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THIRD BIENNIAL NOXIOUS PLANTS CONFERENCE

Integrated Weed Control in the 80's and 90's

Australian National University,
Canberra, May 6–10, 1985.
Conducted by
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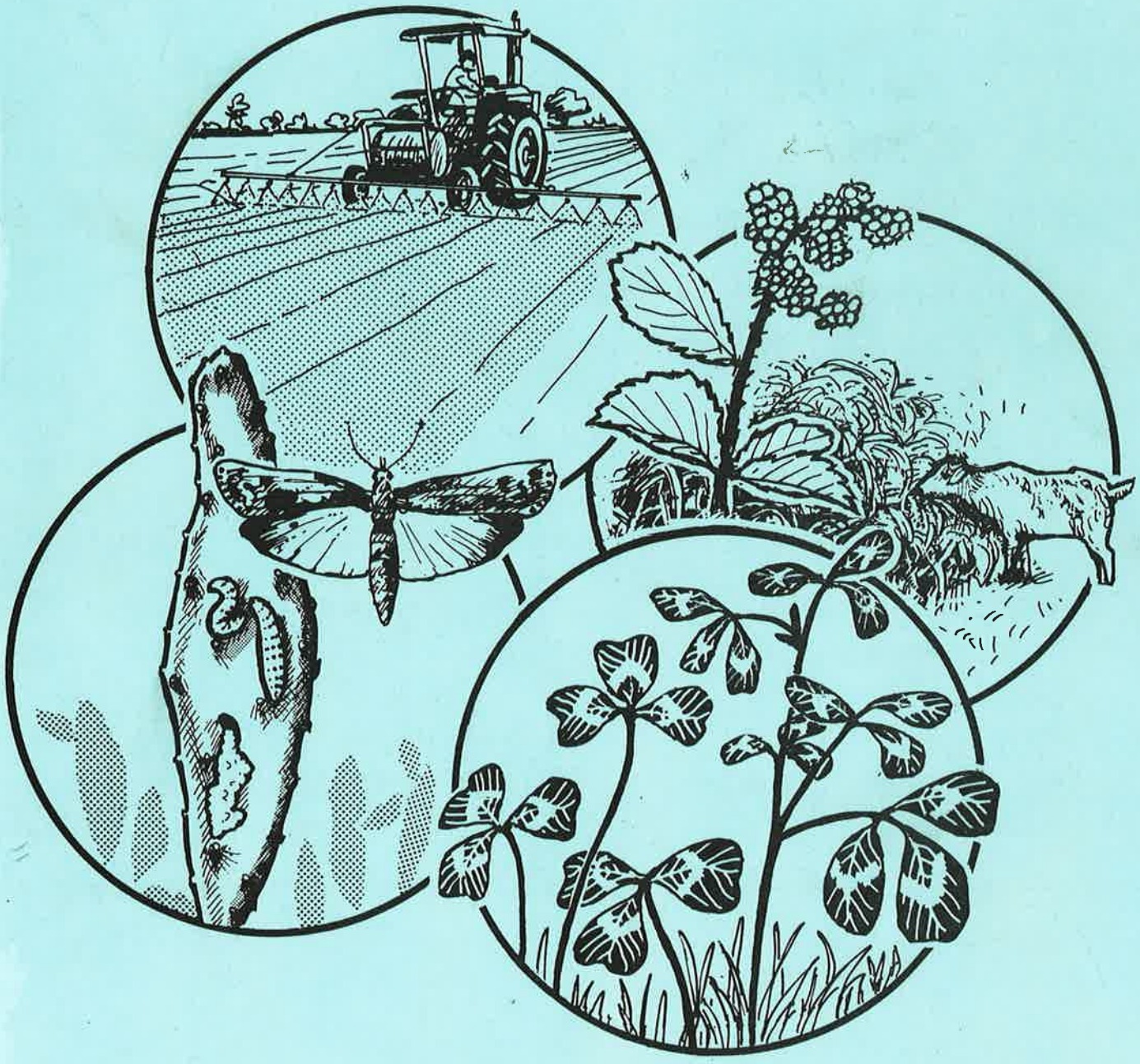

Department of Agriculture New South Wales

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USING "PLANTS OF WESTERN NEW SOUTH WALES"

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CONDOBOLIN

Introduction

The book is arranged in families according to an accepted evolutionary sequence. (The book follows the same order as used by the NSW National Herbarium). Classification is based largely on flower structure. There are four main groups of plants; the ferns, the pines, the monocots and the dicots, and each group consists of several families.

Each family has certain common characteristics which distinguish it from other families. Within each family, plants are further grouped into genera and species on the basis of other distinguishing but less important characteristics. Often it is sufficient only to identify a plant down to generic level as it involves detailed examination to get to species level.

In this book plants contained in each family are listed in alphabetical order of genera and species except where families are large and it has been more convenient to group similar looking plants together, eg. Asteraceae and Myrtaceae.

As the book relies heavily on photos for plant identification the photos which have been selected show the important traits of the family or genus and are not necessarily the prettiest photo. Sometimes the photos show typical plant habit or form rather than detailed taxonomic detail as it is this which often makes field identification easy. Where possible scales have been included in the photos so that the size perspective is not lost.

To be able to quickly recognise plants from the book a knowledge of plant family characteristics is of definite advantage. Unfortunately this knowledge comes from continual use and familiarization with plants or from an educational background in botany. From a personal standing it may take several years of plant collecting and identification to acquire this knowledge. However, it should not be too difficult for someone to identify a plant from the photos contained in the book if they start with a suitable sample of the plant in question. Generally the specimen selected for identification should contain flowers, fruit and leaves.

The following guide very briefly lists the main characteristics of some of the larger and more important plant families. The gradual change in characteristics which occurs from one family to the next can be seen from this summary.

A GUIDE ON HOW TO USE "PLANTS OF WESTERN NSW"

Partitioning of the Book

There are four main groups of plants. These are:

(i) the Ferns (pp.27-34), 19 species.
(ii) the Pines pp.35-36), 4 species.
(iii) the Monocots (grasses, sedges and lilies (pp.37-206), 474 species and
(iv) the Dicots (broad-leaved plants) (pp.207-728), about 1500 species.

The Ferns:

Members of this group are very characteristic in plant form and habitat preference. They usually only occur in sheltered situation and their fronds make them easy to identify. One exception is mulga fern which is widespread in habitat requirement but easily recognisable by plant form.

The Pines:

Again these are easy to sort out on habitat preference and shape and structure of the cones. There are only 4 species or subspecies.

The Monocots:

This group of plants can be fairly easily distinguished from the bigger group of dicots which follow. They include many (but not all) of the waterweeds, the grasses, sedges and rushes, lilies and orchids. All groups in this section tend to have long narrow leaves. The grasses, sedges and rushes split off reasonablhy well as the don't have showy flowers.

The grasses are best keyed out by using the information on page 47-48 of the book. The grasses mostly have 1 large leaf (flag) immediately below the flowerhead and nodes along the round stem. Sedges and rushes on the other hand don't have a flag leaf and stems are triangular or round and without nodes.

The lily-like families have long narrow leaves and the flowers consist of 6 parts, 3 outer petals and 3 true petals.

The orchids are uncommon and the peculiar structure of the flower usually sorts them out easily.

The Dicots:

This is by far the largest group and it is very difficult to give a simple key on how to identify any plant from this group. The 10 largest families in this grtoup account for 900+ of the 1500 species, so if the main characteristics of these families are known it reduces the pains for identifying the remainder.

The ten main families are Asteraceae (265), Chenopodiaceae (146), Fabaceae (146), Mimosaceae (80), Brassicaceae (56), Myrtaceae (56), Malvaceae (44), Solanaceae (44), Euphorbiaceae (39), Goodeniaceae (28).

Some of the main characteristics of the different families are given in order of presentation.

CASUARINACEAE (pp.207-9) (*she-oaks and belah*)	-	trees with long round "leaves", woody fruits.
PROTEACEAE (pp.211-218) (*needlewoods, spiderflowers*)	-	trees and shrubs with "spider flowers"
	-	fruits pointed, often woody capsule which split open at maturity.
LORANTHACEAE (pp.218-224) (*mistletoes*)	-	parasites on other trees.
CHENOPODIACEAE (pp.236-289) (*saltbushes, copperburrs and bluebush*)	-	sub-scrub & forbs (often semi-succulent)
	-	leaves flat or round, scaly or silky hairy.
	-	fruit bracts important for identification.

Allied families include POLYGONACEAE, AIZOACEAE, PORTULACEAE.

AMARANTHACEAE (pp.281-289) (*lamb tails, khaki weed*)	-	forbs, the flowers papery and clusters, often brightly coloured forming dense heads at the end of the stems.
BRASSICACEAE (pp.316-336)	-	forbs
(*mustards, cresses, lepidiuims*)		-yellow to white flowers with 4 even petals in opposite pairs.
	-	fruits a pod, either flat or round with a beak.
MIMOSACEAE (pp.346-376) (*wattles*)	-	trees or shrubs
	-	flowers mostly globular heads, or sometimes cylindrical spikes.
	-	fruits flat or round pods.
	-	leaves reduced to phyllodes.

CAESALPINACEAE (pp.377-383) (*cassias or punty bushes*)	-	shrubs often with divided leaves
	-	flowers yellow with 5 overlapping petals.
	-	fruit flat pod.
FABACEAE (pp.383-430) (*medics, legumes*)	-	mainly forbs, sometimes shrubs or
	-	pea flowers
	-	fruit a pod
GERANIACEAE, OXALIDACEAE, LINACEAE, ZYGOPHYLLACEAE, RUTACEAE SIMAROUBACEAE and MELIACEAE (pp.431-450)		
	-	flowers usually bright coloured with 5 large non-overlapping petals.
EUPHORBIACEAE (pp.452-465) (*spurges, castor oil plant*)	-	shrubs or forbs, often with a milky sap.
	-	flowers small
	-	fruit often a 3 part capsule.
SAPINDACEAE (468-474) (*hopbushes*)	-	shrubs
	-	leaf shape (pg.471) and fruit important
MALVACEAE (pp. 478-492) (*sidas, chinese-lanterns*)	-	shrubs and forbs
	-	large colourful flowers with 5 overlapping petals
	-	fruits of several segments joined around a central axis
MYRTACEAE (pp.510-533) (*eucalypts and bottlebush*)	-	trees or shrubs
	-	undivided thick aromatic leaves
	-	fruit a capsule
APIACEAE (pp.539-545) (*carrot weed*)	-	mostly forbs with divided leaves
	-	flowers small, 5-petalled and clustered in umbels
CONVOLVULACEAE (pp.555-560) (*bindweed, morning glory*)	-	twiners or forbs
	-	large trumpet-shaped flowers

BORAGINACEAE (pp.560-568) (*Paterson's curse, heliotrope, fiddlenecks*)	-	rough-hairy forbs
	-	flowers in curled, caterpillar-like structure
	-	small fruits
VERBENACEAE & LAMIACEAE (pp.568-581) (*verbenas and mintbushes*)	-	forbs or shrubs with opposite leaf pairs, the stems often squarish
	-	flowers tubular with expanded lips
	-	fruits small
SOLANACEAE (pp.581-596) (*thornapples, nightshades and boxthorns*)	-	forbs & shrubs, sometimes with prickles
	-	flowers in short or long tubes expanding into 5 lobes (purple or yellow or white)
	-	fruit a berry
MYOPORACEAE (pp.606-616) (*fuchsia-bushes*)	-	shrubs with undivided leaves
	-	flowers tubular with expanded lobes, the lower one often recurved, brightly coloured
	-	fruit a dry berry
CUCURBITACEAE (pp.624-626) (*paddy melons*)	-	vines with melon fruit
GOODENIACEAE (pp.;630-639) (*fan-flowers and goodenias*)	-	forbs or sometimes shrubs
	-	flowers tubular expanding into 2 upper lobes and 3 lower lobes, commonly yellow or blue
ASTERACEAE (pp.640-728) (*daisies and thistles*)	-	forbs or shrubs
	-	flowers often brightly coloured
	-	fruit often with feathery bristles

LAND CATEGORISATION AND NOXIOUS WEEDS

Michael Henry Potter
Health & Building Surveyor
Tumbarumba Shire Council

Since 1981, Council's officers responsible for noxious weed control have been assessing the results so far obtained through previous weeds programmes. The ending of the drought and the following apparent proliferation of weeds gave some cause for concern and much disappointment. Weeds were everywhere, and worst still, in areas which for some time had been considered to be weed free.

Many reasons were put forward to account for this occurrence; some blamed travelling stock, some blamed contaminated hay, some agisted stock, and some the lack of competition from pasture grasses and clovers which in normal years gave some degree of protection.

Until this year, 1984, Council's policy had been directed primarily to controlling weeds on Council owned and managed lands, it being the precept to clean up Council's own backyard before looking too closely at the backyard of others.

Weed control cannot in all honesty, be seen in this light. Privately owned, Council owned and Government owned land are not separate entities which can be handled individually and at different times. They must be considered in total, as the infestation of one inevitablhy leads to the infestation of the others.

All engaged upon the control of noxious weeds are aware of the vast differences in views amongst County Councils, farmers and land owners when it comes to weed control. Views vary from those who appear to have an obsession to keep weeds out, to those who are content to sit back and watch them grow, the latter types then throwing up their hands at what has developed into a major problem both for themselves and for their neighbours.

To tackle infestations when they first appear, must be the prime objective of any weeds programme. This must, in my view, be the first objective.

Some weeds are present in the Tumbarumba Shire in much lesser degrees than others. The concentration of control measures on the big four: Patterson's Curse, St John's Wort, Blackberry and Sweet Briar; made it possible for those weeds present in lesser proportions to become far more prevalent and to become quite well established. Good examples can be seen in the presence of Hemlock, Tree-of-Heaven, some of the thistles, Bathurst Burr, and Horehound. Do not get the impression that Council's efforts had been wasted or that they were ineffective. On the contrary, many of Council's roads and reserves have seen marked improvements. Do not now come to Tumbarumba Shire to pick blackberries on the roads for you will surely be disappointed.

Out of a combination of maintaining weed free land in that state, in directing control measures against the less common weeds first, and the ever more strident demand to expend moneys in the most beneficial way, arose the demand that a true picture of weed types and weed infestation patterns within the shire should be obtained and that this information should be recorded accurately and in a manner easily viewed and understood.

Parish maps were deemed to be the most appropriate vehicle for recording results and land categorisation, portion by portion.

Land categorisation then, is a means by which the degree of weed infestation can be summarised. In the Tumbarumba Shire we have six (6) land categories ranging in degree from weed-free land (Category A) to land having heavy infestations amounting to 50-100% coverage (Category F).

Since its introduction it has been seen that land categorisation can have a further major role to play in noxious weed control. Its further application in general purpose Councils is readily seen.

All Councils are requested to issue 149 Certificates. These certificates request information about the zoning of the land, whether any outstanding moneys are owed on the land, and whether any outstanding notices are applicable to the land. In fact, some solicitors are seeking information relating specifically to noxious weeds and it is here that land categorisation can be usefully used. It always seems to happen that, when asked, the piece of land being sold is not subject to any notice as either you have not yet issued it or got around to inspecting it. It would be of benefit to all if in answer to any such enquiries the land category accorded to that parcel or parcels could be shown on the certificate. If categorisation had state wide application and significance, then future owners would be more aware of the problems. Sellers may be encouraged to undertake effective control measures to lift the land category. This then may reflect in the selling price.

Land categorisation could also be the basis on which infested land could be quarantined and/or its use restricted so that its produce will not be responsible for the further spread of weeds to new areas.

The updating of parish maps to accurately reflect ownership is of prime importance in recording inspection results. The continuance of updating the maps by recording all approved subdivisions and Notices of Transfers should result, in the long run, in more accurate information, which is vital when formulating programmes and issuing notices. The use of overlays is imperative as this will result in the parish maps themselves remaining uncluttered and usable by other Departments.

Council was fortunate in obtaining the services of a trainee draughtsman through one of the community employment programmes for the purpose of doing this section of the work. This has freed Council's noxious weed staff for inspections and for its own weeds control programme.

Under present circumstances a three year period will be required to complete the categorisation of all lands within the Shire.

The objective of all future weed control programmes undertaken by Council will be simply to improve the land category of all Council, private and government lands within the Shire. If Council can achieve this, then all the effort will be worthwhile.

Prior to adopting the principles of land categorisation, a copy of the proposal was sent to all local farmer organisations and all government departments for comment. A favourable response was forthcoming from all bodies.

STANDARDISED PROPERTY INSPECTION FORMS

By L.W. Smith, P.A. (Weeds), Department of Agriculture
K. Waters, Chief Weeds Officer, NETCC, Armidale

In the Noxious Plants Control Manual (1982) it was suggested that a standardised 'Property Inspection Report' form should be used by Councils for property inspections and a sample of a completed form was illustrated.

I wonder how many Councils in the state now use a standardised form?

It would be advantageous if details on the Property Inspection Report forms could be tied to property records in the Land Titles Office. This would enable computer records to be maintained on all properties in the State at one central office. It would also allow access to data such as the extent of weed infestations in the State which would be available at the touch of a button. This would enable more meaningful submissions to be made for more funds for noxious plant control as well as being able to follow the success or otherwise of special control programmes.

A suggested simplified standardised Property Inspection Report form is illustrated (Figure 1). It is suggested that the form should be filled out in quadriplicate with, the original handed to the occupier, the second copy placed in Council files, the fourth copy retained by the Weeds Officer and the third copy sent to the Noxious Plants Advisory Committee in Sydney for recording in the Land Titles Office.

So that a more uniform classification of the density of the noxious plants on the property can be obtained it is suggested that the density be divided into four classes as follows.

Class I - over 20%
Class II - 6% - 20%
Class III - 0 - 6%
Class IV - not present

Weeds officers should carry diagramatic representation of illustrations of the extent of the three classes of density when making inspections for noxious plants so that uniformity in reporting is obtained.

A method for doing this will be discussed.

Figure 1 - Standardised Property Inspection Forms

Report No. ..... Address:

Phone:

PROPERTY INSPECTION REPORT: Date of Inspection: _____

Valuation No: _____ Shire: _____

Property Name: _____ Area: _____

Owners Name: _____

Address: _____

Name of Occupier/Manager: _____

Address: _____

Owner in Possession of Property ..... years.

Residential/Suburban/Grazing/Mixed Farming:

Noxious Plant	Density	Control

Inspector's Comment:

_____

_____

_____

_____

_____

Inspector's Signature

For Office Use:

County: _____
Parish: _____
Port Nos: _____

_____

Previous Inspections & Notice Numbers:
Further Recommendations/Comments:

_____

_____

_____

_____

LEGISLATION AND NOXIOUS PLANT MANAGEMENT

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Department of Agriculture

1. Introduction

Too often, weed control activities in the past have been random in nature and narrow in perspective, relying on traditional control procedures, rather than a series of measures planned on a continuing basis to meet the specific needs of the situation.

Organisations and individuals may mount a massive attack on a specific weed problem without the organized planning that would define responsibilities and goals, draw on the latest advances and knowledge in weed science, combine specific activities, and ensure resolving the problem by efficient means.

To be effective, a planned programme of noxious plant management must be applied in an orderly fashion and subjected to constant reappraisal and modification. The primary goal of any weed management strategy is to maintain an environment that is detrimental to the weeds through the successful establishment of specific or combined ecological, cultural, mechanical, biological or herbicide methods.

However, the eliminaltion of one week species by certain weed control practices can often result in the increase of another, instead of the growth of desirable species. If weeds are destroyed or controlled they must be replaced by desirable species and the area managed to discourage regrowth of new or the old weeds.

Today when we speak of noxious plant management we mean the whole gamit of operations involving the planning, destruction, replacement and long term management of noxious plants.

2. Aims and Objectives of Legislation

Noxious plant management needs a sound legislative base to operate from. The Noxious Plants Advisory Committee has recently carried out a review of the present legislation and has made a submission to the Minister for Local Government. The review at this time is still being considered by Mr. Stewart but if accepted there will be some major changes in the administration and operation of noxious plant control in New South Wales.

In carrying out the review the Committee established the following aims and objectives of legislation.

(a) Aims of the Legislation

(i) to protect from degradation by noxious plants, land and the environment and to restore land which has become degraded by noxious plants;

(ii) to allow for the development of a system of noxious plant control (administrative and operational) which is both effective and economical.

(b) The main objectives of the legislation should be:

(i) that the "owner" or "occupier" of the land be responsible for controlling noxious plants and the penalties under the Act for non compliance. This should include private landholders, councils, government departments and other authorities;

(ii) that effective coordination of noxious plant control activities on a state, regional and local level is possible;

(iii) that control programmes be based on watershed or catchment areas rather than Shire boundaries or such other area basis that allows effective noxious plant control;

(iv) that persons ("authorized officers") with appropriate training and/or experience, be responsible for inspecting lands for noxious plants;

(v) that flexible preplanned programmes at a state, regional and local level be able to be developed for control and management of noxious plants and the main thrust of these programmes should be concerned with land and environment protection;

(vi) that planning at the local level allows for the proper consideration of all factors likely to influence noxious plant control activities and to include the recording and monitoring of all infestations as well as the coordination of the activities involved;

(vii) that all proclaimed plants (noxious plants) be reviewed at set periods of time (3 to 4 years);

(viii) that there is a need to be flexible in the declaration of plants and for the term "noxious plant" to encompass weeds of all environments i.e. both urban and rural communities, agricultural and non-agricultural situations as well as parklands, recreational areas and forests and to include prickly pears;

(ix) that the strategies developed for management of noxious plants should be flexible to allow emphasis on "control" and "containment" rather than "eradication";

(x) that effective and realistic regulations be able to be developed to enforce control of noxious plants;

(xi) that the penalties for non compliance are reasonable and able to be readily updated;

(xii) that effective action can be taken against pesons or bodies who do not comply with the Act;

(xiii) that the Act bind the Crown.

3. Noxious Plants

It is also necessary to have defined under legislation some concept of what is meant by a noxious plant. The present concept in New South Wales of a "noxious plant" as a plant which is mainly of agricultural significance and legally requiring action to eradicate all those so declared is unrealistic in today's society and community attitudes.

Presently there are 23 plants declared noxious on a statewide basis in New South Wales and over 50 for part of the State. For many of these plants the legal requirement is not currently being fulfilled.

Western Australia, Victoria and South Australia have now recognized the need for categories of noxious plants and South Australia have instigated a special category which has been designated as Community Pest Plants.

There is a need for weeds of urban areas, reserves and parks to be included in the legislation and for the plants to be classified or categorized into groups or schedules for ease of prescribing action to be taken.

4. Objectives of Noxious Plant Management

For any legislation the objectives of the control or management of noxious plants must be clearly defined. The following objectives are suggested as being necessary for control programmes.

(a) to prevent the introduction of plants which are considered to pose a serious threat to agriculture, non-agricultural land or the community and environment as a whole (prevention of entry);

(b) to destroy plants which pose a serious threat before they become established (eradication);

(c) to prevent the spread to other areas of plants which pose a serious threat, once they have become established in an area (containment/control) and where eradication is impractical;

(d) to control or manage those noxious plants which are widespread or established in an area (control or management).

5. Proposed Categorization of Noxious Plants

To achieve the aims and objectives of noxious plant legislation it is apparent that various categories for noxious plants are necessary with different requirements for the type of control required for each category. The following categories are proposed by the Noxious Plants Advisory Committee as being necessary to achieve the objectives.

(i) Prohibited and Restricted Plants

Plants known to cause major problems and which are of very limited distribution, or do not occur in the State or are proclaimed under the Poisons Act as drug plants. Areas of any infestation that occur are small enough for eradication or destruction to be achieved.

Eradication or destruction is required wherever those plants occur and the cost is to be borne by the Government.

(ii) Priority Plants

Plants posing a major threat to both agriculture and the environment, including plants which are present in part of the State only and which have the potential to spread to other areas or which are of such significance as noxious plants as to be given a high priority. Destruction should be the aim for areas where infestations are small, otherwise control or containment should be able to be achieved.

The cost of control on private lands is met by the landholder or occupier of the land. Govermnent grants are available to assist Councils control infestations occurring on vacant Crown Lands and Council lands.

(iii) Pest Plants of Agricultural and Forest Lands (Plants causing major economic loss to agriculture and forestry).

Plants which are well established in an area and eradication or destruction is not possible. Control measures (to prevent propagation and spread of the weed) are enforced where the weed is a threat to adjoining clean areas or is likely to spread through contamination of agricultural produce, livestock and equipment.

The cost of control is met by the landholder or occupier of the land. Government grants are available to assist Councils to control infestations on vacant Crown lands and Council lands.

(iv) Pest Plants of Urban, Recreational and Park Lands

Plants which adversely affect or are detrimenal to non-agricultural areas, the environment or the community in some way and for which effective control measures are available at reasonable cost.

The cost of control is met by the occupier of the land or community in which the plants occur, including the Council. Only in exceptional circumstances would government funding be available to assist Councils.

6. Programme Planning and Noxious Plant Management

The protection of all lands from invasion by weeds, especially noxious weeds, and the clearing of lands already infested should be a major aim of any land protection policy and noxious plant legislation. The proper planning of activities which are aimed at achieving the protection of land from invasion by noxious plants and clearing of existing infestations is essential.

With the restrictions on State Government allocations towards noxious plant control, it is becoming more evident and necessary for local government authorities to justify each dollar being spent and that it is being spent to its top value. In the past, the implementation of noxious plant legislation has been a haphazard affair, mainly due to the lack of a sound noxious plant policy and programme plan by local government authorities.

It is suggested that the development of "Noxious Plant Control Plans" by local councils for their areas as well as the development of statewide and regional policies of noxious plant control is suggested as a way of implementing more planning into noxious plant control activities in the State.

This would also complement the Department of Agriculture's policy on the protection of agricultural land as well as the conserving of natural resources and other lands by the State to maintain their long term productive capacity for the community as a whole.

Over the past two years, councils in the State have been encouraged by the Noxious Plants Advisory Committee and the Noxious Plants Advisory Officers, with the assistance of District Agronomists, to draw up and implement planned noxious plant programmes within their respective councils.

The first step suggested in these programmes is to map the worst noxious plants within each local government area so that you know where action has to be taken.

It should be mentioned that several councils already have established the basis for the type of plan envisaged in their "Noxious Plant Policy Statement" which is circulated to ratepayers. The adoption of Noxious Plant Control Plans is seen as an extension of this idea. Also councils are already familiar with the Development Control Plan concept in the Environmental Planning and Assessment Act and thus have the basis for the planning concept.

AGRICULTURAL PROTECTION

A nationally accredited vocational course offered
by correspondence through the
Riverina Murray Institute of Higher Education

R.J. Banyer,
Senior Lecturer Plant Protection
Riverina Murray Institute
of Higher Education,
WAGGA WAGGA

J.H. Kent,
Lecturer Plant Production,
Riverina Murray Institute
of Higher Education,
WAGGA WAGGA

1. The Course

Agricultural Protection is an Associate Diploma course offered by the external study mode. It normally takes four years of part-time study to complete.

It was designed principally to train people already employed in any of the agricultural regulatory areas but caters also for those with interests in applied areas of plant and animal protection.

2. Course Origin and Development

The need for the course was perceived as early as the mid 1970's during a time when the School of Agriculture of Riverina College of Advanced Education was examining the needs of various sectors of agriculture for formal training.

Early investigations soon identified a potential area amongst the horticultural inspectors and their equivalents in the various State Departments of Agriculture. Although collectively they represented a sizeable number of potential students, there was doubt whether the continuing demand would be sufficient to sustain a viable course.

The need for a highly vocational course was never in doubt, nevertheless one of the early objectives was to develop a broadly based curriculum without losing sight of the major thrust of the programme which was to train people for the agricultural regulatory areas.

Thus, with the concurrence and encouragement of the major employers, viz. Commonwealth Department of Health (Plant and Animal Quarantine Branches), State Departments of Agriculture N.S.W., Victoria, S.A., Tasmania and N.T.) and Pasture Protection Boards N.S.W., the course was broadened to include aspects of animal protection.

Somewhat fortuitously, about the same time there was a growing acceptance and some moves towards combining the plant and animal regulatory services in the various State Departments into an integrated agricultural quarantine/protection service.

This was an important development in so far as it facilitated the offer of a common course to all students and avoided the otherwise costly and possibly prohibitive alternative of offering two major strands covering te plant and the animal protection areas.

The broadened structure conveyed the obvious advantage of having people trained in both plant and animal protection which would enhance their adaptability in the job role and importantly open up further employment prospects.

The descriptive title of the course presented some difficulties.

The alternative title considered, "Agricultural Quarantine", reflected most faithfully the major thrust of the course but it was too narrow in perspective, particularly as there were other areas of potential student interest viz. employment in the agro/veterinary chemical companies and those concerned with weed control either in association with Local Councils or with State Departments of Agriculture.

There was also the need to consider the important question of student acceptance of the title.

Finally, the name "Agricultural Protection" was decided on which caused some concern to the Livestock and Grain Producers Association because of its connotation of trade tariffs and barriers.

The title however gave the scope to broaden the course perhaps even further by appropriate subject electives in response to established demands but still confined within the broad boundaries of plant and animal protection.

3. Philosophy behind the Course

The importance of agriculture to the Australian economy is undisputed. Equally recognised is the devastating effect that pests and diseases can have on our various animal and plant production enterprises.

Australia holds a unique position in the world by its relative freedom from the world's most dangerous pests and diseases and it is imperative in terms of both exports and the domestic market that this position be maintained.

The various plant and animal (agricultural) protection services need a well trained and knowledgeable front-line workforce to effectively carry out legislation designed to protect Australia's agriculture against the introduction of exotics, and to effect control measures and limit the spread of the more important pests and diseases already present.

This course is designed to provide such a training and qualifications which give due professional recognition to those charged with the responsbility of carrying out such important duties.

The course philosophy still reflects a decided emphasis on regulatory agriculture but in the light of a certain lack of employer incentives and possibly a diminishing number of regulatory personnel seeking admission, there may need to be a rethink of the major objectives in the future.

Equal emphasis is now being given in course publicity to attracting students seeking employment in the regulatory and allied areas as to those already employed in these areas.

4. Current Situation

4.1 Student Profile

There are 20 students entering the third year of the programme, 20 entering their second year and it is anticipated that there will be a new intake of 30 students for 1985.

Ordinary admission to the course is the N.S.W. Higher School Certificate or its equivalent and Special Admission permits mature-age (over 21) entry.

The majority of students fall under the mature-age category, with some younger persons possessing the H.S.C. and a few possessing post-secondary qualifications.

It is not surprising therefore that collectively, students represent quite a heterogeneous group with ages varying from 23 to 55. Occupations also vary considerably, for example there are agrochemical representatives, a school teacher, Field Assistants, plant and animal (agricultural) quarantine officers, animal health officers, Rangers and Rabbit Inspectors (N.S.W. P.P.B.), Farm Produce/Grain Inspectors, Weeds Officers (Local Councils and State Departments) and Tick and Brucellosis Inspectors.

States represented are N.S.W., Vic., S.A., Tas., Queensland and the A.C.T.

4.2 Student Performance

Those persisting with a view to completing the course are coping satisfactorily irrespective of their varied educational and experience backgrounds.

There have been no outright failures in the course, the attrition rate being attributed to voluntary withdrawal for a variety of reasons, which are the subject of further

evaluation.

4.3 Interaction with Industry

As with any new course some early problems have been experienced. To assist in solving these problems and to ensure continued significant industry input a Course Advisory Committee has been established. Four industry representatives drawn from the Victorian Department of Agriculture, the N.S.W. Department of Agriculture and the Commonwealth Department of Health currently comprise the Course Advisory Committee.

Of considerable significance is the fact that senior industry personnel have been contracted to write material for a number of specialised subjects. Industry association of this type will be continued when updating of material is required.

Apart from maintaining close industry contact by visitations, there is a keen desire to participate directly in some appropriate area of industry activity - consideration has been given for example to performing some plant quarantine function at the College, and the possibility of suitable research activities is also under consideration.

5. The Future

With appropriate and vigorous course promotion, it will be possible to continue to attract viable numbers over the next few years with probably a shifting emphasis towards those seeking qualifications for future employment.

It is of considerable regret, bearing in mind the philosophy behind the course, that there has not yet been changes in existing awards which would provide progression and promotion incentives for those already employed in the regulatory areas to undertake the course.

It is to be hoped that continuing endeavours in this direction at the "grass-roots" level will eventually 'bear fruit' and that graduates of thecourse will have a significant role to play.

THE PLACE FOR USTILAN IN NOXIOUS WEED CONTROL

Ken Russell
Research & Development Officer
Bayer Australia Limited

Controlling noxious weeds is in essence a seek and destroy mission.

Both aspects of the operation are repetitive because control measures often adopted do little if anything to alter the environment which allowed the noxious plant to establish in the first place.

Furthermore there can be a reservoir of seed in the soil waiting for suitable seasonal conditions to germinate and perpetuate the species - and the problem.

Sometimes control measures are only partially effective. One reason for this is the technological shortcomings of the available control measures. Are we still looking for more effective methods of controlling blackberry?

Methods Used

Noxious weed control is concerned with killing growing plants rather than preventing their establishment. Thus where herbicides are used, it is a necessity that they have post-emergence capability. However, such herbicides, without added pre-emergence capability, can only be a short term solution to noxious weed control problems in places where the weed is known to have seeded and nothing is done to change the environment sufficiently to prevent that seed germinating and perpetuating the problem.

Where the infestation occurs in cropping paddocks, repeated application of a post-emergence herbicide which has no residual pre-emergence capability to control successive germinations, is the only control strategy. Such a situation occurs where there are Bathurst and Noogoora burrs in river country, now used for cotton growing after previously being used for grazing.

However there are situations where the land usage imposes no such restrictions on the choice of herbicide and selective noxious weed control is not mandatory.

In these situations a herbicide with not only post-emergence capability but added pre-emergence capability becomes an acceptable alternative. There is the advantage that one application will not only kill established plants but in addition any which reappear after establishing from seed already present in the soil at the time of treatment.

A herbicide with this capability is Ustilan.

Properties of Ustilan

* Chemical and Toxicological

Ethidimuron, the active constituent, is a substituted urea herbicide developed by Bayer AG. The chemical name of the compound is 3-(5-ethylsulphonyl-1, 3,-4-thiadiazol-2-yl)-1, 3-dimethytl urea.

Ethidimuron is soluble to the extent of 3000 ppm in water. It is not hydrolysed in buffer solutions - pH4.7 and pH9 at 30°C and 50°C after 30 days.

Ethidimuron has a favourable toxicological profile. The acute oral LD50 for male and female rats is 5000 mg kg^{-1}, the acute dermal LD50 for male rats is 5000 mg kg^{-1}, and it is not a skin irritant, and not mutagenic. It is exempt from the provisions of the uniform poisons standard and, therefore, may be classified as safe.

* Biological

The active ingredient is absorbed mainly through plant roots and is transported in the transpiration stream to aerial parts.

Ethidimuron is a photosynthetic inhibitor. Its speed of action depends on its movement to the root zone, which in turn depends largely on rainfall.

* Formulations Available

Ustilan 700 WP	-	for mixing in water and spraying.
Ustilan 150 G	-	a granular formulation for distribution by a mechanised granule applicator.
Ustilan 50 G	-	a granular formulation for hand or shaker pack application to small areas or isolated patches.

Performance of Ustilan

Ustilan has been found highly effective for controlling many annuals declared noxious, for instance annual thistles - saffron, star, St. Barnaby's and spear thistle. It kills not only established plants but those which attempt to establish from seed one, two or more years later. Ustilan will do the same where there is Paterson's Curse - indeed even some perennials, such as skeleton weed and St. Johns Wort, provided it is given time to reach the root zone.

Some species of established noxious weeds, such as Johnson grass are more effectiverly controlled with other herbicides, such as Roundup.

Where such weeds are a problem and a post-emergence herbicide such as Roundup is used, the environment is not sufficiently changed to prevent re-establishment of the species from seed. In such situations expected re-establishment can be prevented by using Ustilan after established plants are killed and before or shortly after there is a new germination of the species.

This strategy has worked well in Southern Queensland where Ustilan has been used in autumn or winter to prevent Johnson grass re-establishing from seed after an application of Roundup at the appropriate time in summer. This type of approach applies no matter what species constitute the weed problem. Experience with Ustilan since its commercial introduction in late 1970 has shown that it will prevent any species of plant colonising from seed provided there is a residue of Ustilan in the soil.

Such broad spectrum activity makes it highly suitable for both treatment of many kinds of established weeds and prevention of weed growth from seed of any species. Once in the root zone it is non-selective. These properties make Ustilan useful in many situations, and potentially suitable for many different species of weeds.

An interesting example of this is the now proven suitability of Ustilan for controlling Alligator weed. Tests begun near Raymond Terrace in November 1981 showed that a roadside infestation can be eradicated by spraying once with Ustilan 700 WP - 15 kg/ha to which a knockdown herbicide such as Ustinex Super 60 is added, or spraying with a lower rate of Ustilan 700 WP - 10 kg/ha to which a knockdown such as Ustinex Super 60 is added and spot spraying any regrowth which may be present one year after the first treatment with Ustilan 700 WP 10 kg/ha alone.

Limitations

Because Ustilan is such a broad spectrum herbicide which can produce and maintain ground bare for long periods - several years in winter rainfall zones, it should be used only where bare ground is acceptable and where roots of desirable plants including and importantly, trees, do not or will not extend. It is therefore a specialised tool suitable for treatment of isolated infestations of some noxious weed species and prevention of re-establishment from seed.

EXTERNAL COURSES IN WEED CONTROL

By Rowan Wall
T A F E
SYDNEY

TAFE's Weed Control Course

External courses in rural studies offer weed control operators, and others involved in the weed control industry, an interesting means of expanding their knowledge in the field of weed control and a means to broaden their horizons beyond current activities.

The Weed Control Practice, Bookkeeping, and the Management courses aid in increasing the efficiency of your occupational pursuits. Other courses such as Pest Control, Environmental Management, Pasture and Soil Management, Greenkeeping and Horticulture encourage the planned development of interesting and profitable sidelines to current activities.

Weed Control Practice has not been one of our most popular courses with only 53 students out of the 2,000 enrolled in Rural Studies. Traditionally the more popular courses have included: Agriculture, Care of the Horse, Husbandry of Farm Animals. However, in recent years Beekeeping, and Wildlife Management have experienced strong demand.

The driving force behind external studies courses, such as Weed Control Practice, is to make education more enjoyable and convenient, while fulfilling the practical needs of the weed control industry and the community at large.

The Weed Control Practice Course was designed initially to assist the eduation of people isolated by distance from a centre where suitable courses are offered. But now, the main reason is that it suits student's time commitments as they can study at their own pace, in the comfort of their own home. With fluctuations in labour needs in the weed control industry this can be very important. This study system is highly suited to weed control operators who face seasonal demands on their time and effort. Another advantage of external studies courses is that they can be commenced at any time of the year.

Each course is divided into roughly 20 units, which should take students around two hours to read and comprehend. Once students feel confident that they understand the unit, a series of four or five questions are answered and mailed to a teacher. The questions give an opportunity to use the course in a practical way.

Students are encouraged to make use of their own experiences and local conditions. For example, a student studying weed control practice may be asked to prepare a comprehensive report on weed control programs in their area in one unit, and submit pressings of problem weeds in another. A student studying agricultural marketing will be asked to compare the various ways in which agricultural production in his local area is marketed, with the marketing systems described in the course notes. In other courses, students are asked to send in examples of their practical work. For example, in fruit production samples of grafts are required.

In marking the units teachers make all sorts of helpful comments and corrections. If students have difficulties with their course, there are teachers qualified in the various fields of agriculture ready to assist them. The teachers we employ to mark units in weed control practice units are usually employed in the industry full time. These teachers look to the teaching as an interesting sideline to their main occupation, and one where they can make an additional contribution to the industry. This is great for the students and appreciated by us.

Practical sessions of usually one or two days duration are arranged at many locations throughout the State of New South Wales. To give students a wider look at what is happening in the industry and hands on experience, for example, we have recently conducted discussion groups for students and council weed control operators at our office in Sydney, and conducted demonstrations in the use of weed control equipment in crop and pasture conditions, on the outskirts of Sydney.

Through the satisfactory completion of a course students can often gain recognised accredition in the field, or entrance to other courses of higher educational standing.

It costs nothing to enroll in external studies courses, so members of the industry and those intending to get involved in the industry have everything to gain and nothing to lose. TAFE supplies your lecture notes, slides and in some cases audio tapes and videos.

The College

The College of External Studies is one of the largest TAFE colleges in the State of New South Wales. The Rural Studies School in which Weed Control Practice is run has around 2,500 students enrolled, which is double what we had five years ago. Overall, the College has close to 30,000 students in some 600 subjects covering a range of subjects from Business Studies to Fashion, Plumbing, Applied Electricity, Building, Civil Engineering, Food and Secretarial Studies, as well as Rural Studies.

The College has 65 full time teachers and a massive 800 contract teachers. It is a very large operation, but much of it is behind the scenes with maintaining, updating, typing and printing lesson material.

Developments

Technology is enhancing the efficiency of external studies as a mode of teaching, and making it a much more attractive way for students to study.

Consider the following developments:

- Today, teachers are playing more of a facilitating and organisation role, because as skills and trades become more specialised, student needs can be serviced better by arranging and coordinating experts to write courses, mark papers and instruct at practical sessions.

- Audio-visual resources are being developed at a very rapid rate. These resources are being structured into comprehensive educational packages.

- With comnputers information transfer mechanisms are also progressing at a rapid rate. This means that courses can be delivered to students more efficiently.

Computerised records also means that groups of students in specific areas can be easily traced and contacted in order to conduct practical sessions.

- With word processors, lesson units can be updated far more regularly.

- Programmed learning systems are being investigated where students work off a computer and monitor. Text, graphs, and diagrams, all come up on the screen and the student is asked various questions. Depending on whether the answer is right or wrong the system leads the student through various steps, at a rate of learning dependent on the individual. To date these programmed learning systems have been used mainly in areas such as mathematics, but they are now expanding rapidly into engineering, medicine, and vet science, as well as english and story writing.

- The latest developments are where a computer, video and TV screen are all linked together. It is rather like the programmed learning system, but far more educationally efficient because of the visuals.

Weed Control Practice - A Course Outline

A course specifically designed for those engaged in weed control work. The course develops a knowledge of, and skills in, the identification and control of weeds. It also includes an examination of the laws relating to noxious plants and the application of these laws according to the needs of local government.

Topics

1. Identification - Plant classification, parts of a plant, plant reproduction.

2. Identification - Physical characteristics of plants, classification and nomenclature of plants.

3. Identification - Identifying plants, ecology

4. Identification - Collection, preparation and preservation of plant specimens, using botanical key, plants declared noxious in New South Wales.

5. Control - Methods of and need for weed control, weed characteristics, role of weed officers.

6. Control - Chemical weed control, use of herbicides

7. Control - Types of spray equipment and methods of application

8. Control - Herbicides

9. Control - Management systems used for preventing weed infestation

10. Field Work - Preparation of an industrial weeds program

11-16. Sections 11 to 16 relate to applications of the law relating to weed control practices.

The weed control practice course is currently being updated by Peter Gray and Peter Gorham, Noxious Plants Advisory Officers with the New South Wales Department of Agriculture.

Other Weed Control Courses

Attached to your notes is complete list of TAFE External Studies Courses Australia - Wide. You can see under rural studies that courses are run in South Australia and Western Australia, as well as in New South Wales. Furthermore we have no objection to a person in another State enrolling in our course.

AERIAL APPLICATION OF HERBICIDES

Jim Watt,
Research Officer,
Bayer Australia Limited

Herbicides make a major contribution to Australian cereal production and there are many situations where they can only be applied by aircraft. There is no alternative to aircraft when large areas must be treated quickly, crops are too tall for tractors or the season is wet. It is therefore important that Australian Agriculture continues to have access to aircraft.

1. First Priority - Use of Professional Pilots

Newspapers and television programmes are given to making dramatic presentations about drift from aircraft and there have been a significant number of court judgements against aerial operators because of real, but more often alleged, drift problems. As a result the general public, who are never informed of the great bulk of professional and necessary work done by aerial operators, fear aerial spraying. Herbicides can be applied by air without drift. They may also be applied safely by professionals who use drift skilfully to increase efficiency. The key to the safe use of herbicides by aircraft is the professionalism of the operator.

