grants, I've watched some really grovel,
On hands and knees to Drs Smith and Mears, they did it with a shovel
But as a winning innovation, and to save their aching knees,
This year they went and serenaded the good Dr Andrew Leys.

And tho' there were some young men who came with hearts aflutter,
And thoughts of scant clad maidens, whose hearts they'd melt like butter,
The only two who had a win, were old and grey and tired,
And though I don't think they really scored, at least they really tried.

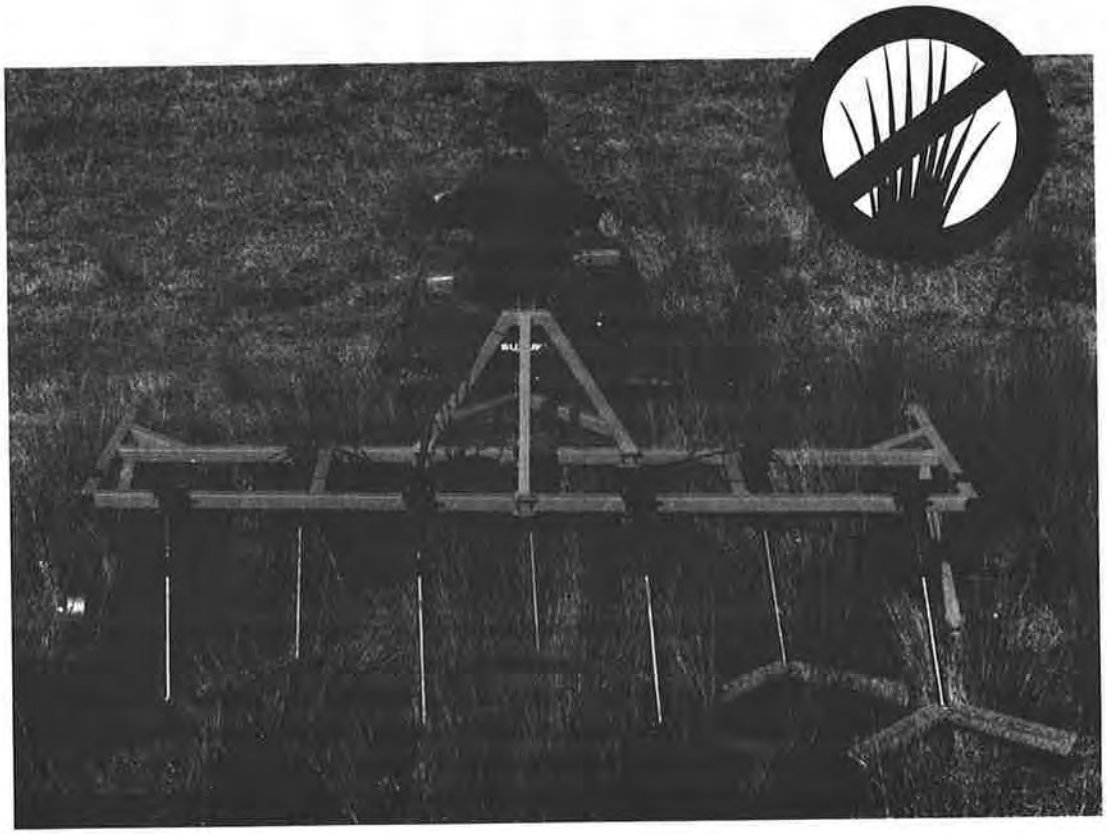
The Association has new leaders, and the Act is now in place,
The training is decided, so we start a brand new race,
And we offer to those workers, who did the work in hanks,
Our sincere congratulations and a lot of heartfelt thanks.

So now my friends 'tis time again, to bid you fond farewell,
To wish for you safe journey, to wherever that you dwell
And, until we meet again in two years time, wherever that may be,
May Good Health, Happiness and Good Fortune be there for You and Me.

Editors note
The Author A. Sprayer is the pseudonym of a virtually unknown Weeds Officer, who has hovered around the edge of total obscurity for about 16 years and his contributions will most likely cease in the year 2010.
No apologies are made for the lack of content in this contribution . He is, after all a Weeds Officer.

The Weedbuster

The all-terrain selective contact chemical applicator



An invitation to the world's best farmers to VALUE ADD on your property

The Weedbuster

Designed by an Australian farmer out of a need to combat one of the biggest problems facing Australian Agriculture – Weeds

Stop noxious perennial weeds...

When you want better pasture, start with Frenock® - the only herbicide that gives long-term control of noxious perennial grasses.

- Serrated Tussock
- Parramatta Grass
- African Love Grass

For the best results, use Frenock® when perennial weeds are actively growing.
Apply Frenock® from the air, from the ground or by spot spraying.

See your local ICI Dealer.

ICI Crop Care

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7th Biennial Noxious Plants Conference – Attendees.

