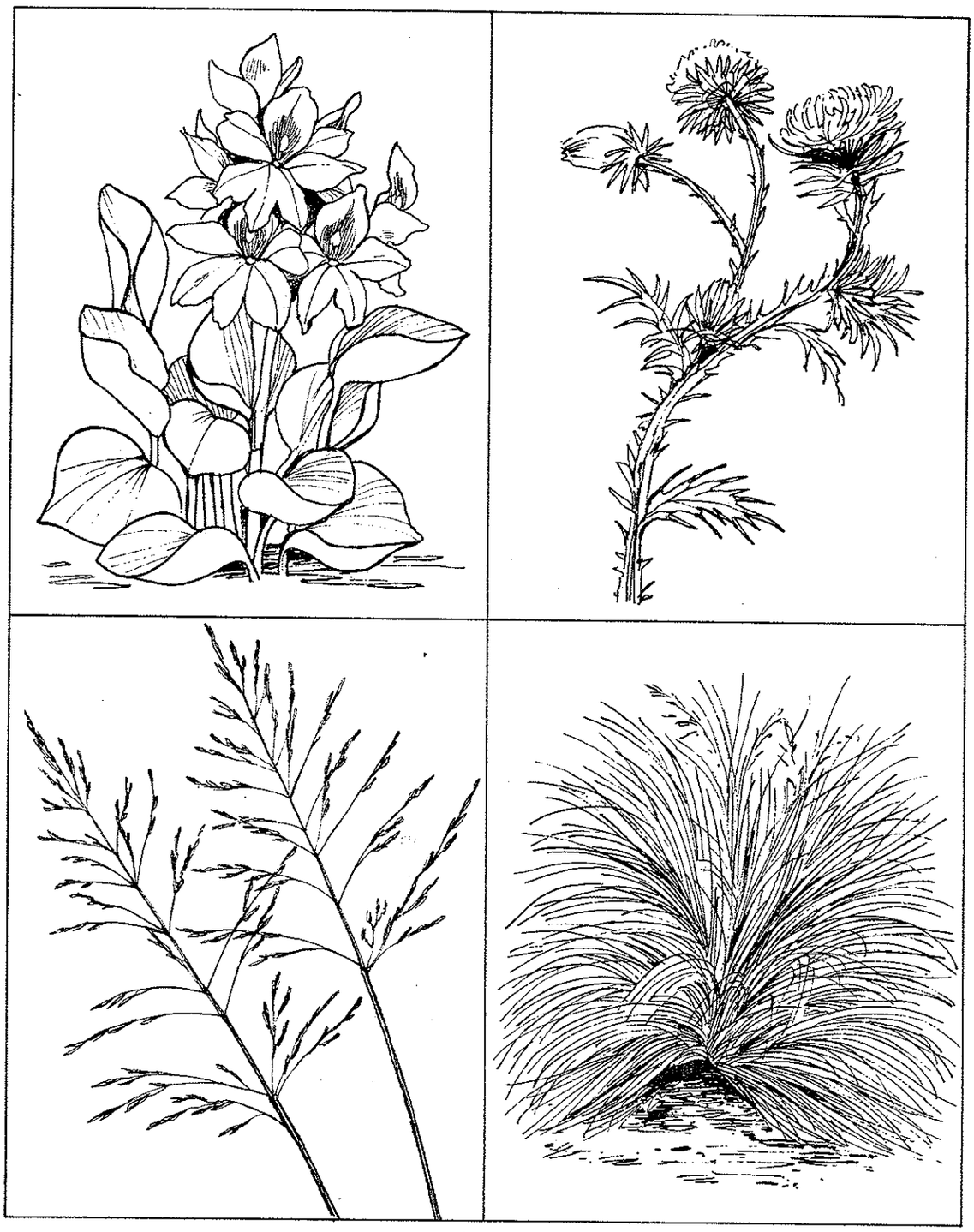
Leon W. Smith

FIRST BIENNIAL NOXIOUS PLANTS CONFERENCE

Agdex 640

Riverina College of Advanced Education,
Wagga Wagga, NSW, July 6 - 10, 1981.
Organised by the NSW Department of Agriculture.



EDITORIAL NOTES

EDITING AND COMPILATION OF THE PROCEEDINGS OF THE 1ST BIENNIAL NOXIOUS PLANT CONFERENCE

Many thanks to those speakers who co-operated in forwarding their written material to me for inclusion in the Conference Proceedings. Unfortunately, others have arrived too late to be included prior to the conference.

The collection, editing, typing, correlation and printing of this volume has been an ongoing task for a number of people since last February. It has not been an easy task to meet all the deadlines.

For this reason, those papers not included in this conference proceedings, will be printed as a supplement and forwarded to you after the conference.

Included in this supplement will be a Register of Attendance, it will include names and addresses etc. of everyone attending the conference.

It is also proposed to print additional copies, every Local Government Council will be presented with a copy.

Derek Brown,
Field Officer (Weeds).
TAMWORTH.

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1ST BIENNIAL NOXIOUS PLANT CONFERENCE

MONDAY JULY 6TH, 1981 DAY 1

PROGRAMME

SESSION CHAIRMAN, HUGH MILVAIN, FIELD OFFICER (WEEDS), LEETON.

AM REGISTRATIONS

12.30 pm LUNCH

1.15 pm WELCOME
B. Thistlethwayte, Dean, School Agriculture R.C.A.C.

1.20 pm OPENING ADDRESS
Mr George Knowles, Director General, Agriculture, Sydney.

1.45 pm THE BASIS OF WEED CONTROL AT LOCAL GOVERNMENT LEVEL
Bob Phelps, Weeds Officer, Gunning Shire.

2.10 pm PASTURE PROTECTION BOARD WEED CONTROL
T. Nelson, Ranger, Forbes.

2.25 pm NATIONAL PARKS AND WILDLIFE
A. Love, Protection Systems Officer, Queenbeyan.

2.40 pm WEED CONTROL BY THE FORESTRY COMMISSION OF NSW
A. Edwards, Regional Forester, Wagga.

3.00 pm AFTERNOON TEA

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SESSION CHAIRMAN, DEREK BROWN, FIELD OFFICER (WEEDS), TAMWORTH.

3.30 pm PROBLEMS ENCOUNTERED BY COUNCILS IMPLEMENTING A NOXIOUS PLANT PROGRAMME
Kevin Waters, Chief Weeds Officer, Armidale.

3.40 pm BRINGING UNPRODUCTIVE COUNTRY BACK INTO FULL PRODUCTION
Cec Webb, Weeds Officer, Wellington.

4.00 pm GORSE CONTROL ON ARABLE AND NON ARABLE LAND
Steve Dickman, Weeds Officer, Bowral.

4.10 pm BIO CONTROL OF ST JOHN'S WORT
Bill Ryan, Weeds Office, Mudgee.

4.20 pm 25 YEARS AS A LOCAL GOVERNMENT WEEDS OFFICER
Herb Wharton, Weeds Officer, Goulburn.

4.30 pm ADMINISTRATION PROBLEMS WITH AQUATIC PLANTS
A Marciniah, Weeds Officer, Maitland.

4.45 pm PROBLEMS WITH ALLIGATOR WEED
Peter Gray, Field Officer (Weeds), Dubbo.

5.00 pm CLOSE.

PROGRAMME

SESSION CHAIRMAN, PETER GRAY, FIELD OFFICER (WEEDS), DUBBO.

8.30 am AIDS TO NOXIOUS PLANT CONTROL - ROADSIDE PASTURE MANAGEMENT
Terry Launders, Research Agronomist, Taree.

9.00 am Gary Radunz, Weeds Officer, Narrabri.

9.15 am John Kerrison, Weeds Officer, Harden.

9.30 am CALIBRATION FILM, TASMANIA DEPARTMENT OF AGRICULTURE

10.00 am MORNING TEA

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SESSION CHAIRMAN, PETER GORHAM, FIELD OFFICER (WEEDS), COWRA.

10.30 am WILD RADISH
Brian Scarsbrick, Regional Director of Agriculture, Leeton.

11.00 am WATER LETTUCE - THIRTY CENTS WORTH OF TROUBLE
Norm Ritchie, Weeds Officer, Taree.

11.15 am CHEMICAL RESIDUE EFFECTS - LIVESTOCK
Eric Cuthberton, Wagga.

12.00 SOIL EFFECTS ON PLANT GROWTH AND CONTROL
John Pratley, Lecturer, R.A.C.E., Wagga.

12.30 pm LUNCH

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SESSION CHAIRMAN, CLIVE WILMOT, WEEDS OFFICER, MOREE.

1.30 pm COMMUNICATION - AUDIO VISUAL AIDS
J. Sugden, Regional Publicity Officer, Orange.

2.30 pm NOXIOUS WEED ASSESSMENTS AND DISTRIBUTIONS
Eric Cuthbertson, Wagga.

3.00 pm AFTERNOON TEA

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SESSION CHAIRMAN, GREG COLLIER, WEEDS OFFICER, GUNNEDAH.

3.30 pm MANAGEMENT PRACTICES
W. Mark, Institute of Management, Sydney.

5.00 pm LEGAL ASPECTS - FAULTS AND PROBLEMS
Bob Leach, Weeds Officer, Berridale.

5.30 pm PRE-EXCURSION BRIEFING

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7.30 pm to 9.30 pm WEED OFFICER ASSOCIATION MEETING

WEDNESDAY JULY 8TH, 1981 DAY III

PROGRAMME

FIELD EXCURSION

8.30 am to 5.30 pm	COACH TOUR	CO-ORDINATORS: FIELD OFFICERS (WEEDS)
	FIELD NOTES	

THURSDAY JULY 9TH, 1981 DAY IV

PROGRAMME

SESSION CHAIRMAN, GRAEME MATHEWS, WEEDS OFFICER, BELLINGEN

AIDS TO NOXIOUS PLANT CONTROL USING AERIAL AGRICULTURE FOR PASTURE ESTABLISHMENT

8.30 am Hazelton Air Services, Cudal

8.45 am Vowell Air Services, Canberra

9.10 am Malcolm Campbell, Senior Research Scientist, Orange

9.35 am Bob Leach, Weeds Officer, Berridale

10.00 am MORNING TEA

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SESSION CHAIRMAN, RON ARCHER, WEEDS OFFICER, COFFS HARBOUR

10.30 am INCORPORATING WEED CONTROL INTO FARM MANAGEMENT
Jim Cherry, Chief Weeds Officer, Quirindi.

10.45 am SPINEY BURR GRASS
Ross Slack-Smith, Chief Weeds Officer, Coonamble.

11.15 am AQUATIC PLANT CONTROL
Chris Ripper, Field Officer, W.R.C., Griffith.

11.45 am SILVERLEAF NIGHTSHADE
Deirdre Lemerle, Research Agronomist, Wagga.

12.00 LOVE GRASSES
Bill Johnson, Soil Conservation Service, Wagga.

12.30 pm LUNCH

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SESSION CHAIRMAN, DON ARMSTRONG, COUNCIL WEEDS OFFICER, CASINO

1.30 pm NEW PRODUCTS
Bernie Horsfield, Dupont Agrichemicals, Sydney.

1.50 pm DOW CHEMICALS, SYDNEY

2.10 pm SPRAY DAMAGE EXERCISE
Deirdre Lemerle, Research Agronomist, Wagga.

3.00 pm AFTERNOON TEA

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SESSION CHAIRMAN, DICK HONEYMAN, WEEDS OFFICER, JERILDERIE

3.30 pm EFFECTS OF NOXIOUS PLANT CONTROL OF LOCAL GOVERNMENT AMALGAMATION
Ron Nalder, Chief Weeds Officer, Molong.

4.00 pm NOXIOUS PLANT ADVISORY COMMITTEE FUNCTIONS AND CHANGES TO LEGISLATION
N.P.A.C. Member, Sydney.

4.30 pm PRICKLY PEAR CONTROL,
Garry Ryan, Commissioner, Tamworth. John Hosking, Field Officer, Tamwo.

5.00 pm CLOSE

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CONFERENCE DINNER

FRIDAY JULY 10TH, 1981 DAY V

PROGRAMME

SESSION CHAIRMAN, JACK WHITNEY, WEEDS OFFICER, SCONE

8.30 am EQUIPMENT AND ACCESSORIES

- STATIC DISPLAYS
- SHORT RESUME

10.00 am MORNING TEA

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SESSION CHAIRMAN, JOE SPONG, WEEDS OFFICER, MOULAMEIN

10.30 am PESTICIDES ACT, 1978
Hugh Fisher, Inspector (Pesticides), Leeton.

11.00 am NOXIOUS PLANTS AND THE STATE RAIL AUTHORITY
Alex McLennon, Agronomist, SRA, Sydney.

11.20 am WEEDS - WATERSHED CONTROL COMMITTEES
L. Clark, Chairman, Narromine Committee.

11.50 am OPEN FORUM AND CONFERENCE EVALUATION

CLOSE OF CONFERENCE

LUNCH.

THE BASICS OF WEED CONTROL AT THE LOCAL GOVERNMENT LEVEL

R. G. Phelps,
Weeds Officer,
Gunning Shire.

(1) AIMS - Immediate and long term.

(2) POLICY - Practical and realistics.

(3) IMPLEMENTATION - of Policy.

(4). RESULTS - as to (1) Weed control in the area.
(2) Benefits to the area economically and otherwise.
(3) Benefits to the landholders.

Aims

Looking at the past history of weed eradication in New South Wales, it may be said there are few instances where one could say that any specific plant has been permanently eradicated.

Many plants have, and are being controlled, so it seems reasonable to assume that the main aim in any local government area with the weed problem should be that of control in that specific area with perhaps less emphasis on immediate eradication.

Immediate and long term

The immediate then becomes obvious. A detailed survey of the area to ascertain the location of, together with the degree of infestation of, priority weeds is the first step.

Having gained this information the second step is to implement a program for controlling all scattered, outlying, and light infestations, so that the more heavily infested areas are isolated and the spread contained. At the same time steps must be taken to gradually reduce economically these heavily infested areas over the long term.

Policy

In determing its policy the authority should look at the following important factors, and these points have been borne out of experience.

If the owner with light or scattered infestations cannot or will not control the plant in question on his property, then what hope have the authorities in obtaining the cooperation of the owners in the more heavily infested country who have a far greater physical and economical problem?

It cannot be denied that heavily infested areas are a source of seeding, but it can be argued from the other side that if the authorities cannot control the spread of these light/scattered areas why victimize those on the heavy areas, for to contain and stop the spread is the first priority.

So one important point regarding policy emerges: that is, public relations.

With public relations it is imperative that prosecutions be kept to a minimum, to be used only as a last resort.

For this reason any policy envisaged should be framed along the lines of owner education and of, wherever possible, showing the owner that through co-operation and adopting the authorities policy he will receive every assistance, and also improve his financial position and production. This is in areas where it is practical to do so.

So, one important aspect regarding policy should be firstly, you help those who help themselves.

Secondly, with the problem owner, who for various reasons cannot or will not cooperate, then it is essential that firmness be the policy with every avenue within the Act being used. At all times one must try to be fair.

Thirdly, another important aspect in determining policy is that in the process of controlling noxious weeds in the area, certain definite benefits will eventuate.

For example, where applicable, pasture improvement results in higher land valuations and greater productivity with better livestock being available for market. The result is greater financial returns to the landowner.

Lastly it should always be realized it is the owners themselves who have the problem, and who will or will not control the weed. Having them on side is vital to the success of any policy.

If one can get the cooperation of the majority, then the problem to a great extent resolves itself.

Implementation of policy

Once a policy has been adopted, one has to then resolve to implement that policy fully and without variation.

Understandably the owner with only light infestations will be some cases resent having to carry control out when in his mind he considers the threat is probably his neighbours.

In these cases the policy and the reason for the policy should be fully explained, and hopefully cooperation achieved. If cooperation is not forthcoming then the Act should be implemented, culminating in entry by the authorities' servants under Section 474 or, if necessary, prosecution.

In the case of the heavily infested areas, these owners should be approached, informed of the policy and every effort made to obtain their cooperation in implementing a control programme, if necessary extending over an agreed period of time.

Remember, from both a practical and economical aspect do not approach this owner with the idea of having him attack the whole problem immediately and expecting the situation to be resolved in perhaps one year. This could be financially impossible.

The owner could, in many cases become antagonistic, bad relations develop and the situation reach a stalemate.

So where appropriate, you cooperate with him. You help him, as in other cases, by offering the various services which in the policy are available, pointing out the advantages to be gained through weed control.

The authority should try to promote goodwill through carrying out private works at reasonable cost, provide advisory services, and arrange seed, chemical, and fertilizer supplies.

A program of aerial spraying should be organized to include all owners affected at that particular time.

All these points enhance the image of the authority. The public gain confidence, they are relieved of the burden of problems of organization, their costs are reduced, and more important, they feel they are getting something in return for their cooperation. It becomes a two way street.

The authority should encourage weed control in those areas under its jurisdiction, and not adopt a policy of policeman where the owner feels he is being told "get rid of those weeds or else".

RESULTS

By adopting these principles it is reasonable to expect that within a few years the majority of owners in the area will become weed conscious, and also be fully aware of the advantages of correct pasture and stocking methods.

Through these owners communicating with others the practice becomes more widely adopted.

With a successful program one has the advantage of being in a position to show to new owners to the area the beneficial results achieved.

To enable one to gauge the success or otherwise of such a policy, and to keep up to date with results, it is good practice to compile an annual progress report which will indicate whether or not the program is lagging, and also illustrate to what degree the weed problem has diminished.

WEED CONTROL BY THE FORESTRY COMMISSION OF NSW

A.E. Edwards,
Regional Forestor,
WAGGA.

SUMMARY

The New South Wales Forestry Commission spends considerable funds each year in controlling noxious weeds and animals as well as removing unwanted commercial tree species and similar vegetation from forests.

Weeds of major importance are blackberry (Rubus spp) and lantana (Lantana spp). Most money spent is on these two weeds and on rabbit control.