Considering that aircraft spray around 4 million hectares annually with insecticides and herbicides the number of problems, both real and alleged, is remarkably small. The impact of such problems is out of all proportion, currently the whole Agricultural Aviation Industry is under threat. As herbicides provide visible evidence of drift it is up to you to help minimise herbicide drift problems for the sake of your own work and Australian Agriculture

To do this you should understand the basic principles and only employ professional pilots not the cheap inexperienced kind.

2. Drift Control

2.1 Large Drops

The main factor affecting drift is droplet size. Drops larger than 200 microns (1/5 mm) in diameter fall like stones, are little affected by wind and hence do not pose a drift hazard. Where drift is likely to cause a problem the aerial operator can choose larger nozzles fully trailed (i.e. pointing aft with the airstream) or the even larger Raindrop nozzles which eliminate drift entirely. Unfortunately, such nozzles give poorer coverage and hence need larger volumes of water. These large droplets fall onto horizontal surfaces so are unsatisfactory for spraying grasses and vertical surfaces or for penetrating dense crops.

2.2 Smaller Droplets

Where better coverage, penetration or catch on vertical surfaces is needed, smaller droplets must be used. They are produced by smaller nozzles angled into or across the airstream or by Micronairs. Once droplets are below the critical size where their weight predominates they are carried by the wind and thus can catch on vertical surfaces - or drift in the absence of such surfaces. The key to understanding is the wind which drifts infinitely over bare surfaces or sparse crops but reacts with denser and taller crops to form turbulent eddies which are trapped in the crop.

This point must be emphasised - where there is a good catching surface and a crosswind the spray is trapped by the crop. This process of turbulent capture applies to all droplets carried by the wind. There is clear evidence to show that it does not matter whether the droplet is 5 microns or 150 microns, as both are carried and controlled by turbulent eddies and deposited at the same distance from the emission point.

Obviously when small droplets are used the wind should be blowing away from the sensitive neighbouring crop. When this cannot be done a buffer zone 300 metres wide will catch the spray provided there is a good catching crop and a crosswind. If there is bare earth or a seedling crop catch will be poor and drift excessive. If there is no wind the small droplets can be caught in thermal updraughts and drifted for miles at random. Similarly light variable winds and inversions are treacherous as they too can provide random drift.

To summarise, to prevent drift, spray a dense crop in a good wind.

2.3 Release Height

Flying height also has an effect on drift. If small droplets are used they will drift twice as far if the release height is doubled. This is another reason for only employing professional pilots who always cut off cleanly before the aircraft climbs over trees.

2.4 Evaporation

Evaporation can reduce droplet sizes but this too can be overcome by the professional who chooses the correct droplet spectrum for the prevailing temperature and relative humidity. Anti-evaporants can be added and although this is rarely necessary it is a developing practice.

2.5 Formulations and Products

Often the choice of product or formulation can be changed to avoid drift problems. If drift is a potential hazard, either change the product for a safer one or choose the correct droplet, wind, time or operator to prevent drift.

Drift is quite unacceptable if using:-

2,4-D esters and susceptible crops within 6 km radius (subsequent volatilisation problems).

2,4-D amine and susceptible crops up to 6 km downwind.

Any herbicides that affect adjacent crops within 3 km radius when there are thermal updraughts.

Any herbicides that affect adjacent crops when winds are light and variable in direction.

Any products which could cause residue problems.

Any products with health hazards or very objectionable odours when people live downwind.

Any "emotional" product that could be objected to by vexatious litigants nearby.

Drift is desirable and sometimes essential if using:-

Herbicides that must penetrate the crop canopy.

Herbicides for grasses or capture by vertical plant surfaces.

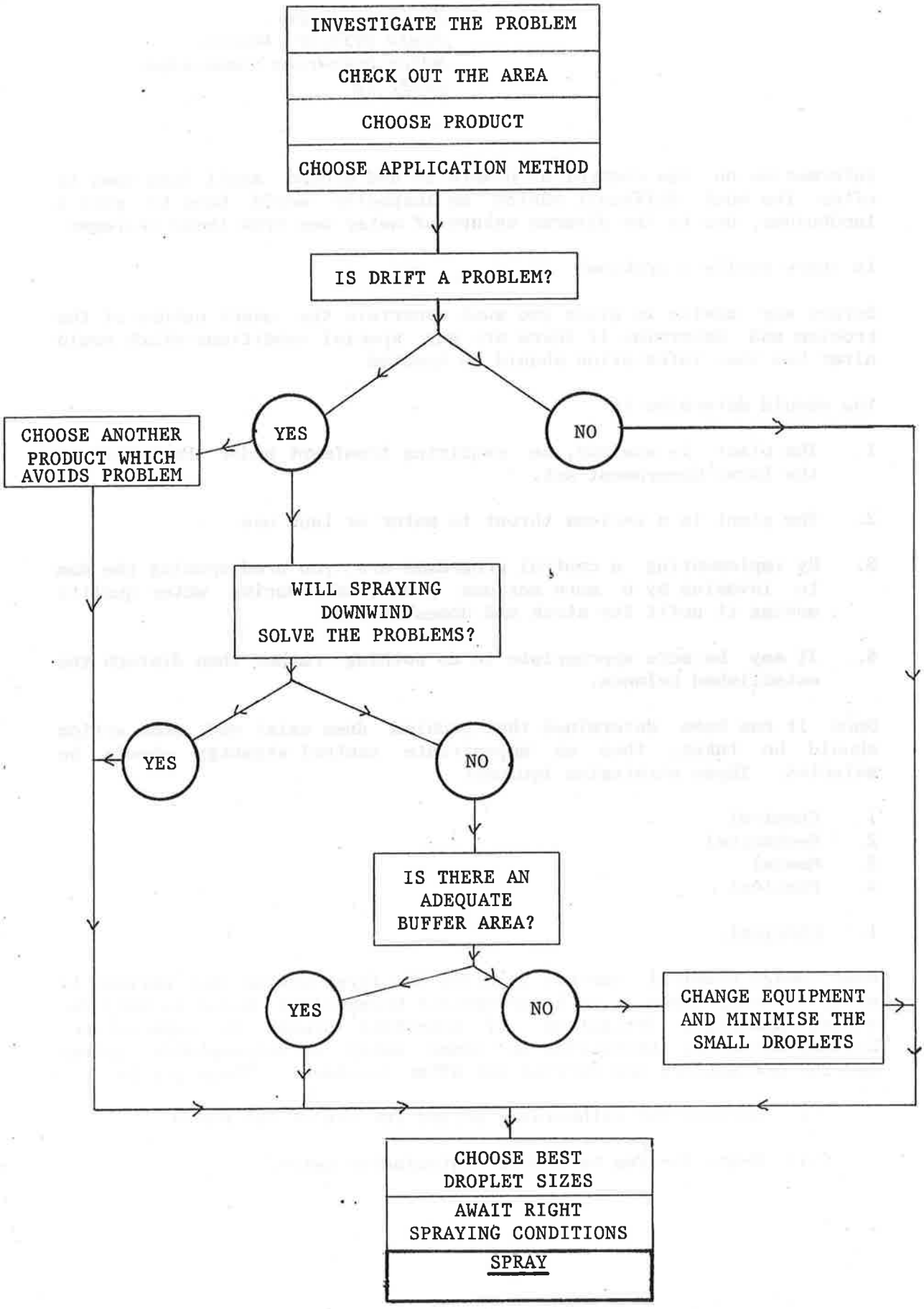
Any product where maximum plant coverage is needed.

Products needed for coverage of large areas of small or sparse crops.

Expensive products where maximum efficiency and minimal wastage are needed.

By using these broad principles and discussing your particular project in advance with a skilled pilot it is possible to prevent drift of herbicides onto adjoining crops without sacrificing efficiency. You may need to wait for suitable weather or obtain different products so there must be time for planning and consultation. To assist you in your planning we offer the following Drift Control Chart.

DRIFT CONTROL CHART



AQUATIC WEED CONTROL IN DAMS

By Chris Ripper,
Field Officer (Weeds),
Water Resources Commission,
GRIFFITH

Information on the control of plants in and around small farm dams is often the most difficult advice an inspector would have to give a landholder, due to the diverse nature of water use from these storages.

Is there really a problem?

Before any advice is given you must ascertain the exact nature of the problem and determine if there are any special conditions which would alter how that infestation should be treated.

You should determine if:

1. The plant is noxious, so requiring treatment under Part XXII of the Local Government Act.

2. The plant is a serious threat to water or land use.

3. By implementing a control programme are you predisposing the dam to invasion by a more serious plant, or reducing water quality making it unfit for stock and domestic use.

4. It may be more appropriate to do nothing rather than disturb the established balance.

Once it has been determined that problem does exist and some action should be taken, then an appropriate control strategy should be selected. These strategies include:

1. Chemical
2. Mechanical
3. Manual
4. Physical

1. Chemical:

Even though chemical control is often the first option that springs to mind, in many cases it is inappropriate because the water is used for stock, domestic, irrigation of sensitive plants or aquaculture. Contamination by herbicides in these cases is unacceptable unless special precautions are carried out after treatment. These may be:-

(i) Observe the withholding period for use of the water.

(ii) Drain the dam to remove contaminated water.

(iii) Only treat a small section at a timne to keep contamination at an acceptable level.

Below is a list of plants that may cause problems in small dams and some herbicides which may be used on them.

ALGAE:

Copper Sulphate (Bluestone)

400 gm/ML - 1000 gm/ML (Max).

The use of copper can result in a rapid kill of an algal bloom which will lower the Oxygen level in the water. A fish kill may result.

The copper sulphate must be distributed evenly throughout the dam.

Ferric Alum.

Up to 100 kg/ML

Treatment Mid October.

Ferric Alum reduces the total phosphorus in the dam.

FLOATING PLANTS:

e.g. Salvinia, Water Lettuce, Water hyacinth, Azolla and Duckweeds.

Diquat (Reglone).

Apply as an overall spray. The contamination rate must not exceed 1 ppm A.I. and there is a minimum withholding period of 10 days.

AF100

Apply as an overall spray.

AF100 is only effective where the water is deep enough so that the plants sink completely and where the plants are not crowded so they are self supporting.

SUBMERGED PLANTS:

e.g. Ribbon Weed, Milfoil, Pondweeds and Elodea

Dichlobenil (Casoron G or Du-Cason).

Plants may have to be harvested to enable granules to reach the dam bed.

Treat August - September prior to active growth beginning.

Observe the 70 day withholding period on water use.

Application rate will depend on water depth.

Diquat (Reglone).

Inject into the water body at a rate not exceeding 1 ppm.

Is not effective in turbid water or old plants with extensive algal and stil cover.

EMERGENT PLANTS:

e.g. Cumbungi, Common Reed (Phragmites) Water Couch, Rushes and Sedges.

Glyphosate (Roundup)

Cumbungi, Common Reed.

Apply late in the growing season - March - April ensuring complete coverage of the plant.

Water Couch

Apply to actively growing plants - February - March.

Glyphosate is not effective against species such as Jointed Rush, Umbrella Sedge, Dirty Dora.

Amitrole + Ammonium Thiocyanate

Amitrole T, Weedazol T.L. Plus.
Amitrole is effective against those species tolerant to glyphosate as listed above. Not registered but label change is being applied for.

Cumbungi - Apply January - April.

T.C.A.

Is only effective if the plants are out of the water. A period of six weeks should elapse before the treated area becomes submerged.

Should not be used where roots of desirable trees extend into the treated zone.

Contaminated water should not be used.

Emergent plants should not be burnt or cut for a period of at least 2 months or for as long as possible after treatment.

2. Mechanical Control

Where the water is used for stock and domestic or the irrigation of sensitive plants, chemical control is often not possible. Mechanical control, even though more expensive may have to be used. Removal of plant material will prevent oxygen depletion and subsequent fish kill or water putrification which can result after an extensive chemical treatment.

The method of control will depend on the type of plant in the dam.

(i) Floating species
Use a scoop net or rake.

(ii) Submerged species
Use a drag chain or wire rope

(iii) Emergent species.
Cutting plants such as Cumbungi and Common Reed below the water surface in Autumn will retard regrowth.

Excavation of plants with a vigorous rhyzome system can spread these species and should not be attempted, for example with Common Reed.

Mechanical control of plants such as Water Couch will reduce the plant density but growth will quickly reoccur because of the plant fragments and roots remaining.

This method relies on the infestation being small enough to allow plants to be controlled by manual removal. The technique is ideal for continuing control of plants such as Salvinia after the initial infestation has been controlled.

4. Physical Control

This technique changes the conditions in or around the dam in some way to prevent or limit the growth of plants.

(i) Shading the dam by planting trees.

(ii) Indcreasing the water depth by excavation to reduce the area of bed with sufficient light for plant growth.

(iii) Reduce nutrient inflow by:

(a) providing watering points for cattle below the catchment area.

(b) preventing inflow from nutrient rich areas such as stock yards.

THE IMPORTANCE OF REPLACING WEEDS WITH PASTURE - CHEMICAL, CULTURAL AND MANAGEMENT METHODS

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QUEANBEYAN

Removing weeds by whatever means is of little value unless they are replaced by a competitive, useful plant to prevent re-invasion by the weed species. This paper will support this statement with reference to a wide spectrum of weeds and various control measures.

Eradication should be the aim with noxious weeds whereas weed control may be a satisfactory aim for less troublesome species. There are three main control methods:-

i) Chemical

ii) Mechanical (ploughing, chipping and grubbing)

iii) Biological (insects, diseases and grazing animals).

Burning and slashing are also considered for they are sometimes used. Provided they are combined with other methods they can be useful techniques but burning alone can create more problems than its solves.

The paper will consider specific examples covering all the principle weed categories - tussocky perennial grasses, woody bushes, broadleaf weeds and annual grasses.

CONTROL OF PERENNIAL TUSSOCK GRASSES

1. Serrated Tussock: This Region's most serious noxious weed. It flourishes in situations where there is little competition. For example an oat paddock last sown in 1979, when after several ploughings and two crops of oats, it contained no serrated tussock - is now covered by approximately 65% tussock.

Severe and continuous over-grazing of pastures can also allow serrated tussock to invade. In 1980, such a phalaris paddock contained only 7% phalaris and 65% serrated tussock. Spraying with Frenock in November 1979 resulted in a total kill of serrated tussock. The area was fenced to permit sensible grazing management, in particular spelling from October to January, to permit grass and clover seeding. This was followed by heavy grazing in late summer to enable good seedling establishment with the Autumn break. By 1982, despite dry years, there was no serrated tussock, 65% phalaris, plus clover.

Burning removes competition. In May 1983 at Anembo, a fire swept through the 1982 spray trial. Plots contained no live tussocks or seedlings at that time however, the fire obviously promoted the germination of much of the hard seed and bared the soil making aerial pasture seed establishment more difficult. The pasture sown in June 1983 failed following three months of warm, dry conditions after initial germination, 7.5 tussock seedlings per square metre were able

to establish during the summer of 83-84. Interestingly, other aerial pastures sown in the area 4-6 weeks earlier established extremely well highlighting the importance of early sowing, established on coarse grained soils and exposed north westerly aspects.

The abovementioned examples show that in the absence of perennial competition, serrated tussock can establish, but I am frequently asked about tussock seedlings establishing during the pasture establishment phase. Dr. Malcolm Campbell has documented the death of 280,000 seedlings of serrated tussock per hectare when white clover and grass plants were allowed to grow over them in the first Spring and Summer after the pasture was sown.

2. Poa Tussock: Poa is not a noxious weed, but in 1980 Braidwood graziers classed it as the most troublesome weed on their properties. The problem was its very vigorous response to Super and Clover, coupled with a free seeding habit which allowed it to invade the sub clover portion of pastures in Summer. Cattle are reasonably effective in keeping Poa under control, provided it isn't too great a proportion of the pasture. At heavy stocking rates, goats graze Poa preferentially and can control even heavy infestations.

Providing Poa is removed first (by chemical, cultural or biological means, or a combination, such as burning and ropewick treatment in a run-out pasture), re-invasion can only be prevented by a competitive perennial pasture.

This was graphically illustrated when in 1983 a 35 ha paddock was sprayed with chemical to remove Poa on a property south of Braidwood. The kill was excellent as can be seen in Table 1, but when aerially seeded it was flown too wide (as for spreading Super) and the fescue and phalaris have only established in strips. The number of tussocks two years later is inversely proportional to the level of grass establishment.

Table 1

"Trafalgar Bill", Braidwood

Aerial Poa Tussock Control Demonstration

Initial Poa Ground Cover April 1983	Average Plants Per Ha	% Perennial Grass Cover Feb 1985		% Poa Ground Cover Feb, 1985	
		A.Good Plots	B.Poor Plots	A.Good Plots	B.Poor Plots
44%	24,200	67%	12%	7% (3,400 seedlings per ha)	32% (16,400 seedlings per ha)

CONTROL OF WOODY WEEDS

Experience in the Yass district has shown that continued heavy grazing by goats will reduce Biddy Bush to almost zero levels in about three years. However, the continued presence of a small goat population is then necessary to maintain this control. The essential feature of such a programme is that the goats over-graze the weed, not the pasture. Goats are also being experimented with for Teatree (*Leptosperum*)) control using a similar technique.

Over the last couple of years, I've obtained some interesting results following the spraying of blackberries in a run-out cocksfoot/white clover pasture. Chemicals such as Grazon, Garlon and 40% 2,4,5-T which have little effect and the pasture had less than one seedling per bush 12 months after spraying whereas Roundup treated bushes average 9 seedlings per bush following destruction of the pasture. In 1983, half the bushes of a further trial were burn't, but no pasture was oversown. All treatments, except Grazon (soil residual action) had approximately 6 seedlings per bush if burn't, but less than one per bush if unburn't.

CONTROL OF BROADLEAF WEEDS

Patersons curse and scotch thistle are noxious weeds in many tableland Shires. Both weeds are most severe in annual, e.g. Sub Clover, or thin perennial grass pastures as seeds are able to germinate and establish in bare areas in Autumn.

The essential principle in pasture establishment in these situations is to reduce seed carry over. This is best achieved if thistles are selectively removed and prevented from seeding the year before pasture sowing is contemplated. Slashing at the correct time is useful in this regard. Sometimes spraying is necessary. At Braidwood in July 1984 many chemicals were effective, but 2 litres per ha MCPA was the best overall, because it had the least damaging effect on the clover and due to the clover competition, there was a much reduced further thistle germination in the Spring.

Severe scotch thistle infestations never occur in a good established phalaris pasture. I believe the same holds true for patersons curse and experience at Braidwood has shown that removal of this weed from a vigorous tall fescue pasture in early Autumn prevents its re-invasion. However, in the year of pasture establishment continued seed germination in bare areas is a major problem and if left can result in severe damage to the young pasture. One way to lessen this problem is to sow fodder oats in the year prior to pasture sowing and to apply the spray - graze technique in the oat crop.

CONTROL OF ANNUAL GRASSES

Annual plants are also prolific seeders and seedling numbers can be enormous. Fortunately, the majority of annual grass seeds germinate the year after they mature, i.e. there is little if any hard seed carry-over. Therefore, any technique that prevents seeding in the season prior to sowing is an effective control.

Barley grass and silver grass (*vulpia* spp.) are the two worst annual grass weeds in the tablelands and both can smother young pastures and even cereal crops. On arable country fallowing prior to seeding is

very effective. On non-arable country spray-topping techniques are very useful however, there are problems especially if there is a small percentage of vulpia in a severe barley grass site. Barley grass runs to flower 2-3 weeks earlier than vulpia and spray-topping barley grass can allow vulpia plants to expand and seed massively giving a vulpia problem the following year. I personally consider this weed the most difficult to handle and because it is so innocuous I am sure it is responsible for many pasture failures and subsequent weed successes.

In conclusion, it is my opinion that pasture competition is the most important factor in keeping weeds at bay. It won't keep all weeds out, but will greatly limit their numbers, providing grazing management is applied to graze hard or spell at specific times to achieve specific aims. Some spraying will always be required, but "Kick them while they're down" is the most effective advice with regard to spraying.

THE USE OF GOATS TO CONTROL SOME NOXIOUS PLANTS

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Some early reports (e.g. Blaxland, 1903), described the ability of goats to control woody weeds in NSW. Despite these reports, other techniques, such as mechanical and herbicidal, found more favour than goats. Currently, goat numbers are increasing rapidly in Australia, partly as a response to the needs of weed control.

DIET

The diet preferences of animals can be broadly categorised into:

- cattle: mid to tall grasses
- sheep: short grasses and herbs
- goats: shrubs and more fibrous parts of plants.

Most pastures contain a mixture of grasses and herbs, while many also contain woody shrubs. It is possible to alter the proportions of the pasture components by manipulating factors like the type of livestock, stocking rate, seasonal resting or soil fertility.

This paper is most concerned with the integration of goats into weed control and thus it is convenient to discuss this in the two broad ecologcal areas of high rainfall and semi-arid.

High Rainfall

High rainfall refers to the non-arable permanent pasture areas that are typical of the slopes and tablelands of eastern Australia. Within these areas there are several broad weed types that can be categorised as woody, grass and broad-leaf.

* **Woody weeds:** There are many native and introduced species that can become weeds under these conditions. Not all species can be controlled by goats, while some are so highly palatable that they are rapidly reduced to insignificance by goat browsing. Within the "highly palatable" category are the major weeds of blackberry and briar. Blackberry was estimated, in 1984, to cost NSW farmers $21 million per year (Dellow, J. pers comm.) in lost production and control costs. These plants appear to have good feed value as goats are highly productive when consuming them and are so highly palatable that even at relatively low stocking rates they are readily controlled by goats.

  There are two distinct strategies that can be adopted when using goats to control blackberry and briar.

1. High stocking rates (about five to 15 goats per hectare); aimed at complete defoliation of bushes within one season, or

2. Low to moderate stocking rates (about two to five goats per hectare); aimed at preventing bush expansion in the current season with limited overall reduction in bush size.

Another introduced woody weed that is more important in Tasmania than on the mainland, is gorse. Trials with goats and sheep shows that it can be controlled by goats, while sheep production continues. Again, this plant has high feed value, so that production from goats is satisfactory and higher than sheep. New Zealand work (Ratcliffe, 1983),has shown similar results.

Other woody species can become a problem if allowed to grow unchecked. Some of the more common types that can be controlled by goats include wattle, eucalypt and other native species. Wattles are generally considered to be highly palatable and when within browsing height are readily controlled. All eucalypts are eaten, although some more readily than others, so it is difficult to suggest which may be eaten first. It may be necessary to stock goats at fairly high rates to achieve satisfactory control of many of these weeds.

* **Grass weeds:** Some that can be a problem include Poa and serrated tussocks. Results of goat grazing trials in the southern tablelands of NSW show that goats can be effective in the control of Poa tussock (Holst, pers. comm.). This is achieved at moderate stocking rates, but require good soil fertility levels and improved pasture species.

Often described as the worst pasture weed of NSW, serrated tussock has been controlled by a goat grazing treatment (Campbell et al, 1979). The results are not easily repeated so it is not generally recommended, at this time, to use goats to control this weed.

* **Broad-leaf weeds:** There are many of these and relative dominance varies between sites. Thistles are fairly common on improved pastures and in sheep camps. The ones controlled by goats include variegated, slender, black and saffron. Others, like nodding and scotch thistle are controlled under most conditions, although observations are not widespread enough for complete confidence in the results in all areas. The action of goats is to remove flowering heads of thistles without eating rosette leaves, except in species that have "fleshy" leaves. The effect is to deplete the stock of viable thistle seeds in the soil, so that in succeeding years less and less plants germinate. This allows other pasture species to take over and to provide more and cleaner pasture.

Other broad-leafed weeds are controlled by goats, although not necessarily by them being eaten. Goats will remove the

flowering parts of Patersons Curse, eat crofton weed and lantana and cause severe mechanical damage to bracken fern while only eating small amounts.

Goats prefer a higher fibre diet than sheep. This is most obvious during late winter when goats can be seen ring-barking some trees or consuming old pasture trash. Under these conditions it is necessary to protect wanted trees to avoid damage.

After extended sheep grazing, it is relatively common for improved pastures to become grass dominant. Such pastures can be renovated to return to a balanced grass and clover pasture through goat grazing.

Semi-arid

Goats have become feral throughout semi-arid areas that are dominated by Acacia (mulga) or Eucalypt (mallee) woodlands. There has been an increase in scrub throughout these communities which has led to reduced sheep carrying capacity and productivity. During the late 1970's, some producers tried to control scrub with goats with the aim of improving sheep carrying ability. This has been partially successful, as can be seen by the steady increase in goat production in these areas in eastern Australia, although the emphasis has changed to some degree. Goats are proving to be an economically viable enterprise that can be run in addition to existing enterprises. This means that the removal of too much scrub is now considered undesirable as it will reduce goat returns.

IMPLICATIONS

Some of the implications of using goats for weed control have been discussed above. These include:

* increased stocking rates,

* improvement in pasture quality and

* diversification into another enterprise.

Some of these need to be discussed further and others introduced.

The control of weeds is an obvious result of running goats. However, it leads into pasture and range management, as well as direct increases in production from a given area of land. Stability of permanent pastures often relies on maintaining a balance between perennial grasses and herbs. In high rainfall areas, pasture mixtures are often of introduced species and are partially maintained by fertiliser application. These are expensive operations that can only be considered if the pasture maintains high productivity over a long time. Goats assist in achieving this by controlling woody and many other weeds that are associated with high fertility, and by helping to maintain a suitable balance between grasses and clovers. Long term stability of highly productive perennial pastures insure other

livestock can maintain their production, so goats can contribute indirectly to the productivity of other stock being run on the same area.

Chemical and mechanical methods have been the main techniques used to control many weeds. In some situations, they can be replaced with goats, reducing the direct costs of control, while being an environmentally acceptable alternative.

VALUE

The ability of goats to control weeds has obvious cost saving benefits; their use in maintaining more productive pastures will increase returns; the ability to run them in addition to existing stock allows more efficient pasture production; and, their economic value provide diversification of income. All of these factors are fairly obvious and have been discussed before, but other valuable benefits also come from running goats. A weed free property has higher value than one infested with weeds. A well managed goat flock will increase in value if it has been selected for higher production and it will increase in number through reproduction. These increases in land and livestock capital may not be seen directly as income but they are valuable improvements in a landholders assets.

The major cost associated with the use of goats for weed control is usually fencing, although the purchase price of goats can be substantial in some cases. Fencing for goats need not be elaborate, but it must be sound enough to insure that the stock remain in the paddock. Details on new fences and on up-grading existing fences is available in Agfact A7.2.1 "Fencing For Goats".

CONCLUSION

Goats have demonstrated their ability to control many weed species, some of which are noxious. Their use in this role can reduce direct weed control costs, increase property value and returns and improve pasture management. These factors indicate that the use of goats by Australian farmers will increase. Another aspect is that goat products represent a new bag of exportable commodities that will help maintain our balance of trade.

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INTRODUCED SPECIES IN KOSCIUSKO NATIONAL PARK

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The common definition of a weed as a "plant out of place" may be extended in a national park context to include any non-native plant species. Such species may be grouped into 2 broad categories:

(a) Those more or less confined to disturbed sites such as road verges, quarries or periodically inundated land around reservoirs, e.g. *Oenothera erythrosepala*, *Echium vulgare*, *Melitotus alba*, *Achillea millefolium*, *Verbascum* spp and *Conyza bonariensis*.

(b) Those that can spread into relatively undisturbed vegetation communities, e.g. *Rumex acetosella*, *Hypochoeris radicata*, *Hypericum perforatum*, *Rosa rubiginosa*, *Cytisus scoparium*, *Rubus fruiticosus* sp. agg. and *Pinus contorta*.

The impact of introduced species in large national parks such as Kosciusko National Park is often difficult to determine. Problems are encountered both in locating and identifying weed infestations and in devising programs to control these infestations while minimising the effects on natural ecosystems.

There are now approximately 210 species of exotic plants recorded for Kosciusko National Park. Some of these have been deliberately introduced for soil conservation purposes (e.g. many agronomic grasses and clovers and several persistent tree species such as willows and poplars), or as "aesthetic" plantings around townships, construction sites and ski resorts (e.g. lupins and ornamental conifers). However the majority of species have been introduced accidentally as a result of past and present land use activities. These include burning, grazing, recreational activities and the development of the Snowy Mountains Hydro-electric Scheme.

The number of introduced species in Kosciusko National Park has increased considerably in the last 30 years. As a percentage of the total number of species in the alpine and subalpine zones, it has risen from 11.7 in the early 1950's to 21.2 in 1984 (Costin, 1954; Thompson & Gray, 1981; Mallen, unpub. data).

Vehicles are an important dispersal agent for plant propagules (Wace, 1977). Approximately 600,000 vehicles passed through the entrance stations on the Kosciusko Road and the Alpine Way in 1983. As it was not possible to sample material directly from vehicles, a study was undertaken to determine the "carpark flora" of the major ski resorts of the Perisher Range, all of which are located in the subalpine zone. Soil samples were taken from the carparks or carpark edges on a monthly basis for 14 months, and germinated in an unheated

glasshouse for 7 months. This study aimed to determine whether the occurrence of any species collected and germinated from the carpark soil could not be explained by local seed sources. A total of 81 species has germinated to date, comprising 32 native and 49 exotic species. Seventeen were considered not to have been within their typical distributional range and therefore almost certainly had been imported to the ski resorts on vehicles or their occupants.

Plant propugales may also be dispersed by native and introduced animals and by humans. Grazing is no longer permitted in Kosciusko National Park, so pedestrians are now probably the most important means of dispersing propagules away from vehicle tracks in the higher areas. A pilot study was carried out in January 1984 to evaluate the sock flora of hikers. Two groups of hikers were utilised; a group of 40 people walking 20km on alpine walking tracks (a total 1600 sock-km), and a group of 30 people walking 5km cross-country through subalpine vegetation (a total 300 sock-km). New socks were issued at the start of the walks. Only 16 seeds were found in the alpine sock sample, 9 of which were of introduced species. From the subalpine walk, approximately 2600 seeds were collected, and 420 were of introduced species. The difference between the walks can be partly explained by -

1) the relative abundance of the introduced flora at different altitutde,

2) different stages of maturity of the vegetation,

3) track differences, and

4) the prominence of *Acaena anserinifolia* (Bidgee Widgee) in the subalpine sample.

A further study was undertaken to determine the composition of the road verge flora, and to determine the relative susceptibilities of native vegetation communities located adjacent to road edges, to exotic invasion. Paired 20m x 6m plots were sampled at 4km intervals along the Kosciusko Road and the Alpine Way. One plot was located immediately adjacent to the road surface, and the paired plot was located 5m from the roadside/native vegetation boundary. Preliminary results from this study indicate -

1) a generally inverse relationship between the number and cover of introduced species and altitude,

2) the importance of disturbance in determining weed diversity and abundance, and

3) the very limited number of weed species which can invade and provide >10% cover in vegetation adjacent to roadsides. These included *Aira caryophyllea*, *Trifolium arvense*, *Rubus fruticosus* and *Scalix* sp.

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THE TASMANIAN SYSTEM OF NOXIOUS WEED CONTROL

THE NOXIOUS WEEDS ACT

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The Purpose

Noxious Weeds Legislation gives the State Government the power to:-

1. prohibit the introduction into the State of designated weeds
2. undertake the eradication of weed species
3. take action aimed at preventing their spread within the State of specified weeds
4. require that action be taken against weed species where this is necessary to alleviate or prevent a particular problem.

Administration and Implementation of the Noxious Weeds Act

The Noxious Weeds Act of 1974 gave the Department of Agriculture the prime responsibility for the implementation of noxious weeds legislation in Tasmania.

In certain declared metropolitan or urban areas City Councils and Municipal Authorities are also empowered to exercise control and appoint their own inspectors.

Administration of the Act is organised on a regional basis, the State being divided into the Southern and the Northern Regions, each under the control of a Regional Weeds Officer. These are based in Hobart and Devonport respectively.

Within each Region there is a number of State Inspectors, each responsible for a section of the Region. At present inspectors are based at New Norfolk, Campbell Town and Sorell in the South, Launceston and Whitemark, Devonport, Deloraine, Burnie and Currie in the north. In addition there is a Serrated Tussock Inspector at Sorell who has special duties concerned with the eradication campaign against that species.

Administration and co-ordination is the responsibility of the Senior Weeds Field Officer, based in Launceston, under the overall direction of the Senior Agricultural Officer (Weeds).

Classification Weed Species

Plants may be declared to be noxious, secondary or prohibited weeds for the whole, or for any part of the State.

1. **Noxious Weeds:**

   These are species known or believed, to be capable of causing especially severe economic losses or presenting a serious hazard to public health should they become established and wide-spread in the State.

   Eradication campaigns are in progress against all declared noxious weeds.

   A species will be included in this category only if eradication is practible.

2. **Secondary Weeds:**

   These are species known, or believed, to be capable of causing economic losses or of interfering with the utilisation of a resource, or with being a potential hazard to health.

   By having them declared secondary weeds control measures can be required to be undertaken as appropriate.

3. **Prohibited Weeds:**

   This group includes all the noxious and a number of the secondary weeds. Prohibited weeds may not be brought into the State, nor may they be moved from one place to another within the State.

Infested Areas

Areas in which a noxious weed occurs may be declared 'infested areas'.

Quarantine restrictions may be imposed controlling the movement of animals, plants etc. from such an area.

Weed Control

The onus of controlling declared weeds lies on the landholder, who is responsible for all costs incurred.

The Minister for Primary Industry may, however, pay compensation to a landholder in respect of abnormal costs incurred in controlling a noxious weed in an infested area.

Regulations under the Act may prescribe the control measure which must be taken against a noxious or secondary weed.

In addition an inspector may serve upon a landholder an 'enforcement notice' requiring him to take specific action against a declared weed within a specified period of time. Any landholder aggrieved by such notice may appeal against it before a magistrate.

Control Requirements

1. **Noxious Weeds:**

   There are prescribed control measures for all species of noxious weeds under which all land owners are automatically obliged to ensure that these weeds are destroyed before they have the opportunity to reproduce.

   Failure to carry out such control measure is automatically an offence under the Act.

2. **Secondary Weeds:**

   Prescribed measures for secondary weeds species have not been gazetted.

   If it is considered necessary that action be taken against a secondary weed the measure required to be undertaken will be decided taking into consideration all the circumstances affecting the problem. As far as possible control of secondary weeds by management - crop rotation, stock management etc. - is encouraged and enforcement of the use of direct chemical or mechanical control methods avoided.

   There are a number of control or containment schemes against specific weeds running at present.

   In the North-West, from Devonport west, a containment policy against Slender and Varigated Thistle is in operation. Landholders are required by Weeds Inspectors to control all infestations every year.

   In the Midlands, the far North-West and the North-East there is a containment policy against Ragwort, and in the North-East an eradication program against gorse was started in 1983. This policy requires land owners to undertake measures to prevent the establishment and spread of the weed in these areas.

   In addition to the above, inspectors will normally require landholders to take action against secondary weeds under the specific circumstances listed below:-

(i) Control of the following species will be required wherever they are found:

African Daisy	Lagarosiphon
Alligator Weed	Onion Weed
Apple-of-Sodom	Saffron Thistle
Common Helitrope	Sagittaria
Egeria	Salvinia
Feathertop	Skeleton Weed
Hornwort	Water Hyacinth
Hydrilla	Water Lettuce

(ii) Because of the toxic nature of its sap Caper Spurge must be destroyed wherever it occurs in areas to which the public, and in particular children, have access.

(iii) In order to limit their spread the following species must be controlled around public sale yards and stock pens and yards used by animals in transit:-

Barnyard Grass	Hemlock
Blackberries	Horehound
African Boxthorn	Stinking Mayweed
White Weed	Paterson's Curse
Docks	Ragwort
Crow Garlic	Oxalis
Three-Corner Garlic	Sweetbriar
Gorse	All Thistle Species

(iv) Control of the following may be required along boundaries to prevent their spread from an infested to a clean property:-

Gorse	African Boxthorn
Blackberries	Horehound
Sweetbriar	Ragwort
All Thistle Species	

3. **'Urban Weeds'**

The following species are of little or no agricultural significance but can be obnoxious or cause problems in residential areas:-

Fennel	Soursob
Oxalis	Three-Corner Garlic
Pampas Lily-of-the-Valley	

Weeds Consultative Meetings

Each year delegates from the farmer's organisation and local government meet with Department of Agriculture officers and representatives from other Departments and Instrumentalities concerned with land management and weeds to review the current

situation and consider future action to be taken in respect of noxious and secondary weeds.

Previous Legislation

Noxious Weeds Legislation in Tasmania dates back to the Californian Thistle Prevention Act of 1870.

Under this Act a Justice could require the owner or occupier of land to cut down Californian Thistles 'so as to prevent the same from seeding'. Failure to comply could result in a penalty of up to £20.0.0., and the Justice could order that the thistle be cut down and the cost charged to the owner or occupier.

Fines or penalties imposed within the area of a Municipality were paid into the Municipal fund; otherwise they became part of the General Revenue.

A Justice could authorise any person to enter land to search for thistles 'in the day time';.

In 1871 an Act to Extend the Operation of the Californian Thistle Act added Spear Thistle (***Circium vulgare***) which was at that time called the Scotch or Black Thistle.

This Act introduced a provision that automatically required a person upon whose land thistles were growing to cut them down within five chains of a boundary with land that did not have thistles on it.

The above Acts were replaced by the Californian Thistle Act of 1878 which applied only to Californian Thistle and did not include Spear Thistle. The prescribed measures requiring control along a boundary were also omitted.

This Act was essentially similar to the 1870 Act, but made provision for the appointment of Inspectors. It laid down that, following petition signed by five owners or occupiers of land in a Road District of Rural Municipality, the Governor in Council could require Road District trustees or a Municipal Countil to appoint an inspector to enforce the Act, and to pay for his services out of the funds at their disposal. In the event of the Trustees or Council failing to comply, the Governor in Council could appoint an Inspector and pay him out of Consolidated Revenue. However, the Colonial Treasurer would then deduct such payment from moneys payable to the Trustees or Council.

A somewhat sinister provision apparently included to encourage complaints against infested land was that 'one moiety (ie. a half) of all penalties imposed .... shall, when recovered, be paid to the informant'. The balance was paid to the Municipality, the Road District Trustees or Consolidated Revenue as appropriate.

The legislation was again revised by the Californian Thistle Act of 1883. The provisions were again broadly similar to those of the

earlier Acts, with the important difference that enforcement was placed in the hands of Inspectors instead of the Justices. All expenses recovered by Inspectors were paid into the Treasury.

In 1887 this Act was extended to cover Bathurst Burr. It also made the sale or removal of hay, straw or grain containing seed of the species covered, illegal and required owners of 'infested' land to return an annual estimate of the area infested.

The term 'Noxious Weed' was first used in the Local Government Act of 1906, which empowered the Governor to proclaim plants as such generally or in any particular locality. This Act gave Councils the authority to exercise the provisions of the Californian Thistle Act 1883 in respect of all Noxious Weeds, Councils were also empowered to make by laws 'prescribing the means to be adopted for the destruction and extripation of any Noxious Weed'.

The first comprehensive Noxious Weeds Act was enacted in 1938. The Act required every Municipal Council to appoint 'a sufficient number of Municipal inspectors for the purpose of this Act'. Regulations made under the Act prescribed the control measures to be taken in respect of each species and 'the occupiers of premises where any Noxious Weed is known to be growing' were required to comply with them.

Initially 13 species were scheduled as Noxious Weeds for the whole State and a further 22 for parts of the State only. Thereafter, from time to time, other species were added.

The implementation of the provisions of the Noxious Weeds Act of 1964 remained the responsibility of the Municipal and City Councils and each Council was required to appoint Weeds Inspectors for its area.

This Act also made provision for the appointment of three Regional Weeds Inspectors. These officers appointed by the Department of Agriclture were required to advise and assist municipal officers and co-ordinate their activities. Councils were required to submit a report each month to the Regional Inspector giving details of the activities of their municipal weeds inspectors. The Regional Inspectors were responsible to the Department of Agriculture's Senior Agronomist (Weeds).

The species covered by the Act were declared to be noxious weeds, and could in addition be declared to be dangerous weeds. Either classification could be in respect of the whole or part of the State. The Act did not differentiate between the two classifications or establish criteria under which a plant would be declared noxious or dangerous.

Control measures were prescribed for each declared species, and Inspectors were also able, through the use of an 'enforcement notice', to require a landholder to take any measures considered necessary to 'secure the eradication of', or 'prevent or minimise the dissemination of any noxious weed'.

An enforcement notice had, however, to be endorsed by a Regional Weeds Inspector before it was legally valid. Such notices could be appealed against.

Provision was made to enable parts of the State to be declared 'infested areas' and for controls to be placed 'on the movement of plants, animals, materials, articles and other things' from or within such an area. This section of the Act allowed the Serrated Tussock infested area in the South-East to be placed in quarantine.

Responsibility for, and the costs incurred in noxious weed control remained the responsibility of the landholder. Provision was, however, now made to enable the Minister for Agriculture, under certain circumstances, to make compensatory payments to landholders who had incurred exceptional expenses.

Three Weeds Advisory Committees, one in each Region, were established with their membership drawn from local government, farmer organisations and the Department of Agriculture. They were established to permit consultation between the organisations concerned with the incidence and control of noxious weeds.

Following representation from local government the 1964 Act was amended in 1974, to give the Department of Agriculture the prime responsibility for noxious weed control. Municipal participation in the enforcement of the legislation was confined to designated urban areas.

The other main changes were the classification of weeds in three classes, 'noxious', 'secondary', and 'prohibited' and the consolidation of the three Regional Advisory Committees into a single State-wide Weeds Advisory Meeting.

Advice on Weed Control

Advice on the control of noxious and secondary weeds is readily available, free of cost, from the Department of Agriculture.

Landholders who wish to receive assistance can contact their nearest State Weeds Inspector, or District Officer. Farm visits can be arranged so that control measures suited to the property's problem and intergrated into its overall management can be suggested.

Species declared as Weeds Under the Noxious Weeds Act

Noxious Weeds

Serrated Tussock	Artichoke Thistle
African Feathergrass	Spiny Emex
Bathurst Burr	Silver-Leaf Nightshade
Noognoora Burr	One-Leaf Cape Tulip
Cotton Thistle	Parthenium Weed
Nodding Thistle	Tiger Pear

All Noxious Weeds are also declared Prohibited Weeds.

Secondary Weeds

a. **Terrestrial Plants**

Californian Thistle	Soursob
Saffron Thistle	St. John's Wort*
Slender Thistle	Paterson's Curse
Winged Slender Thistle	Ragwort
Spear Thistle	Skeleton Weed*
Varigated Thistle	Hoary Cress or White Weed
Blackberries	Apple-of-Sodom*
Gorse	Caper Spurge*
African Boxthorn	Stinking Mayweed
Sweetbriar	African Daisy*
Horehound	Crow Garlic*
Pampas Lily-of-the-Valley	Three-Corner Garlic
Bindweed	Onion Weed*
Greater Convolvulus	Banyard Grass
Broad-Leaf Dock	Feathertop*
Curled Dock	Common Helitrope
Hemlock	Two-Leaf Cape Tulip
Fennel	Oxalis

* also declared Prohibited Weeds

Cumbungi	Water Hyacinth*
Glyceria	Water Lettuce*
Alligator Weed*	Hydrilla*
Canadian Pondweed*	Lagarosiphon*
Egeria*	Sagittaria*
Hornwort*	Salvinia

* also declared Prohibited Weeds.

PARTHENIUM WEED

By Clive Willmot,
Weeds Officer,
Moree Plains Shire

Many of you present today will recall at the 2nd Biannual Conference at Armidale 1983 I spoke to you on parthenium with the heading "Will It Cross the Border", this meaning the Queensland border into New South Wales.

At the time of presentation of this paper three infestations had been found in the Moree Plains Shire area, a similar number of infestation had also been located in the Narrabri Shire.

These infestations consisted mainly of singular plants up to a maximum of 3 plants. Whilst at the seminar I received an urgent phone message that an area of 6 to 8 acres of heavily infested parthenium had been found within the Moree Plains Shire. This was the beginning.