SURNAME	INS	C/name	ADD 1	ADD 2	Pcde	ORGANISATION	PHONE
Abbott	JR	John	Perry Ave, 18	Springwood	2777	DuPont	047.511135
Abra	BE	Brian	PO Box 420	Moree	2400	Moree Plains Shire	067.524831
Adams	KA	Kevin	PO Box 5	Darlington Point	2706	Murrumbidgee Shire	069.684166
Amidy	L	Lee	PO Box 63	Gunnedah	2380	Gunnedah Shire	067.420422
Anderson	L	Len				Noxious Plants Advisory Cte.	?
Armstrong	WD	Don	Warina Pl. 3	Mullumbimby	2482	Far North Coast County	066.842491
Arnst	B	Brian		Melbourne	3000	Monsanto Australia Ltd.	03.5227122
Atley	J	John	PO Box 499	Deniliquin	2710	Central Murray County	058.812139
Aulsebrook	B	Bill	PO Box 450	Forster	2428	Great Lakes Shire	065.546277
Ayliffe	D	Des	Burns Rd. 125	Thirlmere	2571	Wollondilly Shire	046.819291
Baker	H	Harvey	Elizabeth St.729	Waterloo	2017	Australian Cotton Foundation	02.3193677
Baker	RW	Ron	Mooloobar St. 10	Narrabri	2390	Narrabri Shire	067.921758
Baldwin	DF	Don	Lee St. 7	Kelso	2795	Upper Macquarie County	063.371360
Bate	A	Tony	PO BOX 148	Kiama	2533	Illawarra County	042.571907
Borrowdale	I	Ian	PO Box 42	Nowra	2541	Shoalhaven City	044.293111
Boulton	PMD	Mike	PO Box 205	Deniliquin	2710	Noxious Plants Advisory Cte.	058.811736
Bowles	AG	Allan	Kennedy St. 6	Sth. Grafton	2461	Nymboida Shire	066.431396
Bowling	SJ	Scott	Coldstream St. 15	Ulmarra	2462	Ulmarra Shire	066.477020
Bracken	JC	John	Collaroy Rd. 22	New Lambton	2305	Newcastle City	049.299111
Bray	S	Stuart	PO Box 546	Gunnedah	2380	Land Care Coordinator	067.423655
Briese	D	David	PO Box 1700	Canberra	2601	CSIRO	06.2464045
Brightwell	P	Peter	PO Box 614	Turramurra	2074	Macspred	02.8202015
Brooks	MW	Michael	PO Box 172w	Narrabri West	2390	Narrabri Shire	067.923712
Brown	PR	Paul	PO Box 148	Goulburn	2580	Mulwaree Shire	048.211933
Bulley	B	Brian	Dandaloo St.	Narromine	2821	Narromine Shire	068.891254
Bunn	K	Ken	PO Box 42	Raymond Terrace	2324	Port Stephens Shire	049.830290
Burford	BW	Brian	PO Box 485	Griffith	2680	Griffith City	069.621277
Burgess	PR	Phil	PO Box 184	Goulburn	2580	Mulwaree Shire	048.214549

Bushby	AH	Alan	PO Box 122	Muswellbrook	2333	Upper Hunter County	065.433524
Burton	K	Kevin	Menangle St. 62–64	Picton	2571	Wollondilly Shire	046.571111
Byrnes	K	Kevin	Rita St. 25	Thirlmere	2572	Water Board	046.810114
Bywater	BR	Brian	Lime St.	Guerie	2831	Dubbo City	068.871113
Campbell	D	Doug	PO Box 63	Gunnedah	2380	Gunnedah Shire	067.420422
Carnie	GR	Gerald	PO Box 448	Broken Hill	2880	Broken Hill City	080.889266
Carr	J	James	PO Box 10	Crookwell	2583	Crookwell Shire	048.321022
Carter	B	Bruce	PO Box 547	Tamworth	2340	NSW Agriculture	067.665566
Carter	P	Paul	PO Box 155	Blackbutt	2529	Shellharbour Minicipal C.	042.216191
Chadban	J	John	PO Box 450	Forster	2428	Great Lakes Shire	065.546277
Chapman	IC	Ian	PO Box 138	Mudgee	2850	Mid–Western County	063.742214
Cheetham	R	Robbie	PO Box 499	Deniliquin	2710	Central Murray County	058.812139
Cherry	J	Jim	PO Box 155	Quirindi	2343	Central Northern County	067.461755
Clancy	BG	Brian	Killarney	Pleasant Hills	2658	Lockhart Shire	069.207727
Clark	AJ	Alan	Audley St. 55	Narrandera	2700	Narrandera Shire	069.592991
Clayton	SP	Steve	PO Box 81	Dubbo	2830	Dubbo City	068.827665
Clinton	D	Don	Myack St	Berridale	2628	Snowy River Shire	064.563246
Colless	RH	Rick	East Valley	Inverell	2360	Far North West Slopes County	067.232924
Collins	WT	Tim	Rockbrook	Candelo	2550	Bega Valley Shire	064.932309
Colwill	EG	Jock	Cootamundra Rd. 1	Temora	2666	Temora Shire	069.771614
Cook	AS	Tony	ARAS, PMB	Glen Innes	2370	NSW Agriculture	067.324391
Cooper	LR	Ray	Kumbatine Close 9	Wauchope	2446	Hastings Municipal C.	065.851081
Cooper	M	Mick				Forrestry	
Corey	S	Sharon	GPO Box 1700	Canberra	2601	CSIRO – Entomology	06.2464135
Coulton	JM	Jack	Avondale	Gravesend	2401	Far North Western Slopes County	067.297107
Couston	MB	Mark	Pacific Hwy 818	Gordon	2072	Kurringai Municipal C.	02.4980811
Cowled	N	Noel	Freight Rail	Cootamundra	2590	State Rail	069.420417
Crombie	SB	Steve	PO Box 1038	Tuggeranong ACT	2901	ACT Agriculture and Landcare	06.2365190
Csaszar	J	Jan	PO Box 450	Forster	2428	Great Lakes Shire	065.546277
Davies	PT	Peter	PO Box 177	Kempsey	2440	CaLM	065.631212
Deane	P	Peter	PO Box 91	Braidwood	2622	Tallaganda Shire	048.422424
Death	TJ	Tom	PO Box 342	Cowra 2794		Cowra Shire	063.441155