INTRODUCTION

The forests of New South Wales can be classified into three major groups based on locality and forest type. These comprise:

1. Coastal forests including all forest types growing generally east of the Great Dividing Range. They vary from poor hardwood forests dominated by eucalypt species growing on poor soils with relatively low rainfall by coastal standards, through to the moister hardwood types and rainforests in the north east corner of the State on fairly fertile soils with a sub-tropical climate and high rainfall.

2. Highland forests including native hardwood forests dominated by eucalypt species growing in cool to temperate areas with a relatively high rainfall. Also the exotic pine plantations around Tumut, Bathurst and Nundle which grow in 120 mm plus rainfall areas.

3. Western forests which grow on the western slopes of the Great Dividing Range and the western plains. These forests are dominated by cypress pine on the areas away from rivers on well drained sites; by river red gum along the rivers on land prone to flooding; and there is a small area of mixed forest on stony ranges where various eucalypts, casuarinas and black cypress pine grow.

The problem weed species growing on these forests can similarly be grouped fairly distinctly into these forests types.

1. Lantana is the major weed on coastal forests.
2. Blackberry is the major weed on highland forests.
3. Burrs are largely confined to red gum forests but do occur on the other western forests.

Total expenditure on noxious weeds and animals over the three years 1976/77, 1977/78 and 1978/79 was $867519. The major part of this expenditure was on blackberry control within pine plantations on the highland forests.

The major work carried out by the Forestry Commission in noxious weed control is with blackberry and lantana. Control methods for these weeds are dealt with in detail as the methods used are possibly outside the experience of many people and will be of more interest than the more agricultural type weeds usually dealt with. However, problems with these will be described as well.

LANTANA

Attempts at controlling this weed satisfactorily go back a long way and have involved considerable expense in research. This research has benefitted all of the community who are bothered by lantana because it has been aimed at finding a

biological solution.

Queensland Department of Lands and Queensland Forestry had for many years been involved in bringing insects into Australia to control lantana, which was regarded as a serious weed. CSIRO was also involved in this field but up to 1960 had not done any search work in the America's.

The Forestry Commission entered the biological control of lantana field in 1956. At this time, a search of the Central American region had just finished and several insects were either in quarantine facilities in Queensland or in Hawaii, which was used as a stepping stone before bringing in these foreign insects.

The insects were Neogalea esula and a few other species never released in Australia. Neogalea esula (a moth) was easy to rear, was host specific and was soon established in northern New South Wales and Queensland. However, it was attacked by a viral disease and although there were massive liberations, only a few insects reached maturity. It is now present in northern New South Wales and southern Queensland in very low numbers, not sufficient to make its presence obvious. It is considered a failure.

In 1959 another leaf-eating moth was liberated in New South Wales. Anania haemorrhoidalis, the lantana leaf-folding caterpillar, could not be established in New South Wales or in southern Queensland though it was feeding on lantana in central and northern Queensland. The damage by this insect is obvious, but unfortunately it is a failure in New South Wales, mainly because it requires high temperatures.

The next leaf eater was brought in some years later in 1974. It was a moth, Autoplusia illustrata, whose larvae feed on lantana. All field liberations failed in Queensland and New South Wales because the larvae were preyed upon by birds, spiders and ants. It was considered a sufficient period to determine whether this moth would survive in the field.

The latest leaf eating insect is a flea beetle, Oedionychus spp, the larvae and adults of which feed on the lantana foliage. The adults live for many months and are capable of doing much damage. The first supplies were received from CSIRO in early 1981. At present supplies are being built up for field liberations in 1982.

The leaf mining beetles have been more successful than the other insects. The first two species Octotoma scabripennis and Uroplata girardi were liberated in 1968 in New South Wales. Since then many thousands of beetles have been collected in Queensland and liberated along the coast of New South Wales. Both species have extensively damaged lantana in Queensland and more recently northern New South Wales.

Uroplata girardi is more suited to the warmer and drier areas of the coast while Octoma scabripennis does well in warm, moist areas. Both insects thrive in moist, gully situations where they are protected from winds.

In shaded areas of the forest these beetles are of no value, preferring open sunny situations and lush lantana. There is evidence that the insects are surviving in areas south of Coffs Harbour where they initially failed. Releases in areas along the Hawkesbury River are also giving better results in recent years as the insects acclimatize. It is expected that further acclimatization will occur as time passes and it is possible that some damage will occur in lantana areas south of Sydney.

The agressiveness of lantana has been reduced in north coast areas. When the spring is moist the beetles are abundant, particularly in the second generation in February-March.

Another more recent introduction was that of the leaf mining beetle Octoma championi which has been liberated since 1975. This species breeds well in glass houses and cages but in the field it soon disappears.

Other leaf mining beetles have been collected in the America's, but they have either failed in New South Wales or it is too early to judge their potential. It is unlikely that they will be as successful as either Octoma scabripennis of Uroplata girardi.

Sap sucking insects have the potential to damage lantana. The lantana lace bug, Teleonemia scrupulosa, was introduced into Australia during the 1930's and has damaged red lantana severely in some seasons. In areas around Kempsey and Coffs Harbour where red lantana occurs whole hillsides of the weed have been defoliated, but not killed by the lantana lace bug.

As a result of a search of the South American region another lantana lace bug, Lebtobyrsa decora, was introduced by C.S.I.R.O. in 1970. Supplies of this species were released in New South Wales without establishing. It did establish in northern Queensland, but owing to the colder climate and predatory insects it was not able to establish in New South Wales.

One stem boring beetle, Plagiohammus spinippenis, was introduced from the America's and liberated in 1968 and onwards. It has established, but does little, if any, useful damage to lantana. It will probably be dropped from the insect breeding programme soon.

Summary

The leaf mining beetles have been very useful in the biological control of lantana by reducing its aggressiveness thus making it possible for other plants (hopefully useful ones) to compete more successfully with the weed.

There is evidence of these leaf mining beetles adapting to the cooler areas of the Central Coast and hopefully, later, the South Coast. They are of no value in shaded, forested areas where they are needed most of all.

Some hope is held for the flea beetle, but until there are field liberations any comment on their future would be speculation.

The biological control of lantana is far from successful, certainly from a Forestry point of view. Work is still proceeding in the America's where the C.S.I.R.O. has a scientific officer who is collecting other biological agencies including some fungi which they hope are very host specific.

BLACKBERRY

Blackberry has been the major weed species in pine plantations for many years. It is a major problem because it restricts access within the forest and along roads and is a serious hindrance to normal tending operations of the forest.

Various methods have been tried to control the weed and at one stage Bathurst Forestry District (now Region) alone was spending up to $350,000 per year relying mainly on 2,4,5-T. However, even at this level of expenditure there was no cure and it only kept the weed within limits.

In an attempt to find a cheaper solution that was more environmentally acceptable, several other methods were tried. One was the introduction of goats as a biological control under fairly rigid constraints.

The goats were tried on an experimental basis with a good deal of emphasis placed on costs and the effectiveness of the method in two areas as follows:

1. Glenwood State Forest part of cpt. 52, an area of 8 hectares planted to pine in 1968 and 1970. It is a gully site with permanent running water with extremely dense tall blackberries: the worst area that could be found. It also carried briar, fruit apple trees, gum barked eucalypts and a wide selection of grass and weeds, particularly Paterson's Curse (Echium plantagineum).

2. Canobolas State Forest cpt. 262 an area of 23.5 hectares planted to pine in 1970 which covered 95 percent of the area. The remainder was swamp, teatree and a small area of grass. It was watered by dam and spring, both of which dried up during the experimental period, necessitating cartage of water. It had a moderate to light blackberry infestation which, as usual, had climbed well up the trees.

Both areas were fenced and particular care had to be taken with both the siting and the construction of the fences in order to contain the goats.

Area 1 was stocked with 13 goats per hectare in February 1979 and this number was reduced fairly quickly by shooters to 10 per hectare and by November the number was down to 5 per hectare.

The stocking was deliberately reduced to 2.5 per hectare in December 1979 and it was the intention to reduce the numbers to 1.2 per hectare before winter 1980.

Results

On release the goats tried everything but settled down to a diet of blackberry and Paterson's Curse. By April/May a few holes and tunnels had appeared and by July results were spectacular. 90 percent of the blackberries had been pulled down and eaten. They also ate the green canes, the gum barked eucalypt regrowth, apple trees, tussock briars, grass and miscellaneous weeds and were in fat condition.

It is expected that the few blackberry canes remaining can be treated with 2,4,5-T and a maintenance crew of a few goats will keep the weeds down.

Some damage was done to pine trees, mostly small trees or runts still carrying smooth bark. This damage was not important. Area 2 had somewhat similar results, and again losses due to cold weather, hunting domestic dogs and rustlers were severe.

A number of lessons were learnt from the experiment, largely to do with animal husbandry. However, the program appears to be grinding to a halt largely because of shooters and rustlers. Otherwise the method is successful and cheaper than using chemicals.

INLAND FORESTS

The problem

The three basic types of inland forest are:

1. River red gum.
2. Cypress pine; and
3. Mixed hardwood.

The river red gum forests, as indicated by their description occur along rivers and waterways throughout Australia, and in fact this species, Eucalyptus camaldulensis, is the most widespread of all the eucalypts. It is planted very extensively in other countries as a source of wood largely for fuel but also for a variety of other uses.

Red gum grows and regenerates naturally on land that is flooded. Rarely can they be propogated by man. Growing in this situation, the forests are naturally prone to invasion by floodborne seeds of weeds and the two most common are probably Bathurst burr (Xanthium spinosum) and Noogoora burr (Xanthium pungens).

River red gum produces a very durable timber. As a result the breakdown of fallen trees on the ground is very slow and the accumulation of debris on the ground could be the collection of several centuries. This makes vehicle access within the forest difficult, if not impossible, and even access on foot can be difficult.

There is now a great accumulation of weeds on these forests, frequently beyond the control of the occupiers of these forests, who are responsible for their control.

To control the weeds on the river systems of New South Wales, which includes all lands not just State Forest, would require a major co-ordinated campaign for perhaps ten years with a maintenance program for many years after.

This sort of program is beyond the financial resources of any one organization at present and in any case covers various tentures of land, including recreation reserves under the control of councils.

The cypress pine forests cover the dry lands with relatively deep soils, typically the sandhills in the Riverina. The white cypress pine, (Callitris collumelaris) is another widespread species with geographic variations, but the main forest areas are west of the Great Divide on the soil types mentioned.

It is typically good agricultural land, if cleared, and most weed species will grow on it. Control measures are much the same as for agricultural land with the proviso that access is sometimes rather difficult because of the trees and debris on the ground.

Most of our red gum and cypress pine forests are let for grazing purposes and the tanants are legally responsible for the control of noxious weeds and animals.

Possibly the major problem with our inland forests is their productivity and financial return. The major financial return from forests is from the timber grown on them. In the western forests, the usual run of noxious weeds have no effect on timber production and therefore the only reason to control these weeds within these forest areas is a social one, that is to conform to the law that the weeds should be controlled.

Also, because financial returns are low, there is little money available for forest works, and being a forestry commission we naturally prefer to direct our expenditure to improving the wood production of the forest.

It is perhaps fortunate that the most unproductive forest of all, the hilly dry hardwood forests, are also relatively free of noxious weeds, probably because they will not grow there.

The weeding of forests is a part of silvicultural techniques designed to produce more and better timber from a unit area of land. In the natural forests this involves removing or killing unwanted trees so that remaining useful trees will grow faster.

Eucalypts should be ringbarked and poisoned, or felled and poisoned to ensure that the trees are killed. Tordon (R) is a chemical that is frequently used, as well as 2,4,5-T.

In western cypress pine forests it is usually necessary to thin out the seedling stands that have resulted from the reduction in rabbit numbers since 1950 to get any sort of growth on the trees. This is done most cheaply in large areas with a large double disc plough.

Strips of seedlings about 0.5 m wide are left between ploughed lines 4 m wide. These strips are then thinned out with a brushcutter to one tree every 4 m.

In pinus plantations it is usual to space the trees so that non-commercial thinning or thinning to waste is not necessary. However, the lack of a suitable market at the right time may mean that thinning to waste is necessary.

The New South Wales Forestry Commission has a substantial interest in weed control and has developed some very useful expertize in certain areas. Individual officers in the Commission who have developed these skills will co-operate with anyone to solve their problems.

(R) Registered trade name.

PROBLEMS ENCOUNTERED BY COUNCIL IN IMPLEMENTING A NOXIOUS PLANT PROGRAMME.

Kevin Waters,
Chief Weeds Officer,
New England Tablelands County Council,
ARMIDALE.

The new England Tablelands (Noxious Plants) County Council covers an area of 18,196 square kilometres and contains about 13,150 properties. Terrain ranges from open undulating farm and grazing land to very steep and virtually inaccessable gorge country. To effectively control noxious plants in an areas of this size demands a high degree of efficiency in all areas, especially those of management and planning strategy and requires active participation by councillors and dedication on the part of staff.

The problems encountered by our council are many and varied. To examine them in detail I've chosen to divide them into categories presenting first the problem and in most instances our method of solving them.

Past problems

For many years the Council battled with the problem of understaffing. This problem existed at both the clerical and weeds officer levels. The number of hours allowed for the office assistant has been increased to 20 hours per week. This has alleviated the situation, although there is enough work to employ an assistant full-time. Council gradually increased the number of weeds officers and it now employs five permanent officers. These officers are stationed in, or close to, areas for which they are responsible, thereby eliminating as far as possible lost time through travelling. The changeover of permanent staff has been a problem for the Council in the past and will inevitably arise again in the future. When an officer leaves it disrupts the organization not only in his areas of activities but also in those of his counterparts.

Weeds officers employed by the Council are actively engaged in spraying during the growing season. This restricts their summer inspections of known trouble spots and perhaps others unknown. The employment of the fifth officer in January, 1980 allows more flexibility in this regard. It is anticipated that the Chief Weeds Officer will do summer inspections for about two to three months each year from now on.

Problems did exist in the past where councils were operating in isolation, often not to the best advantage. I believe councils are now generally moving away from a parochial attitude to weed control and are actively participating in regional control programmes. For instances, in the northern areas most authorities engaged in weed control are now meeting twice yearly in Glen Innes. The original purpose of these meetings was to co-ordinate the control of nodding thistle (Carduus nutans) in the area. The charter of the original committee was broadened to include all noxious plants and in May of 1980 we saw the formation of the Northern Tablelands and North West Slopes Noxious Plants Advisory Committee.

Land owned by government instrumentalities has presented problems. In the past both council and individual landholders have been critical of the lack of control of noxious plants on land owned by the Public Transport Commission. The P.T.C. is now adopting a more responsible attitude and is carrying out a control programme on a large areas of land. Small infestations of St. John's wort (Hypericum spp.) have been discovered in forestry areas. In most cases these have been dealt with promptly by the Commission.

Equipment is an areas that has many problems. The Council originally had two-wheel-drive units with 200L drums for spray and independent motorized spraying units with very heavy spraying hose.

In March, 1970 the Council bought its first four-wheel-drive unit. It was equipped with a P.T.O. drive spraying unit and modern lightweight hose.

Council now has a fleet of 8 four-wheel-drive units similarly equipped. A progressive policy toward equipment improvement is essential if we are to remain competitive in the private sphere and also to provide the most economical service to the community.

Problems are present in the simple routine tasks. For example, the novice generally has no idea of how to spray or what to use. A brief explanation of technique and a plan of approach is generally all this is needed.

However, a continuing problem with some landholders is one of lack of motivation to obtain up to date information for the successful control of weeds. There are exceptions of course, but generally speaking I take the view that for serious infestations of weeds to be present on properties in New England today after having efficient chemicals for many years indicates a degree of apathy and a deficient management skills.

Rising costs present a major problem for council. I am firmly convinced that the most economical method of controlling weeds is to have adequate resources for a major thrust on a problem instead of nibbling at it. As a result Council can enjoy a decreasing maintenance cost.

Cost increases in many areas are unavoidable but councils can control some. For example, lost time through breakdowns can be minimized by reducing the average age of plant to an acceptable level and by rigid adherence to a scheduled maintenance programme. The Council dismantles all equipment on completion of the spraying season and returns it to the manufacturers for a complete overhaul.

Council considered fuel price increases and the heavy consumption of petrol engines during 1979 and decided that as the units were replaced they would replace them with diesel-powered units. Council now has four diesels which are proving to be tremendously economical, reliable and entirely suited to our operations.

Present problems

The proliferation of subdivisions within a twenty kilometre radius of Armidale has posed a number of problems. The sheer number of these has and continues to be a constant drain on our resources.

The percentage of absentee landholders in these areas is high and possibly this is the cause of most problems. Although council is dealing with a large number of subdivisions they account for only a small percentage of the total area, achieving a balance between them and rural holdings is a difficult task.

A problem peculiar to high altitude areas is the restricted season for control activities. To overcome this the Council has to have a large number of units to carry out the work. This also leads to difficulties in obtaining experienced casual staff each season.

Whilst council is appreciative of Government grants they fall short of its needs. The Council has to rely too heavily on private work to supplement its income.

To date we have not been able to use our equipment to best advantage for the whole season because of financial restrictions.

Book-keeping can present special problems. Records of property inspections have been kept by the Council for many years, however, we need to be constantly seeking to compile information in such a manner that it is current and readily available with minimum difficulty. Also it has to be explicit enought to contain all necessary information in the event of an officer leaving council. I recognize that it won't replace the personal knowledge of the officer. To minimize the possibility of misunderstanding with landholders when carrying out private work it is necessary that the contractual form contain all relevant information for the protection of both parties.

An ongoing program of inspections and dissemination of information is essential if we are to engender a greater public awareness of the noxious plant problem.

We find that a significant proportion of landholders irrespective of the size of their holdings are not fully conscious of the costs involved or of the economic loss sustained by not controlling noxious plants. Some harbour the incorrect view that the weeds on their property affect only them.

There can be problems with a Council's public image. Councils should not be seen as bureaucratic organizations out of touch with reality and the present day needs of the community. The Council has made a concerted effort to break down barriers and demonstrate that it is there for the ultimate benefit of that community.

Future problems

No doubt Council will be faced with the introduction of new weeds and a greater spread of existing weeds. This could be brought about by changes in agricultural pursuits or practice and economic factors. Councils with rapidly growing populations will experience difficulties.

A challenging prospect facing councils in the future will be the use of herbicides.