Today I will endeavour to bring you up to date on the parthenium situation within our area.

Over the past two years some 130 infestations have been found in the Moree area. These infestations range from singular plants to scattered plants through cultivation paddocks of 1,000 acres. The heaviest infested area would be 6 to 8 acres. The Narrabri Shire have recorded some 28 infestations, Gunnedah and Coonabarabran have also reported infestations.The infestations have been found on cultivated paddocks, roadside, Pasture Protection Board stock holding yards, shearing shed areas, feed lots, grazing properties and rubbish dumps.

The areas of infestation have nearly always been traced to a source of the initial outbreak. These sources are mainly headers, stock movement, contaminated grain removal to receival point, or stock fodder to and from feed lots.

All sites are kept under constant surveillance as in most instances new plants are found not on the actual site of the first findings but within some 30-100 metres or possibly a kilometre away.

Soon after the finding of the first infestation the Department of Agriculture called a meeting with Weeds Officers from neighbouring shires and personnel from the Department.

From this meeting Committee Meetings were held regularly at Gunnedah. The object of the Committee Meetings was to create a public awareness programme. From these meetings came media releases electric and newsprint, mail drops were made to some 5,000 householders, hand out printed and distributed, car stickers made available and seed identification cards distributed.

Meetings were held with farmer and grazier groups so that they were made aware of the problems with parthenium infestations. Video slides along with live plant displays in glass cases were always available and displayed at all meetings with landholder groups. Displays in glass cases were always on display at Council Office and other business houses in the district where landholders frequent regularly.

This awareness campaign achieved much, not only did the landholders show concern but also the public in the street, one interesting point arising was that the majority of enquiries were from the women.

A plant galling moth *Epiblema strenuara* for the biological control of parthenium weed and Noogoora Burr has been released in several areas.

In October 1984 legislation was passed to change Ordinance 50 of the Local Government Act. The changing of this ordinance made it an offence for a prescribed agricultural machine being a header, auger or field bin as being used for the purpose of which it was manufactured being brought into New South Wales from Queensland unless first being inspected at a border crossing.

On inspection a permit will be given if the plant has been cleaned to the satisfaction of the border inspector. The permits are in force from the time of issue until the prescribed agricultural machine to which it relates is subsequently transported from New South Wales into Queensland.

The ordinance also allows for inspection of prescribed plant by Council's weeds inspectors, where inspectors have reasonable cause to suspect that parthenium weed is or may be present on or in the prescribed machine.

Inspectors may direct the person apparently in charge of the machine to stop the machine and permit the inspector to search and inspect the machine, give the person directions to treat the machine forthwith in such a manner as to remove, to the satisfaction of the inspector, any parthenium weed.

Any person to whom a direction is given and who does not comply with the direction breaches of this Ordinance is liable to a penalty not exceeding $500.

Some criticism has been made regarding this Ordinance, one being the low penalty of $500. This amount is the maximum amount allowable under the Local Government Act and is now under review.

Another point has been the definition of prescribed agricultural machinery is too narrow. It has been suggested that all vehicles and equipment which move from the agricultural areas of Queensland into New South Wales should be inspected. For this procedure to be carried out would create long delays at crossings.

The human element being one of the main factors for the distribution of noxious plants I could hardly visualise the travelling public lined up at the border going through a dip such as are now the requirements for

travelling stock before entering New South Wales. One has to be realistic.

Since the inception of the legislation permits issued from November to January from the 11 border inspection crossings offices has been 509, Goondiwindi being the largest issuing office with 371 permits, Mungindi 99, the balance being made up from the 9 other offices.

My personal criticism and possible that of many others towards the legislation is that it has been introduced some five to ten years too late. The old saying is and I quote: "It is closing the gate after the horse has bolted".

I honestly believe that parthenium weed is further wide spread in New South Wales than the present known areas, my reasons for this belief are:-

A. Grain sorghum is being moonlighted out of the parthenium weed area of Queensland into New South Wales and crossing into Victoria.

B. Ruptured bags of sorghum coming out of Queensland to New South Wales have been found to be parthenium contaminated.

C. A known fact that parthenium infested agricultural equipment have operated as far south as Hay.

D. In the west of the State last year Tilpa had a boom season with agricultural crops and was inundated with contract harvesters from Queensland and New South Wales.

The Queensland Department of Primary Industries have stated that under ideal growing conditions parthenium weed was spreading at the rate of some 200 kilometres per year in Queensland.

In conclusion I will reiterate with, "Will it Cross the Border" by this I mean should the Victorians now not be asking this question.

ECOLOGICAL ASPECTS OF BIOLOGICAL CONTROL OF WEEDS

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Precis

Three stages in a biological control program are recognised:

1. pre-control, in which plant density fluctuates about some level above the economic threshold of the weed:

2. the control stage, during which introduced natural enemies exert their primary effect by reducing plant density substantially;

3. post-control, when plant density fluctuates, but at a level well below the economic threshold of the weed.

These three stages will be documented for the biological control of skeleton weed (*Chondrilla juncea*) in south eastern Australia.

I conclude that one form of skeleton weed has been controlled satisfactorily not just because of the release of several natural enemies by CSIRO in the early 1970s, but also because of the interaction between biological control and control exerted by competing pasture plants such as subterranean clover.

ECOLOGICAL CONTROL OF SKELETON WEED IN SOUTHEASTERN AUSTRALIA - PAST, PRESENT AND FUTURE RESEARCH

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SUMMARY

Results of 60 years of research on skeleton weed (*Chondrilla juncea*) are reviewed. The widespread form of skeleton weed has been controlled in cereal crops in south eastern Australia as a result of interaction with competing pasture plants, such as subterranean clover, and the effects of a specific strain of the rust fungjus *Puccinia chondrillina*. The vacant niche created has been filled by plants of two other forms of the weed, for which effective strains of rust are not yet available. Other pasture species or cultivars may be required to control skeleton weed in parts of the cereal zone of South Australia and Western Australia.

INTRODUCTION

Skeleton weed (*Chondrilla juncea*) was first introduced accidentally from Mediterranean Europe to the area near Wagga Wagga in southeastern New South Wales about 70 years ago. The plant has two characteristics which made it a major weed of Australian agriculture - firstly, it competes with cereals for nutrients, especially nitrogen, early in crop growth and thereby lowers yields; and secondly, it produces a tall, wiry flowering stem which interferes mechanically with grain harvesting in early summer. The latter characteristic has led to abandonment of cereal production on some farms in several regions of southeastern Australia. The former has led to a preoccupation with finding ways to control skeleton weed in cereal crops over the last 50 years. In fact, the history of research on skeleton weed control (Groves and Cullen, 1981) can be used as a model for the evolution of weed research and its management in Australia generally. There must be few, if any, case histories in Australia for which more complete documentation is available.

Skeleton weed reproduces both from seed and from buds on the crown of the perennial root system. When the root system is cut during cultivation, buds can regenerate to form new plants. The plant is commonly found in its native Europe on sandy soils subject both to natural disturbance (as, for instance, in river beds in France) and to a lack of competition from other plants in winter. These ecological characteristics make it a plant pre-adapted to invade the Australian cereal zone where similar ecological conditions prevail.

I shall summarize the extensive research done on skeleton weed,

assess the present situation, and point to some deficiencies in our present knowledge which, if tackled, may reduce the plant's weedy status in the future. I confine my coverage to south eastern Australia although I believe that there are some interesting parallels to be drawn with research on skeleton weed in Western Australia, especially its inexorable spread there (see Cullen and Groves, 1977).

PAST RESEARCH

An early paper on skeleton weed control (Clayton, 1927) recommended sowing an annual pasture of subterranean clover (*Trifolium subterraneum*) and ryegrass (*Lolium rigidum*) and its maintenance for 3 to 4 years, after which salt (NaCl) should be applied to any remaining plants of skeleton weed. Many papers on weed control using competing pasture plants followed (Judd and Carn, 1935; Pearson, 1950; Moore and Robertson, 1964; Wells, 1969; Groves and Williams, 1975). Collectively, these studies showed the efficacy of including a pasture phase dominated by subterranean clover and/or lucerne (*Medicago sativa*) in the cereal cropping regime. Such a change in land management allows for fixation of nitrogen, an increase in organic matter and the shading of skeleton weed rosettes. The inclusion of lucerne (cf. subterranean clover alone) may have the added advantage of enhancing competition below-ground, as Judd and Carn (1935) first realised. The end result of this research has been to reduce the competitiveness of skeleton weed, especially for nitrogen, in the early stage of crop growth and thereby enhance cereal growth and yields.

Research on chemical control is almost equally long (Cashmore and Carn, 1938, 1940; Greenham et al., 1940; Greenham and Wilkinson, 1942; Greenham, 1946; Green, 1953; Moore and Robertson, 1963; Greenham, 1973). Since the advent of hormone-like herbicides in the early 1940s, chemicals have been effective in retarding the growth rate of the flowering stem sufficiently so that the cereal crop may be harvested. This retardation is achieved using appropriate rates applied at a time when the cereal plant is not susceptible (3-4 leaf stage). Such a practice does not reduce weed numbers however. Application of herbicides produced more recently, such as picloram, controls skeleton weed in the short term but, because of the greater susceptibility of legumes, such chemicals have not been used extensively. Application of herbicides to fallow land prior to cropping was promising (Myers and Lipsett, 1958; Cuthbertson, 1969; Wells, 1971), but biological methods soon proved more effective.

Research on biological control began in 1966. By 1972 a strain of the rust fungus (*Puccinia chondrillina* had been introduced and was widespread on skeleton weed (Cullen et al., 1973). Two arthropods (*Aceria chondrillae* and *Cystiphora schmidti* - the gall mite and gall midge respectively) were also released. All three organisms reduced growth and seeding of skeleton weed plants, although to varying extents in different regions. Release of the organisms did much to reduce the skeleton weed problem in cereal crops in southeastern Australia (Groves and Cullen, 1981).

Results of past research thus provided ways to control the two weedy characteristics referred to initially. Inclusion of a pasture phase dominated by subterranean clover reduced competition between weed and cereal for nitrogen, whilst spraying with a herbicide early in crop growth enabled grain to be harvested without interference. Mycological control gradually decreased the vigour of skeleton weed and further reduced the deleterious effects of these two weedy characteristics. The interaction (i.e. 'ecological control') between a useful pasture plant of Mediterranean origin and a fungus introduced from Mediterranean Europe had effectively controlled this Mediterranean weed in several cereal-growing regions of southeastern Australia by the late 1970s (Groves and Williams, 1975' Groves and Cullen, 1981).

PRESENT RESEARCH

Three genetically stable forms of skeleton weed exist in Australia (Hull and Groves, 1973), only one of which was widespread throughout the cereal zone of southeastern Australia in the late 1960s. The strain of rust fungus introduced in 1971 was effective only on this widespread form. With one exception, the known distribution of the other two forms was limited in 1969 to central New South Wales (Hull and Groves, 1973). At present, with the reduction in vigour and numbers of one form, the distribution of the other two forms has extended considerably (Burdon et al., 1981) through northern Victoria, and into South Australia. Hull and Groves (1973) claimed "that the final distribution of the three forms will eventually coincide" and their claim seems justified. As far as is known, all three forms are equally susceptible to control by competing pasture plants and by herbicides. Thus the changing distribution pattern arises from the differential effects of the rust strain, and to a lesser extent the gall mite (Cullen et al. 1982; Cullen and Moore, 1983), on growth and survival of plants of the three forms of skeleton weed.

Present research efforts concentrate on searching for, testing and monitoring in the field, strains of *Puccinia chondrillina* effective against the other two forms of the weed in southeastern Australia. To date, these efforts have been unsuccessful. Release of a fourth organism, a root-inhabiting moth *Bradyrrhoa gilveolella* (Cullen, 1981), has yet to have a controlling influence. In theory, *Bradyrrhoa* is the most attractive type of organism for biological control of skeleton weed because it attacks the root system directly.

FUTURE RESEARCH

Fifty years ago, Currie (1936) regarded skeleton weed "as the most serious weed problem in agricultural land in Australia". This review shows that subsequent research has done much to reduce the importance of skeleton weed in cereal-cropping areas of southeastern Australia. Research results on agronomic control begun 60 years ago and those on biological control begun 20 years ago have provided an ecological means of reducing skeleton weed growth and numbers to a level acceptable to cereal farmers.

Our understanding of such ecological control and our continued monitoring of the situation are now sufficient to plan a strategy for future research to further reduce the detrimental effects of skeleton weed. Such a strategy must include finding and releasing virulent strains of rust effective in the field against the two other forms of skeleton weed. If these hitherto-less widespread forms continue to spread into the drier areas of Victoria, South Australia and Western Australia, a search should also be made in Europe for strains of the gall mite (*Aceria*) effective in the field in reducing seeding of plants of these two other forms. We should know more about the distribution of the 30 or more forms of skeleton weed in Europe. Especially, we should try to locate sites at which occur morphotypes of the two other forms present in Australia.

Because of the interactive and ecological nature of skeleton weed control by competing pasture plants and the rust fungus, a strategy for future research should investigate more closely the effects of pasture species or cultivars appropriate to soils more alkaline and growing seasons more truncated than those of southeastern New South Wales where most of the previous research was done.

Results of earlier work by Wells (1969) in the Victorian Mallee should be evaluated for their application to the cereal zones of South Australia and Western Australia.

Finally, if we are ever to control effectively all three forms of skeleton weed in all cereal-growing regions of Australia, we should be asking now the question as to what desirabler species we can begin to promote deliberately to fill the vacant niche. At the moment in southeastern Australia that niche is being filled by two other forms of the same weed for which we do not as yet have adequate control methods. Although ecologically interesting, this present situation is not in the best long-term interests of either Australian cereal producers or managers of weed research programs.

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ECOLOGICAL CONSEQUENCES OF BIOLOGICAL CONTROL OF CHRYSANTHEMOIDES MONILIFERA

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Introduction

Biological control is that method of regulation of the numbers of pest plants and animals which relies on natural enemies - parasites, predators and pathogens - to reduce populations to tolerable levels (after Van den Bosch and Messenger 1973). To date the overwhelming emphasis of most biological control projects has been to reduce the numbers of weeds and pest insects through the planned release of insects as natural enemies. These natural enemies act to prevent the normal tendency of populations of organisms to grow exponentially. This concept of biological control is represented diagrammatically in Figure 1, which illustrates the additional concept of the economic threshold of a weed or pest insect, i.e. what it costs the community. What is this cost in economic terms for *Chrysanthemoides* in south eastern Australia? The workshop held at Port Macquarie last year demonstrated that at least for the NSW National Parks and Wildlife Service this economic threshold has become unacceptably high in the northern region of the Service.

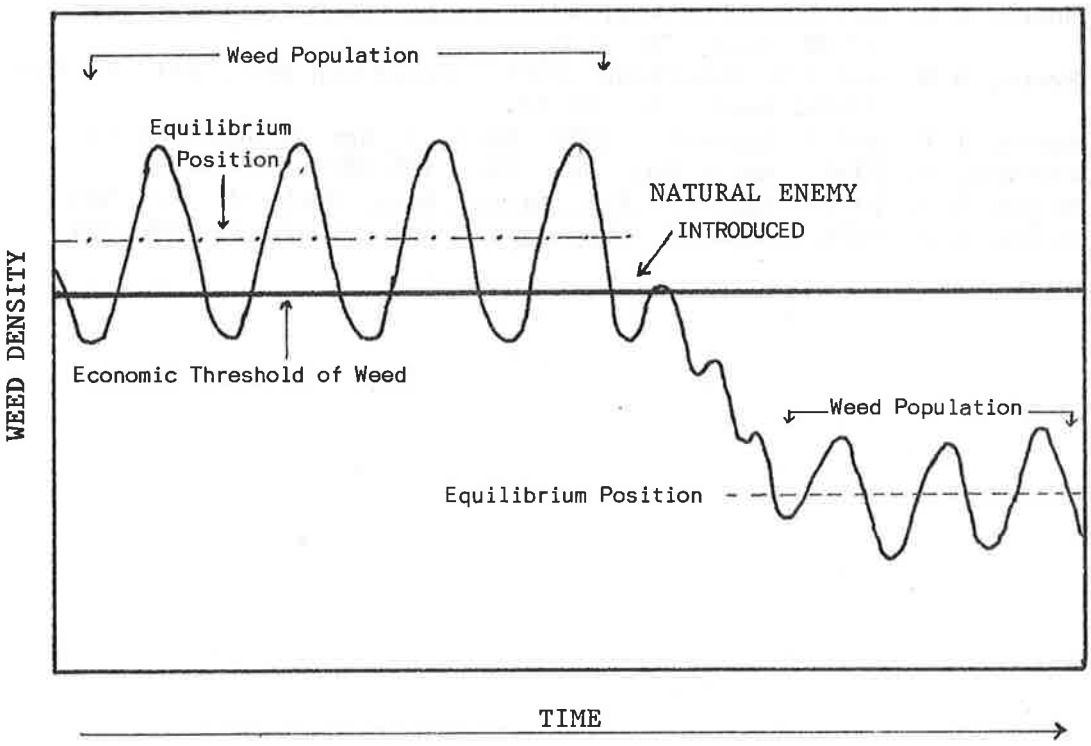

Figure 1. Schematic representation of biological control of a weed as an economic problem (adapted from Fig. 1, Vanden Bosch & Messenger, 1973).

I draw attention to four aspects of biological control which should be stressed in any discussion of its ecological consequences. Firstly, biological control refers to control, not eradication. After the undoubted success of *Cactoblastis* on prickly pear we still have, 50 years later, some prickly pear plants present in eastern Australia. Prickly pear has not been eradicated but it has been controlled to a level where it is no longer an economic problem. Even if biological contrtol of *Chrysanthemoides* were rated a success in 10+ years' time, some *Chrysanthemoides* plants will undoubtedly still be present in coastal vegetation.

The second aspect I wish to stress at the outset is that biological control is only one method of control. It is usually considered when all other control methods have failed or are too expensive to implement. Because the planned use of natural enemies is only one method of control it follows that it will not necessarily lead to the cessation of other control methods in some situations or in some seasons. Hopefully, however, it will reduce the need for these in most situations, thereby lowering the cost of *Chrysanthemoides* to the community.

Thirdly, although biological control has usually been shown to be very effective in cost/benefit economic analyses it remains an expensive form of research to the agency carrying it out. A biological control program involves some years of ecological research in Australia and overseas. The latter is expensive, though not necessarily so relative to the commercial development of a new herbicide for instance. But research administrators take note - to be effective, biological control cannot be done cheaply!

Finally, in the past biological control has been very strongly directed to weeds of agricultural systems and not to natural low-input systems such as those in which *Chrysanthemoides* grows. This is, however, becoming less so with the recent successes of biological control in aquatic systems in the US and Australia and in natural systems in South Africa. Biological control should no longer be viewed as appropriate only to high-input agricultural systems.

Ecological Considerations

My topic is the ecological consequences of a future biological control program on *Chrysanthemoides monilifera* assuming such a program is even moderately successful. In this discussion I shall refer to both subspecies of the plant already in Australia. My presentation necessarily involves making predictions and whilst I shall try to make these predictions as realistic as possible, accurate prediction is extremely difficult in biological control. After being involved in two such programs, one of which (that on *Chondrilla juncea*) has been relatively successful and one of which (that on *Emex australis*) has been unsuccessful, I am somewhat hesitant about making predictions concerning biological control of an agricultural weed, let alone a weed of natural vegetation.

In the above discussion I have focussed on some of the plant ecological consequences of biological control of *Chrysanthemoides*. I have neglected the consequences for wildlife other than plants. If *Chrysanthemoides* is controlled, no matter how, there will be less food and shelter for rabbits, which is presumably desirable, and there will be fewer fleshy fruits for some birds, which may or may not be desirable. One of the two reasons the Victorian Department of Crown Lands and Survey, through its Vermin & Noxious Weeds Destruction Board, used to persuade the Victorian Government to have *C. monilifera* spp. *monilifera* declared noxious in 1969 was that *Chrysanthemoides* posed "an indirect threat to birds and animals by the alteration of their habitat". Presumably in wildlife terms this alteration is reversible but I leave this aspect to discussion by other and more-informed research scientists and land managers. It should not be overlooked, however, as an ecological consequence of control and not just for national park areas.

Integrated Control

In conclusion, I wish to return to one comment I made earlier concerning biologcal control generally. It is that biological control is only one method of control and on its own may not be sufficient to achieve an acceptable level of reduction in weed numbers. If combined with other methods of control into an overall integrated management program its effectiveness may be enhanced and a greater and more acceptable level of control achieved.

To define what I mean by integrated control I again paraphrase Van den Bosch and Messenger (1973). Integrated control is a weed management system that utilizes all suitable techniques (and information) either to reduce weed populations and maintain them at levels below the economic threshold depicted in Figure 1 or to so manipulate the populations that they are prevented from becoming economic problems. "Integrated control achieves this ideal by harmonizing techniques in an organized way, by making the techniques compatible, and by blending them into a multifaceted flexible system. The ultimate goal of any integrated control program is the economical and ecologically acceptable management of pest populations".

For *Chrysanthemoides* an integrated control program presumably will involve the strategic use of herbicides, such as glyphosate (Cooney et al. 1982), and of fire (Lane and Shaw 978). Weiss (1983), on the basis of his attempts to devise a control strategy for infested areas on the South Coast of New South Wales, suggested the use of a herbicide in spring, followed by burning in autumn. In order to control subsequent seedling regeneration, treatment would probably have to be repeated after 12 months, presumably by spot-spraying of *Chrysanthemoides* seedlings. In the future if we can integrate this sort of control with the onslaughts of a seed-eating insect and a fungus able to reduce the vigour of seedlings then the greater (and cheaper?) will be the level of control eventually achieved. If we can deliberately promote the growth of desirable indigenous species

to replace the thus weakened *Chrysanthemoides* we may even achieve a stable long-term reduction in the distribution and dominance of *Chrystanthemoides* in our coastal regions. Such a program seems to me desirable to undertake and, as far as I can predict, it should have mainly favourable ecological consequences.

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HERBICIDE BEHAVIOUR IN SOIL

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The soil is perhaps the largest most important temporary reservoir for the accumulation of herbicide residues. Some portion of practically all herbicides used, whether soil active or foliar applied chemicals, eventually contact the soil. An obvious point of concern is what happens to the herbicide in the soil? Does it temporarily or permanently cause adverse effects on the soil leading to desert? Does it immediately vanish?

In order to answer these questions we must first designate the types of chemicals that are reaching the soil.

With one or two rare exceptions the materials used as herbicides are organic compounds i.e. they are composed of various combinations of the atoms of carbon, hydrogen, oxygen, nitrogen often in combination with chlorine. Organic compounds are distinguished from inorganic chemicals in that the organic compounds can be oxidized by relatively gentle means to form carbon dioxide and water. Therefore, unless we are going to accumulate excessive residues in the soil as a result of our herbicide practice, there must be some mechanism for converting our active herbicide into the harmless products carbon dioxide and water.

There is not just one pathway for degradation. There are eight distinct mechanisms operating to reduce pesticide residues in soil, three of these are primarily concerned with destroying the active compounds and five with physical removal.

The eight mechanisms that operate on a herbicide reaching the soil are:

1. Adsorption onto soil particles.
2. Leaching by rainfall.
3. Chemical decomposition.
4. Photodecomposition by ultra violet light.
5. Vaporization.
6. Microbial breakdown.
7. Soil erosion.
8. Plant and animal uptake.

Not all of these factors operate at once competing for the herbicide; nor do they operate discreetly to the exclusion of other processes; often they work in concert in that, for example, the herbicide may be primarily converted by chemical mechanisms (hydrolysis) to an inactive compound which is unstable for microbial degradation to occur. Similarly, photodecomposition may render compounds unstable for ultimate chemical decomposition.

We demand that the herbicides we use do have different capabilities. We use the foliar herbicides paraquat, glyphosate, 2,4-D etc. and do not wish for any residual soil action. We require that herbicides such as diuron, atrazine etc. have a residual soil action to provide longer term control. By design, the pesticide chemists building a new pesticide will exploit these processes operating in the soil to give either residual or non-residual action. The foliar herbicides are designed to be active on foliage but to be rapidly adsorbed on soil particles and thus inactivated and then quickly degraded. The residual herbicides are designed to be soil active herbicides but to be resistant to the forces operating in the soil. Because of the important bearing these seven processes occurring in soil have on all pesticides, but especially herbicides, a fuller detail is given below.

Factors affecting herbicides in the Soil

1. Adsorption. The soil particle can be regarded as having an active colloidal component, comprising organic matter, clays and metallic oxides. This component affects not only the adsorption of herbicides but is responsible for phosphate adsorption exchangeable base mechanisms etc. In all these adsorption phenomena, nutrient or herbicide, the rate and extent is extremely dependent on -

(a) the organic matter or clay content of the soil;

(b) the pH of the soil and the temperatures to which the soil is subjected;

(c) the solubility of the herbicide in the soil water.

The herbicide may be permanently bound and inactivated as with the case of paraquat, or bound and then form an equilibrium between the adsorbed species and the amount dissolved in the soil water. The adsorption characteristic of the differing soils is highly important in determining the longevity of residues. Is it only when the chemical is in the soil water that most of the other forces can operate to degrade the herbicide further? When in the soil water system the chemical is of course subject to leaching.

2. Leaching is the downward movement of the dissolved herbicide with the soil water. While this is influenced by the complementary consequences of adsorption, it can be a major design feature of the herbicide and is exploited not only in designing residual life but also in placement of the herbicide as the herbicide in this solubilized state is still active. Some effects of leaching on herbicide effectiveness are:

(a) Beneficial effects of leaching -

(i) moving pre-emergence herbicides (linuron, atrazine, lasso, etc.) into the soil. Usually some rainfall is needed to leach pre-emergence herbicides into the soil where the herbicide can be taken up by the weed. Adsorbed to the soil colloids at the surface these herbicides will not control weeds. For this reason, pre-emergence weed control usually fails if rain does not follow herbicide application.

(ii) may move a highly soluble herbicide deeply into the soil where it will kill certain deep rooted perennials without affecting shallow rooted crop i.e. picloram on skeleton weed.

(b) Detrimental effects of leaching -

(i) may move your herbicide out of the zone where your weeds are germinating resulting in poor weed control.

(ii) may leach into ground water and contaminate the environment.

3. Volatilization is the process in which a herbicide or any compound, changes from a solid or liquid into a gas (vaporization). Many herbicides that are in common use are volatile. These herbicides include: 2,4-D esters, EPTC, trifluralin, diallate. To prevent volatility losses of soil applied herbicides, it is necessary to incorporate the herbicide into the soil. With some chemicals it is recommended that the spray boom be mounted directly in front of soil incorporation equipment to prevent volatility losses. Factors affecting volatilization are:

(a) soil temperature. Volatility increases sharply as soil temperature increases. Soil surface temperatures may often exceed 40°C and volatility losses under such conditions can lead to excessive herbicide loss (and poor weed control).

(b) soil type (adsorption). Volatile herbicides are usually more active in heavy soils (non-volatile herbicides are more toxic in light soils). In heavy soils adsorption prevents losses from, or rather escape of the herbicide from the soil. This delayed escape (by diffusion through the soil pores into the atmosphere following soil incorporation) allows greater herbicide uptake by the plants.

(c) soil water. Volatile herbicides are more effective on relatively dry soils compared to wet soils. This is because there is less adsorption (more volatility losses) in wet soils.

(d) air movement. Air movement will enhance volatility losses by moving the vaporized herbicide away from the soil.

4. Photodecomposition is breakdown of the herbicide by the energy provided by ultra violet light. This energy provides the stimulus for parts of the molecule to be broken off, causing inactivation, and leaving the main bulk of the molecule susceptible to further degradation by the other mechanism. While many herbicides are susceptible to photodecomposition, (diruon, atrazine, linuron, picloram, 2,4-D and bromacil), these compounds are generally adsorbed into the soil surface before significant losses occur. One exception is the nitralin group of herbicides such as trifluralin which can be degraded by over 80% if left on the soil surface. This is the primary reason for incorporation of trifluralin after application.

5. Chemical decomposition is a general term covering the loss, and subsequent inactivation of the herbicide molecule. Modern herbicides are designed to have parts of the molecule susceptible to the chemical reactions occurring in the soil. By careful choice of these groups, the persistence of the herbicidally active compound can be programmed for certain lengths of time i.e. life of crop. For example, the addition of an extra chlorine group to 2,4-D, forming 2,4,5-T alters the persistence from 20 days to 90 days because the extra chlorine group protects the molecule. While chemical degradation is regarded as distinct from photodecomposition, they do achieve the same purpose rendering the herbicide molecule inactive and subject to other means of removal. Photodecomposition usually results in a loss of photounstable group whereas chemical decomposition is a substitution of a herbicidally active group with an inactive group. Dechlorination and hydrolysis reactions are a feature of this mechanism.

6. Soil erosion factors are forces which physically move the herbicide from one area to another, e.g. wind or water. These may be important means by which herbicides enter the environment, for example, a pre-emergence herbicide being transported by surface run-off into a stream.

7. Microbial degradation is breakdown of herbicides by soil borne micro-organisms, for example, bacteria, fungi, moulds and algae. Certain species of soil micro-organisms are capable of breaking dcown herbicide molecules. This is a major pathway in the degradation of herbicides because most of the chemicals used are organic and they can be utilized by the soil micro-organisms as a food source. Often there must be a preliminary disruption of the herbicide molecule by photodecomposition or chemical means before these microbial reactions can use the remainder of the molecule. In some cases the degradation (e.g. by chemical means) is promoted by enzymatic attack (from the soil micro-organisms) and dissipation of the herbicide from the soil is extremely rapid. Micro-organisms have the potential for adapting to the metabolism of a vast array of synthetic organic chemicals. It is quite common that the persistence of the herbicide is reduced if the soil has had a history of repeated applications of that herbicide as the micro-organism population has accepted it as a food source. The rate at which a herbicide is broken down by soil microbes is dependent on a

number of soil conditions as well as the chemical structure of the herbicides. Factors favouring microbial breakdown:

(i) High soil fertility and organic matter;

(ii) Aeration, drainage and moisture levels;

(iii) Warm soil;

(iv) Chemical structure of the herbicide.

8. Plant and animal uptake. Significant amounts of herbicide can be removed by plants growing in treated soil. Maize plants remove atrazine from soil and detoxify it into harmless compounds. Soil fauna may unwittingly take up herbicide residues in the soil.

With all these forces acting on the herbicide in soil it is a wonder that we do have persistent herbicides at all. However, it must be remembered that the optimum conditions must be met for these forces to act in concert. Our problems with herbicide carry-over or untoward effects, can generally be attributed to the less than optimum conditions favouring breakdown. This behavious in the soil must be understood so that misuse of these herbicidal chemicals does not occur.

The behaviour in soil may affect selectivity as in the case of control of deep-rooted perennials with readily leached herbicides. The manner in which the herbicide is applied (pre-plant incorporated Vs. pre-emergence) will affect activity. In other words, knowing the forces operating in the soil, we can adapt a method of usage that will either exploit or negate one or more of the forces operating on that herbicide. Failure to understand these forces can lead to accumulation of unwanted active residues.

Herbicides have not presented a long term adverse effect on the environment. With the knowledge available on soil behaviour and the requirements of registration ensuring that detailed research is carried out on the chemical before release, it is highly unlikely that herbicides will pose an environmental problem. The directions for use on the label exemplify such research and the directions as shown must be followed closely if optimum efficacy and no adverse effects are to be obtained.

Some examples of herbicide persistence in soil -

* 2,2-dpa is readily broken down in soil by chemical processes and only persists for 6-8 weeks.

* 2,4-D is broken down readily in soil by microbial action and poses little environmental hazard in soil (2-3 weeks).

* diruon is slowly broken down by microbial action and photodecomposition, it can last 6-8 months in soil.

NOXIOUS PLANT COSTING AND PROGRAMMING WITH COMPUTERS

Alan Smith
Weeds Officer
Bega Valley Shire Council

INTRODUCTION

Providing detailed information to support submissions of various types is how an important function of a Weeds Officer. Forms! Forms! Forms! There seems to be an endless supply of Forms, Reports, Surveys and Submissions that should have been completed yesterday, by the Weeds Officer.

The aim of this presentation is to demonstrate that simple but effective costing/recording techniques can save time and improve the efficiency of noxious plant control within Local Government Organisations. Most if not all Councils now have computer facilities available which should be utilised by all staff. Those Councils that have not yet utilised computers would most likey have a very similar system called a "Works Cost Report" in use by its Engineering Section. Therefore Weeds Officers should communicate freely with other staff and Department heads within Council, to gain better knowledge of and access to facilities and services provided by these various sections.

BEGA VALLEY'S SYSTEM

I adapted an existing system 3 years ago to record information in a format that was useful to me. The cost? NIL! The basic operation is part of all other outdoor staff recording/costing procedures. Every job that needs identification for accounting puroses is given a job number. All outdoor staff record details of work performed on Weekly Timesheets. Overseers then code this information by job number, so that administrative staff can allocate the details of labour, material and plant costs to where Section Heads want it recorded.

Bega Valley Council utilised the services of Shoalhaven City Council's computer up until the end of 1984. Two types of reports are printed each fortnight. One is a General Ledger Transaction Report which provides details of wages paid, plant hire earned, on costs and material used during the previous two weeks. These must be checked for accuracy! or the whole system can become meaningless. The second is a Personal Cost Report which gives a progressive summary total of the information. This information is essential to check the progress of programmes and provide certain information necessary to complete many of these submissions and reports.

HOW IT ALL WORKS;

Firstly lets look at a section of the Personal Cost Report. Council's vote for roadside control of Noxious Plants is identified by the number A4500. To identify individual species I then add two decimal digits i.e. ".01" = Blackberry, ".02" = African Love Grass, ".03" = St John's Wort and so on, until the very minor problem weeds, which are lumped together under ".50" as Sundry Weeds.

Sundry items of expenditure not directly related to specific weeds are recorded under Sundry Items ".51". All on costs are recorded under the one number of ".95". The last decimal digit is a computer check number and is designed to prevent allocation to wrong numbers. It also is changed annually to separate each years figures. The information recorded for each species appears under the following heading: Labour/hours labour/costs, plant hire, stores, other, on order. These columns are totalled vertically and horizontally which provides just about all the information you will need.

HOW DO YOU RECORD INFORMATION?

My spray operators fill in a timesheet which must identify:

(a) each species controlled,

(b) whether it was private contract or council job,

(c) Plant hire details, and

(d the total time spent.

It only takes me a few minutes to write in the relevant allocation job numbers. Existing staff within Council then process the time sheets along with the other 150 or so.

Stores issues dockets record herbicide and other materials used, these dockets are signed by the Weeds Officer who completes the allocation number before they leave the store.

Fuels, oils, tyres, registration, repairs, etc. are all booked to the item of plant and are paid for by the hire it earned.

WHAT'S THE SCOPE FOR EXPANSION?

Private contract details are recorded the same way. I have a master number A7006 that refers to all private contract jobs whether full job or sale of herbicide only. I can then add decimal digits from .00 to .99 to identify individual jobs. If you do a lot of private contract work or sell a lot of herbicide, take out 10 numbers, i.e. A7000 to A7010. When you add the decimal digits you have the capacity to record 1000 entries.

Inspector costs such as salary, sick leave, annual leave, workers compensation, etc. can all be recorded in a similar manner.

This type of recording could easily be adapted to private property inspections, where several inspectors are employed. It means that some type of recording sheet is required and is best completed daily. Computer entries could be made weekly by other Council staff, all this then would provide useful information for submissions at a future date. It also provides a good record of where time is spent in regard to certain programmes.

WHAT ARE THE ADVANTAGES?

1. Detailed information is readily available for use by Weeds Officers when reporting, preparing submissions or completing survey forms.

2. Raises the status of noxious plant control by demonstrating efficiency in accounting.

3. Enables a check to be made on the progress of various programmes.

4. Provides a sound basis for structuring future programmes.

5. Provides accurate and important information suitable for inclusion in a "Statement of Facts" for legal proceedings.

CONCLUSION;

My final comments are:

1. Find out what system your Council is using now to record "Works Costs" within the Engineering Department.

2. Investigate if its possible to adapt this system to your needs.

3. Approach the Shire Clerk or your department head to have a Personal Cost Report prepared by existing staff for your convenience.

4. Don't just think about it - do it!

SCREENING PROCEDURES FOR BIOLOGICAL CONTROL AGENTS FOR WEEDS

Dr Ernest S. Delfosse
Senior Research Scientist
CSIRO
Division of Entomology

A classical biological weed control program can be divided into three main phases: (1) initiation and approval; (2) pre-introduction studies (foreign exploration, host-specificity testing, and agent approval); and (3) post-introduction studies (importation, quarantine clearance, mass-rearing, release, evaluation and re-distribution). The screening of potential agents for weeds ("host-specificity testing") is the most important step in the procedure leading to liberation of an agent in Australia. As indicated, the tests are usually done overseas, but sometimes are done entirely or in part in quarantine in Australia.

Determining the likely host range of an introduced, phytophagous organism following its release in a new environment, free from the natural enemies in its native habitat, and potentially exposed to thousands of plant species with which it has never before come into contact, is not an easy process. Obviously, some risks are associated with such movements of living organisms, and introductions should never be done until exhaustive testing is completed and evaluated by competent individuals.

Contrary to much popular belief, the majority of insects which feed on plants show some degree of specialisation to their hosts. Some feed on several species, usually related (e.g., members of the same plant family); some may utilise only one or two closely related species; and a number have only a single species as their host. A common situation is that one plant species is the preferred host and the most suitable, but survival is possible on species closely related to it. The close adaptation of a species to a particular host, evolved over a long period of time, usually confers an ability to utilise that host more efficiently than a more general feeder utilises the same species. Such adaptation may also remove the species from direct competition with other species inhabiting the same environment.

The acceptability and suitability of a plant as a host for a phytophagous species is mediated by a series of inter-related reactions to chemical, physical and environmental stimuli. If one or more of these are different from those provided by the normal host plant, the acceptability and/or suitability decreases or disappears entirely. The more closely related are two plant species, the greater the probability that they will have chemical and physical properties in common. Thus, if more than one plant species is attacked, they are likely to be closely related. Therefore, considerable emphasis is placed on family relationlships in determining a list of plant species for testing.

Another point to consider is the possible mutation of an introduced agent, resulting in expansion of its host range. The complex relationship between a host-specific agent and its host plant is controlled by many genes, and the chance of any one mutation causing a change in host range is extremely small. When changes do occur as a result of a single mutation, they are likely to be very limited. Over a long period, however, changes may arise as part of the evolutionary process. If an extension of host range does occur, it is most likely to be to species most closely related to the original host plant, because the changes required are smaller than for less closely related species. However, over the period of operation of classical biological control of weeds (about 80 years), no such changes have been recorded, and the possibility of such changes is considered as very remote, particularly to any but the most closely related plant species. If a change of specificity by mutation was considered a real possibility, Australia would have more to fear from the 100,000 or so native species of insects than from the 80 carefully studied, introduced, biological control agents.

The goal of host-specificity testing, therefore, is to determine the risks presented by each potential agent for biological weed control, so that its likely host range can be predicted with reasonable accuracy, and an informed, impartial decision can be made as to the desirability of its liberation in Australia.

This process, while becoming increasingly sophisticated, has proved valid in over 80 years of use: a mistake has never been made in biological weed control when proper procedures have been followed. This is not to imply that plant species other than the target weed have never been attacked to a limited degree, but that such attack was predicted by the testing, and the risk of such attack was judged to be minor compared to the potential benefits due to successful biological control of the weed.

Basically, there are three inter-related sets of data that are needed to determine the likely host range of a potential agent of a weed, and thus the risk involved in its introduction to the flora of Australia. These are: (1) the range of test plants on which the agent will lay eggs; (2) the range of test plants on which the agent will feed as adults and immatures; and most importantly, (3) which plant species will support complete develolpment, from egg to adult, of the agent.

Two basic testing strategies can be employed to determine host range: (1) the crop testing method; and (2) the biologically relevant method. These two strategies are often integrated (i.e., they are not mutually exclusive), and may involve laboratory, field-caged and field-uncaged procedures.

The crop testing method is often used when the potential agent is from a region where little is known about its taxonomy and host range, or about the pests of crops in that region. Important crop plants from the intended country of introduction are tested. This strategy can yield misleading results, because test plants which are attacked by agents confined on them in cages may lack the stimuli which attract the agent or which induce feeding or oviposition in nature, or they may

lack inhibitors which prevent attack. Another disadvantage of this strategy is that a series of negative results on a number of plants that are unrelated to the target species yields very little information about the expected host range, and therefore does not allow prediction of the agent's reactions to plant species not tested.

The biologically relevant method is preferred, especially where there is adequate background information. The theory supporting this method is that if the host range (and ideally, the basis of host-specificity) is known, that a priori, all other plants are immune. In this strategy, plants are selected on the basis of their perceived risk of attack; crop plants are also tested, but as they are usually distantly related to the target weed, they are theoretically less at risk.

A combination of the two strategies has been developed by the CSIRO Division of Entomology, and is in widespread use throughout the world. It is known as the "centrifugal phylogenetic testing procedure". This procedure relies heavily on the close evolution of natural enemies and their hosts. In this procedure, it is assumed that plants closely related to the target weed are more at risk from attack by a natural enemy of the target weed than they are to those more distantly related, and thus testing is heavily biased in favor of those species. Six groups of plants are tested with this procedure: (1) those in the same botanic genus, family and order as the target weed (this category is the most important in determining the biological host range); (2) plants of Australian or non-European origin not widely cultivated in the region from which the target weed originated; (3) plants which, for eco-climatic reasons, have not been exposed to the potential agent; (4) plants important to Australia whose entomological fauna is poorly known in the region in which the target weed originated; (5) plants attacked by species in the same genus as the potential agent; and (6) other cultivated plants not in the other categories or suggested by Plant Quarantine officials. A list of plants in the above categories is submitted for approval to Plant Quarantine officials. Once approved, testing begins.

Three types of tests are commonly employed: (1) no-choice; (2) paired-choice; and (3) multiple-choice tests. These are used to determine the range of plants on which oviposition, adult and immature feeding, and especially, completion of development occurs. In no-choice tests, the potential agent is given only one species on which to feed ("starvation tests") or lay eggs. If some attack occurs on species in no-choice tests, paired-choice tests are often conducted, whereby plants of the target weed and the species attacked in the no-choice tests are offered at the same time to the potential agent, and it is observed if it makes a choice between them. In the same way, a multiple-choice test might also be used, in which the attacked test species, the target weed, and several other plant species are offered to the potential agent. It should be noted that these tests are modified for each species of potential agent, and that the precise order and type of tests used can vary with each species.

Oviposition tests are conducted to determine if the potential agent will lay eggs on the test plant. In general, adults of the potential agent, including gravid females, are placed in a cage containing the

test plant(s), and notes are made on normality of oviposition, as well as number of eggs laid. This is done because if the "wrong" cues for oviposition are present, oviposition will either be unsuccessful or abnormal. One complication with oviposition tests is that some otherwise host-specific agents are promiscuous in the oviposition under laboratory conditions.

Where applicable, both adult and immature feeding tests are conducted. For adult feeding response, generally a no-choice test is conducted first. If serious feeding occurs on a test plant, then it can be paired with the target weed and comparative feeding noted (a paired-choice test), or placed with the target weed and other test species (a multiple-choice test). Feeding by immatures can be rated in a similar way.

In determining if the potential agent can complete development on a test species, two procedures are commonly used. One is to take plants on which oviposition was successful, and observe if eggs hatch, if immatures enter the plant (if applicable) and began to feed, and if they complete development (i.e., became adults) on those plants. The second procedure is to place eggs or newly-hatched immatures of the potential agent on (or in) the test plant, and determine if they complete development. The ability of any adults reared on a test plant to reproduce and to complete subsequent generations on the same host is investigated.

In all of these tests, controls are run at the same time, using the target weed as the control treatment. If there is no reaction to the target weed, the test is considered to be invalid and is repeated. Also, the data should be recorded in a quantitative way (number of eggs laid, number of larvae hatched, number of feeding spots or mm of tissue eaten, etc.) as well as in a qualitative way (eggs laid, larvae hatched, feeding occurred, etc.), because this leads to a better understanding of the reaction of the potential agent to the test plants.