Dellow	J	Jim	Kite St. 161	Orange	2800	NSW Agriculture	063.913889
Dircks	RC	Ruth	Alison Heights	Dungog	2420	Australian Academy of Science	049.923008
Dodgson	P	Patrick	Kite St. 161	Orange	2800	NSW Agriculture	063.913100
Donohoe	RW	Robert	PO Box 24	Grafton	2460	Grafton City	066.425435
Drenkhahn	M	Mark	PO Box 499	Deniliquin	2710	Central Murray County	058.812139
Eather	IF	Ian	PO Box 122	Muswellbrook	2333	Upper Hunter County	065.745136
Edgell	N	Noel	PO Box 75	Kiama	2533	Kiama Municipal C.	042.322588
Egan	PA	Paul	Tyalgum Ave. 4	Panania	2213	Noxious Plants Advisory Cte.	027724398
Ennis	J	John	PO Box 177	Macksville	2447	Nambucca Shire	065.681280
Ensbey	RP	Rod	ARS PMB2	Grafton	2460	NSW Agriculture	066.477121
Eyles	T	Terry	PO Box 20	Wyong	2259	Wyong Shire	043.531333
Fagan	R	Robert	Fitzroy St. 113	Tamworth	2340	DuPont	067.663979
Featherstone	A	Tony	Goodooga Mt Vincent Rd	E.Maitland	2323	Maitland City	049.334857
Ferris	G	Greg	Freight Rail	W. Tamworth	2340	State Rail	067.641744
Field	RH	Bob	Faithful St. 72	Goulburn	2580	Goulburn City	048.230444
Fisicaro	G	Joe	PO Box 499	Deniliquin	2710	Central Murray County	058.812139
Fitzgerald	JA	John	PO Box 881	Armidale	2350	New England Tablelands County	067.725149
Flemming	R	Ross	PO Box 122	Muswellbrook	2333	Upper Hunter County	065.432866
Gamble	J	Jeff	PO Box 1594	Griffith	2680	M.I.A. Rural Services	069.313866
Gardiner	M	Mark	PO Box 21	Lockhart	2656	Lockhart Shire	069.202080
Garrard	W	Wayne	PO Box 601	Tamworth	2340	TCM Coordinator	067.667977
Giles	PW	Peter	Pangee St. 15	Nyngan	2825	Bogan Shire	068.321749
Gill	L	Linda	PO Box 450	Forster	2428	Great Lakes Shire	065.546277
Goldfinch	BA	Brian	PO Box 51	Sth Grafton	2461	Nymboida Shire	066.431876
Gordon	DJS	John	PO Box 881	Armidale	2350	New England Tablelands County	067.724112
Gordon	FM	Fiona	Keirle St. 6	North Manly	2100	Private	02.4510864
Gorham	P	Peter	PO Box 129	Cowra	2794	NSW Agriculture	063.423104
Grace	BJ	Barry	Watson St. 11	Wallendbeen	2588	Cootamundra Shire	069.432532
Gray	PJ	Peter	PO Box 865	Dubbo	2830	NSW Agriculture	068.825283
Graddon	RM	Ruth	Darryl Place 18	Gymea	2227	Sutherland Bushcare Volunteers	02.5252590
Griffiths	NW	Neil	PO Box 9	East Maitland	2323	NSW Agriculture	049.302404
Harding	G	Graham	PO Box 99	Moruya	2537	Eurobodalla Shire	044.737216

Harrison	F	Frank	Campbell St. 33	Wauchope	2446	Hastings Municipal C.	065.832099
Harvey	F	Fred	PO Box 220	Maitland	2320	Maitland City	049.349700
Hayes	KN	Ken	PO Box 155	Coffs Harbour	2450	Coffs Harbour City	066.537125
Hayman	D	Don	Kite St. 161	Orange	2800	NSW Agriculture	063.913100
Hayman	SR	Steve	PO Box 448	Broken Hill	2880	Broken Hill City	080.889266
Hedger	M	Milton	Myack St	Berridale	2628	Snowy River Shire	064.563246
Hibberson	NR	Neil	PO Box 99	Holbrook	2644	Holbrook Shire	060.362358
Hibbert	K	Kevin	GPO Box 5280	Sydney	2001	Public Works	02.7985360
Hill	R	Bob		Orange	2800	ICI Crop Care	063.372379
Hillier	DJ	Dennis	Yass St. 123	Gunning	2581	Gunning Shire	048.451262
Hiser	KP	Kevin	PO Box 112	Queanbeyan	2620	Yarrowlumla Shire	06.2319758
Hocking	D	Doug	Kite St. 161	Orange	2800	NSW Agriculture	063.913150
Hodge	PJ	Peter	PO Box 1700	Canberra	2601	NSW Agriculture	06.2978297
Hokin	G	Geoff	Lang St. 54	Inverell	2360	ICI Crop Care	067.222665
Holtkamp	RH	Royce	RMB 944	Tamworth	2340	NSW Agriculture	067.653902
Honeyman	RI	Dick	PO Box 96	Jerilderie	2716	Jerilderie Shire	058.861499
Hopton	CH	Chris	PO Box 450	Forster	2428	Great Lakes Shire	065.544010
Horsfield	B	Bernie	PO Box 614	Turramurra	2074	Macspred	02.4888283
Horsfield	S	Shirley	as above			Macspred	02.4888283
Hosking	JR	John	RMB 944	Tamworth	2340	NSW Agriculture	067.655990
Hotham	DJ	David	Lee St. 7	Kelso	2795	Upper Macquarie County	063.314200
Howard	DR	Dennis	PO Box 45	Nyngan	2825	Nyngan RLPB	068.321098
Howse	N	Ned	Prime Drive 45	Seven Hills	2147	O'Malley & C0.	02.8389188
Hughes	P	Pat	PO Box 220	Maitland	2320	Maitland City	049.349700
Hurn	E	Eric	PO Box 10	Crookwell	2583	Crookwell Shire	048.482255
Huxley	P	Peter				Stratcom	?
Ingles	G	Graham	Wattle Crsc. 30–32	Glossodia	2756	Hawkesbury River County	045.765239
Jackson	K	Kevin	Myack St.	Berridale	2628	Snowy River Shire	064.563251
Johnston	JA	John	Tunglebung Crk.	Via Tabulam	2469	Far North Coast County	066.655146
Jones	AEV	Ted	Deep Creek	Ulmarra	2464	Clarence River County	066.445468
Karlson	CF	Colin	RMB 259	Taree	2430	Karlson Services	065.537827
Karlson	D	David	Bradley Rd. 1	South Windsor	2756	Hawkesbury River County	045.773318