The flood of misleading information and emotionalism surrounding 2,4,5-T at present, for example, containing at best half truths and innuendoes needs to be countered and the record set straight. Unfortunately people representing this vocal minority are generally quite removed from the practical applications of agriculture. Councils need accurate unbiassed information on herbicides to be able to answer these criticisms. To help overcome the possibility of public opposition to the continued use of chemicals it is of paramount importance that everyone concerned with their use generally recognizes the importance of using chemicals with care and in accordance with directions.

A council should never rest on its laurels but rather analyze situations and anticipate problems as far as possible so corrective or preventive action can be taken to meet the needs of the community in the future.

JOHNSON GRASS : TWO METHODS OF ATTACK

Cec Webb,
Weeds Officer,
Wellington Shire.

Johnson grass (Sorghum halepense) is a serious weed in all warm areas of the world.

In Queensland and New South Wales, it is widespread in both dryland and irrigated cropping areas. Whole paddocks become infested over a few years, when rhizomes from isolated plants are spread by cultivation.

The weed is difficult to control because it produces large numbers of rhizomes (underground stems) and dormant seeds. Establishment of perennial plants, from either the seeds or the rhizomes, is rapid. Johnson grass seedlings and sprouts take an average of only three weeks to set a rhizome spur.

The Department of Agriculture is undertaking field work and exper i ments to determine methods of controlling the spread of Johnson grass and of eradicating the weed from those areas already infested.

Shire and Municipal authorities (through their noxious weeds staffs), County Councils set up specifically for the control of noxious weeds, and groupings of concerned people and organizations such as the Macquarie Valley Watershed Johnson Grass Eradication Committee, have been pooling their knowledge and experience and attacking the problem weed on a local level.

Research by NSW Department of Agriculture

Noeline Monaghan, Research Agronomist at the Agricultural Research and Veterinary Centre at Orange, is investigating the ecology and control of Johnson grass.

The aim of this project is to determine how Johnson grass is spread and identify which types of infestation (roadsides, riverbanks) should be controlled to minimize spread to new areas.

Topics under investigation include:

Extent and distribution;
Methods of spread from infested areas;
Regeneration in infested areas;
Conditions necessary for the establishment of isolated seeds and rhizome buds (in progress).

Other work includes:-

Determining yield responses to chemical control of Johnson Grass;
repeated slashing for control and variation in herbicide susceptibility.

Extent and distribution. A survey in 1977 indicated that there were 78,722 ha agricultural land, 10,781 km roadsides, 761 km railways and 313 km riverbanks infested in New South Wales. Johnson grass was most common in northern New South Wales especially the Northern Slopes. Some small areas, mainly irrigation and roadsides, were infested in southern shires.

Dispersal of seeds and rhizomes. Seed traps were used to find whether Johnson grass seeds are moved by normal riverflow. Low numbers of Johnson grass seeds were trapped with the assistance of Wellington Shire Council in the Bell River at Wellington near infested river flats but none were found down diver in the main channel of the Buddah Lake Irrigation Scheme, Narromine. This indicates that Johnson grass is not spread much by river flow. However, other experiments have indicated that roadside graders and cultivation equipment may be important in spreading rhizomes.

Regeneration. Johnson grass tops are killed by frost. Regrowth occurs in the following spring. Work on regeneration in 1978 and 1979 showed that Johnson grass in established infestations regenerates mainly from rhizomes and that up to 75 percent of seeds produces are lost from some sites. The fate of these seeds is unknown and requires further investigation.

Problems caused by Johnson grass. The weed also harbours sorghum midge and virus diseases of sorghum, and its pollen can contaminate sorghum seed crops. Hybrid off-types resulting from pollen contamination can spread by rhizomes if their presence in a crop is not detected. The New South Wales Agricultural Seeds Regulations (1976) set a nil tolerance in sorghum seed of Johnson grass seeds and of seeds physically indistinguishable from them.

Also, sowings of seed crops are generally restricted to 0.8 km from uncontrolled infestations to reduce pollen contamination, although some companies maintain 1.2 km borders free of sorghums (Edwards, 1975). Grow-out tests are used to check for pollen contamination.

Keeping Johnson grass-free borders has become more difficult in some seed producing areas. Eventually infestations can restrict the potential of farms or even whole regions for growing sorghum for seed.

Chemical control. Preplant application of Roundup (R) to Johnson grass on the Bell River alluvial flats near Wellington gave a 180 percent increase in marketable lettuce weight.

Landholder participation at Wellington

The recipient of the largest Special (Johnson grass) Grant made by the Noxious Plants Advisory Committee in the current financial year, was the Wellington Shire Council.

It has been a longstanding policy of the Wellington Shire Council to try and secure the co-operation of landholders in controlling noxious plants, firstly by gaining their interest in the methods available, and secondly by demonstrating the benefits to be derived in returning the land to full productivity.

Experience has shown the many advantages of this policy over the alternative, where reluctant landholders are dragged through the Courts, becoming even more reluctant in the process to do control work.

To illustrate the effectiveness of this policy, the Council called the public meeting of landholders in the Johnson grass affected areas of the Wellington Shire. The meeting was publicized in newspapers and on radio and was well attended as a result. Some 65 landholders were present to listen to addresses by Mr. Alan Mears, Principal Agronomist (Weeds) and two other senior officers of the Department of Agriculture, Mr. Brian Scarsbrick, Special Agronomist (Weeds), and M/s Noeline Monaghan, Research Agronomist from the Research and Veterinary Centre, Orange.

Ciba Geigy Australia Limited co-operated with the Council by providing technical officers to show slides and advice to landholders.

The Johnson grass situation along river flats in the Wellington District is "appalling" according to Mr A. Mears, formerly Principal Agronomist (Weeds) of the New South Wales Department of Agriculture. Mr Mears addressed a meeting of concerned landholders and Wellington Shire Council representatives held recently.

The Shire Council called the meeting to discuss the problems connected with controlling the noxious weed, and to organize a liaison between landholders and Council during spraying operations.

The Department of Agriculture, in conjunction with the Council, is advocating the use of two recently developed herbicides which have proven successful in combating the grass.

Johnson grass is particularly resistant to most types of weed control and flourishes on alluvial soils and irrigated areas. River flat crops generally cannot compete with the weed, resulting in lower yields.

(R) Registered trade name.

During the evening, Council Weeds Officer, Mr Cec Webb showed slides taken on a local property, showing grass growing to a height of 1.2 m, before spraying with the recommended herbicides. Slides of the same paddock after spraying showed a thriving lucerne crop.

Mr Len Clark, Chairman of the Macquarie Valley Johnson Grass Eradication Committee, said that he had never seen Johnson grass in such great quantity. He added that he thought Timbregongie Shire's Johnson grass problem was bad until he saw Wellington's.

Mr Brian Scarsbrick of the Department of Agriculture (formerly at Orange) said that the recommended herbicides were completely biodegradable and non toxic to stock.

Several of the landholders who are participating in the programme for eradication of Johnson grass, had commenced their own control programmes.

One method has involved the sowing of lucerne to create competition to suppress the Johnson grass. The American aphid-resistant strains of lucerne were recommended and were well adapted to conditions at Wellington. Besides being successful in this primary use, the lucerne has become the basis of a minor industry by its sale as stock fodder. The owners of some other properties have relied only on chemical control, with varied success.

It is expected that, with better climatic conditions next year (they could hardly fail to improve), more landholders will participate in both the chemical-and agronomy-based control programmes.

A television feature on Johnson grass was compiled at the Orange Research and Veterinary Centre and screened on the "Focus" programme by Channel 8 during the year.

The current grant provided for the continuation of the spraying programme together with a further addition to the new spray unit of an electronic spray monitor to allow much more accurate application of herbicide than in the past. This has led to greater efficiency and less wastage of chemical. During the 1978/79 season, some 265 km of infested roadways were sprayed.

The following is the assessed extent of the Johnson grass problem before spraying, and the approximate lengths sprayed.

Density	Length before 79/80 spraying.	Lengths sprayed in 79/80.
Dense	140 km	120 km
Medium	70 km	70 km
Light	255 km	225 km
Sparse	225 km	85 km
Total	690 km	500 km

Johnson grass had seriously reduced the productivity level of the valuable alluvial river flats in Wellington. Since the control programme was commenced in 1978/79 and landholders have seen the benefits, those who have taken steps to control this weed on their own land have now been able to reap the benefits of increased prosperity and higher productivity.

GORSE CONTROL ON ARABLE AND UNARABLE LAND

S. Dickman,
Weeds Officer,
Illawarra County Council.

GORSE (Ulex europacus)

Introduction

Gorse (Ulex europacus) is an imported weed of European origin. Introduced as a hedge plant it spread vigorously and now covers wide areas of Tasmania, Victoria, New South Wales and South Australia.

It is a dense, spiny shrub which can grow to a height of 3.5m and is a declared noxious weed in South Australia, Tasmania, Victoria and New South Wales.

Importance as a weed

Being a vigorous grower with spines, gorse is not grazed by stock and quickly spreads and dominates pasture and provides a haven for noxious animals, such as rabbits and foxes.

Propagation

It is a prolific seeder, the seeds being ejected from pods with a splitting exploding action noticeable on hot days when the pods are mature.

Seeds remain viable for a long time and are germinated by fire when the area is burnt. This causes dense seedling growth.

Control methods on arable land

There are a number of methods of control on arable land as follows:-

1). Gorse up to 2 m high can be cross-ploughed using a powerful tractor pulling weighted disc ploughs, cropped for two years, then sown down to pasture.

2). Spray with the chemical 2,4,5-T at the rate of 500 to 1 plus wetting agent during spring and summer, followed by burning in the following winter, then respraying regrowth in the second year.

3). For large bushes, bulldoze them into windrows and burn followed by cultivation in the normal manner.

Control methods on non-arable land

Methods of control are as follows:-

1). Spray with the chemical 2,4,5-T at the rate of 500 to 1 in the late spring to early autumn followed by burning in the winter. Respraying for regrowth and seedling gorse is necessary the following season.

2). Spray with the chemical 2,4,5-T at the rate of 500 to 1 in the late spring to early autumn, then allow the bushes to degenerate naturally. Overseed with desirable pasture species and apply superphosphate in the autumn. As the bushes disintegrate stock the area heavily as the grazing animals trample and assist in the rapid breakdown of the bushes.

Being legumous the gorse appears to stimulate the pasture growth in the vicinity of the plants by the release of nitrogen as the plants breakdown.

Burning of gorse appears to create much more regrowth and seed germination than by letting the plants breakdown naturally.

In trials the chemicals Velpar (R), Roundup (R), and Weedazol T.L. Plus (R) have shown excellent results in eradicating gorse, but to date 2,4,5-T is the only chemical registered for this purpose.

SUMMARY

For arable land cross ploughing and cropping for 2 to 3 years for a quick return is preferable, but initially expensive.

For non-arable land spray with the chemical 2,4,5-T and overseed and super to promote pasture growth.

Allow the bushes to degenerate naturally providing a source of humus and nitrogen for the soil.

(R) Registered trade name.

BIOLOGICAL CONTROL OF ST. JOHN'S WORT

Bill Ryan,
Weeds Officer,
Mid-Western County Council.

The Chrysomolid beetle was introduced into Australia from southern France in the 1930's to control St. John's wort (Hypericum spp.)

The beetle was so successful in California that most of California is now practically free of St. John's wort, which has been removed from the noxious weed list.

Climate

The climate of California suited the beetle as virtually no rain falls during summer. This enabled rapid multiplication of the beetle as well as helping to suppress the Wort growth.

In New South Wales on the tablelands summer rainfall usually exceeds winter rainfall. This interrupts the life cycle of the beetle so it takes longer to build up sufficiently.

Description and life cycle

The eggs are laid in autumn mainly on the undersurface of the leaves. They are 1.6 mm long and orange in colour. Even though a female beetle can lay up to a thousand eggs and multiplication rate is high it may take up to ten years for the beetles to build up sufficiently to have a marked effect.

Larvae

The larvae that emerge from the egg are reddish with black head and feet and beetles are most destructive at this stage. They are reproduced on the basal growth of the St. Johns Wort and eat the basal leaves. During the winter months it is possible to predict what the beetle population is going to be in the coming season by the amount of basal growth that has been defoliated.

Beetle

After eating the basal growth the larvae goes underground and after some weeks develops into the beetle. There are two varieties of beetles: one is a shiny black and the other is bronze; they are about 7 mm long.

During the day beetles are seen in clusters on the stem of the plants; they are building up fat reserves. At night they feed on the plant and when disturbed drop to the ground. The beetle does not die in summer: it hides out and will survive if summer rainfall is not heavy. However, the beetle might develop too soon and come out in the winter instead of early summer when the Wort is growing and in this case it will die and have no effect.

Summary

The beetle has been most successful in the Shire of Coolah, Rylstone and Mudgee in eradicating vast areas of Wort infested land. We have cages to collect and distribute beetles throughout the County District. If seasonal conditions are unfavourable in one area for the beetles' survival, we have other areas to fall back on for our supplies.

From observation, I feel the beetle is now adapting to the environment on the Tablelands and is dispersing to isolated areas unaided.

TWENTY FIVE YEARS AS A LOCAL GOVERNMENT NOXIOUS PLANTS INSPECTOR

H.J. Wharton,
Weeds Officer,
Mulwaree Shire.

Twenty five years in any job is a long time, but when you start from scratch you realize that you will never learn all there is to know about noxious plants and their control, and the various fields this job opens up.

When I applied for and was appointed to Mulwaree Shire in 1956, I knew nothing about the type of work required. One question put to me by the Council was: "What do you know about noxious weeds?" My reply was, "Nothing". I was told afterwards that this answer was the deciding factor. Everyone else tried to show how much they knew and it appears they knew nothing either, and I was considered honest.

I started my new job with no office, no files, no knowledge of the area, no idea of what was required, no transport, no award and the mattock the only control known. The only equipment was a hand pump, a 200 litre drum and a supply of mattocks. I wondered what I had let myself in for. All for the going wage of $1600 (800 pounds) per year.

Serrated tussock (Nassella trichotoma) was the only noxious plant the council was concerned with so the whole of my time was taken up with inspecting properties, no easy task when the area of the Shire is 5019 sq. km, 1318 km of road equivalent to a long narrow paddock of approximately 2428 ha with every type of weed imaginable to be controlled and thousands of acres of dense infestations of uncontrolled serrated tussock.

Duties

Nothing has ever been laid down or given as to the duties or definition of a weeds inspector.

They come in all shapes and sizes and have many and varied policies to maintain under a varied renumeration for their services. Some get labourers' wages, some agronomists', and in between many and amazing are over the award wages and designations given. One thing is required no matter what the pay: get rid of all noxious plants.

I have tried to give the duties required of me. I know others have other requirements of their time.

Many landowners call, write or phone for appointments for inspections or advice and to make complaints. There are inspections and reinspections, searches of records for ownership, identification of lands, recording typing records, correspondence, preparation of letters and notices, quoting for private work, preparation of reports, supervising work on roads and private property, entering private property, spraying, attendances at monthly meetings of Council, quarterly meetings of the Noxious Plants Committee, attending field days, schools, conferences, etc., and preparation of and manning exhibits at shows and the like. I also order chemicals, prepare grant applications, act as foreman and keep three staff occupied and the machinery mobile, and when one of the staff take a sickie, I do his work. I am rural advisor and know all about sheep, cattle and farming generally, I am required to know every property and infestation of noxious plants, know their names and control measures, be available 7 days a week. (After hours and weekends are often the busiest times). If anything goes wrong I take the blame and remain a human being. Above all I keep the councillors happy by ensuring there are no noxious plants in their areas. I am also the middle man in all the domestic differences between neighbours, appear in court for legal proceedings, and when there are bush fires along with my men and equipment I become

a firefighter.

Grants

In 1954, Mulwaree Shire Council received a grant of $400 (200 pounds). In 1956 the grant was $600 (300 pounds), on a pound-for-pound basis.

During the 50's the only progress was on an inspection basis and the only noxious plant causing trouble was serrated tussock. The size of the Shire meant that only half was inspected each year and with the favourite tool, the mattock, no progress was made. Chemicals in use were no good and their cost were the problems.

With the 60's came a rise in Grant money $100 (50 pounds) in 5 years. In 1963 we received $700 (350 pounds): 1963 was the year of the big spender. The Government of the day released special grant money on a 2:1 basis for special purposes. Our grant was $1600 (800 pounds) and our contribution $800 (400 pounds), making $2400 (1200 pounds).

It was decided to subsidize the purchase of Dalapon for the control of serrated tussock to landowners. It cost at the time $1.99 kg (9/-pound), and sold for $1.32 kg (6/- pound) or a 1/3 subsidy. The money soon ran out. This has been the only time Grant money has been allocated for the benefit of the landowner for weed control on private property.

In 1967 the grant rose to $2,300. In 13 years it increased $2000, a yearly average of $154. Whilst this orgy of spending was going on we had, and still have, two county councils for neighbours, which together would have fitted into our shire. All had the same problems yet they received preferential treatment when grant money was distributed. Their money was always trebled and still is. The logic of this has always escaped me.

With the 70's came new ideas, new chemicals, more money. The same problems still existed: too many weeds, not enough money. Weeds' schools, conventions, conferences, call them what you like, have made their mark. Gatherings of weed officers from all over the State has had a great impact on the learning and understanding of the many problems involved in the job of Noxious Plants Inspectors.

From the mattock we have advanced to chemicals, aerial work and to the oldest form of control, pasture improvement. No control succeeds unless pasture improvement is used eventually.

What have we achieved in the past 25 years?

Mulwaree Shire Noxious Plants Department has progressed now to having office space, phones, files, help, more money, transport and equipment, a policy, expertize, and is able to help owners with advice and a spraying programme. We have an awareness of the dangers and the necessities and have over the years made our mark in the control of noxious weeds. We have the support and help of the neighbouring councils, grant money has risen progressively until in 1976 we received $10,000, 1978 - $24,500, 1979 - $28,3000 and 1980 - $25,600.