As can be seen from the above discussion, the procedures followed to determine the host-specificity of a potential agent are quite complicated. Tests normally take from three to five years for each species of potential agent. If, after completion of the testing, we feel that the agent would be safe to introduce to Australia, application is made, giving the test results, to Plant Quarantine (formerly part of the Department of Health, now part of the Department of Primary Industry), who rules on the application. If approved, the agent is imported into an approved quarantine facility, and the remainder of the procedures mentioned in the first paragraph of this paper are followed.

BOTANICAL STUDIES OF WEEDS

John A. Carnahan,
Senior Lecturer in Botany,
Australian National University

The Botany Department of the Faculty of Science at the Australian National University does not offer any formal training in weed science in its undergraduate courses, although some weeds are used as examples in teaching various aspects of botany. However, Honours and graduate students do have the opportunity to undertake research on weeds, if that is where their interests lie. Over the years, we have therefore had several interesting studies on the biology and ecology of weeds.

Austral Bracken (*Pteridium esculentum*)
Owen Cartledge, 'A study of the community relationlships of bracken, *Pteridium esculentum* (Forst.f.) Nakai, in the vicinity of Canberra'. Thesis for B.Sc. (Honours), 1966.

Publication: Cartledge, O. & Carnahan, J.A. (1971). 'Studies of austral bracken (*Pteridium esculentum*) in the vicinity of Canberra'. New Phytol 70: 619-26

It was shown that bracken patches might be prevented from spreading, either by sheep and cattle tracking round them or by competition from vigorous rhizomatous grasses. However, this was in areas that are marginal for bracken, with relatively low rainfall and infertile soils.

African Lovegrass (*Eragrostis curvula*)

Ian McConnell, 'Some aspects of the eco-physiology of *Eragrostis curvula* (Schrad.) Nees'. Thesis for B.Sc. (Honours), 1979.

An unpalatable strain of *Eragrostis curvula* is taking over the pastures of the Bredbo region because it has almost ideal qualities - for a weed. It has a rapid reproductive cycle; it spreads readily by seeding and by tillering; it is still making vigorous growth at temperatures well above 30o C, when the improved grasses have gone dormant for the summer; and it also persists through the frosts of winter.

Rocksprays and Firethorns *Cotoneaster* spp. and *Pyracantha* spp.
Michael Mulvaney, 'The distribution, ecology, and "weed potential" of naturalised species of *Cotoneaster* and *Pyracantha* within the Canberra region'. Thesis for B.Sc. (Honours), 1984. Some of these species have spread from ornamental plantings in Canberra into the surrounding rural areas. They are being moved forward slowly but steadily by birds. The environments of woodlands and pine plantations are particularly favourable to them, but they have the potential to invade nearly every habitat type in the region.

Seed Banks

Noel B. Pavlovic, 'The variation in seed banks on Black Mountain'. Thesis for Graduate Diploma in Science, 1982.

Publication being prepared.

One of the seed banks studied was in the soil beneath a native grassland dominated by kangaroo grass (*Themeda australis*), from which stock has been excluded for 12 years. There was an unexpected mass of viable seeds of exotic species, including common centaury (*Centaurium erythraea*), cluster clover (*Trifolium glomeratum*), and delicate hairgrass (*Aira elegans*), which could readily be released by disturbance.

Burrs (*Xanthium* spp.)

Robert J. Martin, 'Distribution, ecology and control of *Xanthium* species'. Thesis for Ph.D., 1981.

Publications: Martin, R.J. & Carnahan, J.A. (1982). 'Distribution and importance of Noogoora and Bathurst burrs in eastern Australia'. Aust. Weeds 2: 27-32.

----------(1983). 'The effect of field storage and laboratory conditions on germination of five *Xanthium* species'. Aust. J. Agric. Res. 34: 249-60.

----------(1983). 'A population model for Noogoora burr *Xanthium occidentale*)'. Aust. Rangel. J. 5: 54-62.

Martin & Carnahan
----------(1984). 'Factors affecting growth and reproduction of Noogoora Burr Xanthium occidentale (Bertol) Aust J. Agric Res 35: 271-8

The species of *Xanthium* are annual weeds. Noogoora burr is the worst of these species because of the difficulty of removing its burrs from fleece and because of its continued spread. Its success may be due in part to its rapid germination rate, coupled with the protection of the seed by the burr, and in part also to its ability to maximise burr production.

The populations of Noogoora burr fluctuate with rainfall. Because of its rapid recovery after drought, it is most important to make an extra effort to prevent seeding in the first favouravble year after several succeessive dry years. Biological control may be the only means of controlling large-scale infestations, but the control organism would have to match the life-cycle and the resilience of its host.

The work on *Xanthium* was supported by grants from the Australian Wool Corporation.

FUNGI AS HERBICIDES - MYCOHERBICIDES

Bruce Auld
Senior Research Scientist
Agricultural Research and
Veterinary Centre
ORANGE

Recent research in the USA has shown how fungal diseases of plants can be applied as spores in liquid suspension like conventional herbicides to kill weeds.

The technique utilises plant pathogens already existing in the environment and has not been used with imported fungi. The basic idea is that the fungus is bred artificially in culture and applied at very high concentrations - something like a million spores per millilitre.

The technique only uses fungi which are specific for particular weeds. They do not often kill many weeds in nature because they are poorly adapted for spreading and do not usually occur in high concentrations.

By contrast the rust fungi which have been imported for skeleton weed control are dried-spored-fungi, spread by wind.

There are already two commercial mycoherbicides on sale in the USA. One for control of a weed in rice, another for a vine weed of citrus.

One of the disadvantages of mycoherbicides at present is they are specific for particular weeds - this is undesirable from a commercial standpoint (except for very widespread and important weeds) as it limits the market potential for the product. It is hoped in the future that various fungi and herbicides will be combined to produce broader spectrum products. Research is underway on this.

At the Agricultural Research and Veterinary Centre, Orange we are conducting a joint project with the University of Arkansas on mycoherbicides for control of *Xanthium* species weeds, Noogoora and Bathurst burrs, which are important weeds both here and in the USA. At present we are testing one fungus that is very promising on Bathurst burr and we are testing this and another fungus on Noogoora burr and the other three *Xanthium* species which occur in Australia.

WHAT'S NEW WITH FIREWEED?

Terry Launders
Senior Research Agronomist
NSW Department of Agriculture
TAREE

The most outstanding development in recent years towards the control of fireweed has been finding the correct name of the plant. Previously regarded as *Senecio lautus* and a native species of Australia, fireweed has now been confirmed as *Senecio madagascariensis*, a native plant of south-eastern Africa.

The significance of finding the correct name of the plant is that biological control agents may be obtained from the country of origin of fireweed. A CSIRO team going to South Africa to seek such agents for spiny emex may be asked to collect insects and pathogens which attack fireweed in that country.

Identification

The most common form of fireweed in coastal districts is a low, much-branched, short-lived perennial bush, 10 to 50 cm high, with numerous small, yellow, daisy-like flowers in a loose cluster at the end of the branches.

Distinguishing feature of *S. madagascariensis* is a constant number (13) of yellow petals.

Control by Pastures

The best control for fireweed is based upon a vigorous permanent pasture that can compete strongly with the fireweed seedlings in the autumn to early winter period.

On the mid north coast, the severity of fireweed infestation in pasture paddocks appears to be inversely related to the rainfall and pasture growth during the previous summer. If summer rainfall is low and pasture growth is poor, fireweed is usually thick in the following winter.

Careful grazing management is required to maintain pasture density and ground cover, which in turn reduce fireweed seed germination and suppress seedling gorwth and development.

In areas where they can be established and maintained, productive and permanent winter pasture species such as phalaris, ryegrass, white clover and subterranean clover offer the best form of control.

Perennial summer growing pasture species such as kikuyu, setaria, paspalum and Rhodes grass can also be established and managed to give good control of fireweed.

Biological Control

Diseases and insects have been found attacking and killing fireweed. However, none offer a sufficiently significant or reliable degree of control of fireweed to be useful.

Chemical Control

Strategic applications of herbicides may be required during cropping or pasture improvement programmes to provide competitive permanent pastures.

Chemical Control

Herbicides recommended for fireweed are:-

Spray Equipment - Bromoxynil (Trade Name Brominil)
Apply at 1.4 L/;ha to 2.8 L/ha.

Wiper Equipment - Glyphosate (Trade Name Roundup)
Mix 1 part with 2 parts clean water.

Results from Herbicide Trials

A. BOOM SPRAY

1. Flowering Fireweed Plants in Carpet Grass Pasture

Treatment	Kill	Cost
	%	$/ha
Brominil 2.5 L/ha + 2,4-D ester 1.4L/ha	100	36-22
Brominil 2.5 L/ha	96	26-00
poundup 6L/ha	96	129-00
Roundup 3L/ha	73	64-50
Roundup 1L/ha	41	21-50
2,4-D ester 1.4L/ha	39	10-22
Dicamba 1.4L/ha	37	16-10

2. Young Fireweed Plants in Carpet Grass Pasture

Treatment	Kill	Cost
	%	$/ha
Brominil 2.5L/ha	99	26
Brominil 2.5L/ha + 2,4-D ester 1.4L/ha	98	36-22
2.4-D ester 1.4L/ha	71	10-22
Glyphosate 1L/ha	69	21-50
Dicamba 1.4L/ha + 2,4-D ester 1.4L/ha	45	26-82
Dicamba 2.8L/ha	43	33-20
Dicamba 1.4L/ha	28	16-20

3. Mixed Age Fireweed Plants in Carpet Grass Pasture

Treatment	Kill	Cost
	%	$/ha
Brominil 2.8L/ha	90	29-12
Brominil 2.1L/ha	88	21-84
Brominil 1.4L/ha	82	14-56

4. Young Fireweed Plants in Clover - Ryegrass Pasture

Treatment		Kill	Cost
		%	$/ha
Brominil M	1.4L/ha	100	14-90
Brominil M	2+1L/ha	100	22-35
Brominil	1+4L/ha	99	14-56
Brominil	2+1L/ha	99	21-84
Tribunil	2 kg/ha	96	37-70
Tribunil	1 kg/ha	94	18-85
2,4-DB	4+2L/ha	56	24-07
2,4-DB	2+8L/ha	45	16-05

B. ROPEWICK APPLICATOR

Treatment			Kill
YOUNG PLANTS %			
Brominil	Hand Unit		93
Roundup	Hand Unit		92
FLOWERING PLANTS			
Brominil	Hand Unit		50
Roundup	Hand Unit		76
Roundup	Pipe Unit		96
Roundup	Pipe Unit	1 Pass	69
Roundup	Pipe Unit	2 Passes	94

PRICKLY-PEAR CONTROL IN NSW

G E (Garry) Ryan
Commissioner
Prickly-Pear
Destruction Commission

"Prickly-pear" is the name given to a group of perennial, succulent plants of American origin which belong to the cactus family Cactaceae. It is from the fruit, which is very spiny and pear shaped, that the plant has been given the name of prickly-pear.

"Prickly-pear" or "pear" means a plant of any species within the cactus tribe Cactaceae (or Cerceae), Opuntieae or Pereskieae, but does not include a plant of any description prescribed by the regulations, ie. Indian Fig, for the purpose of this definition. There are about sixteen hundred different varieties in the above three tribes.

History of the Prickly-Pear Destruction Commission

The first body designated to deal with the prickly-pear problem was the Commonwealth Prickly Pear Board. In December 1919 agreement was reached between the Commonwealth, New South Wales and Queensland Governments, and the Commonwealth Prickly Pear Board was constituted.

The Board was financed by the three Governments, 4,000 pounds per annum for five years from the Commonwealth and 2,000 pounds per annum from New South Wales and Queensland. Members of the Board were Mr Gerald Lightfoot of the Commonwealth Institute of Science and Industry, Mr W Gordon Graham, Under Secretary of the Department of Lands, Queensland, and Mr George Valder, Under Secretary of the Department of Agriculture, New South Wales.

The Boards charter was to search for biological control agents, including insects and plant disease organisms. Chemical or mechanical control of prickly-pear was not part of the Board's charter. The Board was terminated in 1939.

The Queensland Prickly-Pear Land Commission was appointed on 14th April, 1924, with authority under the Prickly-Pear Land Act of 1923. The Commissions charter was similar to that of the New South Wales Prickly-Pear Destruction Commission. In 1932 the work of the Queensland Commission became part of the operation of the Land Administration Board.

In 1924 the Prickly-Pear Act was passed in NSW, which made provision for the constitution of a Prickly-Pear Destruction Board, later replaced by a Commissioner, with wide powers to deal with the prickly-pear problems in this State. The Prickly-Pear Destruction Commission commenced operations in 1925 with headquarters in the Land Board Office at Moree. In May, 1931, the headquarters was moved to the Lands Department in Sydney. In January 1975, the Commission was attached to the Department of Agriculture and in October 1980, the Commissions headquarters was regionalised to Tamworth.

The objective of the Prickly-Pear Act, 1924, was the eradication of prickly-pear from New South Wales. For some time it has been obvious that this objective is not likely to be achieved, due to the nature of

the plant and the economics of such a plan. The Commissions past policy had been to aim at eradication in order to maintain a high degree of control. The present policy is an integrated control approach with emphasis on biological control of pest pear species.

Biological Control

Cactoblastis insects *Cactoblastus cactorum* were introduced into Australia from South America during 1926. By 1932 these insects had caused a general collapse and destruction of the thick stands of common pest pear *Opuntia inermis* in Queensland and New South Wales. The devastation wrought by Cactoblastis insects was regarded as a remarkable occurence and a spectacular example of the control of a serious weed pest by biological means.

Cactoblastis insects did not completely eradicate common pest pear in New South Wales but did reduce most infestations to a degree where it was considered economical to control the pear by spraying with chemicals.

Common pest pear can be controlled in most of New South Wales today by the use of two prickly-pear insects, *Cactoblastis cactorum* and cochineal *Dactylopius opuntiae*.

Biological control is currently the cheapest method for large scale control of tiger pear *Opuntia aurantiaca* on non-arable land. The cochineal insect *Dactylopius austrinus* is the main insect used to control tiger pear. Larvae of cactoblastis and *Tucamania tapiacola* also damage tiger pear although they do not reduce infestations as much as cochineal.

Biological control plays a lessor role in the control of the Tree pears, *Opuntia tomentosa* and *Opuntia monacantha*. Trial work is proceeding with the use of the mealy bug *Hypogeococcus festerianus* on Harrisia cactus *Eriocereus martinii*.

Chemical Control

Chemical and mechanical control of common pest pear proved to be inadequate from the time concern was first expressed about the spread of the pest in 1870 until cactoblastis achieved a control situation in 1932.

Chemical control plays a much larger role today. The use of the chemical 2,4,5-T became widespread from 1958, replacing arsenic pentoxide, and was effective in controlling all types of opuntia. Loss of this chemical has caused a considerable problem for the Commission and landholders.

Currently the Commission uses and recommends the registered products Tordon 1040 and Garlon 480. Trial work has shown that low volatile 2,4,5-T can replace high volatile 2,4,5-T in the Commission's product, Prickly-Pear Commission Prickly-Pear Spray. An application to register the changed formulation has been made to the Registrar of Pesticides.

The Dow products Garlon 480 and Grazon have been trialled and found to be more effective when mixed together to obtain optimum formulation suitable to control common pest pear and tiger pear. The Commission has applied for a permit to use and recommend these chemicals.

Mechanical control methods, such as digging out plants and burning or burying them, is suitable for very small infestations. Ploughing arable

country is an economical way of controlling prickly-pear, particularly tiger pear.

Spray Equipment

Recent trial work with the Gas Gun has proved to be interesting. This implement would appear to have some advantages over conventional backpack sprayers.

The Sprinkler sprayer, a Queensland product, has also been used with some success. Further work is being carried out on large infestations of velvety tree pear near Ashford and smooth tree pear on the north coast.

The Commission mainly uses a special heavy duty knapsack and handpiece developed during 1960's. This knapsack will stand up to very rough treatment and is ideal for spot spraying. A lighter version, an adapted Rega unit, is on display at this Conference.

Power sprays are used to chemically treat massed infestations of prickly-pear.

Present Prickly-Pear Situation

Common pest pear is under control in New South Wales. There are still some problem areas, mainly in the Hunter Valley, Turon River frontages, Rylstone and Mudgee districts.

Tiger pear is not under control. Major infestations are located on the Horton, Gwydir, Severn, Namoi, Peel, Castlereagh, Hunter, Goulburn, Turon and Macquarie Rivers' frontages and some of their tributories. Distribution of cochineal insects, use of chemicals, cultivation and other mechanical control methods are producing reasonable results. Control of most isolated infestations has been achieved.

Harrisia cactus, which is a problem in the Boggabilla area near the Queensland border, is being controlled. Constant inspections and chemical treatment are essential to control harrisia cactus.

Tree pear, rope pear, creeping pear and other minor species pose no major threat. Isolated problem areas exist but the Commissions inspection and control programme is producing satisfactory results.

Advice regarding control of prickly-pear can be obtained from the Commission's offices located at Seven Hills, Singleton, Scone, Mudgee, Dubbo, Tamworth, Bingara, Ashford, Moree and Mungindi. Headquarters of the Prickly-Pear Commission is on the 3rd floor, GIO building, 1 Fitzroy Street, Tamworth, (PO Box 643, telephone 067-661988).

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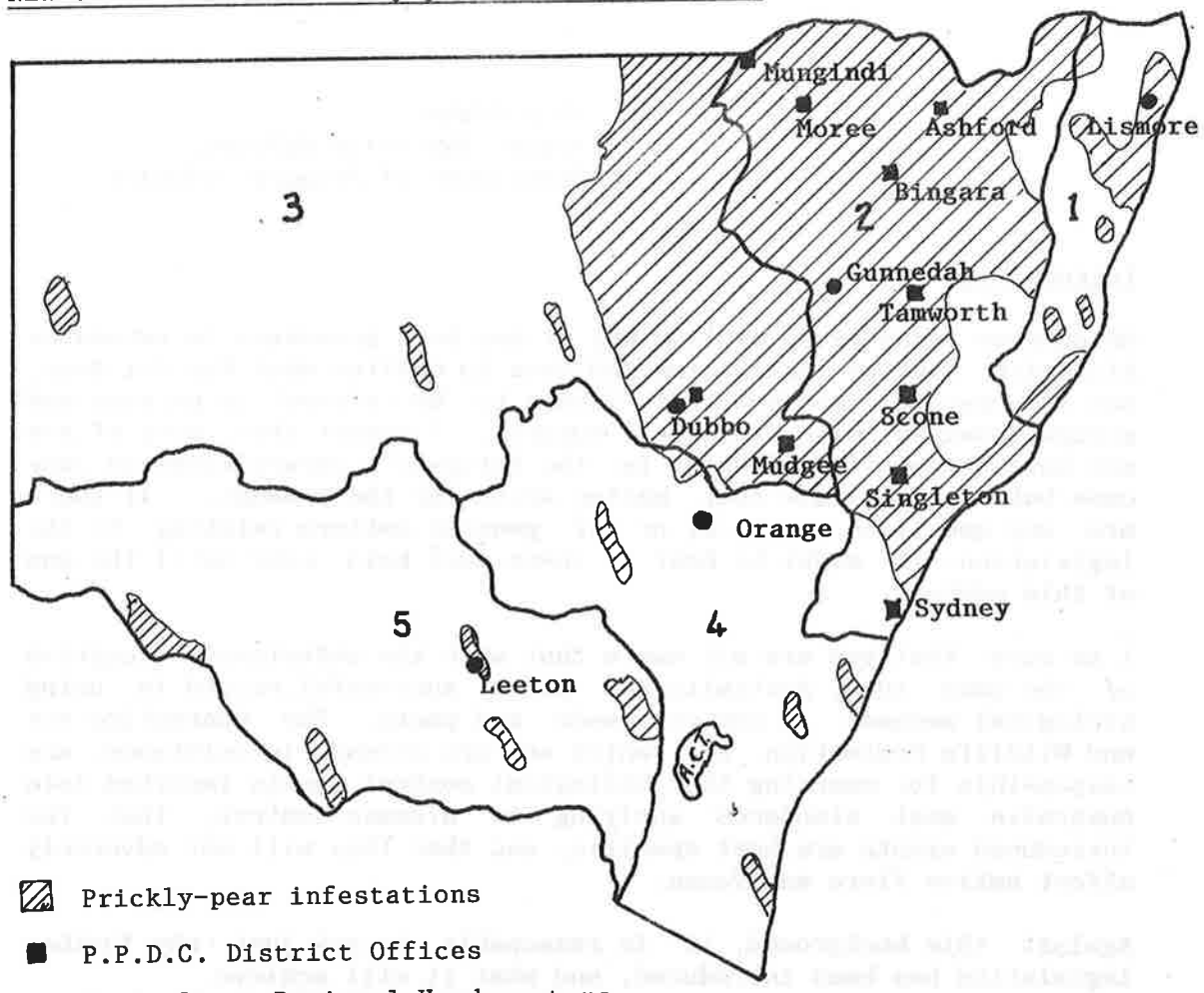
"Further Integration of the Prickly-Pear Destruction Commission within the Department of Agriculture", K Hutton, Dr A N Smith, O R Southwood, G E Ryan.

"Tiger Pear is a Continuing Problem", J R Hosking, P J Deighton.

"Biological Control of Cacti in NSW", J R Hosking.

NEW SOUTH WALES: Prickly-pear Distribution Map



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IMPLICATIONS OF THE BIOLOGICCAL CONTROL ACT 1984

Jack Blaker,
Senior Executive Officer,
Department of Primary Industry.

Introduction

My purpose today is to explain why it has been necessary to introduce Biological Control legislation and then to outline what the Act does, how it operates, and how it is likely to be relevant to persons and groups involved with biological control. I expect that many of you may have a specific interest in the Paterson's Curse/Salvation Jane case but I will leave that matter aside for the present. If there are any questions on this, or any general matters relating to the legislation, it might be best if these were held over until the end of this address.

I am sure that you are all aware that with the unfortunate exception of the cane toad, Australia has had a successful record in using biological methods to control weeds and pests. The Quarantine Act and Wildlife Protection Act, which are are already in existence, are responsible for ensuring that biological control agents imported into Australia meet standards applying to disease control, that the introduced agents are host specific, and that they will not adversely affect native flora and fauna.

Against this background, it is reasonable to ask just why further legislation has been introduced, and what it will achieve.

The Need for Legislation

Put most simply, legislation has had to be introduced because it was found that there was no statutory power to release biological control agents (insects etc), and that it was therefore possible to prevent a release if a successful action could be brought on the grounds of the common law of private nuisance. It is a relatively simple matter to bring a successful action; once legal standing is demonstrated, the propensity of biological control agents to spread across property boundaries means that public nuisance is not hard to demonstrate.

The significant feature of such actions is that common law is concerned largely with the rights of the individual rather than with net public benefit. The situation was, therefore, that in the light of the loop hole demonstrated by the Paterson's Curse case, a potential existed for persons to block ostensibly beneficial biological control activities, or to seek damages where releases were made. For example, a rabbit trapper could possibly block improvements to the myomatosis program, that is, the target of the control may be the issue. Alternatively, but far less likely, a person may not dispute the target but may be concerned about effects

on non-target species, even if these were marginal and a net public benefit was likely.

The implication of all this was that money spent on biological control research and implementation could be wasted and/or that damaged could have to be paid. In the face of this sort of uncertainty, organizations involved in biological control would be tempted to divert scarce human and financial resources to less risky enterprises. The value of biological control in the fight against weeds and pests is such that this possibility was simply unacceptable.

This was the problem that had to be resolved, and legal advice was that the solution had to be by legislation. Constitutional considerations meant that this could only be achieved by the Commonwealth and the States enacting complementary legislation.

The Biological Control Act came into effect on 22 November, 1984, but will only be fully operational when the State and Northern Territory governments enact complementary legislation. That is, all legislation will have to be in place before actual release of any unathorised biological control agent could take place.

What the Act Does

The solution that the Act provides, subject to a number of procedures and safeguards which I will turn to shortly, is to prevent people from taking legal action to prevent or disrupt biological control programs that are found to be in the public interest.

This approach means that certain common law rights have been replaced by an administrative process. As a safeguard, the Act therefore opens the decision making process to public scrutiny. It requires that before any decision is made to authorise a target for biological control, the proposal must be advertised so that public comment can be made and considered. The same process is available for the control agents but because these are carefully screened under the Quarantine and Wildlife Acts to ensure that they are 'safe', there is far less likelihood of them being seriously challenged.

If the process of public comment and review raises substantive doubts about the biocontrol proposal, the matter may be reconsidered and, if necessary, a public inquiry ordered under the Act. This is in fact what has occurred in the Paterson's Curse case.

The final decision on whether to authorise a biocontrol proposal rests with a person described in the Act as the Biological Control Authority. This is presently the Minister for Primary Industry and it is probable that this will remain the case. The Biological Control Authority is the Authority throughout Australia, but will only make decisions after consultation with the State and Northern Territory Ministers on the Australian Agricultural Council. I will summarise this process when I move on to outline how the handling of proposals under the Act - it's actual operation - may affect weeds officers, researchers and the like.

Before I do this, it is important that I point out those things that the Act does not do.

The Act does not require that all biocontrol proposals be submitted for consideration. Agencies are free to proceed just as they have done in the past, but if they do they will continue to accept the risk of common law legal action. Of course, the great majority of biocontrol proposals are both non-controversial and subject to the Quarantine Act, so that the agencies can decide on a case by case basis whether or not they will proceed under the Act.

The Act does not in any way diminish the powers of the Quarantine or Wildlife Protection Acts, nor does it reduce the system of scientific standards applied by agencies, and nor does it affect the priorities given to various biological control activities.

The Act does not require existing biological control programs - those where agents had already been released prior to introduction of the Act - to be submitted to the public review procedures under the Act. They are in effect eligible for automatic authorisation, on application. However, it would be possible for new agents for existing targets to be considered under the Act.

The Act does not require that agents be considered under the Act just because the target that they are directed at has been authorised. The two processes are separate.

The Act does not require the full process of public comment and review to be applied in emergencies. A biological solution to an emergency pest control problem is likely to occur very rarely, if ever, but the Act nevertheless makes provision for this.

The Act does not require that re-introductions or follow-up releases of agents be resubmitted for consideration under the Act. An authorization is permanent, both for targets and agents.

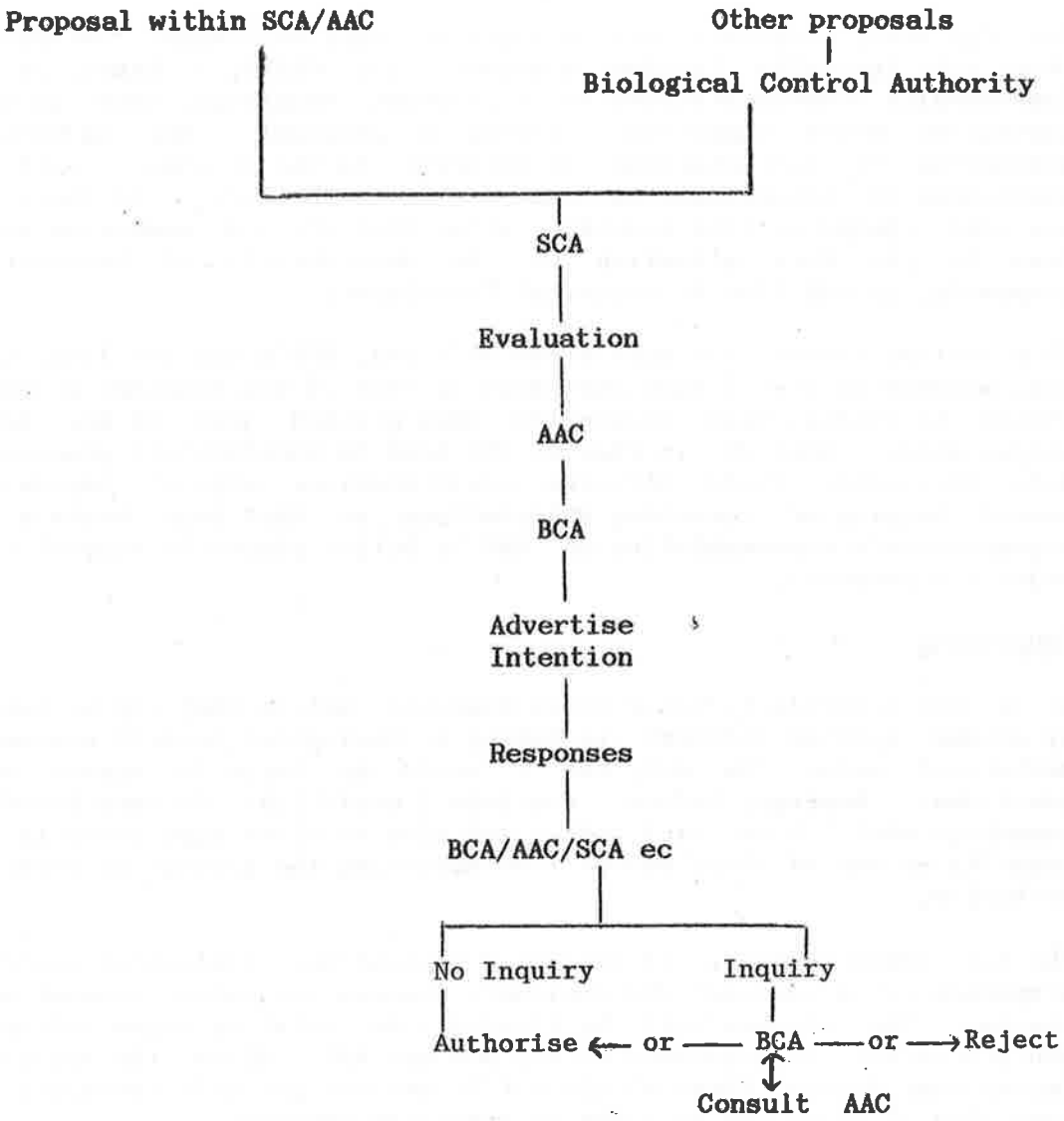
In summary, what the Act does is direct itself at problems or controversies in biological control and provide a rational and equitable means of resolving these problems in the public interest .

Operation of the Act

In all significant respects, the Act does not change anything in the way proposals for biological control have been evaluation in the past. It does not however superimposed requirements for public comment and review, and because the right to take legal action has largely been removed, it places greater demands on those evaluating the proposals, as legal actions on the grounds of negligence are not excluded by the Act.

The chart below summarises the way in which proposals may be handled.

PROPOSALS UNDER THE ACT



As I have already indicated, the need to respond to the element of full public accountability introduced by the Act is the only significant change from the approach previously adopted by SCA committees concerned with biological control. This will no doubt extend the time required for evaluation. Further delaying effects will arise out of the need to consult with AAC, which meets once every six months, although it would be possible for AAC to consider matters out of session if the circumstances demanded this.

For the rest, proposals will proceed as they have done. Briefly, this will typically involve a memeber (eg CSIRO, a State, or a Commonwealth representative) of a relevant Committee, such as the Australian Weeds Committee, raising a proposal. The technical evaluation of, and according of priority to the proposal, will be undertaken in essentially the same way as in the past. If there is any real change in this process, it is that the SCA committee will have to pay more attention to the desirability of biocontrol proposals, in addition to technical feasibility.

In practical terms, for most field officers, PPB's and the like, the real message in what I have just said is that if you consider a weed should be biologically controlled then proceed just as you have always done. However, in view of the need to substantiate proposals more thoroughly, field officers could consider ways of improving record keeping or recording observations so that your State's or organization's representative on AWC is better placed to support (or reject) a proposal.

Conclusion

It is not possible to cover every possible action that can be taken by anyone with an interest in having a biological control proposal authorised under the Act, but I would be happy to answer any questions. However, before I conclude I would like to very briefly summarise what I have said today, and also to offer some views in my capacity as one of those who will be assisting the Biological Control Authority.

The Act offers a means of resolving contentious biological control proposals by a rational and equitable process of public comment and review. This process will be blended into existing organizational and procedural arrangements within SCA and AAC. While the Act will impose some delays, these should not be serious and will certainly be less than if there was no means of resolving problems.

My personal view is that the Act represents the best way of ensuring that biocontrol programs that are in the public interest can proceed without unreasonable risk of being disrupted by litigation. Most biocontrol activities are in no way contentious and it is my own view that it would be a pity if proposals that clearly have no contentious aspect were submitted for consideration under the Act. This view applies particularly to agent organisms, which already have to survive rigorous scrutiny under the
Quarantine Act and Wildlife Protection Act. The decision whether or not to submit a biocontrol proposal for consideration under the Act

rests with the agency or State concerned, and I hope that my views will not be construed as an attempt to dissuade them from using the Act in all but the most highly contentious cases. I do however consider that if wisdom and common sense prevail over the bureaucratic sense of caution, so that only those proposals which merit consideration under the Act are submitted, it will obviously be easier to handle these proposals thoroughly and expeditiously. All I am suggesting is that the Act should be regarded as a problem solving apparatus, and not a sausage machine.

RAGWEED AND SALVINIA BIOLOGICAL CONTROL

Robert Dyason,
Noxious Plants Advisory Officer,
Department of Agriculture,
GRAFTON

RAGWEED

Origin and Spread. Ragweed (*Ambrosia artemisiifolia*) is a plant of American origin, possibly South America. It arrived in Australia as long ago as 1915, its centre of origin being either Kyogle, near Dunbible, or at Currumbin. It occurred in isolated pockets surrounding those areas for a number of years, but since 1969 has spread by up to ten times in area of infestation, and is now widespread and abundant on the NSW north coast as far south as Kempsey, SE Queensland, and on the Northern Tablelands adjacent to the New England Highway, on either side of the border. It has been reported on the Dorrigo Plateau.

Perennial ragweed, *A. psilostachya*, has been found in Victoria, and its spread on the north western slopes and plains has been rapid and is viewed with concern.

Allergic reactions. In the USA and Canada, ragweed pollen is regarded as a major cause of hay fever and allergic asthma. At flowering time the air is loaded with ragweed pollen, which contains powerful allergenic compounds. Similar compounds are found in the closely related genera *Xanthium* and *Parthenium*.

Ragweed pollen is a powerful sensitizing agent - meaning that once you become allergic to ragweed pollen, you become allergic to a range of other previously innocuous compounds. American cities publish ragweed pollen counts daily during ragweed flowering. 75% of hay fever sufferers in the USA are allergic to ragweed pollen (McFadyen 1984).

Ragweed's spread will lead, in Australia, to a massive increase in the number of hay fever sufferers, a prediction not currently shared by the Health Commission.

Control techniques.

1. Roadside slashing is carried out by a number of shires and this is a very effective control technique and integrates well with general roadside management. The difference between slashed and unslashed land is easily discernible.

2. Grazing - very little private property which is grazed by cattle is infested - cattle find ragweed very palatable, especially when young. Horse paddocks are a different matter - they will not eat it, and overgrazed horse paddocks are often full of ragweed. I have no information on whether sheep and goats eat ragweed or not.

Because it is palatable to cattle, ragweed is a problem almost entirely on roadsides, ungrazed reserves, railway land, and other vacant crown land.

3. Chemical control. The chemicals commonly used on ragweed are 2,4-D, Roundup (R),Sodium Chlorate, and Tordon 50-D. Atrazine has been suggested by Max McMillan as having season-long residual effect on ragweed seedling germination. I have no hard evidence that ragweed spraying in urban areas has been effective in reducing the population of ragweed or the pollen count.

   Historically, councils have wanted ragweed declared noxious so they have powers of entry, especially onto vacant urban blocks and urban horse paddocks, which are particularly bad offenders.

4. Biological control. Recognising the potential for ragweed biological control on the north coast, the Department of Agriculture arranged and coordinated the release of the gall forming moth *Epiblema strenuana* at 32 sites, and also assisted in releasing the leaf mining beetle *Zygogramma bicolorata* at two heavily infested sites at Lismore and Casino.

The *Epibleme* was released in two stages, firstly on 4.12.84 at 20 sites in the Far North Coast County District and in Tenterfield Shire, and secondly on 19.12.84 at 12 sites in Grafton City, and Copmanhurst, Nymboida, Ulmarra, Maclean and Bellingen Shires. Simultaneously, the *Epibleme* was released at five sites in Narrabri and Moree Plains Shires. These last five sites have three purposes: 1. to act as a backup in the Parthenium control campaign; 2. to control perennial ragweed which is spreading along roadsides in those shires, and 3. to control large areas of Noogoora burr in the water course country.

It is too early to assess the success of the releases. The insects must become widespread, and increase greatly in density before any effects can be seen. This may take two years, or longer.

Biological control is probably the only really effective method for long term control of ragweed on the north coast. Ragweed grows in areas which render other control techniques difficult to apply, and the owners of the majority of ragweed infested land, e.g. the Crown, the Railways, D.M.R. and Shires do not have the means or intent to control ragweed by the conventional means.

Although ragweed is not a serious weed of agriculture, and therefore not an economically burdensome weed, the biological control was available to us, without any of the problems of initial selection overseas, importation, quarantine, specificity testing, survival following initial release in the field, parasitism, etc., etc. All that was done. Not only that, but *Epibleme* and *Zygogramma* attacked two of our worst agricultural weeds, Noogoora burr and Parthenium. The Department of Agriculture has been impressed with the results of its biological control programmes to date, and is expected to continue to spread the insects when any of its host weeds appear.

Areas suffering heavy infestations of any of the three species of ragweed, or Parthenium, or Noogoora burr (e.g. the Macquarie Marsh Noogoora burr infestation) would warrant releases, based on the Queensland experience. However, weeds such as Noogoora burr in summer crops are probably inappropriate for treatment with biological control techniques. The growth period of the weed would be too short, and the objectives of weed control in crops are not necessarily served adequately with biological control, especially with an insect as the biological control agent.

The backup value of *Epiblema* in the case of Parthenium cannot be over-estimated. It is likely that severe outbreaks of this weed will occur, and not be found in time to prevent seed dispersal. The Croppa Creek infestation is a good example. Biological control, by reducing the flowering and seeding potential of Parthenium will, we hope, effectively contain any outbreak.

Conclusion

It is much too early to draw conclusions from the release. Good establishment is highly likely, and good biological control with a resultant conventional control cost reduction is also quite likely. If we have got the insects, we may as well spread them about. If we don't, we are wasting an opportunity.

SALVINIA

Origin and Spread. *Salvinia molesta* (fam. Salviniaceae) in an introduced free-floating aquatic fern (Sainty & Jacobs 1981). It is a native of South America, and was originally introduced into Australia as an ornamental plant for fishponds and the like. It was first recorded here in 1952, and has since spread from Cooktown in the north to Melbourne, and has penetrated as far as Western Australia and the Northern Territory (Ralph 1982). In the north coast region it is present in almost every river system, a large number of private dams and in many swamps and lakes. Salvinia can still be bought in pet shops for stocking fish ponds, and is still being spread for ornamental and mulching purposes by people who do not realise its potential for disruption of aquatic systems.

Why it is a weed. Salvinia is an extremely fast growing plant - it can take advantage of a favourable environment, colonise large areas of previously clear water and reach a vast biomass in a very short time. The time taken to double in mass can be as little as two days, although a time of 7-10 days is more normal.

These large biomasses accumulate on recreation and water supply dams, making them unsuitable for recreation, and rendering the water stagnant and deoxygenated. Salvinia also accumulates in irrigation and flood mitigation structures, rendering them inoperative. It also detracts from the appearance of waterways and affects native fauna and flora.

Although the public at large has spread this weed, through the dumping of unwanted fish pond leftovers into the nearest creek, the

three levels of government are the targets for such press headlines as "Weed Strangles Creek", "Weed Chokes Creek", "Salvinia 'Killing' Warrell Creek", "Landholders Want Weir Opened" and "Allegations Denies". Needless to say, the pressure on councils, the Department of Agriculture and the CSIRO to develop adequate control techniques was considerable.

Control techniques. 1. Chemical control. Two herbicides are registered for the control of Salvinia. These are: AF 100(R) (calcium dodecylbenzenesulphonate, a wetting agent) and Reglone(R) (Diquat).

Neither of these chemicals is fully effective on dense Salvinia. Raglone (R) is unacceptable to some weed control organisations because of its human toxic properties. Velpar (R), AF 101(R) Caldec + 1% Diuron), and flowable Diuron were probably the three most effective herbicides for use on Salvinia, and all are now deregistered. Amitrole and Roundup (R) have been tried on Salvinia but results are patchy. Salvinia herbicidal control over large areas such as the Swan Pool in Hat Head National Park, the long hole in the Coldstream, near Grafton, and the Sandy Creek infestation near Casino is impractical and probably doomed to failure. Total reinfestation can occur from one plant and banks heavily vegetated with reeds or cumbungi can protect Salvinia from chemicals very effectively. In the past, small areas of Salvinia have been eradicated, especially when Diuron was used. Farm dam infestations of Salvinia can be controlled chemically, especially when the owner of the dam has no special aversion to the use of chemicals.

2. Mechanical control. Salvinia can be mechanically removed from small areas quite easily. In some cases it has been used as mulch in orchards and banana plantations after being removed from dams. Under good growing conditions it can be very hard to keep up with, however.

Such factors as dam and swamp drainage and good flood mitigation structural design also count as mechanical control, and have been practised with some success.

3. Biological control. As a result of the extremely serious situation in coastal streams, and the serious threat to inland watercourses and irrigation channels and because chemical and mechanical control was proving ineffective in the long term, biological control was considered. No predators of Salvinia were introduced into Australia when Salvinia was introduced, and because none of these natural enemies were present, it grew without hindrance. Hence the severe Salvinia infestations, and the need for introducing these natural enemies.

By mid 1980 the CSIRO's Division of Entomology had introduced one insect, *Cyrtobagous* sp., and had bred sufficient for release onto Lake Moondarra which at that time was Australia's largest Salvinia infestation, covering approximately 400 hectares. 1500 adults were released. A further 1500 adults were released in January 1981. By April, sampling of the Salvinia in the lake indicated that the weevil

population had grown from the original 3000 to over 100 million weevils, all consuming the salvinia (Ralph 1982). By the end of May 1981, very little Salvinia remained and the lake was largely clear water, as has been the situation ever since.

4. The New South Wales situation. Following the success of the Lake Moondarra release, the clamour for biological control was substantial. Salvinia was fouling water throughout the north coast. Domestic and stock water storages were not ideal situations for chemical control of Salvinia, and some sensitive areas in national parks could not be sprayed with chemical at all because of a perceived threat to non target species.

Eventually in spring 1984, biological control releases commenced amidst a welcome fanfare of publicity, which fully compensated for the previous condemnatory tirades from the press. Releases were made at four coastal sites in the week 29th October to 2nd November. They were in the Clarence Valley, at Coffs Harbour, Kempsey and Maitland. The weevils survived and reproduced at all four sites. Since then, the trickle of weevil releases has become a flood. A second series of releases took place in the week 10-14th December, at five locations: near Bilambil on the Tweed coast; on Sandy Creek near Casino; in the long hole on the Coldstream, a tributary of the Clarence; in Warrell Creek near Macksville; and in the Swan Pool in Hat Head National Park. A third series of releases are planned for 1985. The sites are not chosen but there are plenty of alernatives.

5. Possible effects. What effect is *Cyrtobagous* going to have on Salvinia on the north coast? Nobody really knows. The Lake Moondarra experience was a freak success. The temperature requirement for successful reproduction of *Cyrtobagous* was lower than that experienced, and a thunderstorm scattered the infested Salvinia all over the lake's surface, with catastrophic result for the Salvinia. We do not expect that sort of result on the north coast in the remarkably short time that it took.

Success was also obtained on the Sepik River in New Guinea, where initial failure was overcome by topdressing a portion of the infestation of Salvinia with nitrogen fertilizer. This indirectly increased the nitrogen nutrition of the weevils, their reproduction rate increased, and control was obtained. I suspect that low nitrogen situations may be found on the north coast, as in the Sepik River, and we might find that nitrogen fertilization is a requirement for successful control in some cases.