Keech	GG	Geoff	Somerset	Duri	2344	NSW Agriculture	067.670321
Kelly	I	Ian	Fox St. 77	Walgett	2832	Castlereagh Macquarie County	068.221420
Kelly	WF	Wal	PO Box 177	Macksville	2447	Nambucca Shire	065.647219
Kelly	SM	Stephen	PO Box 307	Cobar	2835	CaLM	068.362809
Kemmis	NL	Neil	PO Box 63	Gunnedah	2380	Gunnedah Shire	067.436515
Kerrison	JR	John	PO Box 141	Moss Vale	2577	Wingeecarribee Shire	048.712374
Kirby	M	Mick	PO Box 330	Oberon	2787	National Pks & Wildlife Svc.	063.361761
Kneller	SL	Stephen	Bombelli St. 22	Bingara	2404	Far North Western Slopes County	067.241563
Lane	DJ	Dom	PO Box 3	Boorowa	2586	Southern Slopes County	063.853455
Lanting	E	Eddie		Gosford	2250	Gosford City	043.843944
Lawler	AJ	Tony	PO Box 115	Quirindi	2343	Central Northern County	067.461755
Lawrence	D	Don	PO Box 17	Molong	2866	Cabonne Shire	063.642000
Leddy	PW	Paul	PO Box 363	Kempsey	2440	Kempsey Shire	065.668427
Leys	AR	Andrew	Locked Bag 21	Orange	2800	NSW Agriculture	063.913172
Loughran	AI	Ann	Bucklee Cr. 12	Warners Bay	2282	Hunter Institute Of Technology	049.488687
Love	C	Chris	PO Box 1205	Tamworth	2340	DowElanco	067.664920
Lynch	LE	Lew				Far North Coast County	066.631262
McDonald	N	Neil	Fox St. 77	Walgett	2832	Castlereagh Macquarie County	068.221420
McFadyen	RE	Rachel	PO Box 36	Sherwood	4075	Qld. Lands Dept	07.3788314
McPherson	P	Paul	PO Box 61	Tumbarumba	2653	Tumbarumba Shire Council	069.482129
McRae	JW	James	PO Box 881	Armidale	2350	New England Tablelands County	067.711700
Maguire	AJ	Alan	RMB 944	Tamworth	2340	NSW Agriculture	067.641431
Mallen-Cooper	J	Jane	Locked Bag 1502	Bankstown	2200	Noxious Plants Advisory Cte.	02.5214104
Malone	A	Austin	PO Box 105	Bombala	2633	Bombala Shire	064.588027
Marr	A	Jerry	PO Box 141	Hay	2711	Hay Shire	069.931993
Martin	PR	Phillip	PO Box 482	Taree	2430	Greater Taree City	065.913272
Matchett	EM	Betty	PO Box 420	Moree	2400	Moree Plains Shire	067.548135
Matthews	GR	Graham	PO Box 117	Bellingen	2454	Bellingen Shire	066.581894
Matthews	D	Don	Nicholson St. 1	Melbourne	3000	ICI Crop Care	03.6657111
Mathews	KR	Kevin	Croudace St 188 W	Walcha	2354	New England Tablelands County	067.772096
Meek	JA	Jason	Chandos St. 57	Ashfield	2131	Urban Bushland Management Inc.	02.7994182
Merton	PW	Peter	Journey's End	Bathurst	2795	Noxious Plants Advisory Cte.	063.377762