After doing the job for 18 years by myself, we now have three inspectors and employ two part-time operators. We have two four-wheel-drive vehicles set up with spray equipment and an agricultural motor bike. The cost of work for landowners has averaged $15000 in recent years and the sale of chemicals to landowners each year is growing. The Weeds Department is now part of the Shire and is a vital link in the control of noxious plants in the southern area.

Perhaps the greatest advance in the southern area was the formation of the South Coast and Southern Tablelands Regional Noxious Plants Committee at a meeting on Friday, 4th September, 1953. At that time it was known as the Central and Southern Tablelands Serrated Tussock Committee. It was changed to its present

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(R) Registered trade name

name at a meeting on 16th May, 1969, and has been in operation for 28 years.

In this time, it has had a very worthwhile part in noxious plants control and has never once been questioned as to its integrity or its justification. Many and varied are the guest speakers who have appeared and a wealth of knowledge exists in its members who gather from all over the state every three months to discuss weed control and its associated problems.

The part played by this Committee in publizing and educating the public, landowners, politicians and anyone interested in noxious plants is itself something someone should compile in the future otherwise the good that this Committee has done in the noxious plants area may never be known.

The most significant feature of the 80's has been the mass amalgamation of various councils. How this will affect the allocations of funds and the viability of the new county councils is not yet clear. New chemicals have appeared. Frenock (R) and Velpar (R) appear to be the most promising. Both have their problems, as do all chemicals, and we can only hope for the miracle cure as we have since the beginning.

With all the money spent on weed control there appears to be no answer to the problems. The main problem is the mother lode area: vast infestations of serrated tussock supplying seed from which the spread is maintained over clean parts of the State. The problem of serrated tussock cannot be overcome whilst the seedbeds in these areas are allowed to remain. The area has been stated as 72,000 hectares spread all over the tablelands.

Mostly these infestations are in rocky, mountainous country, non-arable land. Control is a financially impossible proposition to owners, and in most cases, infestations have existed for years, increasing in size and ensuring the output of more seed. None of the politicians are interested in these areas.

So today these, and other such areas, exist all over the State continuing to increase and magnify the associated problems of serrated tussock control. Unless something is done to these mother lode areas they will continue to pollute the land and be an ever-increasing threat to the productivity of the pastoral areas of the State and a financial burden to primary producers. I think you will agree that these areas are beyond the financial resources of the landowner and that it has ceased to be a local problem. It is a national problem and in the interests of New South Wales and Australia something should be done to these areas if we ever hope to win the never-ending battle with serrated tussock.

No programme of eradication can succeed whilst these areas remain. While I have quoted serrated tussock, most noxious plants have similar mother lode areas to propagate their species.

Can it be said we have achieved nothing? The same conditions exist today as in the past and in some cases problems are greater. However, had nothing been done in these years the position would have been catastrophic.

ROADSIDE PASTURE MANAGEMENT AS AN AID TO NOXIOUS PLANT CONTROL

Terry Launders,
Senior Research Agronomist,
Department of Agriculture,
TAREE.

The two most critical phases for pastures in a roadside situation are:-

1. establishment, and
2. first year seed set.

ESTABLISHMENT

While cultivation undoubtedly gives the best establishment, there are reasons why it cannot be used for establishing pastures along roadsides. These include:

(a). risk of erosion on sloping or steep areas,
(b). cost of repeated workings on the same ground, and
(c). nature of the weed e.g. cultivation encourages rhizomatous weeds.

Apart from cultivation, sod-seeding and surface broadcasting can be used.

Sod-Seeding

Sod-seeding, also called direct drilling or one-pass-seeding, involves no cultivation other than that during the seeding operation. The seed is placed in cultivated grooves and may or may not be covered with soil.

Disturbance of the existing sward varies from almost nil to quite severe, depending on the implement used and the objective of the operation. Existing vegetation is rarely completely destroyed unless herbicides are used.

Rules. The success of sod-seeding can be enhanced by following these few rules:-

1. sow the pasture species to be sod-seeded at the beginning of its optimum growing season,
2. the sward into which the sod-seeded species is sown should be at the end of its growth cycle,
3. check growth of the existing sward either by hard grazing or by herbicide.
4. sow when the moisture content of the soil is at the best level for plant growth,
5. sod-seed when early follow-up rain is likely, and
6. the machine must be operated correctly.

Machinery. Sod-seeders fall into three main groups:- tine, disc and rotary tiller machines.

Chisel tine sod-seeders are the most rugged machines and best suited to operating in rough country. New attachments have overcome some limitations of the machine.

The triple disc sod-seeder has been the best of the disc models, coping well with heavy matted grasses such as kikuyu. Such machines are expensive.

Rotary type sod-seeders are not yet in general use.

Surface broadcasting

Surface broadcasting simply involves the broadcasting of seed onto the soil surface, either from aircraft or a ground implement (e.g. fertilizer spinner). No attempt at seed placement or seed coverage is normally made.

This method is a low cost system but gives slower and less initial establishment than either cultivation or sod-seeding. However, it can be used in areas inaccessible for machinery, is well suited to timbered country and can sow light, fluffy seeds (e.g. buffel grass) unsuited for drilling.

Similar rules to those of sod-seeding apply in order to get best results.

Split sowings, of half the seed initially and the rest after the first lot has germinated, reduce the risk of seeds being desiccated after germination.

FIRST YEAR SEED SET

Ideally, the treated area should not be grazed until after the sown species have seeded. This is essential for the annual species to provide seed for regeneration and gives the slower establishing perennial species a chance to thicken up in the following season.

Should weed growth be shading the young seedlings, heavy grazing for short periods or herbicides may be required to control the weeds.

Improved pasture species can replace weeds quickly on fertile areas but slowly on infertile areas. A phalaris pasture may take five to ten years to reach peak production.

PASTURE SPECIES

Suggested pasture species for individual situation are best obtained from your nearest district agronomist.

FURTHER READING

New South Wales Department of Agriculture Bulletins P2.2.1. "Sod-seeding", and P.2.2.2. "Aerial Techniques for Pasture Improvement".

JOHNSON GRASS CONTROL

C. Radunz,
Weeds Officer,
Narrabri Shire Council.

Roadside pasture management as an aid to noxious plant control

Pasture management is primarily used in the Narrabri Shire in conjunction with a total kill treatment with herbicides, such as glyphosphate, to discourage the re-establishment of undesirable weed species. The main weed being Johnson Grass (Sorghum halepense).

We have found that after the target species have been sprayed out in this manner, there is a short period of bare ground followed by an upsurge of annual weeds that were previously kept in check by other vegetation. When seasonal conditions again permit germination and growth of Johnson grass, extensive re-establishment occurs, due to the large bank of dormant seeds and unaffected rhizomes remaining in the soil.

Hence using chemicals alone takes a long time to eradicate Johnson grass; if it is successful at all. During this period it would only take one or two seasons of missed control, maybe due to weather conditions or other obligations, for the seed bank to build up to its original status, thereby throwing the whole control system back to scratch.

This is where pasture establishment and management come in, by providing a natural form of competition to reduce the amount of essential compounds available to the germinating Johnson grass.

There are three components essential to the growth of any plant: light, water and nutrients. Germination and the young growth stages are the points at which these factors can most effectively be used against the plant.

By using pasture species that grow well under the prevailing conditions, and mixing them to form a cover of useful vegetation during the germination and young growth period of Johnson grass the re-establishment of the weed may be cheaply controlled.

This is achieved mainly by reducing the amount of light available to the seedling, thus reducing its capacity of synthesize food, and grow to the point at which its food reserves are totally depleted and it dies. To do this a dense cover of vegetation must be present. It may be live or just stubble. Live growth will also use large amounts of water and nutrients, thereby reducing the amounts the seedlings can obtain. This gives a threefold attack.

Johnson grass presents a specific problem in that reproduction is also achieved through a vegetative phase in the form of rhizomes. This extends the new plant's ability to fight against depression from competitive species through having an already established root system and ample food reserves. Hence rhizome control through pastures is limited and you will almost certainly get some regrowth in the pasture. This will have to be spotted out with a suitable chemical before new rhizomes or seeds are produced.

It is because of these factors that an inegrated system of spraying, pasture establishment, pasture management and frequent inspections must be maintained. Not just the old trick of spraying some Johnson grass, throwing in a couple of handfuls of seed and saying; "Well that's fixed that problem, what do we do now?"

Method

The big question is how do you achieve this control method; or more directly how do you establish a pasture in the worst situation that is, on a roadside?

The operations, species and times in establishing a pasture will naturally vary according to the environmental conditions and the type of pasture involved.

The preparation of a suitable seedbed is important. Once the Johnson grass is chemically controlled it is normally slashed to allow machinery access.

Under most conditions direct sod-seeding is all that is required, however, in very tight ground or where there is a problem with stumps and roots, a small chisel plough may be used. A disadvantage with chisel plough is that it may form large clods thus presenting a poor seedbed: so care must be taken in this situation.

Direct sod-seeding has the advantages of:-

1). being cheaper than cultivating a seedbed, because it saves the number of necessary workings,

2). it places small seeds, at a fairly accurate rate, under a light tilth thus allowing easy seed emergence, and

3). it causes only slight soil disturbance thus maintaining structure and avoiding erosion, which is very important on road shoulders.

A mixture of fertilizers may be applied during the seeding operation to give the seedlings a good start.

Other seeding methods may be used in areas inaccessible to the sod-seeder, e.g. a gradient that is too steep or too rocky etc.

This mainly involves application by a fertilizer spreader or hand spreading on a small scale. A mixture of fertilizers and seed are spread over the area with the Johnson grass stubble still standing.

This, however, presents the seed to a poor seedbed and although good results may still be obtained with the right weather conditions they are considerably more variable than with sod seeding.

The seed may be given a better chance of surviving by slashing the Johnson gass stubble over the top of it, thus forming a moisture retentive mulch.

The same elements that are repressed for Johnson grass control must be present for a pasture to be established. Light is normally readily available to the young pasture where the area has been recently sprayed.

Nutrients vary with soil type, but these may easily be increased with the use of fertilizers.

The right temperature is essential for the germination and growth of pastures, but as this is an environmental factor it can only be changed by the manipulation of planting time.

Moisture is another essential environmental factor and apart from the possibility of irrigation, which is not practical and obviously uneconomic, the only way moisture may be presented to the seedling is through proper seedbed preparation. Sod-seeding is the most effective form of retaining soil moisture and placing the seed where it can best use this moisture.

Once a pasture is established it is spread extensively by road maintenance machinery such as graders and mowers. This factor significantly reduces the areas to be sown as it supplements natural spread.

Prevention is better than cure, and this is true when applied to this form of control. It is much easier, cheaper, and more effective to establish a pasture on the roadside before dominant weed species are present. This then acts as a buffer against the infiltration of undesirable weed species.

Hence, the ideal aim is to have all suceptible road covered with pastures before weed growth necessitates expensive control measures. This form of control, may in essence be considered as reversing the normal roles between weeds and wanted vegetation and has proved beneficial in our attempts to control Johnson grass in the Narrabri Shire. Further research along these lines could provide the answer to a large section of noxious weed control.

Comparative economics

Pasture establishment

Tractor/hr	$4.00
Labour/hr	$5.40
Total/hr	$9.40

2 m slasher @ 15 km/hr - 2.7 ha/hr ∴ Cost = $3.50/ha

2 m sod seeder @ 7.5 km/hr - 1.25ha/hr ∴ Cost = $7.50/ha

Average cost seed/ha $20.00

Average cost fertilizer/ha $20.00

∴ The average cost of establishing a pasture with the operations of slashing and sod sowing = $50.00 per ha or a 2 m strip 5 km long.

Spraying a heavy infestation with Glyphosphate
6 lb chemical/ha @ $15.00/lb
This gives an average cost of $90.00/ha onto which labour and plant must be added.

Hence it is economically worthwhile to establish a pasture to reduce Johnson grass infestations before extensive spraying operations are required.

AIDS TO WEED CONTROL-ROADSIDE PASTURE MANAGEMENT

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Motivations

There were two motives that prompted these trials, as follows:

1. The primary motive was to seek and establish a long term weed control system which would lessen the need for the seemingly, never-ending, annual treatment of weeds with herbicides and eventually make this herbicide application an exception rather than a rule; and

2. To offer both Council and landholders working proof that, as an alternative to herbicide application, a practical, viable long term weed control programme, in conjunction with spot treatment with herbicides during pasture establishment, was not only possible but highly desirable. The trials would demonstrate the benefits of permanent pasture establishment, to control weeds.

A suitable permanent pasture can control any undesirable plants other than the woody weeds, eg. sweet briar (Rosa rubiginosi) and blackberry (Rubus spp.) However, the operative weed to be controlled in this exercise was Scotch thistle (Onopordum acanthium). If not contained this weed can render a paddock virtually useless or unproductive for up to ten months each year.

Control is undertaken on creek banks and dam walls where it is unwise to cultivate (soil erosion risk), roadsides, hilltops, around rocky outcrops and under clumps of trees, all of which are inaccessible with ground drawn implements. This excludes the arable, accessible land in the shire were most Scotch thistle is contained by cropping with winter cereals. Thus the surface area sowing method appears to be ideal. Where the surface area sowing method has been used on a large scale, it has been successful as shown in work carried out by Bob Phelps in the Gunning Shire.

However, this aid to weed control is still not being used to full advantage by shires, county councils or landholders.

Procedure

Plots were sprayed and sown using conventional methods. The sites were sprayed on the 23rd June and sown six weeks later. Grass species were treated with ant repellant and the lucerne inoculated and lime pelleted.

Grass and lucerne seeds and superphosphate fertilizer were kept in separate containers and handspread separately as I was not sure whether the ant repellant would affect the inoculant.

Species

The pasture species virtually selected themselves. They were phalaris, lucerne and either currie coxfoot or demeter fescue. The fescue was deleted with currie coxfoot being preferred. The choice of species was confirmed by the District Agronomist.

Climate

The choice of pasture species is not dictated to any great extent by climate, but prevailing seasonal conditions certainly help decide whether to sow in autumn or spring, or indeed if at all. With the seasonal conditions over the last six years I am beginning to think that a "normal" year exists only in history books.

Sowing rates

Seed was sown at:

		hectare
Phalaris	"Sirolan"	4 kg
Lucerne	WL318	2 kg
Currie Coxfoot		1 kg
Fertilizer	Single super	168 kg

Plot selection

Possibly the only criteria used for the actual location of the trial plots was that they be the most unlikely areas on which to establish a pasture, ie. hilltops with very little vegetation, under dense tree clumps where competition for nutrients and moisture would be high, and rocky areas.

The sites themselves were situated at various points throughout the shire and represented a range of soil types from the poor acid soil south of the Copabella Range, to the richer red soil of the orchard district in the north of the shire. In all, eleven plots, totalling one hectare in area, were sown.

Chemical ploughing

Chemicals used for ploughing were:

Armitrole at 1 kg/hectare
2, 2DPA at 5 kg/hectare.

Results

On face value - a failure.

Why?

I reasoned that as the spring, summer and autumn of 1979-80 were exceptionally dry, and as no worthwhile rain fell until mid May, the spring and summer of 1980 would be ideal to establish the pasture trials.

Initially, weather conditions were almost perfect. Enough rain fell to promote the growth of the vegetation, which would become the seed bed. Although mostly consisting of very light falls it persisted, up until 10-12 days after sowing.

Germination, emergence and growth of the sown species were noticeable, particularly the lucerne which struck well, and grew to 8 cm high.

After six weeks without rain an inspection of the plots revealed that of the original eleven sown, two had been destroyed by scarab grubs, six had provided a banquet for red legged earth mite and the remaining three were showing marked signs of moisture stress. These three surviving plots eventually died from lack of moisture.

Conclusion

Although the initial attempt failed, I feel the failure was not due to any incorrect application of method, but to the abnormal season experienced. On the positive side enough was learnt to justify the experiment and further attempts to establish these pasture improvement trials, hopefully with better weather, would be worthwhile.

WATER LETTUCE (Pistia Strathiotes)

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Identification

The water lettuce (Pistia stratiotes) is a free floating plant found in most tropical countries, and was probably introduced into Australia for use in aquariums. It has greenish yellow fan shaped leaves, ribbed to the edge, and thickened at the base. The leaves are covered with white hairs that trap air, repel water, and give buoyancy to the plant.

The feathery roots extend up to 1 m in the water. It is frost sensitive and grows rapidly under tropical conditions. Many new plants are produced on runners from the parent plant.

Problem

Water lettuce plants float on the surface like salvinia and water hyacinth but are not potentially as dangerous. Dense mats of water lettuce protect mosquitoes, affect light penetration, oxygen levels and fish life. In this particular infestation, most bird life left as there was no area for them to swim. Also, calf drowned while attempting to get out of the weeds.

Control

Spraying with Karmex (R) and Plus 50 (R) at the rate of 2 kg/360L water.

Leaves were sprayed to run-off stage.

The plant gradually turned brown. broke up and disintegrated. Spot spraying was carried out on any remaining plants.

(R) Registered trade name.

CHEMICAL RESIDUE EFFECTS IN LIVESTOCK

E. G. Cuthbertson.

All chemicals are toxic when applied in sufficient quantities. Thus toxicity is relative and is expressed in three ways:-

1. Acute toxicity: the dose which, given in one application, kills;
2. Sub-acute: the dose which, given in several applications over a short period, kills or injures; or
3. Chronic toxicity: the small dose which, given in repeated applications over a long period of time, kills, or injures.

Because individuals vary in their response to biologically active compounds it is impossible to define a single lethal dose accurately. Consequently, toxicity is expressed in terms of LD50 or the dose which, on average, kills 50 per cent of the sample population. This figure is also relative in itself because animals, as well as individuals, vary in their response to pesticides.

While acute toxicity problems cannot be ruled out, sub-acute and chronic toxicity are more likely as a result of the ingestion of herbicide-treated forage. For example: in one experiment steers fed 250 mg of 2,4-D alkanolamine salt for each kg of bodyweight daily for five days in every seven showed signs of poisoning after three weeks; others fed 100 mg 2,4-D per kg of bodyweight showed toxic symptoms after 18 weeks; and still others fed at a rate of 50 mg/kg of bodyweight showed no apparent symptoms even after 23 weeks of feeding. Clearly then there are threshold levels below which damage does not occur.