The temperature regime of infested sites becomes more unfavourable as one progresses south, so although Salvinia growth is still rapid and a problem, in suboptimal growing conditions, *Cyrtobagous* may reproduce at a rate inadequate for any sort of control over the Salvinia. *Cyrtobagous* has failed to overwinter in the Sydney district, so there must be an effectiveness cut off point somewhere north of that city. Because of the possible environmental limitations to the effective range of *Cyrtobagous*, other insects have been imported for Salvinia control. These are a moth and a grasshopper;. It may be that these insects will be suited to cooler

environments than *Cyrtobagous*, and releases of them will be necessary for control of Salvinia in areas where *Cyrtobagous* establishment has failed.

Conclusion

As with ragweed, it is much too early to predict the degree of success that will be obtained with the biological control insects. Measurements of temperature, biomass and plant nitrogen levels which are being taken at the four original NSW release sites are likely to show that control of some sort will be obtained.

If the insects are a success, then that success will be widespread. At the current rate of introduction, and with releases from home grown material on the first four release sites, the insects will be steadily chewing away at every Salvinia infestation on the north coast. As it is with ragweed, if this spread does not take place, we are wasting an opportunity, and failing in our jobs.

Acknowledgements

I would like to acknowledge the help of the Queensland Department of Lands, and especially Dr. R.E. McFadyen of that Department, whose assistance greatly facilitated the ragweed program in New South Wales. I would also like to point out the major role taken by the CSIRO in the importation and release of the Salvinia biological control. My part in the Salvinia exercise was incidental.

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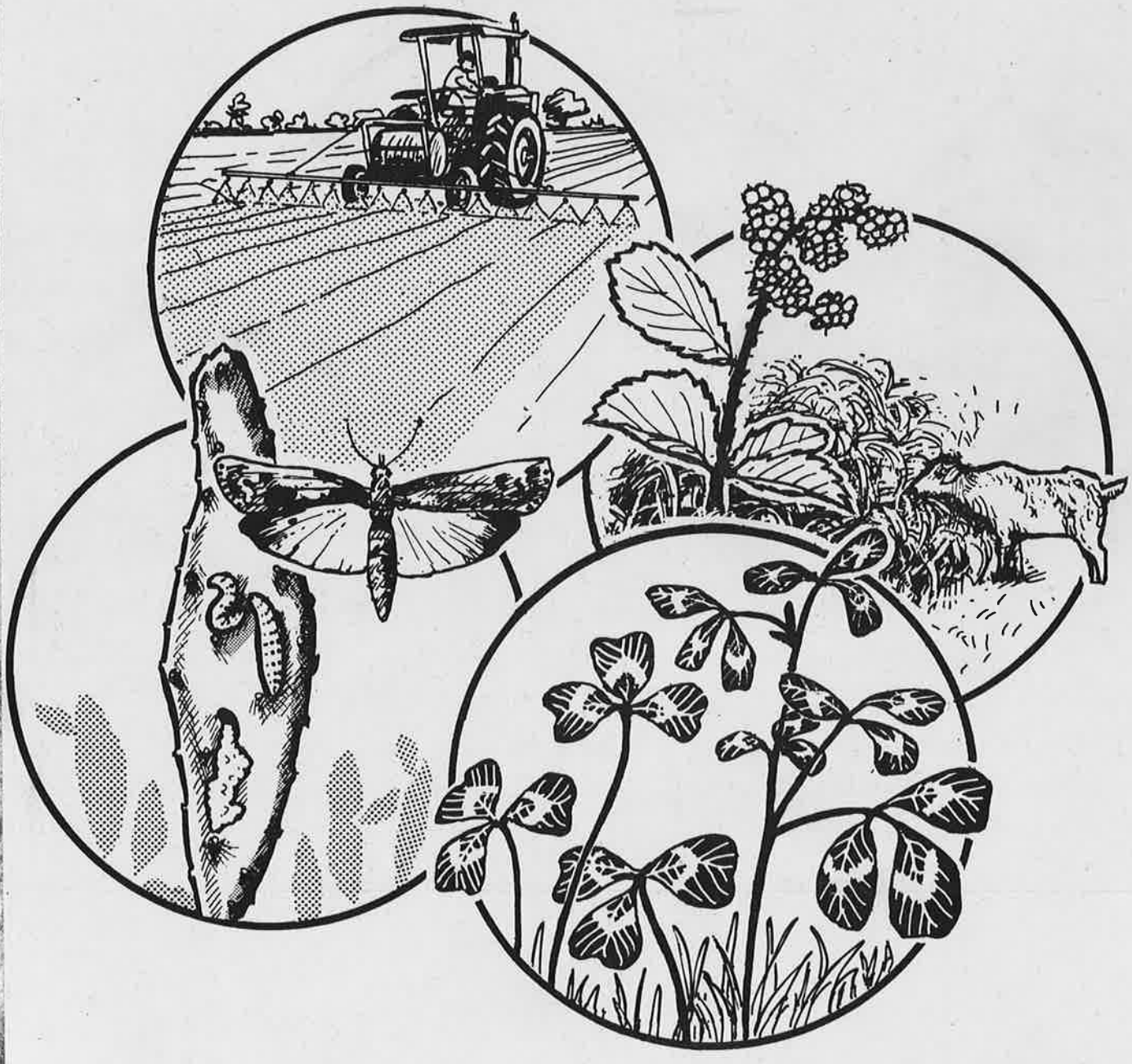
THIRD BIENNIAL NOXIOUS PLANTS CONFERENCE

Integrated Weed Control in the 80's and 90's

Australian National University,
Canberra, May 6–10, 1985.

SUPPLEMENT



Department of Agriculture New South Wales

PROCEEDINGS OF THE THIRD BIENNIAL NOXIOUS PLANTS CONFERENCE

SUPPLEMENT

AUSTRALIAN NATIONAL UNIVERSITY

CANBERRA A.C.T.

5TH MAY - 10TH MAY, 1985

Editor : P.J. GRAY

A MESSAGE FROM THE CONFERENCE CONVENOR

THIRD BIENNIAL NOXIOUS PLANTS CONFERENCE

As Conference convenor I would like to take this opportunity to extend my thanks and appreciation to the following for their invaluable assistance and support.

Conference Planning Committee

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Stephen Greig	Department of Agriculture	Goulburn
Hugh Milvain	Department of Agriculture	Yanco

Thistle Identification Competition

Jim Dellow	Department of Agriculture	Orange
Peter Gray	Department of Agriculture	Dubbo

Sponsors

Combined Chemicals - Mr Des Thwaites, Management Consultant, Sydney

Du-Pont (Aust) Ltd - Trophy and Prize - Innovative Ideas Competition.

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East Coast Helicopters - Helicopter for aerial spray demonstration.

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Prickly Pear Destruction Commission
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Dow Chemicals (Aust) Ltd.
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Monsanto (Aust) Ltd.
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Typing of Conference Correspondence

Sheryl Smith, Department of Agriculture, Cowra

Typing of Conference Proceedings

Phyllis Lewis, Department of Agriculture, Dubbo.

Printing of Conference Proceedings

Robyn Thompson and Julie Lamb, N.S.W. Government Printer, Dubbo.

On behalf of the Organising Committee and myself, we gratefully extend our appreciation and thanks to the excellent speakers for their presentation of papers.

Finally we thank all delegates who attended. We trust that the knowledge gained from your participation and interaction with others, will be of practical benefit. Without the support of all involved these conferences would not have reached the high standard of professionalism that has been achieved.

Peter Gorham,
Noxious Plants Advisory Officer,
COWRA

CONTENTS

THIRD BIENNIAL NOXIOUS PLANTS CONFERENCE FOR LOCAL GOVERNMENT

5TH - 10TH MAY, 1985

MONDAY, 6TH MAY

8.30 am	-	Late Registrations.
		Session Chairman, Mr Jim Dellow, Special Agronomist, Weeds, Orange Department of Agriculture, New South Wales
9.20 am	-	Welcome Address.
		Professor Peter Karmel, Vice Chancellor, Australian National University, Canberra.
9.30 am	-	Official Opening.
		Mr G.H. Knowles, Director-General, Department of Agriculture, New South Wales.
10.00 am		MORNING TEA:
10.30 am	-	"The Prosecution"
		Mr Alan Russell, Chief Legal Officer, Sydney. Department of Agriculture, New South Wales
12.30 pm		LUNCH:
		Session Chairman, Mr Derek Brown, Noxious Plants Advisory Officer, Tamworth. Department of Agriculture, New South Wales.
1.30 pm	-	"Resume and Discussion of the Prosecution"
		Mr Alan Russell, Chief Legal Officer, Sydney. Department of Agriculture, New South Wales.
3.00 pm		AFTERNOON TEA:
3.30 pm	-	"Noxious Weed Control - A U.S. Perspective"
		Guest Speaker - Dr Delbert Harper, Area Product Development Manager, Monsanto, U.S.A.
4.15 pm	-	"How to Use Plants of Western NSW"
		Mr Peter Milthorpe, Research Agronomist, Condobolin. Department of Agriculture, New South Wales.
5.00 pm	-	CLOSE

TUESDAY, 7TH MAY

8.45 am	-	Session Chairman, Mr Hugh Milvain, Noxious Plants Advisory Officer, Leeton. Department of Agriculture, New South Wales.
		"A Matter of Facts"
		Mr Alan Russell, Chief Legal Officer, Sydney. Department of Agriculture, New South Wales.
9.15 am	-	"Management Techniques"
		Mr Des. Thwaites, Business Management Consultant, Des. Thwaites & Associates, Sydney. (Sponsored by Combined Chemicals)
10.00		**MORNING TEA:**
10.30 am	-	"Land Categorisation and Noxious Plants"
		Mr Mike Potter, Health Inspector, Tumburumba Shire Council, Tumburumba.
10.45 am	-	"Plan, then Write"
		Mr Allan Batchelor, Regional Media Officer, Goulburn. Department of Agriculture, New South Wales.
11.30 am	-	"Management Techniques"
		Mr Des. Thwaites, Business Management Consultant, Des Thwaites & Associates, Sydney.
12.15 pm	-	"Standardised Property Inspection Reports"
		Dr Leon Smith, Principal Agronomist, Weeds, Sydney. Department of Agriculture, New South Wales. Mr Kevin Waters, Chief Weeds Officer, New England T'lands Weeds County Council, Armidale.
12.30 pm		**LUNCH:**
1.30 pm	-	Session Chairman, Mr Graham Mathews, Weeds Officer, Bellingen Shire Council, Bellingen.
		"Legislation & Noxious Plant Management"
		Dr Leon Smith, Principal Agronomist, Weeds, Sydney Department of Agriculture, New South Wales
2.15 pm	-	"Correspondence Course in Agricultural Protection"
		Mr John Kent, Lecturer in Agric. Protection. Dr R.J. Banyer, Snr. Lecturer Plant Protection Riverina Murray Inst. of Higher Education, Wagga.

2.45 pm - "The Place for Ustilan in Noxious Weed Control"

Mr Ken Russell, Research & Development Officer,
Bayer Australia Ltd., Sydney

3.00 pm **AFTERNOON TEA:**

3.30 PM - "Communication Through Radio"

Mr Allan Batchelor, Regional Media Officer, Goulburn.
Department of Agriculture, New South Wales.

4.15 pm - "External Course in Weed Control"

Mr Rowan Wall, Teacher of Agriculture, T.A.F.E. Sydney.

4.45 pm - "Aerial Application of Herbicides"

Mr Jim Watt, Research & Development Officer,
Bayer Australia Ltd., Sydney

5.30 pm **CLOSE:**

7.30 pm - "Applying for a Noxious Plant Grant"

Mr Peter Gray, Noxious Plants Advisory Officer, Dubbo.
Department of Agriculture, New South Wales.

WEDNESDAY, 8TH MAY

8.45 am - Session Chairman, Mr Warwick Roche,
Weeds Officer, Yarrowlumla Shire Council, Queanbeyan.

"Aquatic Weed Control in Dams"

Mr Chris Ripper, Field Officer, Weeds, Griffith.
Water Resources Commission.

9.30 am - "Principles of Cultural & Mechanical Methods of Weed Control"

Mr Mike Keys, District Agronomist, Queanbeyan.
Department of Agriculture, New South Wales.

10.00 am **MORNING TEA:**

10.30 - 11.00 am "The Use of Goats to Control Some Noxious Plants"

Mr Terry Mitchell, Special Livestock Officer (Goat Production), Dubbo.
Department of Agriculture, New South Wales.

11.30 am - Depart Field Trip

Inspection of trials at Gundaroo conducted by Dr Malcolm Campbell, Principal Research Scientist, Orange.
Department of Agriculture, New South Wales.

* Affect of feral goats on control of serrated tussock on infertile soil.

* Affect of herbicides and oversowing on the control of serrated tussock.

* Split applications of Frenock for the control of serrated tussock.

* Wetter TX, on effectiveness of herbicides in the control of serrated tussock.

* Spot spray trials in the control of serrated tussock being conducted by Mr Mike Keys, District Agronomist, Queanbeyan and Mr Ian McGowan, District Agronomist, Yass.
Department of Agriculture, New South Wales.

* Mr Anthony Feez of Dow Australia will be establishing trials for inspection using new products from Dow Chemicals on sweet briar.

* Demonstration of Applying Herbicides by Helicopter.
East Coast Helicopters.

EVENING - Local Government Weeds Officers' Association Meeting.

THURSDAY, 9TH MAY

8.45 am - Session Chairman, Mr Robert Dyason,
Noxious Plants Advisory Officer, Grafton.
Department of Agriculture, New South Wales.

"Weeds of Kosciousko National Park"

Mr Dane Wimbush,Snr. Experimental Scientist, C.S.I.R.O., Canberra.
Ms Jane Mallen, Research School of Biological Studies, Australian National University, Canberra.

9.30 am - "The Tasmanian System of Noxious Plant Control"

Mr Peter Boatwright, Weeds Officer, Devonport.
Department of Agriculture, Tasmania.

10.00 am **MORNING TEA:**

10.30 am - "Parthenium Weed"

Mr Clive Willmot, Weeds Officer, Moree Plains Shire Council, Moree.

10.45 am - "Ecological Aspects of Biological Control of Weeds"

Dr Richard Groves, Research Scientist, C.S.I.R.O. Canberra.

11.30 am - "Herbicide Behaviour in Soil"

Mr Harvey Baker, Senior Chemist, Rydalmere.
Department of Agriculture, New South Wales.

12.15 pm - "Noxious Plants - Costing & Programming with Computers"

Mr Alan Smith, Weeds Officer, Bega Valley Shire Council, Bega.

12.30 pm **LUNCH:**

1.30 pm - Session Chairman, Mr Peter Gray, Noxious Plants and Advisory Officer, Dubbo.
Department of Agriculture, New South Wales.

"Screening Procedures for Biological Control Agents"

Dr Ernest Delfosse, Principal Research Scientist, C.S.I.R.O., Canberra.

2.15 pm - "Botanical Studies of Weeds"

Dr John Carnahan, Lecturer in Botany,
Australian National University, Canberra.

3.00 pm **AFTERNOON TEA:**

3.30 pm - "Fungi as Herbicides - Mycoherbicides"

Dr Bruce Auld, Senior Research Scientist, Orange.
Department of Agriculture, New South Wales.

4.15 pm - "Spray Application to Woody Weeds"

Mr Max McMillan, Special Agronomist, Weeds, Glen Innes.
Department of Agriculture, New South Wales.

4.45 pm - "Demonstration - Gas Gun Herbicide Applicator"

Mr Alan Murphy, Ag-Murf Engineering, Dubbo.

5.15 pm **CLOSE:**

6.30 pm – **CONFERENCE DINNER AND PRESENTATION OF AWARDS**

Master of Ceremonies, Mr Cec Webb,
Chief Weeds Officer, Wellington Shire Council, Wellington

FRIDAY, 10TH MAY

8.45 am – Session Chairman, Mr Max McMillan,
Special Agronomist, Weeds, Glen Innes.
Department of Agriculture, New South Wales.

"What's New with Fireweed?"

Mr Terry Launders, Senior Research Agronomist, Taree.
Department of Agriculture, New South Wales

9.05 am – "Prickly Pear Control in NSW"

Mr Garry Ryan, Commissioner,
Prickly Pear Destruction Commission, Tamworth.

9.30 am – "Biological Control Act. A New Commonwealth Act to Regulate the introduction of Biological Agents"

Mr Jack Blaker, Senior Executive Officer,
Department of Primary Industries, Canberra.

10.00 am **MORNING TEA:**

10.30 am – "Commonwealth involvement in the Approval of Pesticides in Australia"

Mr Lou Jones, Senior Executive Officer,
Department of Primary Industries, Canberra.

11.00 am – "Blackberry Rust - Is it effective in controlling Blackberries?"

Mr Jim Dellow, Special Agronomist, Weeds, Orange.
Department of Agriculture, New South Wales.

11.30 am – "Biological Control of Salvinia and Ragweed"

Mr Robert Dyason, Noxious Plants Advisory Officer, Grafton.
Department of Agriculture, New South Wales.

12.00 noon **CONFERENCE EVALUATION:**

12.30 pm **LUNCH and CLOSE.**

FORWARD TO PROCEEDINGS

L.W. Smith,
Principal Agronomist, Weeds
SYDNEY

Thanks to the efforts of Peter Gorham and his organising committee, the 3rd Biennial Noxious Plant Conference was an outstanding success. Over 180 delegates attended the Conference and the spectrum of people present was much broader than usual.

The theme of the Conference was "Integrated Weed Control in the 80's and 90's" and this was very well chosen, given the pressures which are being placed on weed control activities today and likely to be imposed in the future.

Today more than ever, we must think in terms of noxious plant management rather than control. This involves the planning, the destruction, the replacement and the long term management involved in carrying out programs of weed control. It is essential that we plan all our activities to the last detail and consult as widely as possible to avert any major conflicts.

There were several highlights of the Conference and these included the mock magistrate's court proceedings involving legal officers from the Department of Agriculture and several weeds officers, the talks by overseas visitors from the United States and Tasmania, the emphasis placed on biological control in its many forms including goats and the need for more formal training for weeds officers. Des Thwaites gave his usual "words of wisdom" in relation to personnel management and teamwork and I suggest that if we all went back to the First and Second Conferences and reviewed what Des has said in the past we would all greatly benefit in our day-to-day management procedures. Des has been instrumental in raising the image of Weeds Officers and we must thank him greatly for this.

It was most timely to see the emphasis at the Conference on alternatives to chemicals including goats, biological control and cultural management techniques. In future I am sure we are going to be relying on these techniques more and more to control our noxious plants, but we must not expect too much, too quickly from biological control. It will take many years (10 years or more in some cases) before effective controls are available. While the Conference emphasised alternatives, the responsible use of herbicides still remains a very important weed control method.

It was interesting to hear about the Tasmanian system of noxious plant control and there's possibly some lessons for this in NSW. One of the most rewarding aspects of our Conferences are these exchanges of ideas with other states and we must continue this practice in future years.

Several Councillors who were present at the Conference commented to me on the high standard of the papers presented and the fact that they now have a greater appreciation of the scope of the management and technology expertise needed by weed officers. It is a pity more Councillors were not present in Canberra as it would have given them a better background on the importance of control of noxious weeds. We must make a greater effort to involve them in future conferences.

The thistle identification competition, a new initiative introduced by Jim Dellow was an outstanding success and congratulations go to John Kerrison of Wingecarribee Shire Council, the winner.

It's a pity more entries weren't received in the "Innovative Ideas" Competition for the Dupont Shield. Congratulations to Ken Hayes of Coffs Harbour Shire Council who won this time.

Thanks must be extended to the companies who supported the Conference and all the people who played some role in making the conference such a success.

I urge all conference participants to put into practice as soon as possible all the knowledge and experience you have gained from this Conference. Noxious plant management activities are constantly changing and we all need to be prepared for the latest advances so that our operations are as efficient and effective as possible. It's only through such Conferences that we can keep abreast of developments. I look forward to 1987 to the next Conference, wherever it is held, as being of vital importance for the advancement of noxious plant control in New South Wales.

OPENING ADDRESS BY MR. G. H. KNOWLES
DIRECTOR GENERAL
DEPARTMENT OF AGRICULTURE, N. S. W.

Mr. Chairman, Professor Karmel, Ladies and Gentlemen - I am very pleased to again have the opportunity of opening the Biennial Noxious Plants Conference.

This is your third such conference and it is particularly pleasing to me to note that instead of going backwards, as many such conferences do, the Noxious Plants Conference has really gone ahead. Your programme makes it very clear that there has been a lot of thought given to the organization and the choice of topics and speakers.

Before I go further, I would like on behalf of the New South Wales Department of Agriculture to thank you, Professor Karmel, for your words of welcome. You may be assured that we are most appreciative of the excellent facilities made available for the conference by the Australian National University.

May I also express my appreciation to Dow Chemical Company, Combined Chemicals, ICI, Du Pont, Bayer Australia and East Coast Helicopters for their sponsorship of guest speakers, conference requisites and demonstrations.

I offer you all a warm welcome to the conference. In doing so, I am sure you won't mind if I make particular mention of two people.

Firstly, Dr. Delbert Harper, our guest speaker, who has recently transferred from the United States to take up the position of Area Product Development Manager with Monsanto Australia. Dr. Harper, welcome not only to the conference, but also to Australia.

Secondly, a special welcome to Mr. Peter Boatwright, Weeds Officer with the Tasmanian Department of Agriculture. Peter will be talking to you on the Tasmanian system of noxious plant control.

The importance of noxious plant control is amply demonstrated by the organisations represented here today. Perhaps we might also say that the venue chosen for the Third Biennial Conference, Canberra, is indicative of the fact that noxious plants are a national and not just a state or county problem.

The theme for your 1985 conference is "INTEGRATED WEED CONTROL IN THE 80's AND 90's". I believe this is very timely.

In searching for a logical definition of integrated control, I can think of nothing better than that provided by Food and Agricultural Organization of the United Nations which defines integrated pest control as "A pest management system that, in the context of the associated environment and the population dynamics of the pest species, utilizes available techniques and methods in as compatible a manner as possible, and maintains the pest populations at levels below those causing economic injury".

What this definition says in effect is that we must no longer rely on just one method of control. Using a single control method might be called the "Either/Or Syndrome ", in other words, chemical or chipping hoe.

Experience has shown us very clearly that individual methods of weed control have definite limitations and usually cannot give effective control when used in isolation.

We should realize too that total reliance on herbicides is a costly and wasteful exercise and has become environmentally unacceptable.

Obviously, herbicides will always have their place, but they are better used to reduce the peaks of weed population rather than as a long term suppressant.

Care must obviously be taken to consider social or environmental factors as well as those of pure economics. Other methods, for instance, the use of desirable competitive plant species can often be effective.

Integrated control means examining each case objectively, weighing up the various possibilities and co-ordinating the different methods. To find the best possible solution, the continuous use of any one weed control method, can over time, lead to the establishment of tolerant or resistant weeds.

Integrated control systems reduce both the background and peak levels of the weeds through a series of separate but mutually compatible and supportive methods, each of which puts a different pressure on the weed population.

Integrated systems are usually based on good hygiene and land management. These are combined with the careful use of herbicides, to give short term control of the peaks of weed population.

Apart from reducing the amount of herbicides used and prolonging their effective life, integrated weed control systems offer greater resilience, since they rely on several compatible approaches to weed control, rather than on one of them alone - if one method fails, another is still there to provide some control.

Integrated weed control systems can be developed either for the control of individual weeds or for the protection of a cropping system or no-crop situation.

A separate system has usually to be developed for each new problem, and it must always be based on the biology and ecology of the weeds, the agronomy and economics of crop, pasture, or situation, and an awareness of the methods available for control, and of their short and long term costs and effects.

The development of such a system usually requires some research into each of these three areas, followed by a careful selection of mutually compatible methods for both the short and long term management of the problem.

Such a system can be initiated by anyone who is familiar with the problem and its possible solutions, and does not need a team of experts. Following the introduction of any system, however, it must be both continually evaluated and adapted to meet changing conditions as they arise.

All this calls for a high standard of training and competence on the part of operators, manufacturers of plant protection products, and advisors. They must be aware of the possibilities of protecting and encouraging natural control factors through cultural techniques.

As regards chemical plant protection products, those who operate integrated control need to know the spectrum of activity and the properties of each product so that they can make the right choice.

They must also be aware of the desirable and undesirable effects which these products, and indeed other materials and cultural practices, may have on the ecosystem and on plant populations.

Integrated control thus has great potential and already offers important advantages. It makes correspondingly great demands on those who practise it.

Perhaps we might sum this all up by saying that the primary aim of any weed control system is to maintain an environment that is as detrimental to the weed as possible, by the use of combined ecological, cultural, mechanical, biological and herbicide methods.

Perhaps we might now take the time to examine these different methods of weed control, some of which, of course, will be applicable only in special situations.

Perhaps the most appealing method is the use of biological control agents, which involves the use of natural predators or diseases for the control of certain weeds.

The main objective of biological control is not complete eradication, but rather the reduction of the weed population below the level of economic injury. Basically this means that the weed population must be maintained to sustain the predator.

Biological control requires large inputs of capital to find control agents, but if successful, can then be established at a very low cost.

The C.S.I.R.O. spends $1.5 million annually on biological control of weeds. Efforts are concentrated on national problems or problems which cross state boundaries.

In more recent times a successful programme has been launched against skeleton weed in eastern Australia with the release of a rust fungus and three insect pests.

At present, the C.S.I.R.O., the N.S.W. Department of Agriculture and biological control authorities in Queensland and Victoria are investigating a number of weeds for control by biological methods.

Some of these are salvinia, common heliothrope, St. John's wort, blackberry, ragweed, grounsel bush, silverleaf nightshade, Paterson's curse and several thistles.

Progress is slow, but one can be optimistic since the possibilities are still far from being fully explored.

Another type of biological control is the use of the grazing animal. For example, recent experiments undertaken by the N.S.W. Department of Agriculture on the Central Tablelands have shown that goats are an effective means of controlling extensive infestations of blackberries and briars in difficult terrain.

On several sites the blackberry infestation had become so serious as to necessitate the removal of sheep because of entanglement problems. The goats proved to be effective in reducing the height and density of the blackberries to permit re-stocking with sheep.

There are a number of potential advantages in using goats to control heavy infestations of such weeds in country where conventional control is difficult.

The most important of these are;

- The control process is continuous and is more likely to be effective in the long term;
- It is a biological form of control which is more environmentally acceptable;
- The landholder is provided with a return while achieving control; and
- Goats can be run in conjunction with both sheep and cattle.

Although biological and chemical controls are being increasingly used, physical control such as cultivation, mowing, burning and the establishment of competitive pastures, and grazing, is still the most widely used weed control method.

Cultural methods which involve the use of plant competition or cropping practices which aid in the suppression of weeds, rely on various differences between weeds and crops.

They require more knowledge and sophistication than simple recognition and differences in appearance followed by some direct control action.

The selection of effective cultural control methods demands an understanding of life cycles, growth requirements, responses to environmental changes, and other growth habits of various weeds and crops.

Studies have shown that by using suitable crops and pasture species, cultural control can be very successful. A recent example is work being done at Gilgandra using Rhodes grass to suppress spiny burrgrass.

Turning to herbicides, we should realize that though they may be used in place of other control measures, they are more effective if used in conjunction with control practices - and the choice varies with agronomic, ecological and economic factors.

Herbicides of course have many special advantages. They can be applied to weeds in crops where cultivation would be impossible.

They can be used as pre-emergent sprays to provide early season weed control. Many perennial and woody weeds cannot be controlled by hand labour or cultivation.

There have been many recent developments in herbicide applicators such as rope-wick applicators, control droplet applicators, and spotgun applicators.

These, together with development of the low-volume gas powered spray gun by the Department of Agriculture indicate that researchers recognise the need to develop herbicide applicators that are more effective in hitting only the target weeds, are more cost efficient and also more environmentally acceptable.

With a greater public awareness and the introduction of new techniques, specialised equipment, development of biological control, and sophisticated herbicides, we are in an era of exciting and totally new concepts in the control of weeds.

Unfortunately, the wide variation in attitudes and approaches among organisations has tended to polarize thoughts and actions.

Too often, we mount a massive attack against a specific weed without the organized planning that would define responsibilities and goals, draw on the latest advances in weed science and combine specific activities to ensure resolving the problem by efficient means.

A good example of successful organised planning is the campaign formulated in 1982 by the N.S.W. Department to control serrated tussock in New South Wales.

The programme operates under the name S.W.A.T. (Statewide Attack On Tussock).

Serrated tussock infests an estimated 680,000 hectares in New South Wales and the area threatened by invasion is equal to that already infested. The net social benefits of controlling serrated tussock have been estimated at $19 to $34 million per annum.

Serrated tussock can reduce livestock carrying capacities by as much as 90% and losses in wool production alone have been estimated at $12 million.

The strategies that are being used in the campaign were worked out at special meetings between Departmental and Local Government Officers.

The co-ordinated approach involves an advisory, a facilitatory and regulatory programme as well as a community awareness campaign.

Since the beginning of the campaign in 1982, significant advances have been made in the removal of serrated tussock from the southern tablelands.

The most effective method of weed control is prevention, and this includes taking action to prevent the introduction and spread of weeds.

In 1984, the N.S.W. government enacted the parthenium weed legislation for inspection of headers at the Queensland border.

Control of noxious plants should not be seen as a destructive process, but rather as protecting the natural and/or desirable species which are threatened by invasion.

We are all becoming more concerned with preventing the degradation of our land and our environment, and as our attitudes change, the role of those associated with noxious plant control has become more demanding.

You must be conversant with all aspects of weed control, be able to communicate with the public, and be conscious of the need to protect the environment.

Many of the issues involved are complex. The Department of Agriculture is able to provide advice on a wide range of areas, I urge you to use these facilities wherever possible.

Your programme exemplifies the conference theme "Integrated Weed Control in the 80's and 90's" which will be presented by a team of specialised speakers.

It is comprehensive and highlights the options available for successful integrated weed control. I congratulate the conference organiser, Peter Gorham and his committee for the excellent work they have done organising this conference.

Finally, on behalf of the New South Wales Department of Agriculture, I thank you for your attendance and participation which will ensure the success of this conference.

Mr. Chairman, Ladies and Gentlemen, it gives me great pleasure to declare this, The 3rd Biennial Noxious Plants Conference, officially open.

A MATTER OF FACTS

Alan Russell,
Chief Legal Officer,
Department of Agriculture,
SYDNEY.

A short address by Alan Russell, Chief Legal Officer, NSW Department of Agriculture, on preparing the evidence to take to a solicitor, and prepared by Gerard Carter, Legal Officer, NSW Department of Agriculture.

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When recommending a prosecution, a noxious weeds officer should hand to his solicitor the following:-

1. Letter of instructions.
2. Witnesses' statements.
3. Statement of facts.
4. Recommendation for prosecution.

As to 1, the letter of instructions should instruct the solicitor to act in relation to the proposed prosecution and to appear in court on the hearing. The letter should be signed by the inspector in charge of the investigation, who will normally sign and lay the information after it has been prepared by the solicitor.

As to 2, the witnesses' statements will consist of statements from all inspectors who investigate the alleged offence and any other persons who can give relevant evidence. The statements must be typed, double-spaced, signed and dated. The statements must only contain admissible evidence, i.e. direct observations and exact details of conversations with the proposed defendant. Generally speaking, statements must not contain details of conversations with other persons or opinions as to facts. Any relevant photographs and documents (e.g. documents signed by the proposed defendant) should be attached to the statement.

As to 3, the statement of facts should contain four parts:-

a. Summary of facts.
b. Gravity of offence.
c. Prior convictions.
d. Claim for costs and expenses.

The statement of facts should be from 3/4 to one page in length and typed, double-spaced.

The summary of facts should be a concise summary of the facts and should not set out the evidence in detail. Matters of mitigation or aggravation should

be set out, e.g. the defendant was co-operative and readily admitted the offence, or the defendant used abusive language to the inspector.

The gravity of the offence should set out in one paragraph the reasons for the introduction of the provision in question and a view as to the gravity of the offence in question. The maximum penalty should be noted, with a reference to the relevant sections and regulations.

The prior convictions set out any prior convictions under the law relating to noxious weeds. This would include a brief reference to the offence, the date of conviction, the location of the Local Court and the amount of the fine. Prior convictions beyond 5 years need not be stated.

The claim for costs and expenses should include a claim for one-half a day's gross salary for the informant, together with travelling expenses to and from court. Following on the successful conclusion of a defended hearing claims will be made for all witnesses for the time actually spent in court, together with travelling expenses.

As to 4, the recommendation for prosecution should set out any relevant background to the prosecution and reasons for recommending prosecution. This should be typed double-spaced and signed by the inspector in charge of the investigation.

THE PROSECUTION

Alan Russell
Chief Legal Officer
N.S.W. Department of Agriculture

Damer Walsh
Legal Officer
N.S.W. Department of Agriculture

Gerard Carter
Legal Officer
N.S.W. Department of Agriculture

This is a role play of a prosecution conducted by Legal Officers from the N.S.W. Department of Agriculture in conjunction with Weeds Officers.

a) **Proceedings in court of a plea of guilty, William John Lilywhite of "Hard Luck"**

b) **Proceedings in court of a plea of not guilty, Frederick Francis Farmer of "Black Crow Creek"**

PROCEDURES IN THE COURT ROOM

PLEA OF GUILTY

A fictional case prepared by the Legal Branch of the Department of Agriculture and presented by Legal Officers of that Branch and Weeds Inspectors and/or Officers.

Magistrate: Is anyone present in court in the matter of P.P. Paterson for and on behalf of Gunns Gully Shire Council v William John LILYWHITE?

Grabbit: May it please your Worship, I appear for the informant in that matter. My name is Grabbitt, Solicitor. Might the defendant be called.

Magistrate: Yes, Officer call the defendant.

Harmless: May it please your Worship, I appear for the defendant. My name is Harmless, Solicitor. This is a plea of guilty.

Magistrate: I'll take it now.

Grabbitt: Your Worship,

(*Grabbitt then reads statement of facts aloud to the Court. A copy of the Statement of Facts is attached*).

These are my submissions your Worship.

Magistrate: Yes, thank you Mr Grabbitt. Yes, Mr Harmless.

Harmless: Your Worship, my client is a married man living with his wife and 4 children under the age of 16. At the time of the offence his wife had been in hospital for 2 months recovering from a serious heart operation and 2 of his children were sick with gastric flu.

Your Worship, my client recognizes his legal obligations to rid his property of noxious weeds but in this case owing to his domestic and financial pressures he was unable to carry out the necessary work. In all the circumstances I would ask your Worship to dismiss the information under Section 556A of the Crimes Act.

Magistrate: No, I won't apply the section. Mr Grabbit has informed the court as to the seriousness of serrated tussock and the importance of its eradication. I bear in mind that this is the second time the defendant has been before the court in recent years for an offence of this nature and also the fact that apparently no attempt at all was made to comply with the notice. I see that the maximum penalty for a second offence is $200 but in fixing the penalty I bear in mind the defendant's difficult domestic situation at the time.

I find the offence proved. The defendant is convicted and fined $120 with costs of $124 and court costs of $19. That makes a total of $263. Are you asking for time to pay, Mr Harmless?

Harmless: Would your Worship allow 1 month?

Magistrate: Yes, 1 month to pay.

Mr Lilywhite, you're excused. Officer call the next matter.

Attached are the following:

1. Statement of Facts.
2. Information - General Purposes.
3. Completed Form 2.
4. Sketch.
5. Sections 472, 473 and 474 of Local Government Act 1919.
6. Ordnance 50 and Forms 1, 2 and 3.
7. Noxious Plants Proclamation (Government Gazette No. 52 of 8.3.85)

STATEMENT OF FACTS

A. **Facts**

I hand up a copy of section 473 of the Local Government Act, 1919 and of Ordinance 50.

The defendant is the occupier of a 1,200 hectare sheep grazing property known as "Hard Luck" near Salt Bush Flat. A number of inspections of the property were made by the Council Weeds Officer in April and June 1984 and there were several discussions with the defendant regarding the infestation of his property with serrated tussock. Serrated tussock is a declared noxious plant for the whole of N.S.W. under the Local Government Act. I hand up Proclamation in Government Gazette No. 22 of 4th February, 1983. On 21st September, 1984 a notice, in accordance with Form 2 to Ordinance 50, and bearing that date, was served on the defendant personally. The notice required the defendant to eradicate serrated tussock from the subject land being part of the whole property and being 20 hectares as shown in the sketch accompanying the notice. I hand up a copy of the notice and the sketch. The defendant was given 60 days to eradicate all serrated tussock by cultivation. The Weeds Officer visited the property on 27th November, 1984, which was the 7th day after notice had expired, and inspected the subject land. He observed that no work at all had been done to eradicate the serrated tussock. When spoken to the defendant readily admitted the offence, but stated that his wife had been in hospital for several weeks with a major operation and 2 of his 4 children had been sick.

B. **Gravity of Offence**

The maximum penalty is $100 for a 1st offence and $200 for a second or subsequent offence.

Serrated tussock is the No. 1 noxious weed in N.S.W. 780,000 hectares of land in N.S.W. are infested.

The best methods of control are cultivation on arable land and also chemical treatment. These must be associated with pastures improvement to provide an effective barrier to re-infestation. It is estimated that serrated tussock costs N.S.W. graziers $20 million each year in lost productivity. The Department of Agriculture is presently mounting an intensive campaign, in conjunction with the Councils, to contain this serious agricultural pest.

C. **Prior Convictions**

The defendant was convicted of a similar offence in respect of serrated tussock at this Court on 25th July, 1981, and was fined $60 with costs of $45.

The defendant has no other prior convictions under the noxious plants provisions of the Local Government Act and Ordinance 50.

D. **Claim for Costs**

I am instructed to claim costs as follows:

Professional Costs	$75
Court Costs	$19
Council Weeds Officer (1/2 day)	$40
Travelling Expenses	$20
	$154

FOR HEARING AT THE Salt Bush Flat Local COURT ~~OF PETTY~~
~~SESSIONS~~ ON Monday, 6th May, 1985

INFORMATION—GENERAL PURPOSES

Local Government Act No. 41 of 1919, /Part XXII section 473,
(~~Regulation~~ Ordinance No. 50 .)

Section 75 B Justices Act, 1902. Proclamation of 2nd February, 1983 under Local Government Act, 1919, published in Government Gazette No. 22 of 4 February, 1983

BE IT REMEMBERED THAT on this Fourth day of February, in the year of Our Lord one thousand nine hundred and Eighty Five at Salt Bush Flat in the State of New South Wales, PETER PAUL PATERSON, for and on behalf of the Council of the Shire of GUNNS GULLY (hereinafter called the Informant) of Main Street, Salt Bush Flat appears before me, the undersigned, one of Her Majesty's Justices duly assigned to keep the Peace of Our Sovereign Lady the Queen in and for the said State, and

Fee: $

informs me that on the twentieth day of November in the year of Our Lord one thousand nine hundred and Eighty Four at or near Salt Bush Flat in the said State, one William John Lilywhite (hereinafter called the Defendant)

of "Hard Luck", Salt Bush Flat, in the State aforesaid did fail to comply with a notice given to him under section 473 of the Local Government Act, 1919.

*Summons
*Warrant Issued

Further Particulars: Notice to eradicate noxious plant, namely, Serrated Tussock, from land known as "Hard Luck" near Salt Bush Flat. Notice dated 21st September, 1984, served on abovenamed defendant on 21st September, 1984, and require the noxious plant to be eradicated within a period of 60 days from the date of the notice.

contrary to the Act or regulation in such case made and provided; whereupon the said Informant prays that I, the said Justice will proceed in the premises according to law.

P.P. PATERSON

EXHIBITED AT Salt Bush Flat
in the said State on the
day first above written,
before me,

W.W. WAUGH, J.P.
Justice of the Peace.

W—S.O. 4263 D. West, Government Printer

Form 2

Form amended, 24/11/61 and 11/2/66

(Ordinance 50)

NOXIOUS PLANTS

Notice to Owner or Occupier.

.....GUNNS.GULLY..... Xxxxxxxxxxxx Shire) Council

To ..WILLIAM.JOHN.LILYWHITE.....
(Name)

..."Hard.Luck"..SALT.BUSH.FLAT.....
(Address)

Description or situation of land to which notice relates -

.....20.hectares.being.part.of.property.of.1,200.hectares.....
.....known.as."Good.Luck"..Salt.Bush.Flat,.indicated.in.....
.....the.accompanying.sketch.....

Notice is hereby given in accordance with Section 473 of the Local Government Act, 1919, as amended by subsequent Acts, that the undermentioned plants which have, in accordance with the provisions of such Act, been declared to be noxious plants have been found to be growing upon the land (above described) *
(indicated in the accompanying sketch), and, as the Council is satisfied that you are not taking reasonable and effective measures to eradicate such plants from the land, you are hereby required to eradicate such plants in the following manner:-

By cultivation, within 60 days of the date of this notice.

Scientific Name	Name by which commonly known
NASSELLA TRICHOTOMA	SERRATED TUSSOCK

The Act provides that if any owner or occupier fails to comply in any particular with the requirements of a notice given to him under Section 473 of the Act he shall be liable to a penalty not exceeding one hundred dollars for the first offence and not exceeding two hundred dollars for any subsequent offence.

(Signed) .....A..Quill..
Xxxxxxx Shire) Clerk.

....21st.September,..1984 Date

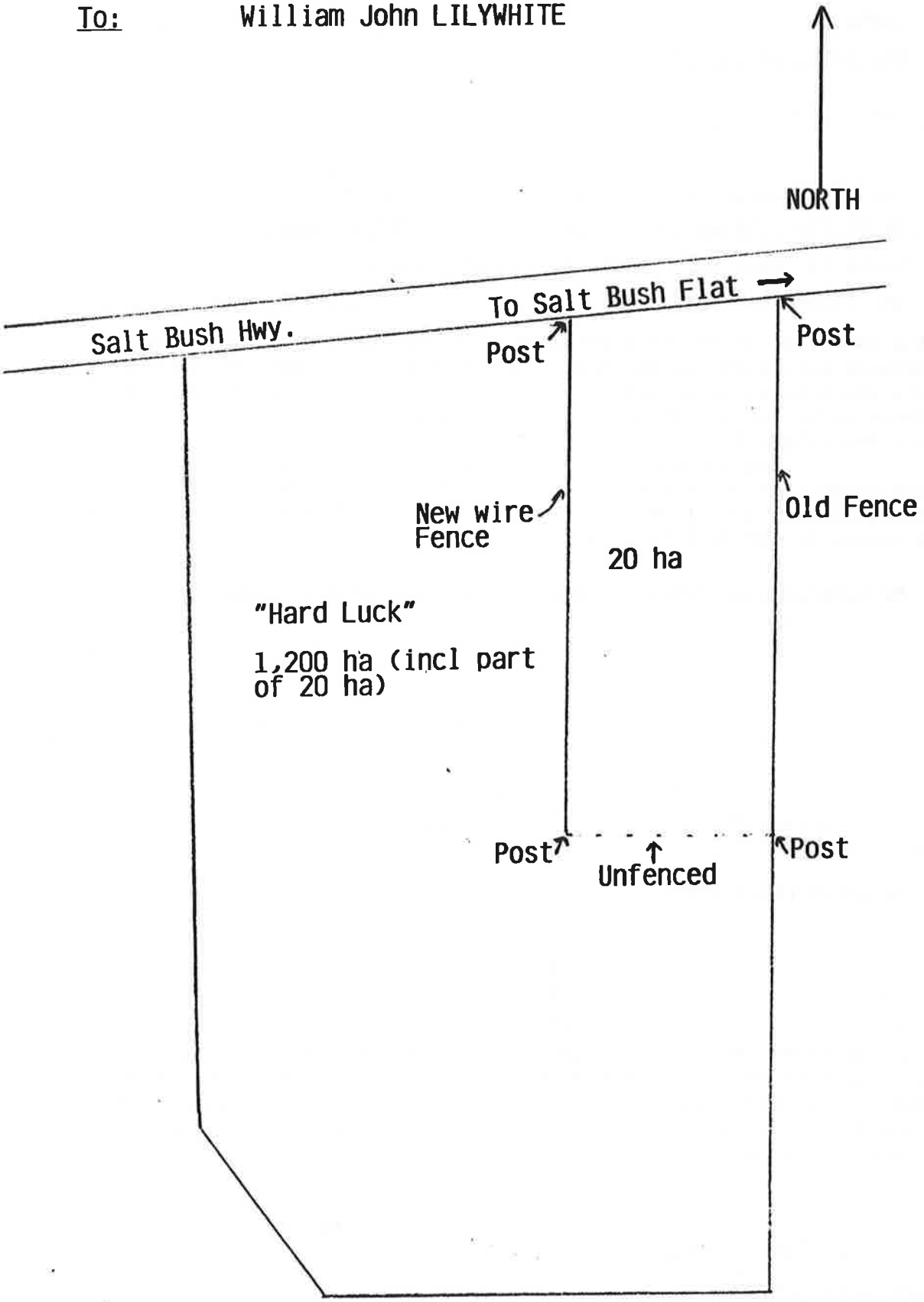
GUNNS.GULLY.SHIRE..... Council's Office, ...Main..... Street

* Strike out whichever is not required.