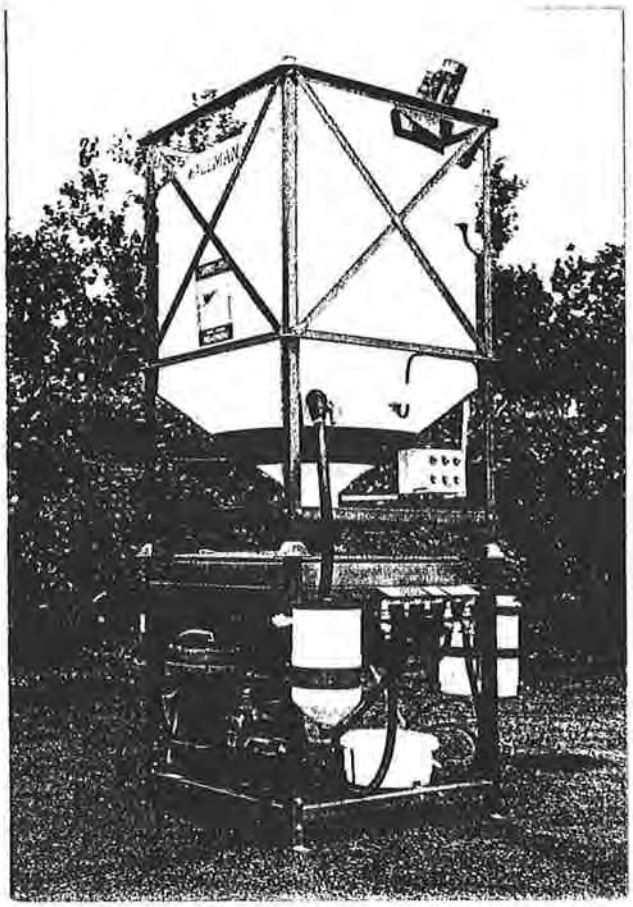
Milvain	HJ	Hugh	Ag. Inst PMB	Yanco	2703	NSW Agriculture	069.557163
Minter	L	Leyland	Halloran St. 36	Lilyfield	2040	Organic Crop Protectants P/L.	02.8181033
Morrison	RJ	Jim	PO Box 394	Leeton	2705	Leeton Shire	069.535378
Munro	P	Pat	PO Box 614	Turramurra	2074	Macspred	02.7564433
Murray	P	Peter	The Avenue 37	Corrimal	2518	Wollongong City	042.277266
Nalder	R	Ron	PO Box 17	Molong	2866	Cabonne Shire	063.642000
Nelligan	KJ	Kevin	PO Box 342	Cowra	2794	Cowra Shire	063.423443
Neville	KJ	Ken	PO Box333	Forbes	2871	Forbes Shire	068.511422
Nicholas	G	Greg	Harbour View St2A	Clontarf	2093	Racal Health	02.9055724
Nicholas	JW	John	Nebraska	Molong	2866	Wellington Shire	068.696247
Nicholson	G	Geoff	PO Box 10	Crookwell	2583	Crookwell Shire	048.322120
Nixon	DE	David	PO Box 447	Glen Innes	2370	Severn Shire	067.324414
Nolan	PW	Peter	PO Box 547	Tamworth	2340	NSW Agriculture	067.668506
Nott	JF	Jack	RMB308 Glen Oak	Via Maitland	2320	Hunter Catchment Mngt. Trust	049.886163
O'Brien	VM	Val	PO Box 138	Mudgee	2850	Mid-Western County	063.735251
Olive	MJ	Malcolm	Wyan	Via Rappville	2469	Far North Coast County	066.667125
Parmenter	C	Colin	PO Box 20	Wagga Wagga	2650	Wagga Wagga City	069.235257
Parsons	B	Brett	PO Box 11	Gloucester	2422	Gloucester Shire	065.582343
Pasenow	E	Eric	Dowling St.	Dungog	2420	Dungog Shire	065.922130
Perkins	JHW	John		Duranbah	2487	Far North Coast County	066.777379
Phelps	D	David	PO Box 42	Nowra	2541	Shoalhaven City	044.293111
Plumridge	KS	Keith	King St. 282	Newcastle	2300	Newcastle City	049.299316
Pomery	DB	David	PO Box 148	Kiama	2533	Illawarra County	042.571907
Popovic	P	Peter	ARS PMB 2	Grafton	2460	NSW Agriculture	066.543224
Portbury	GK	Geoff	PO Box 96	Jerilderie	2716	Jerilderie Shire	058.861676
Rawling	JL	Judie	PO Box 62	Roseville	2069	Urban Bushland Management Inc.	02.4992172
Readford	MR	Ruth	McKinnon St. 2/24	East Ballina	2478	Dune Care	066.869116
Rees	RL	Ron	Blairmore	Boggabri	2382	Narrabri Shire	067.435717
Richards	DN	David	PO Box 63	Gunnedah	2380	Gunnedah Shire	067.421917
Riley	GJ	Geoff	PO Box 111	Merriwa	2329	Merriwa Shire	065.482251
Roberts	RN	Ronny	PO Box 881	Armidale	2350	New England Tablelands County	067.791322
Robertson	S	Steve	Napier St.	Goolgowie	2652	Carrathool Shire	069.651364

Rodway	S	Stephen	Adams St. 256	South Corowa	2646	Corowa Shire	060.333402
Rollinson	D	Don	PO Box 17	Molong	2866	Cabonne Shire	063.642000
Rosewarne	JE	John	PO Box 90	Queanbeyan	2620	Queanbeyan City	06.2971970
Ross	ND	Nikki	Pittwater Rd. 699	Dee Why	2099	Warringah Shire	02.995929
Rossington	NF	Neil	PO Box 214	Tenterfield	2372	Tenterfield Shire	067.361744
Rossiter	DC	David	PO Box 345	Christchurch NZ		DuPont Award Winner NZ	03.3134072
Russell	A	Alan	Kite St. 161	Orange	2800	NSW Agriculture	063.913100
Ruytenberg	KL	Kim	PO Box 168	Kyogle	2474	Far North Coast County	066.335178
Ryan	PD	Paul	PO Box 714	Cooma	2630	Cooma-Monaro Shire	064.524651
Samuels	W	Wal	Montofiors St. 9	Wellington	2820	Wellington Shire	068.452226
Sargent	M	Melinda	Elbow St. 31	Kempsey	2440	NSW Agriculture	065.621114
Schmitzer	TN	Terry	PO Box 84	Port Macquarie	2444	Hastings Municipal C.	065.871120
Scott	J	John	Kallaroo	Somerton	2340	Rhone-Poulenc	067.697668
Sheargold	WJ	Wayne	Cecile St. 2	Parkes	2870	Parkes Shire	068.624850
Sindell	BM	Brian	Gidabal St. 13	Aranda ACT	2614	CSIRO	06.2514297
Singleton	IG	Ian	Pell St. 83	Howlong	2643	Hume Shire	060.265617
Sippel	RJ	Ron	RMB 944	Tamworth	2340	NSW Agriculture	067.641496
Sly	A	Alan	Dandaloo St.	Narromine	2821	Narromine Shire	068.891087
Smith	AR	Alan	High St. 127	Bega	2550	Bega Valley Shire	064.921277
Smith	R	Dick	Prince Will'm Dv11	Seven Hills	2147	Nufarm Ltd.	02.6744355
Spong	AJ	Joe	PO Box 40	Moulamein	2733	Wakool Shire	058.875172
Stanley	RJ	Roger	PO Box 177	Kempsey	2440	CaLM	065.627616
Stansfield	W	Warwick	Warwick Farm	Yass	2582	Contractor	06.2261546
Stegeman	DA	Tony	Pvt. Bag 3 P.O.	Indooroopilly	4068	CSIRO	07.2026783
Stein	HJ	Harry	James St.	Barraba	2347	Far North West Slopes County	067.821114
Stieger	DH	Doug	Kulaba Ave. 13	Warialda	2402	Far North West Slopes County	067.291548
Stratford	A	Andrew	Baker Cres. 7	Fig Tree	2525	Wollongong City	042.281409
Strickland	C	Chris		Coonabarabran	2357	Land Care	
Styles	KC	Kerrin	PO Box 1038	Tuggeranong	2901	ACT Agriculture And Landcare	06.2416490
Sullivan	PR	Paul	RMB 944	Tamworth	2340	NSW Agriculture	067.654555
Sweet	R	Rosemary	Kite St. 161	Orange	2800	NSW Agriculture	063.913100
Szafraniec	E	Ted	Kent St. 400	Sydney	2000	WorkCover Authority	02.3705205