Most herbicides are readily absorbed into the gut after oral administration and are distributed into most tissues. A large proportion (usually more than 90 per cent), of the herbicide is eliminated in the urine and faeces, often as the parent compound, but more commonly as metabolites within the body tissue and may cause damage if in sufficient quantity. Even if the dose is not lethal, unthriftiness and teratogenic response in off-spring are possible when there is prolonged exposure to the toxic principle.

Pastures and crops are most toxic immediately after being sprayed with herbicides. Their toxicity at this stage is a function of the rate of application, the amount of forage present and the inherent toxicity of the herbicide used. The toxicity of the forage declines with time, but the minimum safe period between the application of the herbicide and harvest is a function of herbicide persistence. Such persistence is affected by herbicide penetration and translocation, run-off, volatility, temperature and photodegradation.

Most of the herbicide is degraded eventually but a small proportion always remains within the plant material. The rate of degradation is typified in terms of the "half-life" of the compound. This is the length of time taken for half the quantity of the herbicide present to be degraded. The importance of the environmental parameters in determining persistence is clearly illustrated, in an experiment in which the half-life of butoxyethanol ester residues of 2,4-D ranged from 59 hours in summer to 430 hours in winter.

Herbicide persistence alone, however, is not the only problem. Many herbicides affect the metabolic processes of the sprayed plant in such a way that toxic metabolites are formed. Examples of this response are found in the increased nitrate content of some plants when treated with 2,4-D or with sub-lethal quantities of simazine and atrazine.

SOIL - WHAT ROLE IN WEED GROWTH AND CONTROL?

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WAGGA WAGGA.

Before the role of the soil in relation to the effectiveness of herbicides can be considered the mechanisms of herbicide activity in plants must be understood. This paper considers the factors influencing the susceptibility of plants to herbicides and the role that soils play in this process.

For any situation there are reasons why the plant population comprises the particular plant species present. The species are there because the conditions are suited to their growth requirements and their survival. The following examples illustrate the point.

On unimproved soils, the species present are generally native grasses which have adapted to the soil's low fertility. In a pasture improvement programme, the objective is to increase pasture productivity through improving the level of soil fertility by applying fertilizers, usually superphosphate. Native species are unable to use this improved fertility and as a result other species better adapted to the improved fertility invade the pasture. The alternative is for the farmer to sow desirable improved species suited to the new fertility status.

This adaptation concept is exemplified by indicator plants, so called because the conditions of growth are better suited to their growth requirements than to other species. Sorrel (Rumex acetosella) is a useful indicator of acid soil conditions while the presence of rushes (Juncus spp.) and docks (Rumex spp.) generally indicates that the location is often waterlogged. The absence of a species from an area in a district where the species is prevalent may also indicate that the growing conditions in a particular soil are typical of the area e.g. the disappearance of legumes from pastures in Southern New South Wales results from the soil becoming too acid.

The point is emphasized therefore that plants reflect their environment. This principle applies equally to weeds as to any other plants - they occur because the conditions suit them. Such conditions include soil fertility, soil type and depth, aspect, topography and many others, often in combination. Acceptances to this principle allows man to use it in his efforts to control weeds in his environment.

WEED CONTROL

The principles of weed control require an understanding of why a particular weed species occurs in a particular location and where the weak points are in the life cycle of that weed. The effort must be made to shift the ecological balance away from the weed and towards a more desirable plant population. Reducing the population by spraying with herbicides is an important tool to this end, but also involved, and equally as important, is the need to encourage a desirable population to take over the area. Failure to follow the programme through to this point will result in a reversion to the weeds just sprayed or to the colonization of some other, probably undesirable, species. Tables 1 and 2 demonstrate this point.

Table 1 - The Control of St. John's wort (Hypericum spp.) by pasture establishment (Moore and Cashmore, 1942)

Pasture species.	Yield of St. John's wort (kg/ha) 4 years after sowing pasture.
Perennial rye/cocksfoot/white clover	590
Perennial rye/cocksfoot/sub-clover	1
Phalaris/white clover	568
Phalaris/sub-clover	4
Annual rye/white clover	848
Annual rye/sub-clover	98

Table 2 - Control of variegated thistle (Silybum marianum) by perennials (Michael, 1968).

Pasture species.	Yield of variegated thistle (kg/ha) second season after sowing.
Phalaria	4,144
Phalaris/sub-clover	2,800
Annual ryegrass	23,968
Annual rye/sub-clover	28,112
Sub-clover	27,440
Lucerne	0
No sown species	16,018

In both cases the weed was brought under control by sowing species with a similar growth habit to the weed. Subclover provided severe competition to St. John's wort because both species have a winter/spring growth pattern and hence the competition was more severe than from white clover, which is summer growing. Likewise, lucerne controlled variegated thistle much better than subclover because of its similar growing season.

CHEMICAL CONTROL

One of the processes involved in weed control is the use of herbicides for REDUCTION of the weed population. Rarely does a herbicide totally control a weed. If used properly, most herbicides will give 80 to 95 per cent control, which may or may not be good enough depending on the initial population. A population of 6,000 plants per m^2, for example still leaves a residual 600 plants per m^2 after a 90 per cent kill. This residual population may still be enough to produce a near maximum reduction in the yield of a crop or pasture. Obviously, the nearer one gets to 100 per cent control, the better the job has been done and the more likely the long term success of the control programme.

The means of achieving near maximal effect depends on the operator using the chemical under the most ideal conditions. There are not always available for a variety of reasons and as a result the effect of the herbicide is reduced accordingly.

It is important therefore to look at some of the factors that contribute to using these chemicals most efficiently, assuming of course, that the appropriate herbicide has been chosen for the task.

The correct rate. The label provides the necessary information. Lower rates than recommended may produce inferior results whilst higher rates infringe the Pesticides Act and may leave undesirable residues.

The correct stage of growth. Many weed species are much harder to kill as they become older, often requiring higher rates and in some instances a different chemical. In this regard the nature of the weed, perhaps due to staggered germination, or to the crop in which it is present, cannot be sprayed at the correct stage. In some cases more than one spraying may be required to bring it under control.

Weather conditions. Whilst climate determines the distribution of plants, weather conditions before, at, and after spraying have a large impact on the effectiveness of the operation. Whilst this is a topic in its own right and probably dealt with separately at this or other conferences, its impact as far as the context of this paper is concerned is related to the physiological state of the plant.

Physiological state of the plant. The general rule that may be stated is that a young weed growing under optimum conditions is more susceptible to the application of an appropriate herbicide. This applies to species which are normally killed by the herbicide but may apply conversely to normally non-susceptible species (i.e. higher than normal levels of crop damage may occur when the crop is suffering from some environmental stress).

Temperatures also tend to encourage stomate closure to protect the plant's water balance and this would also affect stage of growth.

THE ROLE OF SOILS IN HERBICIDE EFFECIENCY

Foliar-applied herbicides

The influence of soils *per se* on the effectiveness of foliar-applied herbicides is not very important. However, soils indirectly influence herbicide use by affecting the physiological state of the plant. Because the soil is the major source of water and nutrients for plants, the level of soil fertility and the ability of the soil to hold water (water holding capacity) become major factors in herbicide effectiveness. The absence or low availability of a particular nutrient or nutrients obviously has an impact on plant growth. As explained previously, the extent to which growth is affected will vary with plant species - in many cases where a high weed population exists this factor may not be of great importance.

The water-holding capacity of a soil, however, can have a very large impact on the plants growing on it. As a general rule, lighter sandier soils hold much less plant-available water than heavier soils with a higher clay content (Figure 1). When moisture is scarce, therefore, the lighter soils are unable to provide plants with their moisture requirements for as long as the heavier soils. As a consequence, plant growth and well-being are likely to be affected much earlier and more often in light soils. As previously described, the efficiency with which herbicides act is affected by plant vigour and more variable results therefore would be expected on the lighter soils.

Some soils, either naturally, or due to location or paddock history, are poorly drained and tend to waterlog. Waterlogged soils produce conditions which are not conducive to the healthy growth of plants and herbicide efficiency may be reduced. Where the herbicide is root absorbed, it has to contend with a root system reduced in size because of the low soil oxygen levels present and, as well, it is diluted.

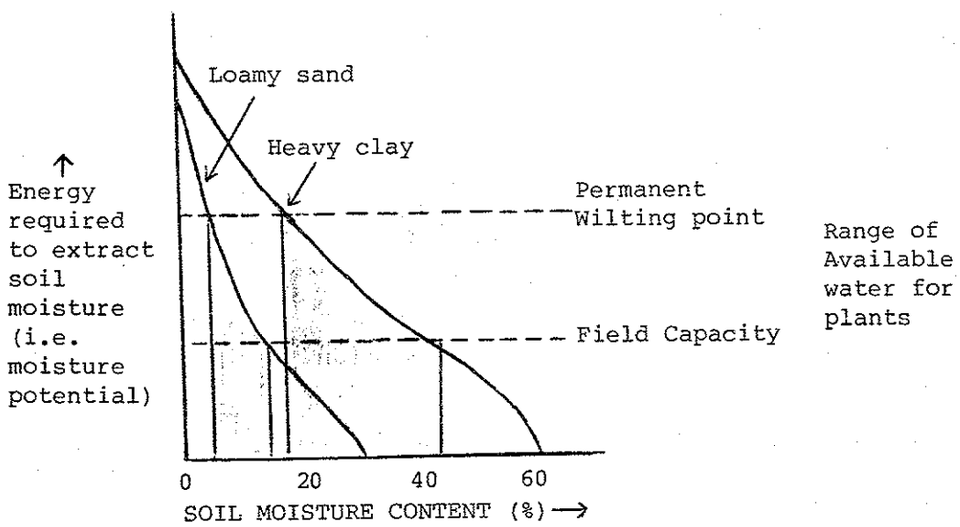

Figure 1. Effect of Soil type on availability of water for plants.

Explanation of Figure

a). Field Capacity is the maximum amount of water a soil can hold against the force of gravity.

b). Permanent Wilting Point is the moisture content of the soil at which plants can no longer extract water.

c). The soil water content between field capacity and permanent wilting point is the water available for plant growth.

d). The energy a plant has to use to extract water from the soil increases as the soil moisture content drops from field capacity to permanent wilting point.

e). The water content curves are quite different for different soil types (compare the loamy sand curve with the heavy clay curve).

f). The amount of water available for plants is much greater in the heavier soil e.g. from this figure:

- the heavy clay can hold up to 25% (44-19) of its own weight as plant available water.
- the loamy sand can only hold up to 10% (15-5) of its own weight as plant available water.

Optimum conditions for growth of a weed involve nutrition, moisture, temperature and light. Limitations to growth by one or more of these factors may reduce the rate of growth and therefore the vigour of the weed in question. For foliar herbicides to be efficient there are four stages which must be successfully completed, namely:

1. contact and retention on the leaf surface,
2. penetration into the cells via the membranes,
3. translocation (movement of water and food through the plant) from cell to cell, and
4. toxic activity at the site of action.

From this it is clear that the efficiency with which these stages are achieved is readily affected by the growth factors already mentioned.

Moisture stress is perhaps the most influential. Moisture stress results in the wilting of leaves increasing the contact angle of the spray droplets with consequent decreased wettability in stage 1. Absorption of the herbicide is also dependent on the moisture status of the plant. Under moisture stress the plant tends to develop more pubescence and thicker and denser wax deposits. The cracks normally present in the cuticle when the leaves are turgid are compressed under moisture stress. This, together with the closing of stomates (which are specialized openings in leaf surfaces for exchange of oxygen and carbon dioxide), severely restricts the entry of chemicals into the plant (stage 2).

The low moisture status of the plant also results in much reduced moisture movement throughout the plant (affecting stage 3) and the general level of metabolism of the plant is reduced to a minimum (affecting stage 4).

The level of metabolism in a plant is also affected by temperature, with both high and low temperatures reducing the rate of metabolism of the plant to the extent where herbicide activity is affected (stages 3 and 4). During high temperatures, evaporation is higher and chemical on leaf surfaces may dry or evaporate before stage 2 can be effected. High by the high moisture level. Both factors contribute to the lowering of efficiency.

For herbicides which are inactivated on contact with soil, a further precaution is necessary. Where rainfall has not occurred for sometime prior to spraying or under conditions where dust is encouraged (e.g. stock movement, proximity to roads) plants become covered with a film of dust. Herbicide sprayed onto such plants will be inactivated to some extent, perhaps giving a disappointing result. Such problems can arise with the herbicides glyphosate (Roundup (R)), paraquat (Gramoxone (R)) and diquat (Reglone (R)), where it is preferable to wait for a shower of rain to cleanse the plants before spraying.

(R) Registered trade name.

Soil-applied herbicides

Herbicides applied to the soil are directly affected by soil characteristics. The length of time that such herbicides remain active or persist in the soil is extremely important because it determines the length of time that weed control can be expected. Some of the soil characteristics which are of major influence are now discussed.

Micro-organisms. In the soil micro-organisms use all types of organic matter, including organic herbicides. When applied to the soil a herbicide is immediately attacked by microbes. The rate of breakdown is directly affected by the number of microbes present, the ease of breakdown of the chemical and the factors which influence microbial activity such as temperature, nutrition, moisture and aeration. A herbicide is more likely to remain toxic longer under cold or poorly aerated conditions, for example.

Soil Type. The amount of clay contained in the soil will influence the soil's ability to inactivate a herbicde by holding it tightly onto the clay particles (a process called adsorption). Organic matter in the soil has this adsorptive property. As a consequence research has shown that:

- soils high in organic matter require relatively large amounts of soil-applied herbicides for weed control.

- soils high in clay content require more soil-applied herbicide than sandy soils for weed control.

- soils high in organic matter and clay have a tendency to hold the herbicide for a longer time than sand. The adsorbed herbicide may be released by the soil so slowly that the chemical is not effective as a herbicide.

Leaching. This is the downward movement of a substance by water in the soil. In some cases this process is used in practice where the chemical is applied to the soil surface and leached by rainfall or irrigation into the upper soil layers. Some herbicides, however, can be removed from the root zone of the soil by leaching. The extent to which this is done is determined largely by:

- the adsorptive capacity of the soil (sandy soils are more readily leached than heavy soils).

- the solubility of the herbicide in water.

- the amount of water passing downward through a soil (this is more likely to happen in sandy soils due to their lower water holding capacity as previously described).

CONCLUSION

The effectiveness of a herbicide is controlled by a multitude of factors. In particular, a herbicide will be more effective on plants which are actively growing. Factors which interfere with the well-being of the plant are therefore interfering with the activity of the herbicide. The role of soils in this regard relates to their ability to provide the plants with conditions suitable for growing a large, healthy root system and an adequate supply of nutrients and water for the production of actively growing leaf tissue. Where such conditions (i.e. poor nutrition, moisture, aeration) are not provided, the vigour of plants is reduced as is their susceptibility to herbicides.

For soil-applied herbicides, effectiveness is a function of the soil characteristics and rates need to be altered to take account of this.

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NOXIOUS WEED ASSESSMENT AND DISTRIBUTION

E. G. Cuthbertson

Successful weed management calls for a co-ordinated systematic approach to eradication or control. The desirability and feasibility of eradication depends on the probability of re-infestation, while the locale dictates the control techniques employed. In both situations the whereabouts and the extent of the infestations must be known as accurately as possible to provide the answer to the immediate problem. For maximum effectiveness the weed must be recorded wherever it occurs and its location mapped regularly.

In brief, the major objectives of weed distribution studies are data supply, the relationship of distribution to ecological parameters, map making and the assessment of control potential.

To my knowledge silverleaf nightshade (Solanum elaeagnifolium Cav.), is the only declared weed whose distribution has been studied in detail more than once. The last survey covered the States of Victoria, South Australia and New South Wales and was carried out by the respective Departmental field officers (weeds) and research officers assisted by Council weeds officers. Data was recorded on cards in a form suitable for transferring to punch cards or computer tapes. The location of each infestation was given as a grid-reference based on 1:250,000 standard map sheets from the Department of Natural Resources. The minimum areas indicated by each grid was a 1-minute-of-latitude x 1-minute-of-longitude square covering an area of about 300 hectares.

A comparison of the distribution in the latest survey with the previous known distribution revealed three important facts:

1. the weed was almost wholly confined to the wheat zone;
2. temperature set altitudinal limits to its distribution; and
3. a marked increase in the number and density of infestations, particularly in southern New South Wales, which appeared to be related to the great increase in summer rainfall in the period between 1945 and 1970.

Council weeds officers should readily provide the data whereby similar information could be derived for all declared weeds. They know where these weeds are in their own areas within very close limits and this knowledge is updated every year. We are obviously losing an opportunity in not using this information to prepare Statewide distribution maps of declared weeds. Not only would this provide a solid base on which to develop unified control procedures, but the information would be useful in many other ways.

The mechanics of the process are already available in the system adopted in the silverleaf nightshade survey. Each standard map sheet was divided into 54 minor grids (10' of lat. x 10' of long.): each minor grid into 25 minigrids (2' x 2')' and each minigrid into 4 microgrids (1' x 1'). The microgrids are identified by a 6 digit and one letter number thus: 72536m2; 725 indicating the State (7) and the map sheet (25); 36 indicating the minor grid; 'm' the minigrid and 2 the microgrid. This type of grid reference is preferred to latitude and longitude, which often requires more digits and describes a point rather than an area. Other grid systems are available, each with their own advantages, which can be substituted for the one briefly described.

A system such as this can also be extended to include other information, such as soil type, aspect, slope, water relation, soil reaction and agricultural situation. These all help to provide reasons for the presence of the weed and, consequently assist in determining the best methods of control.

AERIAL AGRICULTURE AS AN AID TO NOXIOUS PLANT CONTROL

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Department of Agriculture,
ORANGE.

The most important principle in the control of weeds is that: all weeds removed by one method or another must be replaced with better plants. This applies equally to the roadside, the wasteland area, the travelling stock route and the farmer's paddock.

Applying this principle, when using aerial agricultural techniques, is essential because large areas of land are generally involved.

Aerial spraying

If a weed is to be controlled using aerial techniques it must be replaced by:-

1). sowing better species after spraying, or
2). selective removal of the weed from useful species that replace it once the weed has been killed by the herbicide.