SKETCH ACCOMPANYING NOTICE DATED 21.9.84

From: Gunns Gully shire Council

To: William John LILYWHITE



472. (1) Within one month after service upon the council of a copy of any proclamation published under section 467 the council shall, if the proclamation relates to land within its area, give the prescribed notice thereof in a newspaper.

If the proclamation relates to land within the areas of more than one council, any two or more of such councils may unite to give such notice.

If the proclamation relates to land which is wholly or partly in the Western Division and which is not within the boundaries of an area, the Western Lands Commissioner shall, within one month after service upon him of a copy of the proclamation, give the prescribed notice thereof in a newspaper.

(2) Where the prescribed notice has been given in pursuance of subsection (1)—

(a) * * * * * *

(b) every occupier of private land shall take reasonable and effective measures to eradicate noxious plants from the said land.

(3) Every occupier who fails, without reasonable excuse, to comply with the requirements of subsection (2) shall be liable to a penalty not exceeding one hundred dollars for the first offence and not exceeding two hundred dollars for any subsequent offence.

(4) If for any reason the notice required to be given in accordance with subsection (1) is not given within the prescribed time, the Minister may extend the time for the giving of the notice.

473. (1) The council may arrange with the owner or occupier to eradicate any noxious plant from private land at the expense of the council.

(2) Where it is found by the council that noxious plants are growing upon any private land and the council is satisfied that the occupier of such land is not taking reasonable and effective measures to eradicate noxious plants from such land it may give notice to the owner or occupier to eradicate noxious plants from such land.

(3) The notice shall be in or to the effect of the form prescribed, and may specify different periods of time within which noxious plants shall be eradicated to the satisfaction of the council from particular parts of the land described in the notice or indicated in a sketch accompanying the notice, and may also specify which of the prescribed means, measures, methods or acts for or with respect to the eradication of noxious plants shall be taken, adopted or done by such owner or occupier or, if no such means, measures, methods or acts have been prescribed, may require the owner or occupier to take, adopt or do such means, measures, methods or acts for or with respect to the eradication of noxious plants as in the opinion of the council are necessary in the circumstances.

(4) An owner or occupier upon whom such notice is served and every successor in title of such owner or occupier shall comply with the requirements of the notice.

(5) If any owner or occupier fails to comply in any particular with the requirements of a notice given to him under this section he shall be liable to a penalty not exceeding one hundred dollars for the first offence and not exceeding two hundred dollars for any subsequent offence.

474. (1) If the council is satisfied that an owner or an occupier to whom a notice has been given under section 473, or any successor in title of such owner or occupier is not reasonably and effectively complying with the requirements of the notice the council may, after notice in that behalf given as prescribed, enter upon the land, and may take, adopt or do or cause to be taken, adopted or done the prescribed means, measures, methods or acts for or with respect to the eradication of noxious plants, or if no such means, measures, methods or acts have been prescribed, may take, adopt or do or cause to be taken, adopted or done such means, measures, methods or acts for or with respect to the eradication of noxious plants as seem right and proper in the circumstances.

(2) Any costs and expenses reasonably incurred by the council in the exercise of its powers under subsection (1) shall on demand be repaid to the council by the person to whom the notice referred to in subsection (1) was given, and may be recovered from such person by the council as a debt.

(3) The provisions of this Act with respect to—

(a) the charge of a rate under this Act on the land in respect of which it is levied; and

(b) the time within which proceedings for the recovery of the rate may be taken,

shall, mutatis mutandis, apply to and in respect of any judgment recovered under this section against the owner by the council and recorded in the books thereof, as if the amount of the judgment and of any costs awarded to the council in respect of its claim were a rate levied under this Act in respect of the land concerned.

Ordinance No. 50.

Printed in accordance with the provisions of section 578 of the Local Government Act, 1919.

[Certified 4th September, 1970.]

ORDINANCE No. 50.

[*As proclaimed in the Government Gazette of 2nd September, 1938, and amended by proclamations published in the Government Gazettes of 16th September, 1938, 28th March, 1941, 24th April, 1947, 29th October, 1948, 31st July, 1959, 24th November, 1961, and 11th February, 1966.*]

NOXIOUS PLANTS.

(Local Government Act, 1919, Sections 466-475J and 575-579, Local Government (Noxious Plants) Amendment Act, 1937, Section 4 (2).)

Repeal.

1. Ordinance No. 50, as made by proclamation published in the Government Gazette of 24th December, 1919, and amended by subsequent proclamations, is hereby repealed.

Interpretation.

2. In this Ordinance (unless inconsistent with the context or subject matter)—

"The Act" means the Local Government Act, 1919, as amended by subsequent Acts;

"Weed-killer" means Chlorates, Arsenite of Soda, Arsenic Pentoxide, Thiocynates (Sulphocyanides) or Sodium Chloride (Common Salt) or any weed destroyer registered under the Pest Destroyers Act, 1945. Definition amended, 29/10/48.

Notices—Forms.

3. (a) The prescribed notice for the purpose of section 472 (1) of the Act shall be in or to the effect of Form 1 hereunder.

(b) The prescribed notice for the purpose of section 473 (2) and (3) of the Act shall be in or to the effect of Form 2 hereunder.

(c) The notice under section 474 (1) of the Act shall be in or to the effect of Form 3 hereunder.

Methods of eradication of noxious plants, etc.

4. The means, measures or methods to be taken or adopted and the acts to be done for or with respect to the eradication of noxious plants shall (except as hereinafter provided) be one or more of the following, viz.:—

(a) Mechanical.—The noxious plants shall be hoed, mowed, grubbed, ploughed, slashed, brushed or otherwise cut and in any case where

P 93545 [5c]

such plants have matured seeds or burrs, such hoeing, mowing, grubbing, ploughing, slashing, brushing or cutting shall be immediately followed by the careful stacking of such plants to prevent the spread of the seeds or burrs and such plants when dry shall be burnt;

(b) Chemical.—The noxious plants shall be thoroughly sprayed or dusted with weed-killer sufficiently concentrated to kill such plants and where in any case, after such spraying or dusting, regrowth occurs, such regrowth shall be likewise sprayed or dusted: Provided that the plant Rubus fruticosus commonly known as blackberry shall not after the formation of the berries thereon be sprayed or dusted with any weed-killer containing arsenic;

(c) Cultural control.—The land shall be planted with lucerne or such other pasture grasses as will smother the noxious plants or the land shall be so used for the grazing of stock that the noxious plants shall be cropped to the level of the soil and in all cases reasonable measures shall be taken to prevent formation of seed or burrs on such plants: Provided a break (of sufficient width to prevent the spread of noxious plants or the seeds or burrs thereof to adjoining lands) shall be cleared of noxious plants around the boundaries of the land and along any creek or river frontages by eradicating from such break all noxious plants growing therein in accordance with either paragraph (a) or paragraph (b) of this clause.

Methods of eradication of certain plants.

5. (a) The following means, measures or methods shall be taken or adopted and the following acts shall be done for or with respect to the eradication of:—

(i) *Erythroxylum Coca* (commonly known as Coca Leaf), *Papaver somniferum* (commonly known as Opium Poppy) and *Cannabis sativa* (commonly known as Indian Hemp): The plants shall be completely removed from the soil and burnt or the plants and surrounding soil shall be thoroughly sprayed with a solution of weed-killer sufficiently concentrated to kill the plants and to sterilize the soil.

Paragraph omitted, 28/3/41.

(ii) .. ..

(iii) *Senecio Jacobea* (commonly known as Ragwort): The plants shall be thoroughly sprayed or dusted during the months of August or September with weed-killer sufficiently concentrated to kill the plants.

(iv) *Ailanthus glandulosa* (commonly known as Tree of Heaven): The trees shall be frilled or ringbarked as close to the ground as possible and arsenic pentoxide or arsenite of soda applied to the frill or ring; any suckers shall be cut off close to the ground and arsenic pentoxide or arsenite of soda applied to the cut surface of the stump.

Subclause omitted, 28/3/41.

(b) .. ..

Form 1.

(Ordinance 50.)

NOXIOUS PLANTS.

Notice of Proclamation.

Form amended, 10/9/38, 24/4/47, 31/7/59, 24/11/61 and 11/2/66.

..... Municipal (or Shire) Council.

Notice is hereby given under section 472 (1) of the Local Government Act, 1919, as amended by subsequent Acts, that the following plants have been, by virtue of a proclamation published in the Government Gazette of ..... declared by His Excellency the Governor under section 467 (1) of the Act to be noxious plants throughout the area of the Municipality (or Shire) of .....

Noxious Plant.	
Scientific Name.	Name by which commonly known.

In accordance with subsection (2) of section 472 of the Act, every occupier of private land shall take reasonable and effective measures to eradicate noxious plants from the said land.

Every occupier who fails, without reasonable excuse to comply with these requirements shall be liable to a penalty not exceeding one hundred dollars for the first offence and not exceeding two hundred dollars for any subsequent offence.

(Signed) .....
Town (or Shire) Clerk.

Council Office,

.....

.....

Form 2.

(Ordinance 50.)

NOXIOUS PLANTS.

Form amended, 24/11/61 and 11/2/66.

Notice to Owner or Occupier.

.....Municipal (or Shire) Council.

To .....
(Name)

.....
(Address)

Description or situation of land to which notice relates—

.....

.....

.....

Notice is hereby given in accordance with section 473 of the Local Government Act, 1919, as amended by subsequent Acts, that the undermentioned plants which have, in accordance with the provisions of such Act, been declared to be noxious

plants have been found to be growing upon the land (above described)* (indicated in the accompanying sketch), and, as the Council is satisfied that you are not taking reasonable and effective measures to eradicate such plants from the land, you are hereby required to eradicate such plants in the following manner:—

Scientific Name.	Name by which commonly known.

The Act provides that if any owner or occupier fails to comply in any particular with the requirements of a notice given to him under section 473 of the Act he shall be liable to a penalty not exceeding one hundred dollars for the first offence and not exceeding two hundred dollars for any subsequent offence.

(Signed) .....
Town (or Shire) Clerk.

.....Date.
.....Council's Office, ...Street.

* Strike out whichever is not required.

Form 3.

(Ordinance 50.)

NOXIOUS PLANTS.

Notice of Entry to Owner or Occupier.

..... Municipal (or Shire) Council.

To.....
(Name)

.....
(Address)

Description or situation of land to which notice relates—

.....
.....
.....

Notice is hereby given in accordance with section 474 (1) of the Local Government Act, 1919, as amended by subsequent Acts, that as the Council is satisfied that you are not reasonably and effectively complying with the requirements of a notice under section 473 of the Act given to*
on† in relation to the eradication of noxious plants from the land described above the Council by its servants or agents proposes to enter upon such land for the purpose of taking, adopting or doing the prescribed means, measures, methods or acts for or with respect to the eradication of such noxious plants.

The Act provides that any costs and expenses reasonably incurred by the Council in the exercise of its powers under section 474 (1) of the Act shall on demand be repaid to the Council by the person to whom this notice is given and may be recovered from such person by the Council as a debt.

(Signed) .....
Town (or Shire) Clerk.

.....Date.
.....Council's Office, ...Street
.....

*Insert name of person to whom notice has been given.
† Insert date of service of notice.

BY AUTHORITY:
V. C. N. BLIGHT, GOVERNMENT PRINTER, NEW SOUTH WALES—1970

[*Published in Government Gazette No. 22 of 4th February, 1983.*]

LOCAL GOVERNMENT ACT, 1919.—PROCLAMATION

(L.S.) J. A. ROWLAND, *Governor.*

2nd February, 1983.

I, Air Marshal Sir JAMES ANTHONY ROWLAND, Governor of the State of New South Wales, with the advice of the Executive Council and on the recommendation of the Minister for Local Government and Lands and the Minister for Agriculture jointly, in pursuance of the Local Government Act, 1919, by this proclamation hereby—

(1) rescind those proclamations declaring plants to be noxious plants under the aforesaid Act as relate to the declaration of noxious plants throughout the whole State

(2) declare the plants described in the Schedule hereto to be noxious plants in the portion of the State specified therein. (G. 81-905)

By His Excellency's Command,

A. R. L. GORDON.

GOD SAVE THE QUEEN!

SCHEDULE

Portion of State where declared noxious	Plant declared noxious	
	Botanical name	Common name
Whole of State ..	*Alternanthera philoxeroides*	Alligator Weed.
	Salvinia molesta ..	Salvinia.
	Eichhornia crassipes ..	Water Hyacinth.
	Pistia stratiotes ..	Water Lettuce.
	Lagarosiphon major ..	Largarosiphon.
	Xanthium spp. ..	Bathurst, Noogora, Californian, Cockle Burrs.
	Rubus (*fruticosus* agg.) spp.	Blackberry.
	Erythroxylum coca ..	Coca Leaf.
	Sorghum halepense ..	Johnson Grass.
	Sorghum x almum ..	Columbus Grass.
	Cannabis sativa	Indian Hemp.
	Prosopis spp.	Mesquite.
	Carduus nutans	Nodding Thistle.
	Papaver somniferum ..	Opium Poppy.
	Parthenium hysterophorus	Parthenium Weed.
	Nassella trichotoma ..	Serrated Tussock.
	Cenchrus incertus *C. longispinus.*	Spiny Burr Grass.
	Hypericum perforatum ..	St John's Wort.
Shires of—		
Hornsby	*Lantana camara*	Lantana.
Sutherland	*Ricinus communis* ..	Castor-oil Plant.
Warringah		
Cities of—		
Bankstown ..		
Fairfield		
Liverpool		
Parramatta ..		
Sydney		
Municipalities of—		
Ashfield		
Auburn		
Botany		
Burwood		
Concord		
Drummoyne ..		
Holroyd		
Hunters Hill ..		
Hurstville		
Kogarah		
Ku-ring-gai ..		
Lane Cove		
Leichhardt		
Manly		
Marrickville ..		
Mosman		
North Sydney ..		
Randwick		
Rockdale		
Ryde		
Strathfield		
Waverley		
Willoughby ..		
Woollahra ..		
Hawkesbury River County	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp.	Paterson's Curse/Viper's Bugloss, Italian Bugloss.
	Homeria spp.	Cape Tulips.
	Cestrum parqui	Green Cestrum.
Wollondilly Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse/Viper's Bugloss, Italian Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Ulex europaeus	Gorse.
	Pennisetum villosum ..	Longstyle Feather Grass.
Campbelltown City ..	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse/Viper's Bugloss, Italian Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Ulex europaeus	Gorse.
	Pennisetum villosum ..	Longstyled Feather Grass.
Camden Municipal ..	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse/Viper's Bugloss, Italian Bugloss.
	Emex australis	Spiny Emex.
	Rosa rubiginosa	Sweet Briar.
	Ulex europaeus	Gorse.
	Pennisetum villosum ..	Longstyled Feather Grass.
Blue Mountains City ..	*Lycium ferocissimum* ..	African Boxthorn.
	Homeria spp.	Cape Tulips.
	Rosa rubiginosa	Sweet Briar.
	Ulex europaeus	Gorse.
	Sarothamnus scoparius ..	English/Scotch Broom.
Gosford City	*Lycium ferocissimum* ..	African Boxthorn.
	Ageratina adenophora riparia ..	Crofton Weed. Mistflower.
	Emex australis	Spiny Emex.
	Ailanthus altissima ..	Tree-of-Heaven.
	Ulex europaeus	Gorse.
	Pennisetum macrourum ..	African Feather Grass.
Wyong Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Ageratina adenophora riparia	Crofton Weed. Mistflower.
	Emex australis	Spiny Emex.
	Ailanthus altissima ..	Tree-of-Heaven.
	Ulex europaeus	Gorse.
Lake Macquarie Municipal	*Lycium ferocissimum* ..	African Boxthorn.
	Ageratina adenophora riparia ..	Crofton Weed. Mistflower.
	Emex australis	Spiny Emex.
Newcastle City ..	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse/Viper's Bugloss, Italian Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Ageratina adenophora riparia ..	Crofton Weed. Mistflower.
	Emex australis	Spiny Emex.
Greater Cessnock City	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse/Viper's Bugloss, Italian Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Ageratina adenophora riparia ..	Crofton Weed. Mistflower.
	Emex australis	Spiny Emex.
Maitland City	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Ageratina adenophora riparia ..	Crofton Weed. Mistflower.
	Emex australis	Spiny Emex.
Port Stephens Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Ageratina adenophora riparia ..	Crofton Weed. Mistflower.
	Emex australis	Spiny Emex.
Great Lakes Shire ..	*Echium* spp. ..	Paterson's Curse, Viper's Bugloss.
	Ageratina riparia .. *adenophora*	Mistflower. Crofton Weed.
	Salvia reflexa	Mintweed.
Gloucester Shire ..	*Echium* spp. ..	Paterson's Curse, Viper's Bugloss.
	Ageratina adenophora riparia ..	Crofton Weed. Mistflower.
	Ailanthus altissima ..	Tree-of-Heaven.
	Salvia reflexa	Mintweed.
	Sarothamnus scoparius ..	English/Scotch Broom.
Dungog Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Ageratina adenophora riparia ..	Crofton Weed. Mistflower.
	Emex australis	Spiny Emex.
	Salvia reflexa	Mintweed.
	Sarothamnus scoparius ..	Scotch/English Broom.
Singleton Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Sclerolaena birchii ..	Galvanized Burr.
	Rosa rubiginosa	Sweet Briar.
	Salvia reflexa	Mintweed.
	Ailanthus altissima ..	Tree-of-Heaven.
	Centaurea calcitrapa ..	Star Thistle.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Heliotropium amplexicaule	Blue Heliotrope.
	Conium maculatum ..	Hemlock.
	Sarothamnus scoparius ..	Scotch/English Broom.
Muswellbrook Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Sclerolaena birchii ..	Galvanized Burr.
	Rosa rubiginosa	Sweet Briar.
	Salvia reflexa	Mintweed.
	Ailanthus altissima ..	Tree-of-Heaven.

Portion of state where declared noxious	Plants declared noxious	
	Botanical name	Common name
Muswellbrook Shire —*continued.*	*Proboscidea louisianica* / *Ibicella lutea*	Devil's Claw.
	Heliotropium amplexicaule	Blue Heliotrope.
	Conium maculatum	Hemlock.
	Sarothamnus scoparius	Scotch/English Broom.
Scone Shire	*Lycium ferocissimum*	African Boxthorn.
	Echium spp.	Paterson's Curse, Vipers Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Sclerolaena birchii	Galvanized Burr.
	Rosa rubignosa	Sweet Briar.
	Salvia reflexa	Mintweed.
	Ailanthus altissima	Tree-of-Heaven.
	Centaurea calcitrapa	Star Thistle.
	Heliotropium amplexicaule	Blue Heliotrope.
	Conium maculatum	Hemlock.
	Pennisetum villosum	Longstyled Feather Grass.
	Sarothamnus scoparius	Scotch/English Broom.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Merriwa Shire	*Lycium ferocissimum*	African Boxthorn.
	Echium spp.	Paterson's Curse, Viper's Bugloss, Italian Bugloss.
	Homeria spp.	Cape Tulips.
	Chondrilla juncea	Skeleton Weed.
	Cestrum parqui	Green Cestrum.
	Sclerolaena birchii	Galvanized Burr.
	Rosa rubignosa	Sweet Briar.
	Salvia reflexa	Mintweed.
	Ailanthus altissima	Tree-of-Heaven.
	Centaurea calcitrapa	Star Thistle.
	Heliotropium amplexicaule	Blue Heliotrope.
	Conium maculatum	Hemlock.
	Sarothamnus scoparius	Scotch/English Broom.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
ORANA AND FAR WESTERN REGION		
Mid-Western County	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Ailanthus altissima	Tree-of-Heaven.
	Rosa rubignosa	Sweet Briar.
	Centaurea calcitrapa	Star Thistle.
	Salvia reflexa	Mintweed.
	Conium maculatum	Hemlock.
	Pennisetum villosum	Longstyle feather grass.
	Onopordum acanthium	Scotch Thistle.
	Onopordum illyricum	Illyrian Thistle.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Linaria dalmanica	Dalmation Toadflax.
	Homeria spp.	Cape Tulips.
	Heliotropium amplexicaule	Blue Heliotrope.
	Ambrosia—tenuifolia psilostachya	Perennial ragweed.
Castlereagh—Macquarie County.	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Rosa rubiginosa	Sweet Briar.
	Salvia reflexa	Mintweed.
	Verbesina encelioides	Crownbeard.
	Scolymus maculatus	Spotted Golden Thistle.
	Conium maculatum	Hemlock.
	Heliotropium amplexicaule	Blue Heliotrope.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Coonabarabran Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Ailanthus altissima	Tree-of-Heaven.
	Rosa rubiginosa	Sweet Briar.
	Centaurea calcitrapa	Star Thistle.
	Conium maculatum	Hemlock.
	Ambrosia—tenuifolia psilostachya	Lacy Ragweed. Perennial Ragweed.
	Heliotropium amplexicaule	Blue Heliotrope.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Dubbo City	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Ailanthus altissima	Tree-of-Heaven.
	Rosa rubiginosa	Sweet Briar.
	Salvia reflexa	Mintweed.
	Centaurea calcitrapa	Star Thistle.
	Proboscidea louisianica / *Ibiscella lutea*	Devil's Claw.
Wellington Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Ailanthus altissima	Tree-of-Heaven.
	Rosa rubiginosa	Sweet Briar.
	Salvia reflexa	Mintweed.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Narromine Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Ailanthus altissima	Tree-of-Heaven.
	Centaurea calcitrapa	Star Thistle.
	Salvia reflexa	Mintweed.
	Solanum rostratum	Buffalo Burr.
	Verbesina encelioides	Crownbeard.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Bogan Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Brewarrina Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.

Portion of State where declared noxious	Plant declared noxious	
	Botanical name	Common name
Brewarrina Shire —*continued.*	*Proboscidea louisianica* / *Ibicella lutea*	Devil's Claw.
Bourke Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Cobar Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Central Darling Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
Broken Hill City	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica / *Ibicella lutea*	Devil's Claw.
NORTH COAST REGION		
Hastings Municipal	*Ageratina adenophora riparia*	CroftonWeed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
	Echium spp.	Paterson's Curse, Vipers Bugloss.
	Emex australis	Spiny Emex.
Greater Taree City	*Ageratina adenophora riparia*	Crofton Weed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
	Echium spp.	Paterson's Curse. Vipers Bugloss.
Grafton City*	*Baccharis halimifolia*	Groundsel Bush.
	Lantana camara	Lantana (Red).
	Cirsium vulgare	Spear Thistle.
	Gomphocarpus spp.	Cotton Bush.
Ulmarra Shire*	*Ageratina adenophora riparia*	Crofton Weed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
	Lantana camara	Lantana (Red).
	Cirsium vulgare	Spear Thistle.
	Gomphocarpus spp.	Cotton Bush.
Nymboida Shire*	*Ageratina adenophora riparia*	Crofton Weed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
	Lantana camara	Lantana (Red).
	Cirsium vulgare	Spear Thistle.
	Emex australis	Spiny Emex.
	Gomphocarpus spp.	Cotton Bush.
	Sporobolus africanus	Parramatta Grass.
Nambucca Shire	*Ageratina adenophora riparia*	Crofton Weed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
Maclean Shire*	*Baccharis halimifolia*	Goundsel Bush.
	Lantana camara	Lantana (Red).
	Circium vulgare	Spear Thistle.
	Gomphocarpus spp.	Cotton Bush.
Kempsey Shire	*Homeria* spp.	Cape Tulips.
	Ageratina adenophora riparia	Crofton Weed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
	Echium spp.	Paterson's Curse Viper's Bugloss.
	Emex australis	Spiny Emex.
Copmanhurst Shire*	*Ageratina adenophora riparia*	Crofton Weed. Mistflower.
	Lantana camara	Lantana (Red).
	Cirsium vulgare	Spear Thistle.
	Gomphocarpus spp.	Cotton Bush.
Coffs Harbour	*Ageratina adenophora riparia*	Crofton Weed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
	Lantana camara	Lantana (Red).
	Emex australis	Spiny Emex.
	Sporobolus africanus	Parramatta Grass.
Bellingen Shire	*Ageratina adenophora riparia*	Crofton Weed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
	Lantana camara	Lantana (Red).
	Sarothamnus scoparius	Scotch/English Broom.
	Sporobolus africanus	Parramatta Grass.
Far North Coast County	*Ageratina adenophora riparia*	Crofton Weed. Mistflower.
	Baccharis halimifolia	Groundsel Bush.
NEW ENGLAND REGION		
Glen Innes Municipal	*Sclerolaena birchii*	Galvanised Burr.
	Conium maculatum	Hemlock.
	Pennisetum villosum	Longstyled Feather Grass.
	Echium spp.	Paterson's Curse, Viper's Bugloss.
	Carthamus lanatus	Saffron Thistle.
	Centaurea solstitialis	St Barnaby's Thistle.
	Hypericum perforatum	St John's Wort.
	Sarothamnus scoparius	Scotch/English Broom.
	Centaurea calcitrapa	Star Thistle.
Narrabri Shire	*Lycium ferocissimum*	African Boxthorn.
	Typha spp.	Cumbungi.
	Sclerolaena birchii	Galvanised Burr.
	Conium maculatum	Hemlock.
	Salvia reflexa	Mintweed.

Portion of State where declared noxious	Plant declared noxious	
	Botanical name	Common name
NEW ENGLAND REGION—*continued*		
Narrabri Shire —*continued*	*Echium* spp. ..	Paterson's Curse, Viper's Bugloss.
	Ambrosia psilostachya ..	Perennial Ragweed.
	Carthamus lanatus ..	Saffron Thistle.
	Chondrilla juncea ..	Skeleton Weed.
Severn Shire	*Ageratina adenophora* ..	Crofton Weed.
	Sclerolaena birchii ..	Galvanised Burr.
	Baccharis halimifolia ..	Groundsel Bush.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Carthamus lanatus ..	Saffron Thistle.
	Centaurea solstitialis ..	St Barnaby's Thistle.
	Hypericum perforatum ..	St John's Wort.
	Sarothamnus scoparius ..	Scotch/English Broom.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar.
	Stevia eupatoria	Stevia Eupatoria.
Tenterfield Shire ..	*Ageratina adenophora* ..	Crofton Weed.
	Sclerolaena birchii ..	Galvanised Burr.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Carthamus lanatus ..	Saffron Thistle.
	Centaurea solstitialis ..	St Barnaby's Thistle.
	Sarothamnus scoparius ..	Scotch/English Broom.
	Chondrilla juncea	Skeleton Weed.
	Centaurea calcitrapa ..	Star Thistle.
Far North Western Slopes County.	*Lycium ferocissimum* ..	African Boxthorn.
	Typha spp.	Cumbungi.
	Cuscuta spp.	Dodder.
	Sclerolaena birchii ..	Galvanised Burr.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Chondrilla juncea	Skeleton Weed.
	Scolymus masculatus ..	Spotted Golden Thistle.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar.
Central Northern County	*Lycium ferocissimum* ..	African Boxthorn.
	Cuscuta spp.	Dodder.
	Sclerolaena birchii ..	Galvanised Burr.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Chondrilla juncea	Skeleton Weed.
	Rosa rubiginosa	Sweet Briar.
New England Tablelands County.	*Sclerolaena birchii* ..	Galvanised Burr.
	Conium maculatum ..	Hemlock.
	Pennisetum vilosum ..	Longstyled Feather Grass.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Carthamus lanatus ..	Saffron Thistle.
	Centaurea solstitialis ..	St Barnaby's Thistle.
	Sarothamnus scoparius ..	Scotch/English Broom.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar.
Gunnedah Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Cuscuta spp.	Dodder.
	Sclerolaena birchii ..	Galvanised Burr.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss.
	Ambrosia psilostachya ..	Perennial Ragweed.
	Chondrilla juncea	Skeleton Weed.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar.
Moree Plains Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Typha spp.	Cumbungi.
	Sclerolaena birchii ..	Galvanised Burr.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Chondrilla juncea	Skeleton Weed.
	Scolymus maculatus ..	Spotted Golden Thistle.
SOUTHERN AREA		
Wagga Wagga City ..	*Sclerolaena birchii* ..	Galvanised Burr.
	Centaurea calcitrapa ..	Star Thistle.
	Solanum rostratum ..	Buffalo Burr.
	Conium maculatum ..	Hemlock.
	Homeria spp.	Cape Tulips.
	Senecio jacobaea	Ragwort.
	Raphanus raphanistrum ..	Wild Radish.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Ailanthus altissima ..	Tree of Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Echium spp.	Paterson's Curse, Viper's Bugloss, Italian Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
Tumut Shire	*Centaurea calcitrapa* ..	Star Thistle.
	Solanum rostratum ..	Buffalo Burr.
	Conium maculatum ..	Hemlock.
	Homeria spp.	Cape Tulips.
	Echium spp. ..	Italian Bugloss, Viper's Bugloss, Paterson's Curse.

Portion of State where declared noxious	Plants declared noxious	
	Botanical name	Common name
	Senecio jacobaea	Ragwort.
	Raphanus raphanistrum ..	Wild Radish.
	Ailanthus altissima ..	Tree-of-Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
Tumbarumba Shire ..	*Centaurea calcitrapa* ..	Star Thistle.
	Conium maculatum ..	Hemlock.
	Homeria spp.	Cape Tulips.
	Echium spp. ..	Italian Bugloss, Viper's Bugloss Paterson's Curse.
	Raphanus raphanistrum ..	Wild Radish.
	Ailanthus altissima ..	Tree-of-Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
Temora Shire	*Sclerolaena birchii* ..	Galvanised Burr.
	Centaurea calcitrapa ..	Star Thistle.
	Solanum rostratum ..	Buffalo Burr.
	Raphanus raphistrum ..	Wild Radish.
	Solanum elaegnifolium ..	Silverleaf Nightshade.
	Ailanthus altissima ..	Tree of Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss, Italian Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
Lockhart Shire ..	*Sclerolaena birchii* ..	Galvanised Burr.
	Centaurea calcitrapa ..	Star Thistle.
	Solanum rostratum ..	Buffalo Burr.
	Conium maculatum ..	Hemlock.
	Homeria spp.	Cape Tulips.
	Senecio jacobaea	Ragwort.
	Raphanus raphanistrum ..	Wild Radish.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Ailanthus altissima ..	Tree of Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Echium spp. ..	Paterson's Curse, Viper's Bugloss, Italian Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
Junee Shire	*Sclerolaena birchii* ..	Galvanised Burr.
	Centaurea calcitrapa ..	Star Thistle.
	Solanum rostratum ..	Buffalo Burr.
	Raphanus raphanistrum ..	Wild Radish.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Ailanthus altissima ..	Tree of Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Echium spp. ..	Paterson's Curse. Viper's Bugloss, Italian Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
Hume Shire	*Conium maculatum* ..	Hemlock.
	Homeria spp.	Cape Tulips.
	Raphanus raphanistrum ..	Wild Radish.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Ailanthus altissima ..	Tree-of-Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Echium spp.	Paterson's Curse. Viper's Bugloss, Italian Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
Holbrook Shire ..	*Conium maculatum* ..	Hemlock.
	Homeria spp.	Cape Tulips.
	Raphanus raphanistrum ..	Wild Radish.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Ailanthus altissima ..	Tree of Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Echium spp.	Paterson's Curse. Italian Bugloss, Viper's Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
Gundagai Shire* ..	*Centaurea calcitrapa* ..	Star Thistle.
	Solanum rostratum ..	Buffalo Burr.
	Conium maculatum ..	Hemlock.
	Homeria spp.	Cape Tulips.
	Senecio jacobaea	Ragwort.
	Raphanus raphanistrum ..	Wild Radish.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Ailanthus altissima ..	Tree-of-Heaven.
	Lycium ferocissimum ..	African Boxthorn.
	Marrubium vulgare ..	Horehound.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.

Portion of State where declared noxious	Plant declared noxious	
	Botanical name	Common name
SOUTHERN AREA —*continued*		
	Echium spp.	Paterson's Curse, Viper's Bugloss, Italian Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
Culcairn Shire	*Centaurea calcitrapa*	Star Thistle.
	Conium maculatum	Hemlock.
	Homeria spp.	Cape Tulips.
	Raphanus raphanistrum	Wild Radish.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Ailanthus altissima	Tree-of-Heaven.
	Lycium ferocissimum	African Boxthorn.
	Marrubium vulgare	Horehound.
	Onopordum acanthium	Scotch Thistle.
	Onopordum illyricum	Illyrian Thistle.
	Echium spp.	Paterson's Curse, Viper's Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
Cootamundra Shire	*Centaurea calcitrapa*	Star Thistle.
	Solanum rostratum	Buffalo Burr.
	Homeria spp.	Cape Tulips.
	Raphanus raphanistrum	Wild Radish.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Ailanthus altissima	Tree-of-Heaven.
	Lycium ferocissimum	African Boxthorn.
	Marrubium vulgare	Horehound.
	Onopordum acanthium	Scotch Thistle.
	Onopordum illyricum	Illyrian Thistle.
	Echium spp.	Paterson's Curse, Viper's Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
Coolamon Shire	*Sclerolaena birchii*	Galvanised Burr.
	Centaurea calcitrapa	Star Thistle.
	Solanum rostratum	Buffalo Burr.
	Conium maculatum	Hemlock.
	Homeria spp.	Cape Tulips.
	Senecio jacobaea	Ragwort.
	Raphanus raphanistrum	Wild Radish.
	Solanum elaegnifolium	Silverleaf Nightshade.
	Ailanthus altissima	Tree-of-Heaven.
	Lycium ferocissimum	African Boxthorn.
	Marrubium vulgare	Horehound.
	Onopordum acanthium	Scotch Thistle.
	Onopordum illyricum	Illyrian Thistle.
	Echium spp.	Paterson's Curse, Viper's Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
Albury City	*Conium masculatum*	Hemlock.
	Homeria spp.	Cape Tulips.
	Raphanus raphanistrum	Wild Radish.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Ailanthus altissima	Tree-of-Heaven.
	Lycium ferocissimum	African Boxthorn.
	Marrubium vulgare	Horehound.
	Onopordum acanthium	Scotch Thistle.
	Onopordum illyricum	Illyrian Thistle.
	Echium spp.	Paterson's Curse, Viper's Bugloss.
	Rosa rubiginosa	Sweet Briar.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
MURRAY AND RIVERINA		
Wentworth Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Marrumbium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Asphodelus fistulosus	Onion Weed.
Wakool Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella Lutea	
	Cuscuta spp.	Dodder.
	Cardaria draba	Hoary Cress.
	Marrumbium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Centaurea calcitrapa	Star Thistle.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Physalis viscosa	Prairie Ground Cherry.
	Asphodelus fistulosus	Onion Weed.
	Alhagi pseudalhagi	Camel Thorn.
	Acroptilon repens	Hardhead Thistle
Urana Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Cardaria draba	Hoary Cress.
	Marrumbium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Typha spp.	Cumbungi.
Narrandera Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.

Portion of State where declared noxious	Plant declared noxious	
	Botanical name	Common name
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Marrumbium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Raphanus raphanistrum	Wild Radish.
Murrumbidgee Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Marrumbium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
Leeton Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Marrumbium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
Jerilderie Shire	*Lycium ferocissimum*	African Boxthorn.
	Solanum rostratum	Buffalo Burr.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Cardaria draba	Hoary Cress.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Physalis viscosa	Prairie Ground Cherry.
	Marrumbium vulgare	Horehound.
Hay Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Marrumbium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
Griffith Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Marrubium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
Balranald Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisanica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Alternanthera pungens	Khaki Weed.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Asphodelus fistulosus	Onion Weed.
	Echium spp.	Paterson's Curse, Viper's Bugloss.
	Acroptilon repens	Hardhead Thistle.
Corowa Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Cardaria draba	Hoary Cress.
	Marrumbium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
	Physalis viscosa	Prairie Ground Cherry.
Carrathool Shire	*Lycium ferocissimum*	African Boxthorn.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.
	Marrubium vulgare	Horehound.
	Alternanthera pungens	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa	Star Thistle.
	Ailanthus altissima	Tree-of-Heaven.
	Solanum elaeagnifolium	Silverleaf Nightshade.
Central Murray County	*Lycium ferocissimum*	African Boxthorn.
	Solanum rostratum	Buffalo Burr.
	Sclerolaena birchii	Galvanised Burr.
	Proboscidea louisianica	Devil's Claw.
	Ibicella lutea	
	Cuscuta spp.	Dodder.

Portion of State where declared noxious	Plants declared noxious	
	Botanical name	Common name
	Cardaria draba	Hoary Cress.
	Marrumbium vulgare ..	Horehound.
	Alternanthera pungens ..	Khaki Weed.
	Emex australis	Spiny Emex.
	Centaurea calcitrapa ..	Star Thistle.
	Ailanthus altissima ..	Tree-of-Heaven.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Physalis viscosa ..	Prairie Ground Cherry.
	Asphodelus fistulosus ..	Onion Weed.
	Echium spp. .. }	Paterson's Curse, Viper's Bugloss.
	Acroptilon repens ..	Hardhead Thistle.
CENTRAL WESTERN REGION		
Weddin Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Solanum rostratum ..	Buffalo Burr.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Homeria spp.	Cape Tulips.
	Typha spp.	Cumbungi.
	Cuscuta spp.	Dodder.
	Sclerolaena birchii ..	Galvanized Burr.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar.
	Ailanthus altissima ..	Tree-of-Heaven.
	Raphanus raphanistrum ..	Wild Radish.
	Proboscidea louisianica }	Devil's Claw.
	Ibicella lutea .. }	
Upper Macquarie County	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Solanum rostratum ..	Buffalo Burr.
	Homeria spp.	Cape Tulips.
	Cuscuta spp.	Dodder.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Sarothamnus scoparius ..	Scotch/English Broom.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar.
	Ailanthus altissima ..	Tree-of-Heaven.
Parkes Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Convolvulus arvensis ..	Field Bindweed.
	Solanum rostratum ..	Buffalo Burr.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Homeria spp.	Cape Tulips.
	Cuscuta spp.	Dodder.
	Sclerolaena birchii ..	Galvanized Burr.
	Cardaria draba	Hoary Cress.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Centaurea calcitrapa ..	Star Thistle.
	Ailanthus altissima ..	Tree-pf-Heaven.
	Raphanus raphanistrum ..	Wild Radish.
	Proboscidea louisianica }	Devil's Claw.
	Ibicella lutea .. }	
Orange City	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Convolulus arvensis ..	Field Bindweed.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Homeria spp.	Cape Tulips.
	Ulex europaeus	Gorse.
	Cardaria draba	Hoary Cress.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar.
	Ailanthus altissima ..	Tree-of-Heaven.
	Proboscidea louisianica }	Devil's Claw.
	Ibicella lutea .. }	
Lachlan Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Convolvulus arvensis ..	Field Bindweed.
	Heliotropium amplexicaule	Blue Heliotrope.
	Solanum rostratum ..	Buffalo Burr.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Homeria spp.	Cape Tulips.
	Typha spp.	Cumbungi.
	Cuscuta spp.	Dodder.
	Sclerolaena birchii ..	Galvanized Burr.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Centaurea calcitrapa ..	Star Thistle.
	Dittrichia graveolens ..	Stinkwort.
	Ailanthus altissima ..	Tree-of-Heaven.
	Raphanus raphanistrum ..	Wild Radish.
	Proboscidea louisianica }	Devil's Claw.
	Ibicella lutea .. }	
Forbes Shires	*Lycium ferocissimum* ..	African Boxthorn.
	Convolvulus arvensis ..	Field Bindweed.
	Solanum rostratum ..	Buffalo Burr.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Homeria spp.	Cape Tulips.
	Cuscuta spp.	Dodder.

Portion of State where declared noxious	Plant declared noxious	
	Botanical name	Common name
	Sclerolaena birchii ..	Galvanized Burr.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Centaurea calcitrapa ..	Star Thistle.
	Dittrichia graveolens ..	Stinkwort.
	Ailanthus altissima ..	Tree-of-Heaven.
	Raphanus raphanistrum ..	Wild Radish.
	Proboscidea louisianica }	Devil's Claw.
	Ibicella birchii .. }	
Cowra Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Solanum rostratum ..	Buffalo Burr.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Homeria spp.	Cape Tulips.
	Typha spp.	Cumbungi
	Cuscuta spp.	Dodder.
	Sclerolaena birchii ..	Galvanized Burr.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar
	Ailanthus altissima ..	Tree-of-Heaven.
	Raphanus raphanistrum ..	Wild Radish.
	Proboscidea louisianica }	Devil's Claw.
	Ibicella lutea .. }	
Bland Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Convolvulus arvensis ..	Field Bindweed.
	Solanum rostratum ..	Buffalo Burr.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Homeria spp.	Cape Tulips.
	Cuscuta spp.	Dodder.
	Conium maculatum ..	Hemlock.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Centaurea calcitrapa ..	Star Thistle.
	Ailanthus altissima ..	Tree-of-Heaven.
	Raphanus raphanistrum ..	Wild Radish.
	Proboscidea louisianica }	Devil's Claw.
	Ibicella lutea .. }	
	Sclerolaena birchii ..	Galvanized Burr.
Cabonne Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Convolvulus arvensis ..	Field Bindweed.
	Heliotropium amplexicaule	Blue Heliotrope.
	Solanum rostratum ..	Buffalo Burr.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Homeria spp.	Cape Tulips.
	Cuscuta spp.	Dodder.
	Conium maculatum ..	Hemlock.
	Cardaria draba	Hoary Cress.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Salvia reflexa	Mintweed.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Centaurea calcitrapa ..	Star Thistle.
	Dittrichia graveolens ..	Stinkwort.
	Rosa rubiginosa	Sweet Briar.
	Ailanthus altissima ..	Tree-of-Heaven.
	Raphanus raphanistrum ..	Wild Radish.
	Proboscidea louisianica }	Devil's Claw.
	Ibicella lutea .. }	
SOUTH EAST AND ILLAWARRA		
Crookwell Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Sarothamnus scoparius ..	English/Scotch Broom.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.
	Echium spp. .. }	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Rosa rubiginosa	Sweet Briar.
	Onopordum acaulon ..	Stemless Thistle.
Harden Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Sclerolaena birchii ..	Galvanized Burr.
	Cassinia arcuata	Sifton Bush.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Rosa rubiginosa	Sweet Briar.
	Ailanthus altissima ..	Tree-of-Heaven.
	Raphanus raphanistrum ..	Wild Radish.
Gunning Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Ulex europaeus	Gorse.
	Echium spp. .. }	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Rosa rubiginosa	Sweet Briar.
	Typha spp.	Cumbungi.
	Onopordum acaulon ..	Stemless Thistle.
Goulburn City	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Sarothamnus scoparius ..	English/Scotch Broom.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.