Tanner	L	Les	PO Box 1	Bingara	2404	NSW Agriculture	067.241351
Tattam	D	Darryl	Unwinsbridge Rd. 9–13	St. Peters	2044	State Rail	02.5650483
Theriault	D	David	Rodborough Rd. 26	Frenchs Forest	2086	DowElanco	02.9750222
Thurling	RH	Bob	PO Box 94	Culcairn	2660	Culcairn Shire	060.298367
Tofflon	RB	Roger	Kite St. 161	Orange	2800	NSW Agriculture	063.913727
Townsend	N	Norm	PO Box 17	Molong	2866	Cabonne Shire	063.642000
Tull	M	Mark	PO Box 11	Gloucester	2422	Gloucester Shire	065.581601
Tye	IE	Ian	PO Box 171	Maclean	2463	Maclean Shire	066.453257
Vandervelde	T	Tom	Clvain South St.	Inverell	2360	Far North West Slopes County	067.221154
Vanzella	B	Bindi	StGeorges Cr 8173	Drummoyne	2047	Urban Bushland Management Inc.	02.8196543
Wallace	J	Jenny	PO Box 482	Taree	2430	Greater Taree City	065.510122
Waller	RJ	Rob	Possumwood Pl.2	Mullumbimby	2482	Far North Coast County	066.841118
Wass	ED	David	Fox St.77	Walgett	2832	Castlereagh Macquarie County	068.221420
Watt	IC	Ian	Hazlewood Pl 16	Epping	2121	Royal Aust. Chemical Institute	02.8764458
Webber	EK	Ned	PO Box 482	Taree	2430	Greater Taree City	065.913108
Whiteman	T	Tracey	PO Box 75	Kiama	2533	Kiama Municipal C.	042.320222
Whitteron	ME	Max	Lawrence St. 25	Cootamundra	2590	Cootamundra Shire	069.421608
Widdison	NR	Noel	PO Box 21	West Wyalong	2671	Bland Shire	069.723179
Willard	W	Wayne	PO Box 155	Quirindi	2343	Central Northern County	067.461755
Wilson	IRB	Ian	Hollymount	Bingara	2404	Far North West Slopes County	067.294153
Wilson	LG	Gratton	PO Box 714	Cooma	2630	Cooma–Monaro Shire	064.533345
Woods	EA	Errol	Coldstream St. 15	Ulmarra	2462	Ulmarra Shire	066.421469
Woods	K	Kevin	Henty St	Hilston	2675	Carrathool Shire	069.672315
Woods	LH	Len	Kylee	Niangala	2354	Noxious Plants Advisory Cte.	067.692251

SENTINEL

WATER EFFLUENT TREATMENT PLANT



For small scale industrial or agricultural use

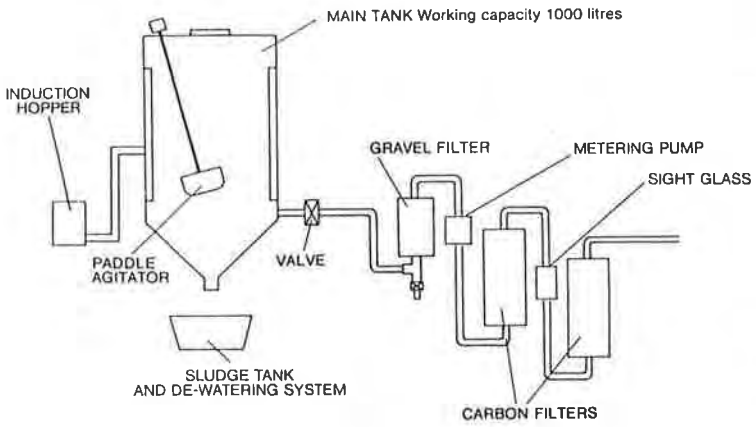
Designed for CARBO-FLO Water Effluent Treatment from ICI

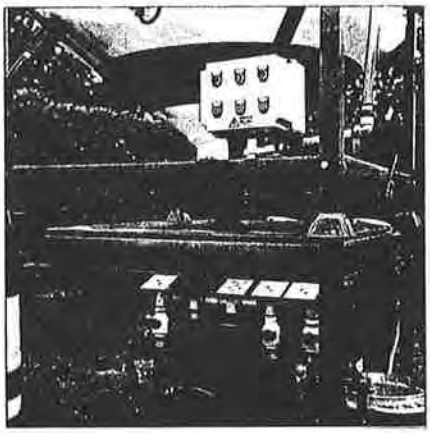
ALLMAN

SENTINEL

ALLMAN in conjunction with ICI have developed the SENTINEL WATER EFFLUENT TREATMENT PLANT for use in small scale industrial operations as well as agricultural and other areas where environmental considerations are important. (The Carbo-Flo Treatment from ICI removes organic substances from water.)