The success of aerial spraying depends on a number of factors, many of which are common to all types of spraying equipment.

Application equipment. The most common spray equipment is the conventional boom fitted to an aircraft with Tee-jet nozzles. The nozzles may be either hollow cone or fan type and spray pressure ranges from 140 to 280 kPa.

Droplet size. Smaller droplets for a given volume per hectare give better coverage of the target, more penetration of foliage cover, less spray volume per hectare lower costs, and less stripping than larger droplets. Thus small droplets should be used when applying herbicides that are absorbed by plant leaves and when the aircraft is able to fly low. For good weed control, droplet density should be 20/cm^2 with droplet diameters ranging from 200 microns to 1000 microns. Larger droplets would be best used when the herbicide applied works through the soil and the aircraft is flown in hill country.

Evaporation. Spray effectiveness can be reduced by evaporation. For example, a 200 micron droplet will fall 80 m before evaporation at 80 per cent relative humidity, but only 20 m at 50 per cent relative humidity. Thus when spraying weeds in hill country (high flying) herbicides should be applied early in the morning when relative humidity is high and weeds are covered with dew; the alternative is to spray in the evening when the relative humidity again becomes high. Spraying in hill country can be undertaken during the day in winter - but check the relative humidity with a wet/dry bulb thermometer before starting. Evaporation can be reduced by adding a foam adjuvant (0.2%) to the spray mixture.

Dew. A moderate dew can deposit 500 L of water/ha on the weeds to be sprayed. This assists the action of most herbicides. However, a very heavy dew will reduce the effectiveness of some herbicides that enter the plant through the leaf (e.g. Roundup (R), Gramoxone (R) because they are washed off the leaf when the dew runs off.

Wind. A change in thinking has occurred in regard to the effect of wind on aerial spraying. In the case of low flying aircraft, wind is now regarded favourably.

If herbicides are applied in calm conditions some of the spray can go up instead of down and thus does not hit the target. The most dangerous situation is when an inversion layer (temperature of the air increased with height from the ground) exists; this can usually be recognized by herbicide covering the windscreen of the aircraft after a spray run. Spraying should be stopped under these circumstances.

(R) Registered trade name.

The best conditions for aerial spraying are steady winds; however, gusty winds are quite acceptable because they vary the overlap which is largely compensated for on the next pass. Strong winds are also acceptable because they give reliable direction and greater swath overlap. The upper limit is generally 20 to 30 km/hr.

Light variable winds are not suitable as they can stop, causing temporary calms or they can change direction.

When spraying in hill country, steady light winds are the best. Naturally more care will have to be taken in hill country than in flat country to ensure drift does not cause damage to adjacent areas.

The most important factor in using the wind is to ensure that the aircraft is flown at right angles to the direction of the wind. Don't worry about the shape of the paddock in formulating spraying direction, find the wind direction (smokey fire) and spray across this.

Drift. Ensure the herbicide does not drift onto non-target areas. When spraying (low flying) in a 12 km/hr wind a 300 m barrier is necessary to protect non-target areas. A wider barrier is needed when spraying in hill country. Some aircraft can make smoke trails which allow the pilot to judge drift more accurately. Drift of spray in a 12 km/hr wind is considerably less than under near calm conditions.

Marking. For accurate spraying the paddock should be measured with a tape and compass, and aircraft runs marked with yellow plastic pieces. Human markers should only guide the pilot to the correct plastic markets. With this technique the direction of the crosswind is known before marking. If the paddock has been marked and the crosswind is in another direction, human markers alone will have to be used. On sunny days, use mirrors to attract the pilot (shine them 50 m to the front, not directly at the pilot). On cloudy days wave white flags.

Pilot. Good liaison between pilot and ground staff is essential. The pilot should be thoroughly briefed before spraying and radio contact between markers at the spray site and ground staff on the airstrip is a great advantage.

Aerial seeding

Seed of improved species should be sown to replace weeds after the residual effect of the herbicide has disappeared and after weeds become affected.

If seed is to be aerially distributed alone, the aircraft should be fitted with a seeding ventuiri or wing pods. Distribution of small seeds through the fertilizer distribution gate results in poor spread. Wing pods will give a wider swath than a ventuir but, with some seed mixtures, they tend to clog up and poor distribution results. Seed mixtures should be free from all string, tags, etc.

The flow rate of a seed mixture should be checked before application. First, determine the flow rate from the aircraft on the ground and then test this over a known area. For example, if the aircraft can sow 1 ha/min and the sowing rate is 5 kg/ha, then 5 kg of seed must flow from the aircraft per minute. Test this over 10 ha before sowing the whole paddock.

Ensure that the aircraft uses a crosswind to distribute the seed. The swath width of light seed, for example, cocksfoot, increases from 24 m to 30 m with an increase in crosswind velocity from 0 to 16 km/hr; however, the swath width of subterranean clover, a relatively heavy seed, is not affected. Thus in a seed mixture there is differential screening with the lighter seed being blown further downwind. There is also a drift of the whole swath away from the line of flight with crosswind. Providing the pilot knows the crosswind drift he can allow for these factors. The effect of altitude by itself does not increase swath width but allows the seed more time in the air for wind to affect swath width. Little increase in swath width can be gained from flying about 60 m.

Seeds should be treated with an insecticide to reduce the numbers taken by ants.

Markers should be used to guide seeding aircraft.

Fertilizer application

Sown plants or surviving resident plants that replace sprayed weeds will need enough of the correct fertilizer for vigorous growth. The type and amount of fertilizer needed can be ascertained from paddock history, soil tests and test strips. Moderate to heavy rates of fertilizer are needed in the first 5 to 10 years of a pasture to ensure it gets through the clover dominant phase and into the grass dominant phase as quickly as possible. Remember perennial grasses e.g. phalaris (Phalaris aquatica) are the best weed controllers.

It is difficult to completely cover an area with fertilizer distributed from an aircraft using normal aerial techniques. Thus, on a recently sprayed and sown area that has never had fertilizer, the normal swath width should be halved and markers used to guide the aircraft. If seed and fertilizer are mixed together, the seed spreads half the width of the fertilizer; thus aircraft should be flown at half the normal swath width and markers used to guide the pilot.

Conclusion

Aerial agriculture can be used to control most weeds on hill country. This article can only deal with a few basic points. Consult your district agronomist for further advice and read New South Wales Department of Agriculture, Bulletin P.2.2.2.

INCORPORATING WEED CONTROL INTO A FARM MANAGEMENT PROGRAM

Jim Cherry,
Chief Weeds Officer,
Central Northern County Council.

A well-looked-after farm usually has all of its weeds under control if not eradicated. Farmers usually realize that the quality and quantity of their agricultural product yield depends upon the degree of weed control during its production.

Most weeds officers will have no trouble in gaining the confidence of the landholder in pointing out to him the gains and losses in undertaking weed control. It is the obligation of the weeds officer to have a knowledge of the situation and experiences of its outcome.

The weeds officer must apply himself and be able to successfully use any available information: from his own experience, the Department of Agriculture, especially the weeds officer and district agronomist, local chemical representatives or local landholders who have fronted similar positions in the past.

Landholders who are reluctant to control weeds need a gentle reminder, with drastic action being taken against the non-conformist.

To begine with, it is important to identify the weed problem or, as in the case with the recent drought, anticipate the weed problem then discuss with the landholder:-

1). the seriousness of the weed problem,
2). the source of the weed problem,
3). what it means to the landholder and his neighbours, and
4). control measures which can be adopted.

These are the basic points that can be incorporated into the farm management program.

The seriousness of the weed problem

Every landholder should know his enterprise and it is the responsibility of the person on the outside looking in, the weeds officer, to observe mistakes (or good points).

Weeds are easily transported and spread.

My experience in just the last two years gives an indication of just how easy this can be. For example because of the drought a farmer had to graze his sheep on the roads and stock routes. He rode onto private property where disused fences had fallen down. Noogoora burr (Xanthium pungens) growing there was taken back to the farmer's property in the wool when he returned the sheep for shearing. This season saw plants growing in the 3 or 4 paddocks near the woolshed. Before this time Noogoora burr had not been seen in this area. The farmer had unwittingly imported a serious weed into the area.

With the drought a lot of grain and hay is being brought into the region for stockfeed because surplus stockfeeds are not available locally. This is a top lucerne-growing area and the introduction of any weed, such as dodder (Cuscuta spp.) in the stockfeed would be disastrous.

As another example, a native plant found mainly in the drier, northern part of Australia was found growing in pasture where feedlot animals were grazed before going into a feedlot complex. This plant was obviously carried in by stock.

Travelling stock can also transfer spiny burr grass (Cenchrus incertus) into clean regions. Most farmers would realize the seriousness of this weed.

The danger in leaving two or three plants until they infest a large area is obvious. For example, a mob of stock infested with Noogoora burr travelled through Queensland and onto the Ord River. About five years later, thousands of hectares had to be fenced off along the river under quarantine and a major eradication program undertaken.

Instances like this must be brought to the landholder's attention. A change of enterprise can create problems: for instance, grazing horses in Paterson's Curse (Echium plantagineum) country without realizing the plant's poisonous attributes.

The source of the weed problem

Before effective control measures can be carried out, re-infestation must be stopped. Re-infestation usually comes from outside the property, but the owner should realize it can also come from inside the boundary fence. It is easy to say it came down in the last flood, or came over the fence in the wind, but one seeding plant left uncontrolled will always produce many new plants next year.

Hard seeds are another factor to consider. Many farms this year have the worst Noogoora burr and Bathurst burr (Xanthium spinosum) problem for years in the area, even with a dry season and no floods. It is obvious the hot dry season and even fire can trigger off the germination process by cracking the seed coat.

Early, late or even short growing seasons can catch farmers unaware and allow some weeds to mature unnoticed.

As mentioned earlier, weed seeds can be introduced with stock feed. To overcome this, feeding out should only occur in strictly defined areas so that the risk of weeds infesting a whole property can be reduced and contained in one or two paddocks.

Ploughing and harvesting machinery can always transport weed seeds in rubber tyres, crevices or corners just waiting to fall back to suitable germinating conditions. Equipment should be thoroughly cleaned down before moving onto another property or even another paddock.

Stock movements onto a property should go through a miniature quarantine process to reduce the risk of a whole property becoming infested. Undigested seeds take about 3 days to pass through the animal's digestive system. Loose seeds would also have time to be scratched or just fall from an animal's coat.

Fencelines, stock yards and machinery and feed sheds are all possible sources of re-infestation by weeds if weeds in these areas are not properly controlled.

What the weed problem means for the landholder and his neighbours

This can be judged in monetary terms by quality or quantity loss in yield, effect on value of property or district, and how a landholder fares with his neighbours' opinions (or actions).

It is obvious the market value of wool will decrease if infested with burrs, that is if it can be shorn. Similar thoughts go for long hair on horses and cattle.

Competition between valuable pasture and weeds such as nodding thistle (Carduus nutans), blackberry (Rubus spp.) mintweed (Salvia reflexa), serrated tussock (Nassella trichotoma), St. Johns' wort (Hypericum spp.) will severely reduce carrying capacity or overall crop yield if not the quality of the yield, especially through seed contamination.

A heavily weed infested property will decline in value if offered for sale in such a condition. Land values of a district prone to weed infestation will also decrease if some areas are heavily infested. A landholder's neighbours will be fully justified in criticizing him if he does not control his weeds because there is a good chance of neighbouring properties becoming contaminated.

If neighbours are not happy with a landholder who does not control his weeds, then the weeds officer should politely point out the position. Irate neighbours may even resort to more positive action.

All of these points should be made to the landholder because the one doing his share of weed control will be the happiest with the bank as well as making good neighbours.

Control measures

The weeds officer should best be able to handle control measures. After observing the problem, then it is up to him to work out the control program which would best suit the landholder and all involved.

To understand the extent of infestation, aerial photographs (or even photostats of them) will give an idea of the property and the location of the infestation. Plastic overlays (a new one for each year) can be used so that the original photo is not disfigured to show movements of the infestation. (These movements could be a decrease or increase in area, or a physical movement of the infestation down a valley, up a valley etc.). Without complicating the overlay too much, spraying programs for each year can also be plotted so that progress can be seen. Mudmaps could be an alternative but are probably less accurate. An approach like this will impress the landholder, as long as the rest of the work can be carried out properly.

The actual control of weeds will include one, if not a combination of the following methods:

1. chemical,
2. mechanical, and
3. cultural (grazing technique, competition)

A large number of herbicides are available, each with its own attributes. They can be used with selectivity, total, or residual control in mind. The weeds officer should be conversant with all chemicals available so he can choose the best to suit the problem at hand.

Another way of weed control is by mechanical means, for example by ploughing, slashing or hand hoeing. Ploughing should physically disturb the weeds in the soil thus causing death. Hand hoeing or interrow cultivation would mean selective control of weeds. Slashing is advantageous if only rank growth or seed heads require control.

Cultural techniques can also be advantageous in weed control. These may be by biological means with insects, rusts etc. or grazing with sheep, cattle or even goats, or even by plant competition. Plant competition can be accomplished by reducing carrying capacity, encouraging better growth by fertilizer and/or water, or by introducing new, more competitive, better suited plants.

The position of the weeds officer allows him to be the catalyst required when a landholder draws up a weed control schedule which benefits the overall farm management program. The weeds officer should wisely use all available experience in choosing the advice which will be of most benefit to the landholder.

SUBJECT : AQUATIC PLANT CONTROL

Chris Ripper,
Field Officer,
Water Resources Commission,
LEETON.

Have you got a problem?

Look closely at the situation and determine if:-

(a) The plant is noxious and/or a serious threat to water movement, water or land use.

(b) By removing the plant in question you might in fact be making way for a far more serious plant to enter.

(c) It might be better to do nothing at all, rather than upset the balance.

Undesirable Plants

Two categories:

(a) Noxious - which must be controlled and if possible eradicated.

(b) Non-noxious - but a problem in terms of recreation or water movement.

Examples

Noxious:

See attached photocopies.

Non-noxious:

- Ribbon weed - Vallisneria spp.
- Pond weeds - Potamogeton spp.
- Water Milfoil - Myriophyllum spp.

Plant I.D.

If in doubt of plant species forward a specimen to the:-

Director,
National Herbarium,
Royal Botanic Gardens,
SYDNEY. N.S.W. 2000

Drying procedure:

1. Plant should have 20-30 cm of stem, flowers and fruits if available.
2. Specimens should be dried between newsprint, and not sent wet.
3. Date and place of collection as well as details as to how the plant grows.

If pressing is difficult then specimens may be preserved, in an aqueous solution containing 70 percent methylated spirit.

Mechanical Control

Three types:

(a) Excavators and Draglines.

(b) Cutters eg. Wilder Weeder.

(c) Pullers eg. Chains.

Chemical Control

Three types:

(a) Non residual
- Roundup (Glyphosate).

(b) Short term residual

- Dalapon 2,2 - DPA
- TCA.

(c) Long term residual
- Atrazine
- Diuron.

It is preferable to use chemicals which are of the non-residual type. Only in cases where these types of chemicals are known not to work should other types be applied.

For example

In the control of sedges, Roundup is not effective so Dalapon or TCA may have to be used.

Equipment

High volume - hand wand
- gun

Low volume - C.D.A.
- rope applicator.

Basis for use of chemicals in Flowing water

(a) Avoid contamination of the water wherever possible.

(b) If (a) is not possible, preferably use a non residual type of chemical and keep contamination to a minimum.

e.g. for Roundup - 1 litre can be applied for every 10 Ml. flow of water through the system. This keeps the concentration of Roundup in the water to below the world health limit of 0.01 ppm for potable water.

Protective Clothing

The reasons for wearing protective clothing is to protect the spray operator from being contaminated by the herbicide he is using.

It is desirable that the following articles be worn by the operators:-

1. When spraying:
   - Overalls - daily change
   - Hats - daily change
   - Socks - daily change
   - Gloves
   - Boots

2. When mixing herbicides:
   - Face shield
   - Plus - overalls
     - gloves

To avoid contamination it is essential that the operators:

- Shower after spraying.
- Wash hands and face with soap before eating.
- Do not smoke while spraying.

If an operator spills a herbicide on himself he must:-

- Change contaminated clothing.
- Immediately wash affected area with plenty of soapy water.
- Shower as soon as possible.

Plant Competition

Use of competitive plants instead of chemical weed control

There is a plant suited to every situation, therefore before residual herbicides are applied to areas adjacent to buildings and structures consideration

should be given to the establishment of a plant which will provide cover but not have undesirable side effects.

Residual herbicides for total weed control around structures should only be used where there is a fire hazard. Otherwise plant a suitable species and the problem of unsightly bare earth and erosion will be permanently overcome.

Remember herbicides are NOT the answer in all situations as the results are short term and the operation is repetitive and costly. Sowing of suitable plants should be included in the original channel construction cost, or where bridges and other structures are updated.

The available seed selection may not suit the locality where planting is planned. Check with the organization marketing the seed before sowing or propogate from pieces known to thrive locally.

Ground cover plants for use above the waterline

If the area can be grazed then a selection of the locally used pasture species would be appropriate. It may be useful to consider some of the following species in addition to the pasture species or instead of the pasture species if grazing is not practicable:

(1) Pennisetum clandestinum (Kikuyu)

A valuable competitive species for planting on channel banks. Generally, should be only be used on channels with permanent flows and capacities above 50 megalitres per day. May become obstructive to water flow in farm channels, but this species is easily controlled with herbicides and can be readily kept short by grazing animals. Grows best in humid conditions but will thrive in the humid microclimate adjacent to the water's edge in the dry south-west of New South Wales. It is frost sensitive. This species can be established from pieces or seed.

(2) Cynodon dactylon (Common Couch)

Perhaps the most versatile species, it is capable of tolerating dry conditions, low fertility and high salinity levels better than most other species. C. dactylon dies back in winter but resumes growth the following spring. It is suitable for most areas of the State. C. dactylon is also moderately resistant to glyphosate and atrazine, and low rates of these herbicides could encourage the spread of couch. Propogation from pieces is often more successful than from seed.