Portion of State where declared noxious	Plant declared noxious	
	Botanical name	Common name
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Rosa rubiginosa	Sweet Briar.
	Onopordum acaulon ..	Stemless Thistle.
Eurobodalla Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Pennisetum macrourum ..	African Feather Grass.
	Conium maculatum ..	Hemlock.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Onopordum acaulon ..	Stemless Thistle.
Cooma-Monaro Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Ulex europaeus	Gorse.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Rosa rubiginosa	Sweet Briar.
Kiama Municipal ..	*Cuscuta* spp.	Dodder.
	Pennisetum villosum ..	Longstyled Feather Grass.
Bega Valley Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Pennisetum macrourum ..	African Feather Grass.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Rosa rubiginosa	Sweet Briar.
Bombala Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Sarothamnus scoparius ..	English/Scotch Broom.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Centaurea calcitrapa ..	Star Thistle.
	Rosa rubiginosa	Sweet Briar.
Boorowa Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
	Cuscuta spp.	Dodder.
	Sclerolaena birchii ..	Galvanized Burr.
	Marrubium vulgare ..	Horehound.
	.. *Echium* spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Cassinia arcuata	Sifton Bush.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Rosa rubiginosa	Sweet Briar.
	Typha spp.	Cumbungi.
Young Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Proboscidea louisianica ..	Devil's Claw.
	Ibicella lutea ..	
	Sclerolaena birchii ..	Galvanized Burr.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Solanum elaeagnifolium ..	Silverleaf Nightshade.
	Rosa rubiginosa	Sweet Briar.
	Ailanthus altissima ..	Tree-of-Heaven.
	Typha spp.	Cumbungi.
	Raphanus raphanistrum ..	Wild Radish.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Onopordum acaulon ..	Stemless Thistle.
Yass Shire	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Rosa rubiginosa	Sweet Briar.
	Onopordum acaulon ..	Stemless Thistle.
Yarrowlumla Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Sarothamnus scoparius ..	English/Scotch Broom.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Rosa rubiginosa	Sweet Briar.
	Ailanthus altissima ..	Tree-of-Heaven.
	Onopordum acaulon ..	Stemless Thistle.
Wollongong City ..	*Echium* spp.	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
Wingecarribee Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.

Portion of State where declared noxious	Plants declared noxious	
	Botanical name	Common name
	Sarothamnus scoparius ..	English/Scotch Broom.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
Tallanganda Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Sarothamnus scoparius ..	English/Scotch Broom.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Rosa rubiginosa	Sweet Briar.
	Ailanthus altissima ..	Tree-of-Heaven.
	Pennisetum villosum ..	Longstyled Feather Grass.
	Carthamus lanatus ..	Saffron Thistle.
	Onopordum acaulon ..	Stemless Thistle.
Snowy River Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Cirsium arvense	Perennial Thistle or Canada Thistle.
	Sarothamnus scoparius ..	English/Scotch Broom.
	Ulex europaeus	Gorse.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Rosa rubiginosa	Sweet Briar.
	Onopordum acaulon ..	Stemless Thistle.
Queanbeyan City ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Sarothamnus scoparius ..	English/Scotch Broom.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Rosa rubiginosa	Sweet Briar.
	Onopordum acaulon ..	Stemless Thistle.
Mulwaree Shire ..	*Lycium ferocissimum* ..	African Boxthorn.
	Eragrostis curvula ..	African Love Grass.
	Ulex europaeus	Gorse.
	Conium maculatum ..	Hemlock.
	Marrubium vulgare ..	Horehound.
	Echium spp. ..	Paterson's Curse, Italian Bugloss, Viper's Bugloss.
	Onopordum acanthium ..	Scotch Thistle.
	Onopordum illyricum ..	Illyrian Thistle.
	Cassinia arcuata	Sifton Bush.
	Rosa rubiginosa	Sweet Briar.
	Onopordum acaulon ..	Stemless Thistle.

(5511)

PROCEDURES IN THE COURT ROOM

PROCEEDINGS IN COURT ON A PLEA OF NOT GUILTY

A fictional case prepared by the Legal Branch of the Department of Agriculture and presented by Legal Officers of that Branch and Weeds Inspectors and/or Officers.

Resume of the Case

Peter Paul Paterson, the Weeds Inspector of the Gunns Gully Shire Council supervised a noxious weeds, namely blackberry, eradication programme extending over an area of 90 hectares at a local feature known as the Water Hole on the property known as Black Crow Creek, a property containing an area of 1,000 hectares on the Salt Bush Road near Salt Bush Flat. There is no house on the land. The programme commenced in 1978 and late in 1982 the infestation was reduced to 10 hectares. On 27th October, 1982, Paterson made his last inspection and understood from the owner, Richard Raymond Rich, that he would complete the programme without any further supervision. Rich had a car accident shortly after this and leased the property to Frederick Francis Farmer. While on a routine inspection on 6th August, 1984, Paterson finds Blackberry covering an area of about 30 hectares growing on the property. He speaks to Farmer, who does not admit he is the occupier.

Paterson reports to Council and was told to interview Rich. Paterson interviews Rich, reports to Council and was told to see Farmer again and direct him orally to eradicate the blackberry. Paterson again interviews Farmer and gives the oral direction.

Paterson makes a further inspection about 1 month later, only about 5 acres worked on and that not satisfactorily done.

Paterson again interviews Farmer and reports to Council.

Council resolves to issue a notice under Ordinance 50.

Paterson serves Notice personally on Farmer.

Paterson re-inspects property - the 5 hectares previously worked over had been ploughed and turned over, no spraying done. About another 2 or 3 hectares had been slashed but the roots not exposed and there was some re-growth. None of the scrub country had been touched and about 2 hectares of the undulating country not touched.

Report to Council. Resolution to prosecute.

Information laid under Section 473 of the Local Government Act and summons served.

Farmer defends the action and the information is to be tried on Monday, 6th May, 1985.

NOXIOUS WEED CONTROL - A U.S. PERSPECTIVE

Delbert R. Harper,
Monsanto Australia Limited,
MELBOURNE VIC

The control of noxious weeds in the United States is regulated at the State level. Each of the fifty States formulates its own list of noxious weeds and is responsible for the control of the weeds on the list. For a weed to be placed upon the noxious weed list in a State, it must either cause some economic loss, cause environmental damage, or create a public health problem. Once a weed is added to one of the noxious weed lists, its control can be regulated by the State.

The fifty States regulate the control of noxious weeds on both public and private lands. How the control is regulated varies from State to State. In general, the enforcement is delegated downward to the county or township level, except in the case of crops grown for sale as certified seed. Certified seed cannot be sold if it contains seed of a noxious weed. This is often regulated after the fact by testing seed samples, but an inspector who notes noxious weeds growing in a field grown for certified seed, can enforce control or the field will lose certification.

Noxious weeds growing on private land other than in certified seed fields are under the jurisdiction of a county or township official. The enforcement varies by State and by weed. If the local body deems it necessary to control the weed, the landowner or tenant is notified and he can either control the weed or the county will provide control and assess the necessary charges. This normally occurs only if the weed is unique to the local area and poses an economic threat if it spreads to adjoining land, or if it causes a threat to the health or environment of the area. An example would be a large amount of common Ragweed (*Ambrosia artemisiifolia*) growing near a municipal area. The pollen from this species is a major irritant to persons suffering from allergies and hay fever.

The major emphasis of this paper will be the discussion of problems associated with weed control on public land. Weed control on public land includes all State and National forests, public parks and recreational areas, municipal areas, and road and highway right of ways. Once an agency is faced with a problem, it has three primary factors to consider in controlling the problem. These factors are:

1) Cost; 2) Effectiveness; 3) Public Opinion.

The first two factors are fairly straightforward. The manager must balance his available manpower with his available funds and try to make a decision on the most economical method.

The third area is becoming increasingly difficult to deal with in the public arena. He must deal with three major areas of public concern that are brought to the surface by concerned citizens and environmental advocacy groups. The primary areas of concern are:

1) Concern about public health due to the use of pesticides;

2) Adverse environmental impact due to the use of pesticides;

3) Pesticide contamination of ground and surface water.

The environmental impact in the last few years in the US has been significant. A few examples of the efforts of concerned citizens to stop the use of herbicides in public lands have been:

1) A total ban on the use of 2,4,5-T. This started with concern about adverse health effects due to the forestry use of 2,4,5-T.

2) A ban on the use of herbicides on Federal lands without first filing an environmental impact statement for each proposed application.

3) Numerous attempts to ban the use of a variety of chemicals at very local levels through local town councils and school boards and park boards or through the use of local referendums.

The three major areas that will be discussed will be weed control in forests, aquatic situations and on roadsides. Forests are managed in two distinct ways:

1) As a source of commercial timber;

2) As recreation areas.

Managing for timber production is fairly conventional and similar to commercial timber production. A typical cycle after forest harvest includes a herbicide treatment prior to the re-establishment of a desirable species. This normally is a treatment to aid burning to clear vegetation. Following the establishment of new trees, a selective treatment is often applied to help release the desirable species.

Aquatic weed control poses an interesting problem for the Vegetation Manager. Irrigation canals, drainage canals, recreational lakes and streams must be kept clear of unwanted vegetation to allow good water movement and to allow access with boats for fishing and other water sports. He must also balance the concerns about the levels of pesticides in water. Glyphosate was registered for aquatic use in the US in 1983 and was also granted a tolerance for potable water. This provided an excellent tool for the Managers to utilize for the control of aquatic species.

The last major area to be discussed is the control of noxious weeds in municipal areas and along public roads. The US State and local agencies responsible for the maintenance of these areas are faced with problems similar to most other Government agencies. They are expected to maintain the areas with less financial support. Two new concepts are being used to help decrease the amount of labour and equipment used to maintain roadsides.

The first is a concept called bermuda release. This concept is used in the eastern half of the southern US. The desirable roadside species is Bermudagrass (*Cynodon dactylon*), or known as Couchgrass in Australia. It is a low growing species, drought tolerant and holds its colour well in hot weather. The biggest problem with Cynadon is that it has a long winter dormant period and tall growing species often get off to a faster

start in the spring. They then require numerous mowings during the summer. A very common practice now is to treat the total area with 1.0 to 2.0 L/ha of Roundup* herbicide. The Cynadon is more tolerant than the other species, usually Johnson grass (*Sorghum halepense*), to Roundup* herbicide and it grows quickly to fill in the area. Various rates of Roundup* herbicide are used and also combinations of Roundup* herbicide and Oust [1] (sulfometuron) are now being used to provide better residual control of Johnson grass seedlings. This treatment in the spring often replaces three to four mowings during the summer.

The second concept is the use of sub-lethal rates of Roundup* herbicide to stop the growth and stop formation of the seed heads of the roadside grass. This treatment uses 300 to 600 ml/Ha of Roundup* herbicide applied in the early growth phases of the grass. The net result is usually a saving of at least two mowings.

In municipal areas the cost of hand mowing is increasing due to increased labour and equipment costs. The use of herbicides for many of the labour intensive trimming and edging is increasing in most municipal areas. They offer economical control and replace more than two labour intensive hand trimmings.

The Vegetation Manager in the US is faced with increasingly difficult problems. He must provide the expected level of service, with less financial support. In addition he is faced with more demands from the public for answers to environmental concerns when he chooses a chemical alternative to solve the problem.

* Registered Trademark of Monsanto Company, USA.

[1] Trademark of Dupont, USA.

TEAM WORK

Des Thwaites
Des Thwaites & Associates,
Management Consultants,
SYDNEY.

Definition

A team is a group capable of achieving the organisational goal (departmental or corporate) as well as individual work needs with the minimum or supervision.

Forming a Team

A team at work is no different from a football team or any group brought together to win a goal. A playing team consists of individuals with specific, sometimes unique abilities. Each is able to perform in their set role better than in another role. Some can interchange their role e.g. are both batters and bowlers, others can not.

The real skill in developing a team is to get all the differing specialists to play the game competently and as a cohesive unit.

Identifying the Team Members and Their Roles

Similar to a football team, one can recognise the role the worker does best by observation over a period. Additionally by discussion and by questioning preferences, attitudes and ambitions can be ascertained.

The Selection of a Team

Apart from specialist roles on the team the following personality types are desirable. They modify, complement and sometimes counter each other to bring out the best possible results.

1. Informer - a creative thinker, an ideas person
2. Commenter - one who adds to the idea or suggestion positively
3. Questioner - the conservative who needs convincing
4. Proposer - a person who wants to adopt the idea
5. Builder - similar to (2) but more future orientated
6. Opposer - irrevocable opposed
7. Delegator - one who can lead another into creative thought
8. Team Leader -

The above constitutes a situation where we can actually choose a team. This is seldom the situation. If the team has already been formed a competent team leader may at times have to adopt various roles to balance the team as a playing captain would in the sports sense.

Communication with the Team

The team leader, if possible should be selected by the team. It is necessary to see that some members do not deliberately elect as team leader one they can manipulate, like a puppet. An elected leader gives the team status as a self managed unit. Information of a wide nature is distributed to the team and the team is encouraged to develop its own system of efficiency to complement that of the organisation and improve on it. Lazy members of the team are disciplined by peer group pressure within the team. The results from good team work are:-

a. Less tension and better communication.

b. Less stirring - fewer rumours get off the ground.

c. Team members are involved with achieving goals.

d. Team members are thinking about their future.

Setting up a Team

1. Groups are formed of six to ten people preferably with the personality differences as indicated.

2. The group has regular meetings in worktime say 1/2 to 1-1/2 hours per week to discuss work, problems and how to solve them.

3. Supervisors need not attend.

Procedure at Meetings

1. Identify problems.

2. Vote on those problems the group wants to solve and set the order or priorities.

3. Discuss one problem at a time.

Management Should Provide

1. Some training to the group on problem solving techniques.

2. Provide information required to solve the problem.

3. Co-operate and give a lead in good-will.

Returns to Management Should Be:

1. Reduction of costs.

2. Work is more satisfying to the worker.

3. Worker is more interested and involved.

4. The organisation becomes more viable.

An experienced developer of team work groups would advise that:

1. Team members are not abused, only ideas.

2. Assumptions are avoided.

3. Feelings as well as facts must be considered.

4. The only stupid question is the one that hasn't been asked.

5. That every team member is responsible to contribute.

6. That current problems receive priority.

7. That the team focuses on its own area.

8. All members are open and frank.

Like the football or cricket team the key is commitment and participation. The team leader (captain) must be a motivator.

A Representative List For Team Discussion

Staff training
Safety and safe working
Job design and methods
Working condition improvement to aid productivity
Motivation
Labour - Management Co-operation
Quality Standards
Managers are still workers
The future

The concept of team work lends itself well to the Weeds Supervisor.

It is not possible to maintain a constant supervisor of a work group on the move. Rather than always tell the group what to do, let them also have an understanding of their role. Try and develop a responsibility whereby the group is working to a goal established by participation.

Look out for and observe the team members for abilities in specific areas. Use these abilities and be conscious of the power that a word of praise has in motivating for greater effort.

MOTIVATION

Des Thwaites
Des Thwaites & Associates,
Management Consultants,
SYDNEY.

The word motivation is an "in" word, but what does it really mean? Motivation is that, which makes, modifies and sustains behaviour.

Motivation is a puzzling subject since it is difficult to observe motives or to measure them. Most philosophers interested in motivation have only at the best produced theories.

Broadly speaking we can think of these under three headings.

1. The factors within people which make them act in a certain way.

2. The exterior factors which might provide some advantage if a person acts in a certain way.

3. The learned factors which by experience tell us what to expect by behaving in a certain way.

One of the most widely read motivationalists is Abraham Maslow whose theory suggests that humans have needs basic in character but capable of ascending on a scale through security and social needs to the need for self esteem and final self fulfilment.

As an illustration of this theory I want to tell you a simple tale of a Weeds Supervisor who took a voyage on a Cruise Ship for a vacation not to learn about motivation!

"A Ship Wreck Story"

Consider a person the victim of a ship floundering at sea away from the main trading routes. The person suddenly in the middle of the night is cast into the sea. Half alert to his situation he manages to tie himself to a piece of timber. The next day the sea is calm but no one else is to be seen. The sole survivor paddles with the current. Thirty six hours later, exhausted, from the terrible ordeal, the survivor is cast up on a deserted beach.

Hardly able to crawl up the beach the survivor manages to reach a point above high water and collapses.

1. List in order the needs of the survivor.

   Having satisfied these basic needs the survivor walks along the beach and sees a giant claw-like series of footprints of some huge animal.

2. What is the next series of needs.

Having spent a relatively restless night the survivor has a need to explore and climbs to a high point. The land is a small island about 5 km in diameter and at one end of the island the survivor sees humans recognisable by their clothes as other survivors.

3. What is the next series of needs.

Having made contact with the group and being welcomed as a fellow survivor,

4. What is the next series of needs:

(a) of the survivor;
(b) of the group.

It is decided to set a watch and a pile of wood is made and turns taken to guard the pile and ignite it if a ship or plane is seen. A plane flies over whilst the group are fossicking for food. The person guarding the pile was asleep and didn't signal the aeroplane.

5. What does the group feel its needs are at this point.

Some decide to build a ship and go for rescue.

6. What is their need or needs.

Some decide life is good on the island and wish to remain.

7. What is their need or needs.

The boat people never return and five years pass.

8. What continuing needs are contemplated.

PLAN AND THEN WRITE

Allan Batchelor,
Regional Media Officer,
GOULBURN

The theme for this session is "Plan and then Write".

You should be writing, not only to your superiors, but also to the people who are affected by your work. In addition, if you are writing, you should plan.

Obviously we are not able to write individual letters to every person who should know about weed control, pointing out their responsibilities.

Some people will say that we have a big stick and we should be hitting people over the head with it, demanding they come to heel and spray and dig and obey without question.

Too often we hop in our vehicles and drive hundreds of kilometres to talk to individual property owners, identifying weeds, and recommending control programs. Sometimes we are able to visit 4 or 5 people a day using this method.

I suggest that with less effort we can communicate with virtually every landholder in our council area and create a favourable impression with the general public and even to our councillors. I am not saying that property visits are taboo. To the contrary, lets visit the necessary people and make these visits effective.

We have so many opportunities of getting our message to every landholder. In fact I will bet any Local Government Inspector here that I could get a message to every landholder in his or her area and in the meaning I want it to be received, and most importantly, at very little cost.

The answer is easy. Every landholder does one or the other of the following;

They either listen to the radio, watch television, read the local newspaper, read a magazine inserted in their local newspaper, read a State or National Rural Newspaper, a LGPA, industry type or Department of Agriculture publication, or they get their rate notices.

I mention rate notices, because everyone reads their rate notice and other pieces of paper enclosed with it. I have to. Otherwise I wouldn't know how to pay the rates in instalments. I would certainly read a message outlining a potential threat to my property and how I could get help and advice.

I can already hear the objections. I'm a Weeds Officer not a journalist, I have a responsibility to get out there and make people control their weeds!

One of the most successful programmes against a weed recently would have to be then one launched against Serrated Tussock. Most people closely connected with that program would agree that the newspaper and newsletter

articles helped create an awareness of the enormity of the problem and why people with Serrated Tussock should co-operate in control measures. It also impressed on the community that there was, and still is, a major problem that Government, Councils and property owners are joining together to beat.

It is often said that weed control has nothing to do with the ratepayers, particularly in our small towns and larger centres. That is a load of nonsense.

If you work for a Council everyone paying rates is helping to pay your wage. For this reason alone, I believe you should be telling all the community what you are doing.

What is wrong with you informing everyone that following the recent good rains that we can expect a high germination of thistles this year. Why shouldn't you say that although we could have problems, a few management techniques taken in the next couple of weeks will overcome any serious affect of the thistles.

Why not say that Council is concerned with the problem to the extent that a herbicide will be made available at cost price.

Why not say that if we all co-operate in this year's control program, we will all reap the benefits.

Some of you may say, "If I give that information to my local paper they will mix it up like some people mix up chemicals".

I have written a couple of articles over the years and at the moment I write a column that appears in some 50 newspapers each week, I write and edit 4 or 5 news releases a week, I am responsible for four newsletters each month that go to some 5,000 landholders. These would include another 40 odd articles.

Over some 11 years, I have never been misquoted. The Department has been very embarrassed only once and that was because one journalist got his hands on an internal memo.

The reason for our good record has not been that I am an excellent journalist. The reason is simply, we plan, then write.

I don't have time in this session to turn you into a journalist extraordinaire, and I'm sure you don't want to be one.

However, I would like to give you a few suggestions. Firstly about news releases.

News Releases

News releases are a very effective way of quickly communicating a message to a large local audience.

Presentation

* Have your release typed double spaced on A4 paper.

* Try to keep it to around 150-200 words (no longer).

Style

* Decide what your message is and make that your introduction.

* The introduction should be no longer than two sentences, and preferably only one.

* Keep your introductory sentence to about 25 words long. Use active verbs that catch the reader's attention.

* Don't begin your release with 'Cooma Shire Council Weeds Inspector Fred Smith, said today that...'. It's better to begin with your message, and then identify the authority. For example, 'Applying pesticides to control banana weevil borer from July to September is a waste of money. This warning has come from Cooma Council's Weeds Inspector, Fred Smith who said "It is also the most inefficient time to control this serious pest".'

* Write in the active voice.

* Use short, simple, concrete words.

* Don't waffle or repeat yourself.

* Use quotes where possible. Quote yourself, and if you quote others, make sure it's accurate.

* Read over what you've written - there's always room for improvement.

NSW Department of Agriculture Newsletters

Newsletters are another effective way of keeping in touch with farmers. The advantages of newsletters are that you have control over the content, when they are published, and who receives them.

Presentation for Newsletters

* Try to keep articles to one page or shorter unless you're writing about something that's really rivetting.

Style

* Use interesting or specific headings for your article to catch the reader's attention.

* Break your article up with relevant subheadings. They help you stay on the subject and break up long passages of text for the reader.

* Newsletters are informal, so you can use an informal writing style. Be personal, write as you speak, but don't fall into the trap of waffling.

* Vary sentence length. An average of 20 words is good. Balance long sentences with short.

* Simple diagrams are always handy. Make sure they illustrate a point in your article and that the reader can understand them. Explain them if necessary (the same goes for tables).

* After you have written your article, put it away for a day or so, then go back over it to see how you can improve it.

How to Write a News Release

1. Most organisations which send out regular news releases use preprinted news release paper.

   If you are sending out a release for an organisation that doesn't have a regular letterhead, type the organisation's name, address, and phone number at the top, and NEWS RELEASE prominently.

2. DO NOT USE FOOLSCAP PAPER. A4 is the preferred size.

3. Type on ONE SIDE of the paper only.

4. Type with DOUBLE LINE spacing or with LINE-AND-A-HALF if your typewriter has it.

5. Use wide margins to give the sub-editor room to work.

6. DON'T FORGET THE DATE!

7. Mark at the top FOR IMMEDIATE RELEASE.
   But if you don't want it used before a particular time and date, state clearly: EMBARGOED UNTIL (time) ON (day, date, month). e.g. EMBARGOED UNTIL 9 am on MONDAY, 25 JULY 1985.

8. ANSWERING QUESTIONS
   You MUST end your release with the name of ONE person, or preferably TWO people, who can be reached for further information. Give each person's full name, address and phone numbers at work and at home.

   Make sure they will be at their phones (and not on holiday, for example) and that they have been briefed to answer all questions.

Style

1. If possible, keep your release to ONE page. If it must be longer, never exceed TWO pages, and then only in exceptional cases.

   Keep lengthy technical explanations on a separate sheet/s. The reporter who wants more information can ring you.

2. Put yourself in the mind of the reporter; write the story from his or her angle, not from yours.

   Your story is much more likely to be published if it is well written.

3. You are writing NEWS, not advertising copy. Don't expect to get free publicity for what is nothing more than an advertising blurb.

4. Follow the principles of good writing;

* Tell the essential news in the introduction.

* Use the next 100 or so words to support and elaborate on your introduction.

* Write in the active voice.

* Use short, simple sentences.
The PR clown who writes "Members of the male gender of advancing years suffer an impairment of their recollective faculties" instead of "Old men forget" is unlikely to be published.

* Don't use abstract words, cliche's, wasted words, flowery language.

* Don't repeat yourself.

5. Use quotes where possible. And make sure the quotes are worth quoting. "Alderman Bloggs said he was concerned about the offensive discharge of an unpleasant effluent from several of the city's drains' is less likely to be printed than "Alderman Bloggs said the city's drains stink".

When Mrs. Rosemary Kyburz of the Queensland Parliament called her government colleagues a "pack of putrescent pansies", she was quoted: so was Russ Hinze's reply when he said she was like an 'old chook running around with her head chopped off'. YOU can't say that kind of thing, but you can quote Russ Hinze if HE said it.

6. BE ACCURATE. Anything that appears within quotation marks MUST be the speaker's EXACT words. If you want to paraphrase them, don't put them in quotation marks - unless you give the speaker the chance to vet your copy before sending it to the press. If she then passes the words attributed to her, that means she approves them as though she had actually said those words herself.

Check the spelling of names (people, products, titles, places). Be particularly careful where numbers appear - dates, times, values, prices, measurements, dimensions, product title (e.g. computers).

Where you are quoting a person, make sure you state the person's first name (or known-as name), surname and title, e.g. Dr. Amanda Nightshade, Mr. Ivor John Thomas, Ms Shirley Bloemfontein, Miss Lee Montant. If the name is unusual and may be difficult to pronounce, put the pronunciation in brackets after it, e.g. Mr. Ray Ctercteko (cher-chee'-koh).

7. When the release has been typed and is ready for copying or printing, proof-read it critically before you pass it for printing, then make sure the mistakes are corrected and shown to you before printing. A shoddy press release does nothing for your reputation.

8. When a newspsaper publishes your release, compare the published version with the release. If there are serious inaccuracies in the published version, ask the paper to correct the mistakes. They will do this if the mistakes are serious.

   Comparing the published version with the release will also teach you how a good newspaper sub-editor can tighten your copy, cut the waffle, and get the essential facts out without damaging the argument.

   If your work is published uncut, you are either very good at your job, or you were lucky enough to get a bad sub-editor.

9. Don't waste a reporter's time by releasing rubbish. You will soon earn a reputation for producing material that can be filed in the w.p.b. That way you could miss having a real story published.

10. Check your finished work, check and check again. All of us develop scotomas (blind spots) about our own work, so that we cannot see mistakes that are staring us in the face. If possible, get your final draft checked by a colleague who is better than you at spotting mistakes.

COMMUNICATION THROUGH RADIO

Allan Batchelor,
Regional Media Officer,
GOULBURN

Radio

Radio is a medium of sound and sound alone. Unlike television there is no picture to tell part of the message.

This means:

* You must describe unfamiliar things so that each listener builds a picture in his own mind.

* Your voice conveys your feelings.

* If the sound stops, your listener doesn't know you're there.

* You must speak clearly to counter interference and distraction.

Radio is personal - pretend you are talking to one person, not a mass audience. Don't make speeches on radio. Use a direct conversational style and be sincere.

Radio is one-way communication, unless you're on a talk-back program, so don't leave obvious questions unanswered.

Radio is immediate - there's no delay in the message and that gives it a sense of urgency. So, make your message topical.

Radio creates awareness. Don't expect it to do more.

An interview that is well done becomes an extremely effective tool. Poorly done means you have wasted your effort and the radio station's valuable time. At all times guard your credibility.

An interview plan has three parts.

(a) **An opening.** Keep concise and avoid time-wasting "waffle". The best openings alert the listener to the fact that someone interesting has something interesting to say and he is about to say it right now. Write your opening (say about 30 words) so that it will sound 'crisp' on air. Do not confuse 'crisp' with 'brusque'.

(b) **Key questions.** Decide what they are and arrange in a logical sequence. Jot questions down, remembering to keep them short, concise, within the subject area and within the time allocation.

(c) **The ending.** Keep about fifteen seconds of interview time in hand to give an unhurried closing and a course of action for the listener to follow should further information be required.

If you have worked out a logical sequence for your questions the interview will flow and your listener will be left with a clear picture of what you are attempting to impart.

There are very few people who can read a fully scripted interview and make it sound spontaneous and natural. That is work for polished professionals. By all means jot down a quotation if it is necessary in the context of the interview, but otherwise, rely on key words or phrases to trigger your responses to questions. If I were asked for one cardinal rule to cover this portion of your extension effort I would have to say: PLAN IT OR YOU WILL BOMB IT.

Voice and Delivery

The first thing I learned from my voice tutor, who practised in the Nabiac pub, was that there is nothing wrong with the Australian accent.

What is wrong is that people are careless in the way they produce sounds that make the Australian spoken word.

Each country produces an accent. These accents can vary slightly or markedly from state to state or country to country. English speaking nations like Britain or America are classic examples of this. To a trained ear, there are variances between states in Australia.

To my mind, this does not matter much just so long as the words are pronounced clearly. That is to say words like hat are said hat not 'at, have not 'av, going not goin', or worse gowen, worse still gorn'.

When you broadcast, your voice goes out to thousands of people who do not think of themselves as part of a mass audience. So, pretend that you are talking to an individual who might be sitting opposite you in a room.

When you talk to people you smile and make gestures to emphasise a point, or show enthusiasm about the matter you are discussing. Try the same thing while you are recording. You will find that it helps. Your listener cannot see you smiling but he will hear it in your voice. The gestures you make will assist your delivery speed and in the emphasis you place on words or phrases.

Remember, there is only a radio receiver at the other end. The warmth and sincerity that projects to the listeners is only as good as the warmth and sncerity that you put into the microphone.

SPRAY APPLICATION TO CONTROL WOODY SHRUBS
- A CLOSER LOOK AT APPLICATION RATES

Max McMillan,
Special Agronomist, Weeds
NSW Department of Agriculture

Introduction

The traditional method of treating woody shrubs with herbicide is to apply herbicide mixture at a specified dilution rate through a high volume handgun to "the point of run-off".

Variable results are usually attributed to variable or unfavourable spraying conditions.

Level of control and cost comparisons are made without reference to the actual rate of herbicide applied.

The purpose of this paper is to clarify the issue of herbicide rates on woody shrubs and to demonstrate that differences in application rate can explain much of the variation in woody shrub control experiments.

It will be shown that for a given application technique, bush size is the most important factor affecting herbicide application rate.

It will also be shown that comparing levels of control and costs on the basis of dilution rates alone is highly misleading.

Background

Ten years ago, 2,4,5-T and 2,4-D were virtually the only herbicides used for woody shrub control. Application methods did not vary greatly and costs were relatively cheap. Under these circumstances the importance of accurate rate definition and cost comparison was minimal.

Now that a range of more costly herbicides is available which require different application techniques, it is necessary to pay much closer attention to application rates and cost comparisons.

In this regard, the Departments of Agriculture and other organisations with an advisory role have a responsibility to provide better information for end users.

What is a herbicide rate?

The ultimate goal of applying a systemic herbicide such as Roundup or Tordon formulations is to achieve a lethal concentration of herbicide within the target plant.

In practice, an "application rate" is chosen which distributes a certain amount of herbicide over a certain sized target.

It is essential to specify both the amount of herbicide and the size of the target in order to define the application rate.

For example, in broadacre boom spraying, the application rate might be given in litres (amount) per hectare (target size).

In woody shrub control, it is more difficult to measure the amount and the target size. Herbicide "rates" for woody shrub control are usually stated in terms similar to this:

> "Mix product X in water at a rate of one part product to 200 parts water and apply to thoroughly wet bushes to the point of run-off".

It is important to realise that the rate given here is a dilution rate and not an application rate, because neither the amount of herbicide nor the size of target are specified.

Because dilution rate has been confused with application rate in woody shrub control, incorrect conclusions have been drawn about the cost and effectiveness of different herbicides.

The main factors which affect the application rate of a herbicide when spraying woody shrubs are

(i) Herbicide dilution rate
(ii) Nozzle output
(iii) Duration of spray application
(iv) Bush size and shape.

The aim of spray application is to manipulate (i), (ii) and (iii) so that bushes of different shapes and size get approximately the correct dosage of herbicide.

Effects of bush size on woody shrub spraying

It is generally observed that large shrubs are more difficult to kill than small shrubs. Some reasons for this are listed below and are illustrated in figure 1.

(a) Easier spray penetration to the centre of the bush
(b) Shorter distance for herbicide to translocate through canes, crowns and roots.
(c) A larger surface area to volume ratio in smaller bushes means that smaller bushes receive a higher dose of herbicide per unit volume of bush size
(d) Large bushes are often older. Victorian research indicates that older blackberry crowns are more difficult to kill with 2,4,5-T. This might also hold true for other herbicides and other species.

Where bushes have been repeatedly treated with 2,4,5-T, the above ground parts of the plant indicate a small plant. In reality, the few canes seen above ground are like the tip of an iceberg, growing on a massive and aged crown and root system. Such bushes can be extremely difficult to kill with herbicide.

This discussion assumes that bushes have not been repeatedly treated with herbicide and that the above ground parts of the plant give an accurate impression of the total plant biomass.

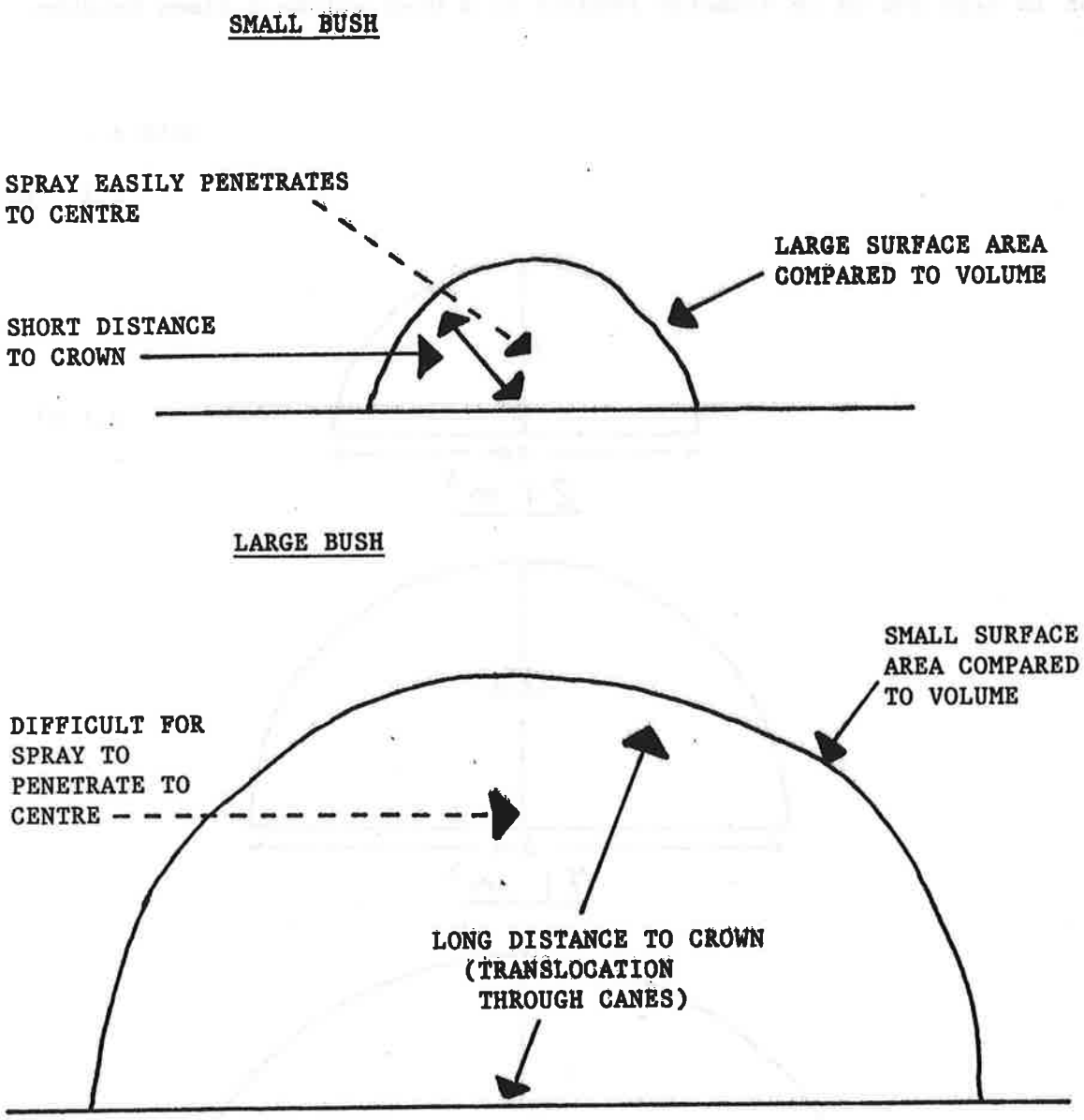


Figure 1. Effects of bush size on woody shrub spraying.

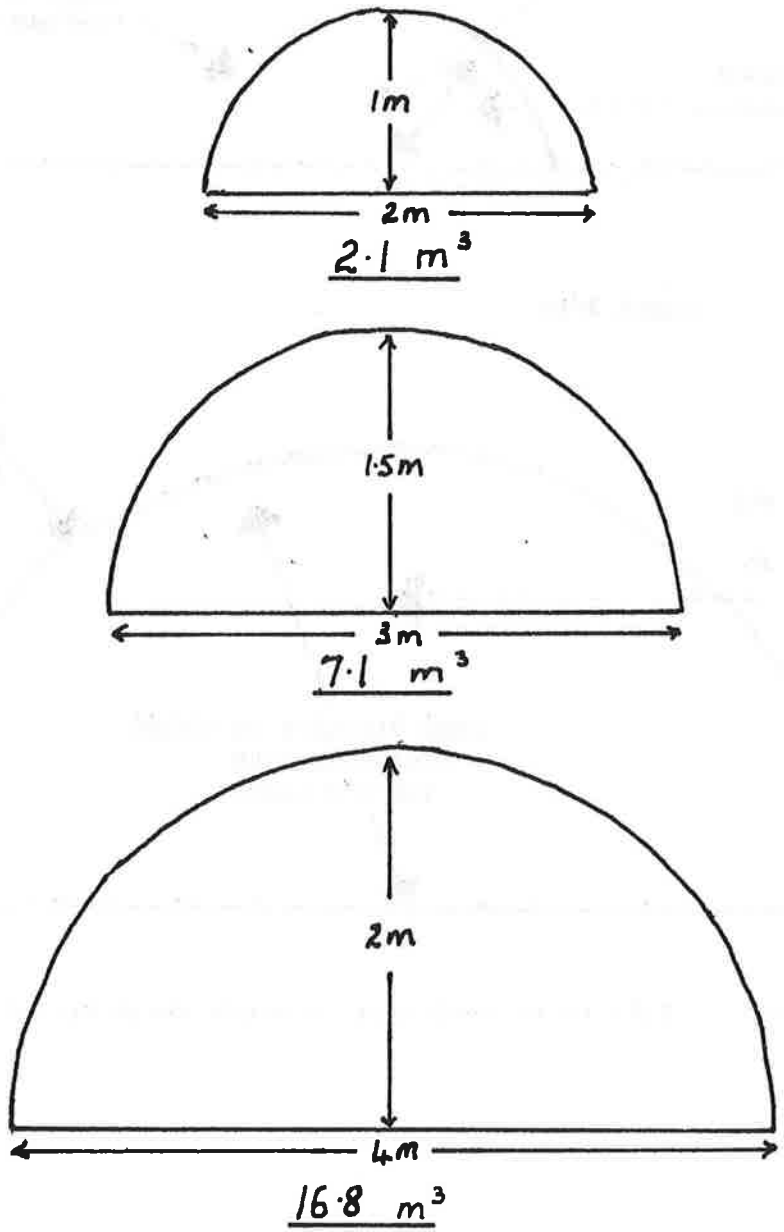
A closer look at bush volume

Few people appreciate how much bush volume increases with relatively small increases in bush height and diameter.

This is illustrated in figure 2 which shows that doubling the dimensions of a bush 1m high and 2m in diameter results in a bush volume 8 times greater.

BUSH A -

2.1 cu.m.



2.1 M³

Figure 2. BUSH VOLUME. Effects of changes of bush height and diameter on bush volume.

This means that in spraying a bush 2m high and 4m in diameter, 8 times as much chemical should be applied as would be applied to a bush 1m high and 2m in diameter to maintain an equivalent dose rate.

A wide range of nozzle flow rates can be obtained by changing the nozzle orifice plate and operating pressure. Table 1 shows the flow rates for a range of spraying systems nozzles at two different operating pressures.

Changing nozzle plates to match bush volume is not practical during field spraying, but the correct choice of nozzle plate at the start of a spraying job is important.

This paper gives examples which show how application rates in woody shrub control are affected by changes in nozzle and pressure.

In the experimental results presented below, both the amount of herbicide applied and the target size have been measured.

The measure of target size adopted was bush volume. It is assumed that bush volume gives a reasonable indication of the total biomass of the plant.

The rate of application given in the following examples is millilitres per cubic metre (i.e. mls/m^3).

Bush volume was calculated from bush height and circumference measurements and amount of herbicide mixture measured by difference in a calibrated 50 litre bottle used as a spray tank.

Herbicides were applied using two different nozzle and pressure combinations through a high volume handgun. Low volume treatments were applied through a sprinkler sprayer and a prototype "Ag-Murf gas gun".

Even with the smaller nozzle in the high volume treatments (D5), it was impossible to avoid some run-off during spraying. All high volume applications could be said to be "to the point of run-off". This is a vague and subjective term which provides enormous scope for variation in the actual amount of herbicide mixture applied. Further details on spraying methods are given in appendix 1.

The experiments were not well designed and they serve to illustrate that incorrect conclusions can easily be drawn from woody shrub spraying trials in which bush volume and amount of chemical applied are not measured.

Table 1. Flow Rates for Various Nozzles at Two Operating Pressures.

Nozzle	Nozzle Output (Litres/Minute) Pressure 500 kPa	1000 kPa
D4	2.48	3.50
D5	3.84	5.38
D6	5.45	7.40
D8	8.63	11.64
D10	11.97	15.64
D12	14.44	18.42

Sprayed with Spraying System Gunjet 43 wide open

Rega twin piston pump

25m of 12mm internal diameter plastic pressure hose was fitted

Nozzle output at increased pressure can be calculated by the following formula:

$$V_2 = V_1 \times \frac{\sqrt{P_2}}{\sqrt{P_1}}$$

where P_1 = initial pressure (at the gun)

P_2 = increased pressure (or decreased pressure at the gun)

V_1 = output of nozzle at pressure P_1

V_2 = output of nozzle at pressure P_2

Spray application treatments were assigned randomly and because of this there were large variations in bush size within and between treatments.

Herbicide Rates and Level of Control

Bush size has a far greater effect on application rate than the dilution of herbicide or the nozzle output.

Table 2 illustrates the potential variation in application rate due to changes in bush size.

Table 2. Application of Herbicides for Red Lantana Control at Coffs Harbour

Spray Treatment	Bush Volume (cubic metres)	Application rate (mls prod/cu.metres)	Score (1-10)
DP60 1:200 + D5 Nozzle @ 500 kPa pressure	3	17	3.8
	17	2	3.1
	343	0.4	3.0
Roundup 1:100 + D5 Nozzle @ 400 kPa	8	7.5	10.0
	10	6.0	10.0
Roundup 1:5 + Sprinkler Sprayer	9	5.6	10.0
	17	3.4	9.2
	17	1.9	8.5

With DP60 applied at a dilution of 1:200 through a D5 nozzle at 400 kPa pressure, the dose rate varied between 0.4 mls/m^3 and 17mls/m^3 due entirely to change in bush size. This does not reflect greatly in the score because the herbicide was ineffective.

In Table 2, the data for Roundup$^{(R)}$ indicate that a dose rate above 4ml/m^3 is needed for complete kill on lantana.

In the sprinkler sprayer treatments, the application rate dropped below this level and reduced control is evident.

Table 3 shows some results taken from a blackberry control experiment near Glen Innes. In this experiment Garlon 480$^{(R)}$ was applied at a dilution rate of 1 in 480 through D8 nozzle or a D5 nozzle, both operating at 2000 kPa pressure.

Table 3. Application of Garlon 480 (R) for Blackberry Control at Glen Innes.

Spraying Method	Bush Volume (cubic metres)	Application Rate (mls prod/cu. metre)	Score* (1-10)
D8 Nozzle @ 2000 kPa	22	2.6	10
	58	1.5	9
	75	1.7	8.3
D5 Nozzle @ 2000 kPa	10	1.3	8
	38	0.45	8
	66	0.7	7

* 10 - complete kill, zero regrowth

0 = no visible effect, zero control.

The results again demonstrate that the smaller bushes receive a much higher application rate than larger bushes.

There is insufficient data to accurately define an optimum application rate but the figures suggest that somewhere around 2ml/m^3 of Garlon were required to reliably achieve 9 and 10 scores under the conditions of this experiment.

In Table 4, data are taken from the same experiment. In this example Roundup was applied through the prototype "Ag-Murf gas gun" (R) and also high volume according to label recommendations.