- ★ A major step forward in the prevention of environmental pollution.
- ★ Treatment packs designed for each 1000 litre batch of effluent.
- ★ A tried and tested system used by ICI in large scale industrial operations worldwide.
- ★ Treatment 'cleanses' contaminated liquors to give cleaned water. The small quantities of sludge produced can be disposed of to waste disposal contractors.
- ★ Tell-tale colour indicator for filter saturation, visible through sight glass.
- ★ Portable or fixed plant available as 1 cubic metre (other sizes available on request).





Sentinel control system conveniently grouped

Specification

COLLECTION TANK – 1000 litre working capacity. Manufactured from polyethylene, rotational moulded, with sludge transfer valve, sight gauge and sampling valve. Overflow safety cut-out to prevent accidental overfill.

CARBO-FLO INDUCTION HOPPER – For active agent infusion.

AGITATION PADDLE – Electrically driven motor, 240 volt AC single phase. Mechanical action.
(12 volt DC for engine powered unit)

FILTERS – One in-line filter. One gravel pre-filter with back flow cleaning facility. Two activated carbon filters with replaceable cartridges.

METERING PUMP – Ensures constant flow.

FILLING PUMP – Centrifugal pump driven by 2hp single-phase electric or 3hp petrol engine.

SIGHT GLASS.

SLUDGE COLLECTION VESSEL – Manufactured from polyethylene c/w sludge drain filter bag and de-watering system.

FRAME – Constructed from mild steel, facility for three point linkage and/or fork lift.

LIQUID CIRCUIT – 5 metres of suction hose c/w floating filter, and all necessary valves and discharge pipes.

NET WEIGHT – 580 kg.

DIMENSIONS – 214 cm x 175cm x 350cm.

OPTIONS – Clean water tank. Other drives available for industrial uses, i.e. electric single-phase, three-phase, pneumatic, etc.

Sentinel is designed for use with *dilute* solutions of organic chemicals. Follow the directions in the instruction manual.

ALLMAN **E. Allman & Company Ltd**
Birdham Road, Chichester, West Sussex, England PO20 7BT
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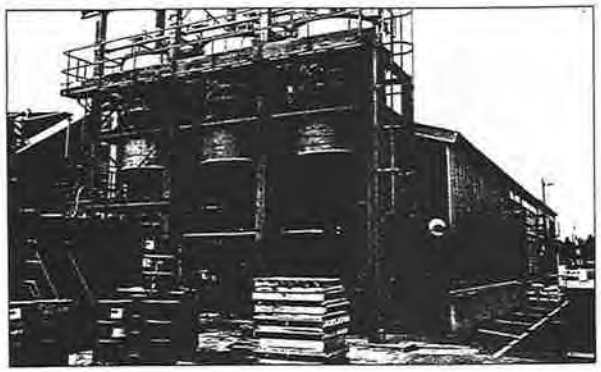
August 1991



The Carbo-Flo plant at Yalding (UK)

Its pedigree

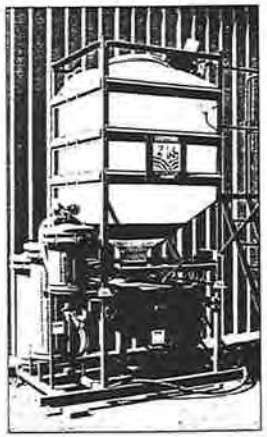
The Sentinel unit was developed by E Allman and Co Ltd in conjunction with ICI Agrochemicals. Units are now operating in 20 countries.

It uses the ICI Carbo-Flo* process employed since the early 1970s at the ICI Agrochemicals plant at Yalding (UK) where up to 50,000 litres of factory effluent is treated every working day.

The Sentinel system has been subjected to extensive testing in the UK, USA and Netherlands. The treated water falls within the limits of the EC Drinking Water Directive.

Specifications

The Sentinel unit is 3000mm high by 1700 mm long and 1300 mm wide when assembled.



It weights 825 kg (empty) and breaks into two parts, each about 1.5 m high for transport.

Tank capacity of the unit pictured [illegible] litres.

The unit consists of a sand filter and two identical activated carbon filters only one of which is in use at any time. The operator switches to the second carbon filter when the appearance of a colour-dye in an inspection tube signals that the first carbon filter is becoming exhausted.

The sludge box below the tank will hold about [illegible] litres of sediment.

For further information

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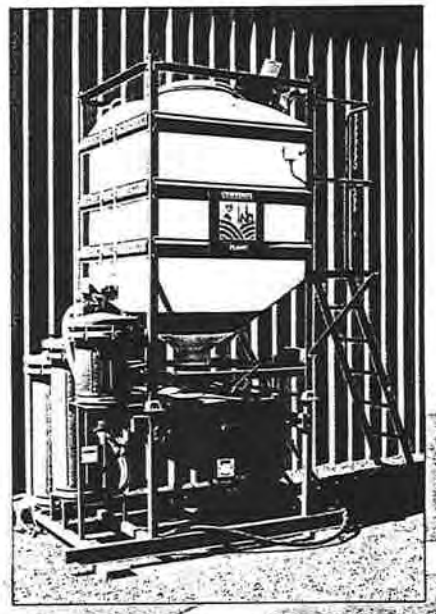
SENTINEL



PREVENTING POLLUTION

What it does

The Sentinel* waste-water treatment unit is a low-cost, transportable system for removing chemicals from effluent to produce cleansed water and small amounts of sludge that can be disposed of safely and inexpensively.

It has wide application in small-industry waste treatment, agriculture and emergency-response situations. And it offers a solution to the major problems faced by local government in disposing of used chemicals containers.