(3) Axonopus affinis (Carpet Grass)

A potentially useful species capable of tolerating limited water-logging and low fertility levels. It is more useful in the wetter areas, but should be capable of growing in most areas of the State and competing successfully against Paspalum dilatatum. Summer growing.

(4) Sporobolus mitchellii (Rat's-tail Couch)

A native species which has great potential in the drier regions of the State. This species should survive under drier conditions and higher salinity levels than Cynodon dactylon, but will produce less growth in winter.

(5) Digitaria didactyla (Queensland Blue Couch)

A summer-growing native species which could be useful in coastal areas.

(6) Agropyron repens (English Couch or Twitch)

A vigorous lawn species in areas with winter rainfall, but could become a problem in natural wetland areas or in areas adjacent to pastures. Probably more suited to channel banks adjacent to cultivated areas.

(7) Juncus spp.

These species are difficult to plant but often occur naturally along the

water line. It is best not to disturb the smaller-growing species unless they are definitely blocking water flow. Juncus spp. often prevent more troublesome species from becoming established. Even the larger-growing J. usitatus appears to provide effective competition against Typha spp. and other more obstructive shore-line weeds.

(8) Phylla nodiflora (Lippia)

A prostrate perennial herb which is a valuable lawn plant that also has potential for planting as a ground cover species adjacent to channels. Lippia thrives in the wetter parts of the State but could be worth including in seed mixes for other areas.

(9) Dichondra repens (Kidney Weed)

Similar to Phylla nodiflora but rather hardier and may be useful in a wider range of conditions.

(10) Trifolium arvense (Hare's-foot Clover); T. dubium (Suckling Clover); T. campestre (Hop Clover).

These are all annual clover species, listed in order to their decreasing ability to withstand moisture stress. One of these species is probably worth including in any seed mixes for channel banks. Winter-spring growing.

(11) Trifolium subterraneum (Sub Clover)

This is a more vigorous annual clover than the previously listed group. Winter-spring growing, it can maintain itself in areas of winter rainfall and under low nutrient levels.

(12) Eragrostis curvula (African Love Grass)

A controversial pasture species which, under some conditions, can become a problem. Plantings should only be of palatable strains and should not be done without consulting local agricultural authorities. This species does seem to have some potential as a summer grower in the drier regions.

(13) Pratia concolor and P. darlingensis (both Pratia)

Low-growing native perennials which will survive waterlogging. These species occur naturally on the heavy soil floodplains adjacent to New South Wales inland rivers and are potentially useful species for growing on channel banks.

(14) Brachyachne convergen, B. ciliaris

Native species related to, and superficially similar to Cynodon dactylon. Both Brachyachne species are worth trying in the drier, summer rainfall areas in the north of New South Wales.

(15) Some tree species can be used to shade waterways and hence reduce water-plant growth. Care is needed, however, as the larger woody roots could damage concrete structures and the smaller, finer roots, and trailing branches may restrict water flow. Trees may also prevent mechanical cleaning of the channel.

Salix spp (Willows), Casuarina cunninghamiana (River Oak), Eucalyptus camaldulensis (River Red Gum), E. largiflorens (Black Box), E. microtheca (Coolabah) and E. robusta (Swamp Mahogany) are worth trying in some circumstances.

Ground Cover Plants : For use below the waterline

Care is needed before introducing any aquatic species into irrigation or drainage systems. Any growth will reduce the flow of water through the channel and submerged growth should only be encouraged if the demand for water is substantially less than the design capacity. If this is the case then submerged growth could be encouraged to stabilize an unstable channel bed or to replace species that are more obstructive or more difficult to control.

The height of the submerged vegetation has a disproportionate effect on the rate of water flow. For example, a plant 10 cm high reduces water flow by much more than twice the amount than do 5 cm tall plants, all else being equal. The relationship is not simple, however, as all else is rarely equal. The ideal submerged plant to encourage is a uniformly low-growing perennial species that forms a turf, spreads by vegetative means, can withstand periodic exposure to air, successfully competes with other more obstructive species, but could still be controlled comparatively cheaply.

Studies of submerged species have been very limited in Australia, Species of the alga Chara have been found to compete with submerged weeds in lakes. Chara species tend to taint water and are not particularly suitable for farm dams or shallow, slowly moving water.

Species of low-growing or dwarf spike rushes (e.g. Eleocharis, coloradoensis, E. acicularis and E. parvula), seem capable of competing with a wide range of submerged plants.

SILVER-LEAF NIGHTSHADE CONTROL

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WAGGA WAGGA.

Silver-leaf nightshade (solanum alaeagnifolium Cav.), also called white-horse nettle and tomato weed, is a native of North America and was introduced to Australia in the 1900's. It was of little importance in New South Wales until about 1960. Since then it has spread rapidly and it now infests over 12000 hectares in cereal growing areas of southern New South Wales. Other infestations occur in the central and northern wheat zones and in the M.I.A.

Silver-leaf nightshade (SLN) is a deep-rooted perennial with annual summer top-growth. New shoots are produced in spring from crowns of perennial roots, lateral roots, and root segments. Flowering begins in December and may continue until February/March. Berries may form in December and usually ripen 4 to 8 weeks after seed-set. The extent of seed germination depends on adequate moisture and humidity and is therefore subject to seasonal variation.

Spread of SLN is caused by seed, sprouting of broken root pieces and creeping of lateral roots. Seeds are dispersed by water, birds, vehicles, machinery and in animal droppings. Rapid spread of SLN results from germination of these seeds under favourable conditions. Cultivation also enhances the spread of SLN by moving pieces of root.

Various properties cause SLN to be an important weed problem. It competes directly with summer growing pastures and severely reduces production of winter pastures. If it grows in a summer fallows, a subsequent crop will suffer reduced yields due to a depletion of nutrients and soil moisture during the fallow. Poisoning of stock has been reported but it is rare. SLN reduces the value of land because management options become limited e.g. stock movement. Once the weed becomes established it is very difficult to eradicate In U.S.A. some areas are so badly infested that cropping is no longer possible.

Control of large area infestations

At present there is no chemical available for adequate control of large area infestations. Tordon 50-D (R) at 20L/ha ($250/ha) will provide 70 to 80 per cent control. However, due to its cost and persistence in the soil it is not a suitable option. For large area infestations it is only possible to limit the spread of the weed. This can be achieved by:-

(1). preventing seed production using 2,4-D (1L/ha 2,4-D ester plus wetter or 2L/ha 2,4-D amine plus wetter at $5/ha); 2,4-DB (3L/ha plus wetter) in lucerne pasture at $15/ha;

(2). preventing spread of seed by stock by confining stock to an area where there is no seed for 3 to 4 days; or

(3). spraying a strip of Tordon 50-D (R) around the fence-line.

Slashing is ineffective as it does not prevent flowering.

Control of small area infestations

Tordon 50-D (R) is suitable for spot-spraying small areas of SLN. A 1 per cent solution plus wetter should be sprayed on the plants sufficient to wet them. An area of one metre should be sprayed around the colony to cover the extensive root system. Successive yearly applications are necessary to achieve sufficient kill. Green seeds sprayed with Tordon 50-D (R) are still viable, so it is necessary to spray before this stage.

Roundup (R) applied as a 2 per cent solution provides good control when applied to actively growing plants, but may not work so well in dry conditions. It has no residual activity and is expensive $17/L. Application of Roundup(R) with a ropewick applicator is a promising, inexpensive, long-term method of SLN control.

Biological control of SLN in Australia has not been examined. A wind-borne nematode is being evaluated in U.S.A. as a potential pest of SLN and progress with this is being monitored in Australia for its potential use here.

Competition between lucerne and SLN combined with short-term chemical control with 2,4-DB is also a promising control option.

(R) Registered trade name.

DEVELOPMENT OF CULTIVARS OF ERAGROSTIS CURVULA FOR SOIL CONSERVATION IN NEW SOUTH WALES.

W. H. Johnston,
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WAGGA WAGGA.

African Lovegrass (Eragrostis curvula) (Schrad) Nees, is a native grass of South Africa. The species is highly variable because it contains a complex group of plants which are taxonomically indistinguishable, including types which at some time were considered separate species.

Seven main E. curvula plant types have been defined based on morphological and agronomic characteristics (Leigh, 1961; Leigh and Davidson, 1968; Voigt, 1970). These are Robusta Blue, Robusta Green, Robusta Intermediate, Curvula, Tall Chloromelas, Short Chloromelas and Conferta (sometime E. Conferta Stent.; referred to by Voigt (1970) as E. curvula var. conferta). A closely related species E. lehmanniana Nees is also hard to distinguish from E. curvula (Streetman 1970).

Some naturalized E. curvula types are declared noxious weeds in a few tableland and coastal shires of New South Wales. In New Zealand it has been recommended that the species be declared a class A noxious plant (P.B. Gow, Personal Communication, 1977). The species occurs in other States of the Commonwealth but, it is only in New South Wales that it has been so declared. The types involved are mainly Curvula and Short and Tall Chloromelas, which have been found to be unpalatable to stock and aggressive colonizers of sown temperate pastures (Auld and Scarsbrick, 1970).

Although the occurrence of E. curvula is generally viewed with concern, its actual weed status remains a matter of controversy. Many landholders value the species for the feed it produces during mid spring and in drought years.

Morphological and agronomic classification of plants within a species is not unusual. Most named agricultural cultivars are defined on this basis. Although satisfactory for descriptive purposes, the legal definition of plants requires the use of the formal classification system as outlined in the International Code of Botanical Nomenclature (Staflen et al 1978). In the case of E. curvula the situation is further complicated because most so-called types can vary over a range, so that intergrade types also occur. Of the seven main types, the most taxonomically distinct is Conferta (Jacobs, in press).

E. curvula reproduces mainly by a process called apomixis. This is best described as a vegetative form of seed production which does not involve out-crossing but requires pollination for the process to occur. Although this is the dominant form of reproduction, and for most populations occurs with a frequency of 100 per cent, some populations have been found with a low out-crossing frequency under some conditions (faculative apomixis) and others with a very high frequency of sexual reproduction.

Populations of sexual Conferta types which are lower producing and less winter hardy than less palatable Curvula types can be used in a plant breeding programme allowing selection of intermediate, highly apomictic perpetual hybrid populations (P.W. Voigt, Personal Communication, 1978). The effect of these intermediate types on the presently distinct Conferta type will be to render the distinction less pronounced. However, as this work is all experimental this possibility is not likely to occur unless highly palatable registered cultivars are released. The breeding work is being conducted in America although some hybrid types have been imported for evaluation at Wagga Wagga.

Field sowings of various lines of E. curvula (mainly Curvula and Tall Chloromelas types) by the Soil Conservation Service of New South Wales in drier areas of the state have demonstrated that the species is potentially a valuable soil conservation and pastoral plant for lower rainfall areas (Cameron, 1954; Johnston, 1974; Lang, 1977). The particular attributes of the species include adaptability to a range of soil and climatic regimes, ease of establishment, persistence, its summer growth rhythm and its outstanding performance on impoverished sites (Johnston and Cregan, 1979).

The species is highly valued as a pastoral plant in America, Argentina and South Africa and use for the grass in particular situations has also been found in Korea, Japan and Sri Lanka. The grass is also favoured for revegetation of acid mine spoils of low pH which are high in exchangeable aluminium (Fleming et al, 1974) but genotypes differ significantly with respect to tolerance levels (Foy et al, 1980).

In view of the controversy surrounding E. curvula in New South Wales selection of cultivars for soil conservation use must first aim for plants which are palatable. Although similar research is being carried out in America, South Africa and Argentina experience has shown that palatability rankings change with the environment in which the plants are grown.

Because of its mode of reproduction and the difficulties of conducting large scale plant breeding evaluations with E. curvula, research in New South Wales has concentrated on selecting palatable types from within a wide range of types and ecotypes of the species. This approach has enabled selection of types which are vastly more palatable than the naturalized types (Johnston and Aveyard 1979). Further testing has enabled the selection of a Conferta type which has been found to be consistently more palatable than the best of the other selections. In America two cultivars of E. curvula have been released after selection for improved palatability (Holt and Dalrymple, 1979) and one after selection for seedling drought tolerance (Wright, 1971).

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EFFECTS ON NOXIOUS PLANT CONTROL THROUGH LOCAL GOVERNMENT AMALGAMATIONS

R. A. Nalder,
Chief Weeds Officer,
Cabonne Shire.

In my experience with Cabonne Shire the amalgamation of councils has permitted the reorganized noxious plants section to operate successfully.

Cabonne Shire Council was formed in 1977 by the amalgamation of Boree and Molong Shires and most of Canobolas Shire. The new Shire is 6,017 square kilometres in area and has a population of 12,100. The country changes from high plateau around the City of Orange, where blackberry (Rubus spp.) and serrated tussock (Nassella trichotoma) thrive, to river flats along the Belubula and Lachlan Rivers in the south and the Harvey Ranges to the west. There are eight towns, non of which are large. Orchards and hobby farms fragment the land around Orange with the remaining major area entirely committed to agriculture.

The administration of the Shire is decentralized with the Shire Clerk's office at Molong, the Shire Engineer's and Health Surveyors headquarters at Cudal and a small staff at a district office in Orange.

Factors which have assisted our management of weed eradication can be listed as follows:-

1). increased funding,
2). employment of full time inspectors,
3). the formation of a Noxious Weeds Committee,
4). the inclusion of Form 2 Notices on Section 160 Certificates,
5). more frequent issue of Form 2 Notices,
6). increased prosecutions,
7). good office records for recording on a card system the issue of notices, radio telephone communication, and
8). revolving grant.

Let me enlarge on these points.

Increased funding

The total normal grant to the three amalgamating councils in 1977 was $16,000. The normal grant received in 1981 was $44,000.

Total expenditure has increased from $32,000 in 1977 to $100,000 in 1981. This increased funding is due to greater support from the Department of Agriculture in recognition of the initiatives instituted by full-time employment of inspectors and better management of our resources.

Full time inspectors

When the three councils were amalgamated, each employed part-time inspectors of which there were four. It could not be said that any council had achieved any marked success in weed eradication. We were confronted with problems of widespread blackberry and serrated tussock, part time inspection and inadequate transport. There was only one four-wheel-drive vehicle available. One inspector who had the most problems in rough country had to provide his own car! Each council's attitude towards weeds was different. Engineers controlled the programme for two councils and Health Surveyor controlled two inspectors for the other council.

We needed an entirely new organization.

These problems were discussed with officers of the Department of Agriculture. We were informed that if council would employ full-time inspectors, then the Department would make more finance available. Council agree to this proposal and by 1979, with the assistance of private hire work, we achieved full-time operation. Our obvious success in property inspection and solving many difficult problems was recognized by Council to the extent that funding permitted the purchase over a four year period, of a small four-wheel-drive

vehicle for myself and two four-wheel-drive, long wheelbase vehicle. The two larger vehicles are used for private property inspection and for spraying on Council-owned land and are fully equipped for spraying. Contractors are not employed.

Full-time employment of inspectors allows us to keep the pressure on property owners throughout the year and ensures that difficult situations are brought to finality and are not abandoned. Extensive property inspections are the key to success.

Noxious Weeds Committee

Noxious weeds have always been "small beer" on a council business paper. It is even smaller whilst an amalgamated council is grappling with the problems of reorganization. At the time of amalgamation weeds were coming a very poor last. Since the council was larger and there were hopes of employing the three inspectors full-time, it was thought that weeds "business" might be big enough to warrant the formation of a noxious weeds committee. And so the committee was formed. It consists of five councillors and meets once a month, for about an hour and a half, commencing at 5.00 p.m. A works committee follows at 7.30 p.m.

The committee meeting allows the Deputy Shire Engineer and myself to discuss our problems frankly and fully. A full report is given of activities each month. We have the confidence of the committee and the committee has the confidence of the shire council. When the committee's report is presented to full council neither the Deputy Shire Engineer nor myself are present and the interests of the Weeds Department are fully supported by the Committee members.

Section 160 certificates

Absentee ownership and the creation of hobby farms is a problem around Orange. There is also frequent change of ownership in some areas, particularly where weed problems are acute. It is found that when property owners realize that they have a costly weed problem and that council is determined to see that it is solved, such realization influences a decision to sell.

All such property is kept under form 2 notice so that the notices appear on section 160 certificates requested by prospective buyers. Almost without fail the vendor is required to either eradicate the weeds before sale or "leave in" a substantial sum to ensure eradication, at least for the first year. A great deal of work is generated by this method which is largely responsible for the employment of four private spraying contractors throughout the season. It also has the added benefit of giving notice of the weed problem allowing us to request immediate work from the new owner since he cannot say that he was unaware of the problem or claim that Council is lax in its inspection work.

Form 2 notices

Council has given the Shire Engineer delegated authority to issue form 2 notices. These are issued frequently and recorded on cards for each property. These cards present a history for easy reference when advising for prosecutions or writing strong letters. Issuing large quantities of form 2 notices is the only way to obtain effective action from property owners. I say this after years of trying to obtain co-operation without form 2 notices. Whilst remaining courteous to landowners we insist on issuing form 2 notices on all properties with a weed problem, even though we believe we have the owner's co-operation. The issue of a form 2 notice has a greater effect on the property owner than a friendly talk. Appealing to people for co-operation in most cases has no great effect.

Prosecution

We have commenced to prosecute those property owners whose weed problems are very large and where the cost of enter and spray operations would be high: say over $1,500 per property. Our short experience so far indicates that this method should be employed without too much vacillation. It would appear that offenders are much more liable to reason on the steps of the court house. There are many instances of first overall spray operations costing in excess of $10,000 and we have adopted a three-year staged approach to overcome this difficulty.

Recovery of costs for enter and spray operations so far has been good. Here again this method is being used often, generally with the property owner's ultimate acceptance. We pay special attention to rendering accounts quickly in these cases so as to achieve early demand, and if necessary have the cost recovered after judgement as if it were a rate on the land.

Communications

The Shire is subdivided into three districts which are in effect the old shire areas. An inspector operates from Orange, Molong and Cudal. These towns are about 40 km apart and face to face discussion is infrequent and time-consuming. Two of the three towns have recently been connected to a radio transmitter on Mt. Canobolas by radio link so that information received at each of the three district offices in these towns can now be passed on immediately to the inspectors (Orange has land line connection). I have had a mobile radio for some time and this year the other two inspectors will acquire mobiles. This will allow me continuous contact and prevent delays in the mornings when telephoning, or interrupting the inspectors at night. Moreover, the inspectors will have immediate access to all form 2 notices and correspondence in the Engineer's departmental headquarters at Cudal. Such contact allows everyone to be well informed and so proceed with confidence.

The Deputy Shire Engineer's secretary handles all weeds correspondence, reports and the issuing of notices. All notices are indexed and at hand for quick reference by inspectors. The size of the operation caused by the amalgamation requires administration to be properly planned and staffed. It is therefore more professional and effective as a result.

Many shire engineers do not have private secretaries and access to information in those cases is slow and time consuming. No longer will property owners put it over the inspectors as checking by radiophone will produce a quick answer.

Revolving grant

Although a revolving grant has no relationship with the benefits of council amalgamation, it nonetheless occurred at a time after our amalgamation and was of considerable assistance in helping us solve a big problem. Twelve thousand dollars was made available for the eradication of serrated tussock.

This made the argument that loans could not be obtained or that interest was too high unacceptable. Our approach was stronger as a result and we were able to solve some key serrated tussock problems which led to obtaining the eventual co-operation of all property owners in that district.

You might think from this address that the Shire is enveloped by noxious plants. This is far from the case. On the whole, property management is good and progressive. The high country, however, is very varied and in the mountainous areas the valleys are perfect for blackberries and the hills ideal for serrated tussock. About one third of the Shire is of this type of terrain and will require much effort and close inspection to obtain and keep under control.

The considerable size of the Shire permits the inspectors to work as circumstances require either together or apart or as separate teams assisted by casual spray operators. At the same time I am able to concentrate on the main problem areas of property inspection without being diverted at critical times. This flexibility is one of the benefits of an amalgamation.

There is much to do. We have resisted the temptation to ask Council for more funds to increase the pace especially since Council's expenditure has increased several times over in a few years. Our experience so far is very encouraging and we believe we can see that eventually we will achieve complete control with our present staff. But that is still quite some years away and will only be achieved by very good management on our part. Fortunately we now have the organization and backing necessary to obtain results and we are able to work with the knowledge that will, in the long run, be successful.

Note: Noxious plants eligible for grant expenditure in Cabonne Shire are blackberry, serrated tussock, St. John's wort, sweet briar (Rosa rubiginosa), African boxthorn (Lycium ferocissimum), true Scotch thistle (Onopordum acanthium), Noogoora burr (Xanthium Pungens), Bathurst burr (Xanthium spinosum), Tree-of-Heave (Ailanthus altissima), Johnson grass (Sorghum halepense).

1ST BIENNIAL NOXIOUS PLANTS CONFERENCE FOR COUNCIL OFFICERS AND OTHERS* JULY 9TH, 1981.

E.G. Ryan,
Commissioner,
Prickly-Pear Destruction
Commission,
TAMWORTH.

The Prickly-Pear Problem in New South Wales

Prickly-Pear (Opuntia spp.) is the name given to a group of perennial, succulent plants of American origin, which belong to the Cactaceae Family. There are about 1,600 different varieties of cacti but only nine varieties have caused trouble in New South Wales and of these, six have become serious pests. They are:-

Common pest pear	found throughout the State.
Tiger pear	found throughout the State but the main infestations are along river systems such as the Turon, Macquarie, Castlereagh, Namoi, Peel, Horton, Gwydir, Dumaresq, Moonie and Hunter.
Harrisia cactus	confined mainly to the northern border districts of Boggabilla and Goondiwindi.
Tree pear - O.tomentosa	a type of tree pear found mainly in the northern border districts of Yetman, Texas and Ashford.
Tree pear - O.monacantha	found along the coastal belt anywhere between Tweed Heads and Eden.
Rope pear	found throughout the State.

A variety of cacti called Indian fig (Opuntia ficus-indica) was prescribed in 1979. This means that Indian fig is not covered by the Prickly Pear Act, 1924, and can be grown commercially. The fruit is popular with people from the Mediterranean area and is sold at markets in Sydney and Melbourne.

The main pear infested areas in the State are the Central Western Slopes and Plains, the North Western Slopes and Plains and the Hunter River Valley.

Prickly-pear was brought to Australia by the early settlers. Most of it came from America, particularly South America. The settlers planted it in gardens around homesteads and as hedges for use as fences. Opuntia moncantha was brought here with cochineal insects to start a cochineal dye industry. The dye was used to dye the soldiers red coats. How such varieties as Common pest pear and Tiger pear arrived in Australia is not known. The first report of Common pest pear was on a farm at Parramatta.

Prickly-pear spreads by seeds and segments. The seeds are spread mainly by birds and segments by water and animals. The early settlers took it everywhere and it quickly became established in many localities. The Hunter Valley was infested from a pot plant of Common pest pear taken from Parramatta to Scone. The Turon and Macquarie Rivers Valleys with Tiger pear from a garden at Sofala. The Gwydir River Valley with Tiger pear from a garden at Bundarra. Many districts were infested from garden plants and in most cases the actual garden is known.

Prickly-pear commenced to cause concern about 1870. The rapid spread in New South Wales and Queensland, the only two States infested, has been regarded as one of the botanical wonders of the world. Four million hectares were covered by the year 1900 and twenty four million hectares by 1920. Large areas of thickly infested land were unproductive and abandoned by owners. Prickly-pear was taking over the land and rendering it useless at the rate of about half a million hectares each year.

The reason why prickly-pear became so bad so quickly was that the country was sparsely settled and landowners did not have a satisfactory method of dealing with the problem. A chemical to kill prickly-pear was not found until about 1915. They were forced to use slow primative methods such as burning or crushing with rollers.

In 1920 a Commonwealth Prickly-pear Board was formed. The New South Wales, Queensland and Commonwealth Governments combined resources to attack the problem from all aspects. Teams of entomologists were sent overseas to investigate biological control prospects. Scientists were employed to try to find uses for prickly-pear. They found fodder, paper pulp, alcohol, dye, oil and soap could be made from pear but all these products could be produced more cheaply and easily from other things. Chemical means of destruction were researched and arsenic pentoxide was found to be the most effective chemical available at that time. Arsenic pentoxide was widely used as the main spray for prickly-pear until 1956 when hormone type sprays came on the market.

The entomologists who went overseas came up with the miracle that saved the situation - the Cactoblastis insect. The first consignment of Catoblastis was sent from Argentina in 1925. The first liberations were made in 1926 and by 1932 there had been a general collapse and destruction of most of the original thick stands of prickly-pear in both New South Wales and Queensland. The success of Cactoblastis is regarded as the most spectacular example of destruction by biological means, of a serious weed pest, in any part of the world.

Other insects have been introduced, with varying degrees of success. The use of prickly-pear insects for biological control is described in the second part of this paper by Mr. John Hosking, Entomologist, attached to the Agricultural Research Centre at Tamworth.

The Prickly-pear Destruction Commission in New South Wales has relied mainly on chemical control measures, with biological control as a secondary measure, since the initial knock down by Cactoblastis in the early thirties.

The high cost of chemicals has forced the Commission to take a closer look at biological control. John Hosking is engaged in a five year research programme. His main task is directed towards improving the effectiveness of the prickly-pear insects in areas of New South Wales where they have not been very successful in the past.

The main chemicals used in prickly-pear control are 2,4,5-T and Tordon (R) (Picloram). Distallate is used as the carrier and the usual mixture is sixty-four ml of 2,4,5-T (Technical Butyl Ester) and 32 ml of Tordon 255 with five litres of distallate. Eighty per cent 2,4,5-T can be used with distallate, the mixture recommended is 96 ml in 5L.

The Commission tries to assist landowners as much as possible with their prickly-pear problems. The Commission has gangs of men who carry out pear eradication work on private properties. Most of the work is done on a dollar for dollar basis. A prickly-pear spray (2,4,5-T Tordon-Distallate) is supplied at cost price and when it is being bought to spray Tiger pear it is supplied at half price. Spraying equipment is available for loan at no charge. Debts for eradication work carried out by Commission employees can be repaid by instalments at a 4 per cent interest rate. Cactoblastis and Cochineal insects are supplied and liberated on properties for landhowners free of cost.

The assistance given by the Commission in the form of free spraying work, free chemicals and the free supply and liberation of insects, will amount to about $400,000 this financial year. The Commission also assists both State and Commonwealth bodies, many semi-government bodies and numerous trusts with eradication work.

In October, 1980 the headquarters of the Prickly-pear Destruction Commission was transferred from Sydney to Tamworth as part of the regionalisation of the Department of Agriculture. It is expected that this move, into the centre of one of the State's most heavily infested areas, will be benefical to the Commission's operation.

Many weeds officers work in close liaison with Prickly-pear officers. The co-operation and help we receive is appreciated.

(R) Registered trade name.

BIOLOGICAL CONTROL OF CACTUS IN N.S.W.

J. R. Hosking,
Agricultural Research Centre,
TAMWORTH.

There are a large number of cactus species in New South Wales and many insects have been released for their control. Although some insects feed on many species, most restrict their attention to one or, at the most, a few species. The main cactus pests will be dealt with in order of importance and biological control agents will be mentioned for each species.

Tiger pear (Opuntia aurantiaca)is the major cactus pest in New South Wales. A species of cochineal (Dactylopius austrinus) causes considerable damage to this plant. Larvae of two moth species (Cactoblastis cactorum and Tucumania tapiacola) also damage tiger pear, but to a lesser extent than cochineal.

Although cochineal has been used to control tiger pear since the early 1930's little was known about its life history until recently. Females are soft-bodied, red sacks up to 6 mm in length, oval in shape and hidden by a white silky covering. The covering consists of a mass of white wax threads. Eggs laid under this cover hatch within a few hours and crawlers about 0.5 mm long emerge. Male offspring commonly complete their development under or near the silky cover. Female offspring behave differently, spreading over the plant or walking to the highest point on, or near, the plant. From these high points they are carried by the wind to new plants. Many crawlers die at this stage having failed to reach another tiger pear plant. Once on another plant, females find an appropriate point to insert their mouthparts, and then remain in the one position for the rest of their life. Males develop to the cocoon stage and then change into small winged adults. They seek out and fertilize the females before dying. Numbers of offspring produced are high, commonly over 1,000 per female, at temperatures between 25° and 30°C. This high reproductive rate is probably essential to ensure that at least some crawlers reach new plants. As cochineal relies on wind dispersal of crawlers for establishment of colonies in new areas, it is most destructive in dense tiger pear but is of little use in scattered infestations.

Research is currently aimed at determining areas where control of tiger pear by cochineal is feasible. The degree of control achieved has been found to vary with locality and year. Development of cochineal depends on temperature development occurring between 15° and 33°C. However, the time for development varies considerably between these temperatures. High temperatures result in rapid population increase, whereas the reverse is true at low temperatures (to reach the same stage in successive generations requires 110 days at 20°C and only 31 days at 32°C). This means that cochineal is more effective in the warmer regions of the State such as around Boggabilla, Moree and Gilgandra.

Dry conditions also assist in cochineal control of tiger pear. Under these conditions the cactus is less able to withstand attack by the insect; and the insect itself is less liable to damage from rain.

In the field, numbers of cochineal build up rapidly from late December to around April. The optimum time to spread these insects would be in November or December. In this way insects would be able to increase and cause considerable damage over the one summer and autumn period. This is important from the Prickly Pear Commission's point of view, as farmers are more willing to pay for immediate results than for long term benefits. Future research will be aimed at methods of obtaining large numbers of crawlers for release in November and December.

The second most important cactus in New South Wales is common pear, (Opuntia inermis). Cactoblastis cactorum controls this plant over most of the State but common pear is still a problem on ridges around the Hunter Valley and hilly country around Bylong and Hill End. Cactoblastis cactorum is not as effective in these areas, probably because of low temperatures. Another species of cochineal, Dactylopius opuntiae, also damages common pear. Although other insects have been released to control this cactus, non of them cause much damage.

Other cacti are less important but are still of some concern.

Velvety tree pear (Opuntia tomentosa) is a problem in northern New South Wales from Boggabilla to the coast. Insects cause little damage to mature plants. Small plants are often killed by Cactoblastis cactorum while Dactylopius opuntiae causes minor damage to plants.

Smooth tree pear (Opuntia monocantha) occurs along the New South Wales coast from Newcastle to the Queensland border. A third species of cochineal, Dactylopius ceylonicus, has recently been introduced to New South Wales for control of smooth tree pear. Hopefully this cochineal will prove to be as successful in New South Wales as it has been in Queensland. The latter State now relies on cochineal for the control of smooth tree pear. Cactoblastis cactorum has also been found feeding on smooth tree pear but it only causes minor damage.

Creeping pear (Opuntia compressa) is a problem around Singleton where the number of plants is gradually increasing. Cactoblastis cactorum causes a small amount of damage to this cactus. No other insects have been found on creeping pear in New South Wales.

Harrisia (Eriocereus martinii) is becoming a problem around Boggabilla. Insects have recently been introduced to Queensland for the control of this plants. The most promising species is Hypogeococcus festerianus, another sucking insect similar to cochineal.

Three other species of cactus are minor problems:-

(1). Indian Fig, (Opuntia ficus-indici) which can now be legally grown for its fruit. This plant is attacked by both Cactoblastis cactorum and Dactylopius opuntiae.

(2). Rope pear (Opuntia imbricata) which occurs in drier areas of northern New South Wales and is partially controlled by Dactylopius tomentosus.

(3). Opuntia lindheimeri which is a problem in the Araluen Valley east of Canberra and is attacked by Dactylopius opuntiae and Cactoblastis cactorum.

Advice on the most appropriate method of cactus control for any particular situation should be sought from offices of the Prickly-pear Destruction Commission. Head Office of the Commission is on the 3rd Floor, G.I.O. Building, 1 Fitzroy Street, Tamworth (P.O. Box 643, Telephone 067-661988 - office hours 8.30 a.m. - 4.30 p.m. Monday to Friday). Other offices are located in Sydney, Mudgee, Dubbo, Singleton, Scone, Bingara, Ashford, Moree and Mungindi. The best times to contact these are early on Mondays and late on Fridays, as staff are usually involved with control work at other times.

NOXIOUS PLANTS AND THE STATE RAIL AUTHORITY.

Alex McLennan,
Railway Agronomist,
State Rail Authority,
SYDNEY.

I have interpreted this to mean why vegetation controls are necessary in the State Rail Authority and how much importance the Authority places in noxious weed control.

The Authority requires its track area to be, where possible, vegetation free so that:-

* track is maintained in a safe and reliable condition,
* signal and points movement is unrestricted,
* clear vision at crossings for both train drivers and motorists,
* ease of movement on track by maintenance gangs, and
* firebreaks, and fire protection around bridges and buildings.

Railway agronomists face different constraints and our major efforts go into providing safe tracks.

Examining the control practices in our Rights of Way (R.O.W.) we require:-

* scrub height to be reduced, by cutting;
* vegetation buildup - reduced by burning (Rail Act); and
* that noxious weeds in major economic areas be contained.

Because of the variety of topography and terrain throughout our track lengths, it is necessary for the Authority to aim for achieving an acceptable level or standard of vegetation management at the least possible $ dollar cost per hectare or kilometre.

The term "Acceptable Standard"

In every case "acceptable" weed control will refer to a particular situation and/or economics, such as:

* track 95 per cent weed free,
* wheat crop free of weed competition, or
* blackberry eradication - Shire declaration.

Our R.O.W. are not used for agriculture - rather they are used to:-

* to stabilize the track bed,
* cut run off,
* control erosion, and
* provide access for maintenance.

Any vegetation cover is accepted as part of the eco-system at that particular location. We consider the eco-system as a whole and not necessarily reduced into acceptable or unacceptable species.

There has been a tendency for the land owner and some semi-Government people to say that all our weeds come from the railways. Eco-systems tend to balance themselves; rapid build-up of any one plant species is unlikely and therefore all undesirable plants do not come from Railway land.

However there are several noxious weeds within our R.O.W. If we examine the weed surveys of our line conducted by Field Officers "Weeds" of the department, it is interesting to note the trends and low percentage of infestation.

Control

In general we control noxious weeds by using our tractor spray units or T.I.C./Trolley Spray Units. Unfortunately there are not enough of these to cover all areas.

We also contract local Shires or Councils to control specific programmes. This works well for a major control campaign such as Johnson Grass.

We also contract independant operators for 2 or 3 years to control noxious weeds.

We do, within the limits of our man power resources, equipment and funds, try to control our noxious weeds.

Closer co-operation has developed between our Divisional operation and personnel over the last few years. There will probably always be misunderstandings when there are, please let us hear about them and by discussing and acting maybe we can achieve the ultimate goal of not have a plant out of place.

ERADICATING JOHNSON GRASS IN THE NARROMINE SHIRE

L. Clark,
Chairman,
Narromine Johnson Grass
Eradication Advisory Committee.

The following is a summary of the attempt to control Johnson Grass (Sorghum halepense) in the Narromine Shire.

1. The effective weed control programme over many years by the Narromine Shire Council.

2. Opening up of vast areas in the Macquarie Valley to irrigation following completion of Burrendong Dam.

3. Infancy of Hybrid Sorghum Seed production in the Valley.

4. Rapid spread of Johnson grass throughout the entire water-shed and the threat posed.

5. The urgent and immediate need to eradicate Johnson grass firstly in our shire where the vast majority of irrigation schemes lie.

6. To publicize in all ways possible and co-ordinate all private, public and governmental bodies firstly to the menace facing us and then to take positive action in eradicating all established plants and maintaining constant vigilance and eradication of emerging seedling plants from dormant seed.

7. By such co-ordination to obtain the greatest possible results from grant monies received as the emphasis moves from one location to another.

Members: Narromine Johnson Grass Eradication Advisory Committee comprise:

Shire representatives, Department of Agriculture, Department of Main Roads, State Rail Authority, Chemical Advisors, Shire Weeds Officers, Dubbo Pastures Protection Board, Managers of three (3) large irrigation schemes, Yates, Pacific and Pioneer Seed Companies and a farmers representative.

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