The unit treats contaminated water in batches of 1000 litres. A 5000-litre unit is available for permanent installation.

The first stage of the treatment cycle is the addition of a prepacked flocculant to the effluent in the tank. After about 45 minutes most of the chemical contaminants have settled-out.

The second stage operates automatically for about 3 hours. It uses cartridges of sand and activated charcoal to further cleanse the water to at least 99 9% purity.

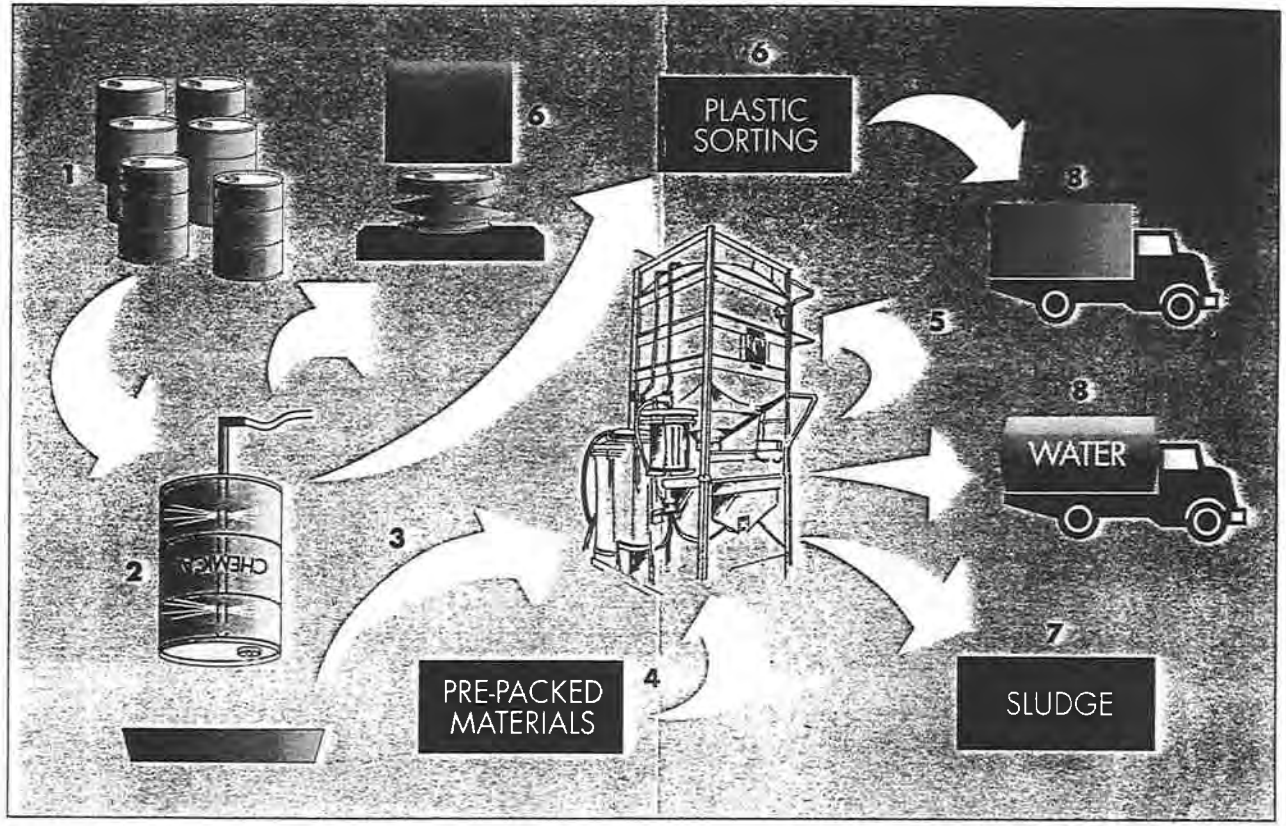
The following are typical results of the treatment of a cocktail of insecticides, herbicides and fungicides.

The figures are in parts per million. The first figure is the concentration in the tank before treatment: the figure in brackets is the concentration in the water after treatment:

Demeton-S-methyl, 250 (<0.02); gamma-HCH, 530 (<0.02); Pirimicarb, 180 (<0.02); Propiconazole, 100 (<0.02); Cypermethrin, 28 (<0.02); 2,4-D, 61 (0.01); Mecoprop, 119 (0.01); Paraquat, 580 (<0.5)

Hands-off operation

Because it uses measured, prepacked materials (shown below) the Sentinel unit requires no special skill in operation. The sludge is removed for disposal at an approved site. The treated water can be discharged to a soakaway or recycled as washing water.



The diagram shows a system (below) that could be used at a local-government chemical-container disposal site.

Key to recycling

ICI Crop Care sees the Sentinel unit as the key to an efficient system for disposing of chemical contaminants safely and for safe recycling of chemicals containers.

For small industries, this means collection of spent and washdown liquid in an approved sump for processing through the unit as batch volumes are collected.

The treated water is colourless and odourless and can be discharged to drains (subject to official requirements). But it should be stored and recycled as washdown.

The sludge is dried and stored in a secure area till enough has accumulated for economic disposal at a designated land-fill site — or for high-temperature incineration where that is available.

For local-government authorities, the system offers operator safety and environmental security in the disposal of used containers.

The system lends itself ideally to operation by contractors to groups of local authorities.

Typical procedures would be:

1. Contractor moves Sentinel, drum crusher and other equipment to container-collection site
2. High-pressure washing of containers and collection of washing water
3. Pumping of water to Sentinel tank
4. Treatment by Carbo-Flo process.
5. Recycling of treated water in the washing process
6. Crushing of clean steel drums for recycling, and sorting of plastic containers for shredding and recycling where possible.
7. Collection of sludge for safe disposal
8. Removal of all material from the site