The results suggest than an application rate of about 3ml/m^3 of Roundup was required to reliably achieve high levels of control in this experiment.

In the gas gun treatments on large bushes, less than half of this dose was applied.

On the small bushes, the effective application rate was <u>greater</u> because the small bushes have a greater ratio of surface area to volume. The higher application rates were reflected in better control.

Table 4. Application of Roundup (R) for Blackberry Control at Glen Innes.

Spray Treatment	Bush Volume (cubic metres)	Application Rate (mls prod/cu.metre)	Score (1–10)
Roundup 1:10 gas gun (large bush)	107	1.3	7.2
	96	1.4	7.5
	99	1.2	7.3
Roundup 1:10 gas gun (small bush)	15	3.0	10.0
	6	5.5	9.5
	17	3.9	8.8
Roundup 1:100 high volume D5 nozzle, 400 kPa)	10	7.0	10.0
	22	4.6	10.0
	79	2.5	8.5

In the high volume Roundup treatments, application rates were well in excess of 3.0 ml/m^3 except for the largest bush.

From these examples, it can be seen that bush size is the most important variable affecting chemical application rate in a field spraying situation.

With constant application method and dilution rate, responses to change in application rate due to bush volume alone have been demonstrated.

Results presented clearly show that specifying application to the point of run-off and dilution rate does not define application rate.

Comparisons between treatments where application rate is not measured are not valid. Conclusions based on such experiments should be treated with extreme caution.

Cost Comparison

Valid cost comparisons must take into account the application rate. That is they must show the cost of controlling a certain amount of target bush.

In the example below, data were taken from the lantana control experiment at Coffs Harbour.

The volume of herbicide mixture used to treat a 20 cubic metre bush was determined for each nozzle/pressure combination (see Figure 3).

LANTANA SPRAYING COFFS HARBOUR

Bushes each of 20 cubic metres volume.

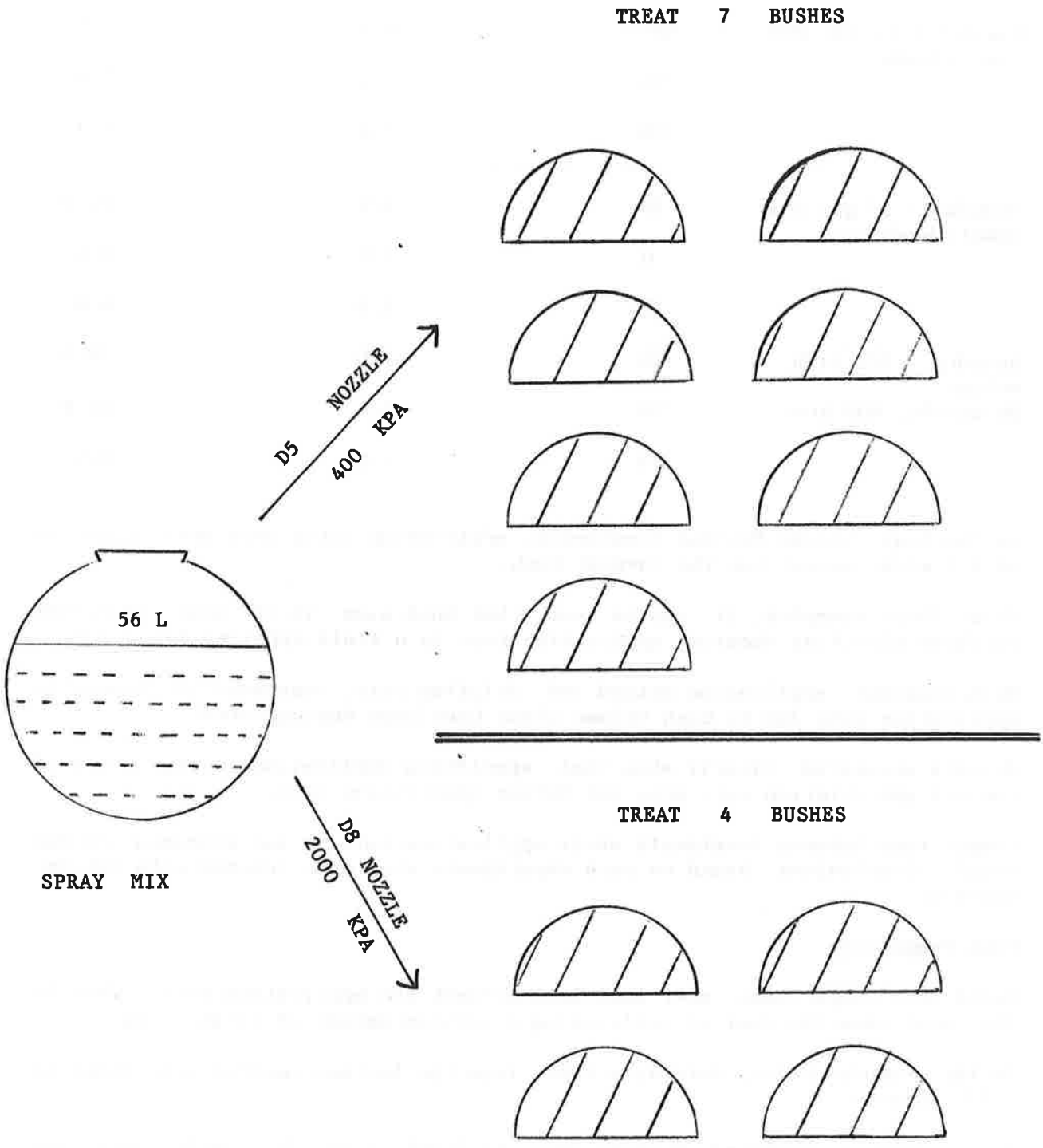


Figure 3. Effect of differing nozzle/pressure combinations on the volume of herbicide applied to a bush.

In this experiment the D5 nozzle operating at 400 kPa, would apply eight litres of spraymix to each bush and a spraytank containing 56 litres of spraymix would treat seven bushes.

The D8 nozzle, operating at 2000 kPa would apply 14 litres per bush, allowing only four bushes to be treated with 56 litres of spray mix.

Roundup (R) was applied through the D5 nozzle and Tordon 50-D(R) through the D8. The costs of treating ten bushes, each of 20 cubic metres in volume are compared in table 5.

The cost per 100 litres of spraymix for Roundup is about $18.00, while the cost per 100L of Tordon 50-D spraymix is about $16.00.

However, 140 litres of Tordon 50-D spraymix would be required to treat 10 bushes, compared to 80 litres of Roundup spraymix through the smaller nozzle.

When this is taken into account, the cost to treat with Roundup would be $14.40 for ten bushes compared to $22.40 for Tordon 50-D.

This example illustrates clearly that cost comparisons based on dilution rate alone are extremely misleading.

There are many factors to consider when choosing a herbicide. In this example drift potential, seedling regrowth, selectivity in pasture situations, water quality and availability, rainfall incidence and most of all, efficacy, need to be considered along with cost.

Unless accurate costing information is available, it is not possible to effectively incorporate the cost factor into the decision making process.

Table 5. Cost Comparisons between Two Herbicide Treatments on Lantana at Coffs Harbour.

	Herbicide Treatment **	
	Roundup (R)	Tordon 50-D(R)
Volume of spraymix required to treat 10 bushes*	80 litres	140 litres
Cost per 100 litres of spraymix	$18.00	$16.00
Cost to treat 10 bushes	$14.40	$22.40

* A bush size of 20 cubic metres is assumed.

** Roundup was applied at a dilution rate of 1 in 100 through a D5 nozzle operating at 400 kPa pressure (60 psi).

Tordon 50-D was applied at a dilution rate of 1 in 100 through a D8 nozzle operating at 2000 kPa pressure (about 290 psi).

Practical Implications of Product/Bush Volume Concept

* Measurement of application rate in woody shrub control experiments will produce:

  (i) More accurate efficacy information.

  (ii) More accurate cost information.

This will provide for better decision making and encourage more effective and economical weed control.

* Ultimately, it is hoped that application rates for woody shrub control will be specified for registration purposes, and added to current label instructions along the lines suggested in this paper.

This will provide for commercial flexibility in herbicide application and circumvent anomalies in current labelling procedures.

* For weed control operators, the goal is to apply the appropriate dose of herbicide to bushes of varying sizes in the field.

In practice, this is extremely difficult to achieve for three reasons:

  (i) the difficulty of rapidly and accurately estimating bush volume.

  (ii) the difficulty in making adjustments to the amount of herbicide applied in the field.

  (iii) the problem of calculating the appropriate dose in a field spraying situation.

For high volume spraying, control would have to be at the hand gun. One can envisage a "dial-a-dose" system based on bush dimensions. In theory this could be achieved through altering concentration and/or flow rate. In practice there are many difficulties associated with this concept.

For low volume spraying, the potential for matching application rate to bush volume is greater, especially with devices such as the "Ag-Murf gas gun" which gives a metered dose.

* Examples presented here are to illustrate principles, indicate directions for future research and to demonstrate a need for providing better information for council weed control officers, farmers and others involved at a practical level in woody shrub control.

The application rates quoted are based on limited data and no recommendation is implied or intended.

APPENDIX I

Spraying methods used in the experiments mentioned here were as follows:

a) D5, 400 kPa application - the best description of the method employed is that it is like the first coat of a spray paint job. No attempt was made to wet canes or produce run-off. In practice, it is impossible to avoid run-off and this method could still be regarded as application "to the point of run-off".

b) D8, 2000 kPa application - two steps are involved in this method. In the first step, a narrow jet is used to penetrate the bush and wet canes and underneath leaves.

In the second step the cone is widened to provide a thorough coverage of the bush surface. The bush is sprayed from bottom to top until leaves begin to drip.

c) Gas gun application - this application is through a Spraying Systems 8003E nozzle operating at 200 kPa. A 50 millilitre shot is applied to approximately five square metres of bush surface. It is essential to use a marker dye in order to minimise overlap and prevent missed strips.

d) Sprinkler sprayer - a small rotating low pressure irrigation sprinkler was used to apply herbicide. The sprinkler applies herbicide in a hollow cone pattern on a three metre swath. The sprinkler used was operating at 100 kPa pressure and a flow rate of 760ml/min.

A marker dye was used in an effort to ensure coverage of all parts of the bush.

APPENDIX II

Products Names

TORDON 50-D GARLON 480	Registered Trade Name of The Dow Chemical Company
ROUNDUP	Registered Trade Name of Monsanto, U.S.A.
"Ag-Murf Gas Gun"	Further information available from Ag-Murf Engineering Pty Ltd., 17 Siren Street, Dubbo, New South Wales, 2380.
Sprinkler Sprayer	Further information available from Mr Tom Anderson, Alan Fletcher Research Station, PO Box 36, Sherwood, Queensland, 4075.

A LOW VOLUME, GAS POWERED SPRAY GUN

By L.W. Smith,
Department of Agriculture,
SYDNEY

and

J. TOFT,
Department of Agriculture,
RICHMOND

A special low volume, gas powered, spray gun has been developed and constructed by Alan Murphy formerly of the Department of Agriculture, in consultation with Mr John Toft to spray blackberry and other woody perennials. This gun is now the subject of a patent application but an illustration of one of the prototypes is shown in Figure 1.

Figure 1

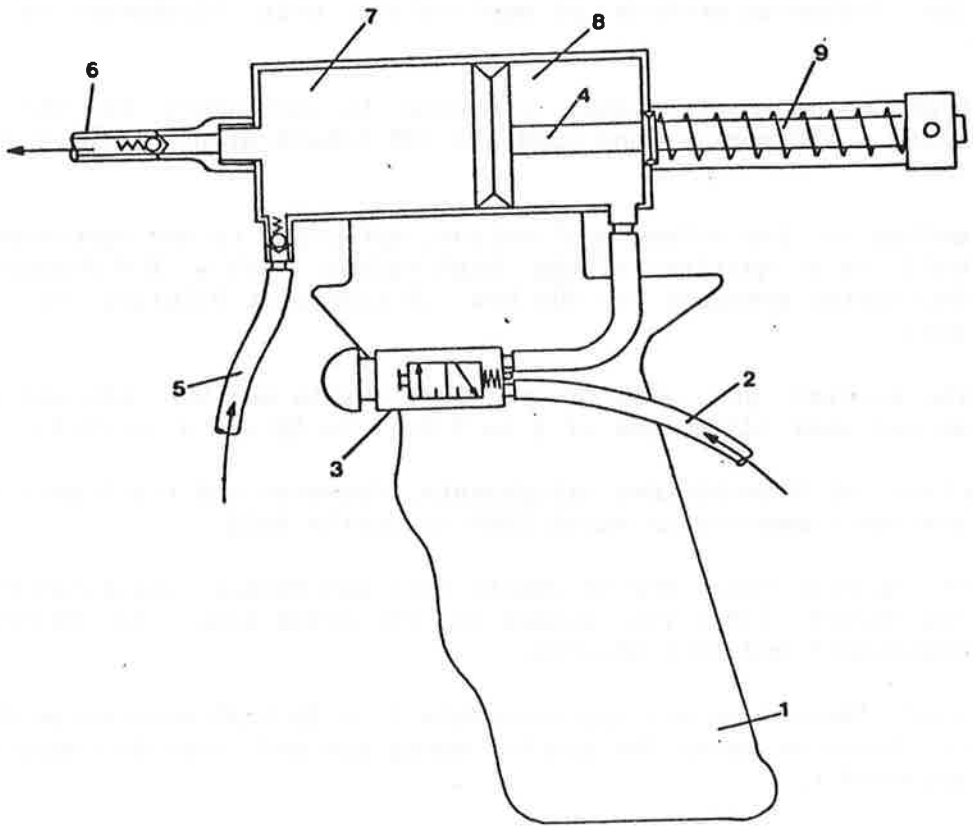


Figure 1: Diagram of trotype, low-volume, gas-powered spray gun.

1. pistol grip handle,
2. gas inlet for L.P.G. cylinder,
3. trigger mechanism,
4. plunger
5. herbicide inlet from backpack
6. spray outlet to nozzle
7. liquid chamber
8. gas chamber
9. returning spring and volume adjustment.

This spray gun is more efficient than conventional high-volume spraying as the amount of chemical needed and the cost of application of three herbicides is considerably reduced when using the gun. The special spray gun would seem to be especially useful in treating blackberry in inaccessible terrain as the volume of application is reduced by 50-60 times with no reduction in effectiveness. Also the technique allows a reduction in the amount of chemical needed to control bushes by one quarter compared to high volume spraying.

The gun can deliver a variable amount of solution from 20 to 60 mL on each activation of the trigger. Preliminary testing with different nozzles and pressures resulted in selection of "T-jet" nozzle number 8003 and pressure of 300 kPa as giving best spray cover in relation to arm movement of the gun. A 50 mL shot covers approximately $5m^2$ of blackberry bush when a steady sweeping movement of the arm is used.

Initial screening trials using several herbicides indicated that blackberry bushes treated with the gun were controlled to the same extent as when bushes were sprayed by normal high volume applications.

Three preliminary trials using a prototype spraygun were carried out in December 1981 and March and October 1982 at Castle Hill. These trials tested three herbicides (glyphosate, fosamine and triclopyr) at various dilutions[1] from 1 to 1 to 1 to 60 to establish the range of dilutions at which the chemicals were effective when applied by the special gun.

To compare application methods a trial was commenced at Walcha, NSW in April 1983 using the following methods of application with Glyphosate as the herbicide:-

- high volume application, spraying to thoroughly wet the bush using a D-8 nozzle and 2000 kPa (30 L/bush at dilution of 1.3 to 100)

- medium to low volume application, spraying to use approximately half to a quarter of the high volume with a D-4 nozzle and decreasing pressure to 400 kPa (5 L/bush at dilution of 1.3 to 100)

- the special gun, with "T-jet" 8003 nozzle and 200 kPa set at 50 mL per shot (dilutions of 1 to 7.5, 1 to 10 and 1 to 12.5).

Also a comparison of 3 herbicides (glyphosate, fosamine and triclopyr) using the special gun was commenced in March 1983 at Castle HILL.

Weather conditions were very dry at Castle Hill and bushes exhibited severe drought stress except for a few bushes in the creek bed. At Walcha the bushes were unstressed and very healthy.

In another trial lantana bushes approximately 1 to 2m high were sprayed with glyphosate and fosamine using the special spray gun and results compared to high volume application.

[1] dilution of herbicide relate to amount of product mixed with water.

The general results from these trials have indicated that when used to spray blackberry and lantana the low-volume, gas-powered gun gave results which were just as effective as conventional high volume and medium to low volume applications. Moreover the cost of chemical used for treatments with the gun was considerably reduced compared to the cost of both conventional high volume and low volume applications. The cost of treating blackberry bushes with glyphosate approximately 2m high and 20 paces (14m in circumference can be as low as $0.50-0.80 per bush compared to $6-$7.80 per bush for high volume application. The economics in favour of using the special gun are considerable.

Observations when using the gun have indicated that it is essential to include a marker dye in the spray solution to see where spraying has taken place. Tests with different coloured dyes have indicated that a white or yellow coloured dye is to be preferred to indicate where spraying has occurred. The dye currently used is titanium dioxide which has slight detrimental effects on the usè of glyphosate, but the effect on other hericides is unknown. The use of a more suitable dye is being investigated.

The use of the low-volume, gas-powered, spray gun has several advantages over current high volume and low volume application techniques. These include:-

- the ability to work in inaccessible areas
- it is not necessary to carry large quantities of water or other carrier material
- high quality water can be used with less chance of deliterious spray-water interactions
- a 1 litre gas cylinder gives 960 shots of spray solution (3c - 16c/100 shots)
- the gun accurately measures the amount of herbicide applied to bushes and adjustments can be made in chemical applied depending on bush size
- spray drift associated with conventional high or low volume applications is reduced to a minimum.

Experiments conducted in the last five years have indicated that:

- the high volume application equipment currently used is using far too much herbicide
- no herbicide treatment gives 100 per cent kill after one application
- the second year application (regardless of equipment used) require proportionately more herbicide to kill the small percentage of escaping runners. This is due to interfering old (dead) canes from the previous year and weed growth from under the bush. For example, for a very big bush, the first year's application was 50L spray (cost $10.00) and regrowth prior to second application was about 5 - 6 per cent. The re-spray volume required was 35L spray (cost $7.00) and resulted in 2 per cent regrowth 12 months later.

- other means of destruction of the bushes after initial chemical treatments to be considered are: slashing, crushing and burning

- the cost of treating blackberries can be reduced by using the special gun or if high volume spraying equipment is used, at least with glyphosate then reduce the nozzle size to D-4 and decrease the pressure to 400 kPa to effectively decrease the volume at least to half the conventional spray volume

- experiments with the new low-volume, gas-powered, spray gun indicate that up to 80 per cent cost reductions in chemical cost can be achieved when using the gun.

The gun is being produced by Ag-Murf Engineering
17 Siren Street
Dubbo 2830

For further information contact Alan Murphy, phone (068) 82 4366.

COMMONWEALTH INVOLVEMENT IN THE APPROVAL OF PESTICIDES IN AUSTRALIA

By L.C. Jones,
Department of Primary Industry

Introduction

In less than three years, Australia will celebrate its bicentenary. Concurrent with settlement came farming with the first attempts at grain production and raising sheep being made in 1788.

Australia's first harvest was reaped in 1789 at Rose Hill - a credible 5.4 tonnes of wheat, 953 kilograms of barley and small quantities of oats and maize.

The first sheep were Cape Fat Tails which came ashore in 1788, it not being until 1794 that John Macarthur brought 60 Bengal ewes and lambs to Australia and 1797 when a small flock of Spanish Merinos was introduced.

From these humble beginnings, Australia developed to a leading agricultural production nation by the turn of the 20th century. Today, farming and grazing occupy an area of almost 500 million hectares; about 64% of the total continent.

The Australian Bureau of Statistics estimates that there are 168,000 professional farms in Australia, mostly family-owned enterprises.

Australian farmers are recognised as among the most efficient in the world, each producing sufficient food for 70 other people.

There can be no doubt that agriculture is a growing industry with the volume of agricultural output having increased by more than 200% in the past 30 years. The value of agricultural production in 1983/84 reached a record $15.5 billion with wheat contributing $3.62 billion, wool $1.91 billion, beef $2.06 billion, and dairying $1.23 billion.

Historical

The use of toxic chemicals to combat pests is by no means new. Homer mentioned the fumigant value of burning sulphur, and Pliny (AD 79) advocated the insecticidal use of arsenic. By the 16th century, the Chinese were employing moderate amounts of arsenical compounds as insecticides, and at least three hundred years ago the first natural insecticide - the nicotine in extracts of tobacco - was in use against the plum curculio and the lace bug. By 1828, another plant, pyrethrum was providing a second natural insecticide and in the middle of the 19th century, soap was added to the list of insecticides, for it was being used to kill aphids. Sulphur had been advocated as a fungicide on peach trees.

By the middle of the 19th century the first scientific and systematic studies were appearing. The range of materials used for pest control widened somewhat, but the materials remained of simple chemical composition. Experimentation was new, arsenical compounds led, for example, to the introduction in 1867 of an impure copper arsenite called Paris Green in an attempt to check the serious spread of Colorado beetle. Bordeaux mixture,

comprising copper sulphate, lime and water was introduced as a fungicide in 1885 and until comparatively recent times Bordeaux mixture has remained one of the most important fungicides.

The use of pesticides accelerated between 1920 and 1940 and the number and complexity of the materials employed increased simultaneously. Two advances of note occurred during the Second World War. One of these, the discovery of the insecticidal properties of DDT, was made in Switzerland and the second, the introduction of insecticidal organophosphorous compounds, was a German success. Although discovered in 1942, the great insecticidal potential of DDT was not fully appreciated until 1944, when it enabled a severe typhus epidemic in Italy to be brought under control. In 1942 BHC (benzene hexachloride) was discovered in the biological laboratories of Imperial Chemical Industries Limited in England.

Several organic substances had found rather restricted use as fungicides long before the success of the organochlorine and organophosphorous insecticides gave additional impetus to the search for new materials. Organomercury compounds had been marketed as seed dressings since 1912. In 1931 a patent was issued to an American firm covering the fungicidal uses of the dithiocarbamates, a group of fungicides which has proved to be one of the most valuable introduced so far.

Organic herbicides of a more or less selective nature such as petroleum oils and dinitro-ortho-cresol assumed an increasing importance in the late 1930's but it was discovery of the effect of the phenoxyacetic acid group of compounds in 1945 which opened up the field of potent, selective and safe herbicides.

The Present Situation

Among the pressing problems confronting the international community of nations is the need for increased food production and protection of human health from vector-borne disease. Improvement in both the economic and aesthetic qualities of life is directly dependent upon an ample supply of food and individual and community health. Without these, the inventive and productive capacity of society is constrained, thus limiting development. One of the variety of inputs required to achieve the goals of higher food production and freedom from vector-borne disease, pest control ranks high on the list.

We now do have the necessary tools and we need them badly because the world population is increasing far more rapidly than the world's food production facilities. There is only limited perspective in extending world-areas for agriculture, horticulture and animal husbandry: in most developed countries these areas are tending to decrease whilst in developing countries the average increase in cultivated area is very slow, just as is the increase in crop yields per hectare.

Improvements in world food production therefore seems to lie in intensifying agriculture, horticulture and animal husbandry in a way that promises more and better crop and animal yields per hectare.

Maximum productivity and efficiency in agriculture will depend on the development and wider use of improved practices, such as growing varieties with disease and insect-resistance, application of proper kinds and amounts of fertilizer, efficient use of water on irrigated lands, and improved labour-saving machinery and equipment. But these advantages will be lost

without the use of crop protecting chemicals.

There are pest problems today for which no satisfactory control methods exist to replace the use of chemicals and, chemical pesticides will be the most dependable weapon of the applied biologists unless and until more acceptable techniques can be developed.

Agrochemicals and veterinary chemicals have played and continue to play an essential and indispensible part in modern and rational agriculture. Developments of the last 50 years have proved the enormous food production capacities of modern agricultural methods and the role of agrochemicals.

At present, developing countries are using relatively little in the way of chemicals to control pests in the majority of crops. In developed countries the use of crop protecting chemicals has played a major role in the increased and more efficient production of food (Table 1). Pesticides provide immediate effective control at practical costs.

Table 1

Usage of Agrochemicals in Developed and Developing Countries

Countries	Herbicides	Insecticides	Fungicides	Total
		% of total		
Developed	90	55	88	80
Developing	10	45	12	20
	100	100	100	100

The Agrochemical Industry Today

World sales of agrochemicals in 1980 were estimated at US$11,800 million to users split up between four main usage groups, namely; herbicides, insecticides, fungicides and growth regulators and others (Table 2).

Table 2

Agrochemical Usage Groups

Group	Sales 1980 US $ billion
Herbicides	4.7
Insecticides	3.9
Fungicides	2.5
Growth regulators and others	0.7
TOTAL	11.8

The major crops which accounted for over 75 per cent of global use are set out in Table 3.

Table 3

Usage of Agrochemicals by Crop - 1980

Crop	US $ billion
Maize	1.5
Cotton	1.3
Rice	1.2
Soya beans	1.0
Wheat	0.9
Sugar beet	0.4
Vines, fruit and vegetables	2.5

Trends in Australian Use of Pesticides

Australia's agriculture extends from the tropics to cold temperate climates.

Most of our major pests have been introduced by accident from abroad and in some instances these proliferate without inhibition from natural predators.

Farms operate with minimum hired labour and while the success of Australian farmers is due to many factors there can be no doubt that agricultural and veterinary chemicals and the technical services provided by the agricultural and veterinary chemical industry have contributed significantly to the efficiency of Australian agriculture. Thus agricultural and veterinary chemicals represent important tools to the Australian primary producer.

The low and unreliable rainfall and dependence on export markets results in a low input agriculture with consumption of chemicals being low by world standards. Expenditure as part of on-farm cost varies from 1-2% in the sheep and wool industry; through 3-5% in wheat growing; 12-15% in deciduous fruit culture, to 18-20% in cotton growing.

In terms of the world pesticide end user market of $11.8 billion, Australia's pesticide usage is less than 1% compared to USA/Canada 31%; Western Europe 22%; Latin America 12% and Japan 11.5%.

It is useful to give some examples of the significance of pesticides to agriculture.

The plant protection market alone in Australia is a $260 million industry which has grown 73% in the past five years. Herbicides make up $160 million worth of this market, insecticides $58 million, fungicides $28 million and other chemicals $14 million. The 108% increase in the amount spent on herbicides in the five year period demonstrates the significance which farmers place on weed control.

One of the major growth areas is Western Australia where the largest market is in the cropping industry. The area treated with herbicides for weed control in cereals and lupins increased from 2.99 million hectares in 1980

to 6.23 million hectares in 1983 with a cost increase from $15 million to $47 million. This growth has been associated with the revolution in planting techniques with the emphasis on minimum tillage. It is estimated that around 40% of the 6 million hectares of crops planted in Western Australia in 1983 was sown with a single cultivation made by the planting implement. It has been estimated that the cost in cereal yields if herbicides had not been used in Western Australia in 1981 would have been of the order of $286 million.

The animal pesticides and insecticides used for crop and plant protection are a focus of considerable attention because of their direct biological activity on the lower members of the animal kingdom. Their use in Australia has been a story of the introduction of a chemical followed by the development of the resistance of the target insects, and of increasing concern over the use of chemicals which are only slowly degradeable, particularly the organochlorines.

Up until the mid 1950s DDT, lindane and dieldrin were widely used on many fruit crops, effectively controlling many important pests but in turn elevating secondary pests to major pest status. Except for the control of several pests attacking the root systems and trunks of fruit trees and for the control of pests such as thrips, organochlorine insecticides ceased to be important to the horticultural industry by the late 1950s, being replaced by organophorphorus and carbamate materials.

Except for use against a number of important soil pests against which no suitable alternative insecticides have been found the organochlorines which had been so successful through the 1950's and 60's have been phased out. Generally it has been possible to continue the use of these materials in a way that has kept residues within acceptable limits.

The introduction of cattle tick with its attendant Babesiosis from South East Asia in 1872 decimated the cattle industry in tropical Australia until suitable arsenical dips were developed. BHC likewise proved most useful but both materials had to be replaced after about fifteen years when newly developed analytical techniques revealed the presence of substantial residues in meat fat and dairy produce. Fortunately by this time dioxathion and diazinon had been developed as effective dipping agents. They were quickly followed by ethion, coumaphos and carbaryl.

As with other acarines subjected to selection with organophosphorus materials it was not long before OP resistant strains of cattle tick emerged. First one and then another useful material became ineffective. It looked for a while as though we would be completely without weapons at a stage where there was no immediate hope of finding alternative means of controlling ticks or preventing the spread of tick fever. The combined effort of the chemical industry and government research agencies gave little hope until chlordimeform was shown to be an effective additive for use in organophorphorus cattle dip baths.

To a sheep population of 133 million, the introduction of the sheep blowfly in the 1890's has presented enormous problems especially during years of good rainfall. Organochlorine insecticides provided an undreamed of solution to this problem until the discovery of residues and the development of resistant strains forced them to be abandoned. Fortunately diazinon had by this stage proved remarkably effective, providing up to sixteen weeks protection for treated sheep. Other OP materials also came into general use about 1959. When applied at strategic times during the season this protection was sufficient to virtually eliminate the problem. By 1968 however OP resistant

strains had rendered most of the organophosphorus insecticides ineffective against blowfly and had reduced the protection afforded by diazinon to about six weeks. The level of resistance has however not increased to the point where diazinon has become ineffective though today the protection afforded is often not greater than several weeks.

In a country which could almost claim to be the home of the termite and where timber is often the only available building and structural material, the long lasting effects of dieldrin and heptachlor have been of extreme value in protecting private and public property. Fortunately the application of these materials to building timbers and beneath the foundations of timber structures represents little hazard to the environment. Without this type of protection many of our homes, buildings and timber structures would be quickly destroyed.

Australia produces around thirty million tonnes of raw grain annually and markets are up to twelve thousand miles away. The preservation of stored grain and its protection against insect attack is therefore of vital importance. The development of malathion and later fenitrothion as grain protectants provided a simple solution to a problem which had previously appeared insoluble.

Following its introduction in 1958 the use of malathion sprays rapidly increased to the point where all grain delivered to storage was treated on intake. The emergence of insect resistance to malathion created a need for and development of alternate insecticides for control of insect pests of stored grain.

The 1970's and 80's saw the introduction and development of the synthetic pyrethroids which have now made such valuable in-roads into all facets of household pesticide use and animal and crop protection. Their effectiveness and generally low toxicity coupled with low application rates assure their continued acceptance especially where environmental and health considerations are of major concern.

In May 1982 the National Health and Medical Research Council made a recommendation which opened the way for certain oestrogens to be considered as animal growth promotants. The economic benefits to beef cattle producers of using growth promotants is undeniable although their acceptance world wide is yet to be achieved, because of the theoretical possibility that residues in edible tissue might endanger consumers.

History of Local Companies

While a number of firms currently operating in the industry were established during the nineteenth century, almost all major companies now involved in manufacture and formulation entered the industry in the post-war period. This development coincided with the post-war emergence of synthetic chemicals with useful pesticidal qualities. This initiative has come almost entirely from overseas and is operated through subsidiaries.

Few organisations in Australia synthesise technical material from basic raw materials obtained in Australia. There are exceptions, the most notable of which is the production of vaccines, technical concentrates for heavy metal fungicides and a number of herbicides based on 2,4-D and 2,4,5-T. The final synthesis steps in the production of thiabendazole and diazinon were also performed in Australia. However most processes performed in Australia involve the formulation of imported technical grade active constituents.

There are many instances where relatively complex operations are involved although in some cases it may merely be blending and mixing of suitable materials.

Research and Development

Almost without exception pesticides are developed in the research laboratories of major international chemical companies who are also engaged in the development of other chemical products including pharmaceuticals, dyestuffs, plastics and the like. The requirements are so stringent that, over recent years, only 1 in 10,000 chemicals synthesised and tested for biological performance ever reach the market place as pesticide products.

The cost of this research and the accompanying development work, including toxicological research, residue studies, performance testing, ecological and environmental studies and the generation of data to satisfy clearance and registration requirements, is generally high, around $25-30 million, with many man years of effort involved before products are marketable. Part of this investment is of course necessary to protect the company's commercial interests. However, a substantial proportion is necessary to meet the interests of public safety, acceptability and the requirements of national and overseas governments. ANNEX I sets out the flowchart for the development of an agrochemical as adopted by a typical research based manufacturer (Hoechst).

It is to the credit of the majority of manufacturers of pesticides throughout the world that a keen awareness exists for the problems associated with the use of toxic substances by the general public and the potential effects upon non-target species and food as well as upon operators. Enlightened self interest, as well as moral responsibility, demands that no reputable manufacturer releases a new material on the market before it has been adequately tested for both potential toxic hazard and pesticidal efficiency. Sometimes, in the light of new experience or unforseen mishaps, it has been found necessary to modify or extend the preliminary testing procedures, but at any one time the tests performed have usually been those demanded by the whole fund of experience and foresight available at that time.

Thus, with the technological sophistication that has taken place in the detection of minute quantities of chemicals, the advances made in toxicological evaluation techniques and the understanding that chemicals may possibly have previously unconsidered potential for harm, new parameters for chemicals evaluation have developed and the minimum requirements that must be met in presenting a chemical for registration have expanded.

Considerable resources and effort are employed by State government agencies in determining optimum conditions for the use of pesticides as part of the research to find solutions to problems which affect primary producers. The activity of State authorities is particularly directed to the solution of regional problems and problems affecting minor industries.

Legislation

In Australia, responsibility for matters of agriculture and public health rests predominantly with the States but in recent years the Commonwealth has been increasingly involved in co-ordination and liaison with State authorities on matters of common interest and concern.

Many pesticides, by their very nature, are classified as poisons. Their

labelling, packaging, distribution and sale are regulated under numerous provisions of the Poisons Acts of the States. The quality of food is determined under Food and Drug legislation originally enacted about the turn of the century. Chemical contaminants of food are regulated under this legislation which is continually up-dated.

The sale, labelling, packaging and advertising of chemicals used for the control of pests (ie. insects, arachnids, diseases, weeds, fungi, bacteria, parasites, vermin, predators and physiological conditions in plants or animals) are regulated under acts of State Parliaments some of which date back almost 60 years. All States have had legislation for almost 40 years and much of this has been up-dated several times.

Hand-in-hand with the increasing complexity, potency and application of chemicals designed to control unwanted animal and plant life has developed an increasing but understandable concern about the safety of these chemicals to users, domestic animals, wildlife, the environment, and especially to consumers of foods produced or protected with their assistance.

This public concern has made it necessary for Governments to review the standards and procedures of evaluation and acceptance of these new chemicals prior to sale. A system involving registration has evolved and, under increasing pressures has become increasingly complex and stringent.

The context in which the safety-in-use of such substances is considered bears spelling out. Safety is a judgement of the acceptability of risk, and risk is a measure of the probability and severity of adverse effects. Thus, a thing is safe if its attendant risks are judged to be acceptable.

This definition contrasts sharply with the more simplistic idea that "safe" means "free from risk". Nothing can be absolutely free from risk. One is hard-pressed to think of anything that is not able to cause harm under some circumstances. Because nothing can be absolutely free of risk, nothing can be said to be absolutely safe. There are degrees of risk and consequently there are degrees of safety.

Few people beyond those professionally involved with pesticides, are fully aware of the multiplicity of controls and inter-locking safeguards that exist in Australia to ensure adequate safeguards apply in the use of pesticides.

Professional people have a special responsibility. They must see that the full facts are kept under review and that the accumulated knowledge is put into the hands of those who need it. Administrators must see that this knowledge is used for the betterment, benefit and safety of all.

Australia has a proud record of achievement in the use of pesticides. This is directly attributed to wise and effective laws, a respect for the law by pesticide manufacturers and distributors, a responsible chemical industry, excellent collaboration between Government agencies and last but not least, an economy which does not encourage wastefulness. Let us work together to keep the record clean.

This paper outlines the activities of the many agencies which provide the foundation for the enviable record of safety which has existed throughout Australia for many years in the use of chemical tools in agriculture.

Regulatory Control

In Victoria, agricultural chemicals legislation began with the Fungicides Act of 1916 which covered fungicides and weed and vermin destroyers much as they are today.

This legislation was consolidated in 1928 but it was not until 1935 that a requirement was introduced to register products as well as label them. Similar requirements under US legislation did not come about until 1947.

In recent years the legislation has been modified several times to accommodate changing trends and attitudes.

The development of other State's legislation was along similar lines and because of the many agencies involved, the nature of the problems and the complexity of technological devèlopments, the various State and Commonwealth departments sought the assistance of the Commonwealth in the role of co-ordinator.

A summary of agricultural and veterinary chemicals legislation is to be found in PB 494 - Agricultural Chemicals - Assessment and Regulations, February 1985.

Co-ordination

Co-ordinating Committee on Agricultural Chemicals (CCAC)

Because of the multiplicity of agencies involved, the nature of the problems and the complexity of technological developments, the various State and Commonwealth Departments sought the Commonwealth's involvement in a co-ordinating capacity. In 1962 the Co-ordinating Committee on Agricultural Chemicals (then known as the Co-ordinating Committee on Pesticides) was appointed by the Australian Agricultural Council (AAC) to over-sight national and international interests and responsibilities arising out of the use of chemicals in agriculture. This body comprises senior officials chosen for their expert knowledge and experience in numerous disciplines including animal husbandry, plant protection, entomology, public health, toxicology, wildlife, export inspection, analytical chemistry, environment and conservation and pesticide science.

Over the years the Co-ordinating Committee on Agricultural Chemicals has advised on both technical matters and policy through the Standing Committee on Agriculture (SCA) of the Australian Agricultural Council. Its Agricultural Chemicals Committee (ACC) comprising senior officers of all States and numerous Commonwealth departments has provided a forum for the exchange of technical information, research data and professional opinion which has ensured a cohesive effort by the many authorities concerned with the various aspects of agricultural chemicals. Through these efforts residues of pesticides in agricultural commodities, food and the environment have been adequately controlled and potentially adverse effects have been minimised.

Agricultural and Veterinary Chemicals Section

The Agricultural and Veterinary Chemicals Section (formerly Pesticides Section) was established within the Department of Primary Industry in 1967 in accordance with recommendations made, following a meeting of all Commonwealth and State authorities concerned with pesticides (for greater detail see PB Document 98 - Co-ordinating Committee on Pesticides - Background and Terms of Reference (1969)). The Section was seen as a means of providing a central authority for the stimulation and co-ordination of Australian activities associated with the many diverse and complex issues arising from the use of chemicals in agricultural production.

It was envisaged that the Section would serve the following functions:-

- Develop and administer Australian Government policy on pesticide problems affecting production and marketing of Australian agricultural commodities.

- Co-operate and liaise with State Departments on agricultural practices with implications for Australian marketing interests.

- Prepare comments relevant to the work of the Codex Committee on Pesticide Residues and participate in the work of FAO and WHO Committees concerned with pesticides.

- Examine trends in Australia and developments overseas which might have implications for exports of Australian agricultural produce.

- Prepare reports and make recommendations on pesticide issues requiring joint Commonwealth/State action for consideration by Australian Agricultural Council.

- Liaise and co-operate with Committees of the National Health and Medical Research Council concerned with pesticide residues in food, with the scheduling and labelling of pesticides, and with occupational health hazards related to pesticides.

- Liase with Commonwealth and State Health Departments generally.

- Provide a central information service for obtaining and distributing information on pesticides from overseas and Australian sources.

- Organise and stimulate investigational and research work needed to resolve problems arising from the use of pesticides.

- Encourage the establishment of representative interdepartmental committees in States and Territories of the Commonwealth.

- Supervise and assess surveys of pesticide residues in primary produce destined for export and advise the various relevant Commonwealth and State authorities regarding situations in which excess residues are found.

- Recommend appropriate Commonwealth and State legislation to

bring about uniformity in the registration, regulation, labelling, sale and use of pesticides and related products.

- Service those Commonwealth/State committees established by Australian Agricultural Council to bear responsibility in the field of pesticides.

In compliance with this last-mentioned term of reference the Section services the Co-ordinating Committee on Agricultural Chemicals (CCAC), (formerly the Co-ordinating Committee on Pesticides) and its three subsidiaries:-

. Agricultural Chemicals Committee (ACC), formerly the Pesticides Sub-Committee.

. The Technical Committee on Veterinary Drugs (TCVD), (formerly the Technical Sub-Committee on Livestock Feed Additives)

. The Technical Committee on Agricultural Chemicals (TCAC).

A Secretariat is provided for each of the four committees and chairmen are provided for the two Technical Committees.

Although the TCVD and TCAC do not hold frequent meetings they function continuously by correspondence and actually account for considerably more than half the total work load of the Agricultural and Veterinary Chemicals Section.

Officers of the Section also serve on a number of ongoing committees and ad-hoc working groups convened by Health and Environment, by State Departments of Agriculture, the Standards Association of Australia and by commodity boards.

Technical Committee on Agricultural Chemicals (TCAC)

In 1968, following representations from the Agricultural and Veterinary Chemicals Association of Australia, meetings of Commonwealth and State officials and representatives of Industry were convened by the Co-ordinating Committee on Pesticides to recommend ways and means of harmonising the requirements and procedures for registering agricultural chemicals in Australia.

On the advice of the Co-ordinating Committee on Pesticides (which in 1974 was renamed Co-ordinating Committee on Agricultural Chemicals) Standing Committee on Agriculture recommended to the Australian Agricultural Council that the TCAC be established as a central authority to evaluate agricultural chemicals prior to registration.

The Australian Agricultural Council also recommended, and State authorities agreed, that registration of new agricultural chemicals be withheld until clearance had been obtained from the TCAC. These procedures have now been in operation since 1969.

To guide applicants in the requirements for clearance of agricultural chemicals Document PB 179 was issued by the TCAC in May 1974. This was updated to cover certain products exempt from clearance and was issued as Document PB 310. A further revision, PB 310A has been considered by all relevant parties and agreed and is about to be published as PB 310B.

The responsibilities of the TCAC are as follows:

1. To receive submissions and to consider all proposals for the use of new agricultural chemicals or for new uses of established agricultural chemicals.

2. To evaluate the implications of such use in Australia.

3. To evaluate the agricultural and ecological hazards and to recommend precautions in accordance with good agricultural practices and to fix withholding periods appropriate to specific applications.

4. To refer to NHMRC Committees, where appropriate, data for determination of:

   (a) Poisons Schedule classification

   (b) Maximum residue limits in specific commodities.

5. To make recommendations to State authorities in respect of the registration of agricultural chemicals.

Under the responsibilities of the TCAC, an "agricultural chemical" is defined as:

   (a) Any substance or mixture of substances used or intended for use for preventing, destroying, repelling, attracting, inhibiting or controlling any insects, rodents, birds, nematodes, bacteria, fungi, weeds or other forms of plant or animal life or viruses, which are pests;

   (b) Any substance or mixture of substances used or intended for use as a plant regulator, promoter, defoliant or desiccant;

used in agricultural, food storage, household, industrial and non-agricultural applications.

The term does not include veterinary drugs, stock medicines, stock feeds or stock feed additives which are dealt with by the TCVD.

Since 1968 all new agricultural chemicals and all new uses of existing products have come under the control of the Technical Committee on Agricultural Chemicals. The technical Committee on Veterinary Drugs has performed a similar function in respect of veterinary drugs and stock feed additives used for the mass medication of food producing animals. These Committees, comprising senior State officials, together with representatives of the National Health and Medical Research Council, the Wildlife Authorities and the Commonwealth Department of Primary Industry, evaluate each new use of these chemicals in the interests of the safety of users, bystanders, consumers, crops, domestic animals, pets, wildlife, the environment and trade. The Committees together with subsidiaries of the National Health and

Medical Research Council concerned with poisons scheduling and the establishment of maximum residue limits in foods (see below) provide an interlocked and balanced assessment of agricultural, human health and environmental protection considerations.

The National Health and Medical Research Council (NHMRC)

The National Health and Medical Research Council provides an important role in advising State Departments of Health and in co-ordinating the many health issues. Its Public Health Advisory Committee, comprising Directors-General of Health of all States and the Commonwealth, is guided in matters relative to pesticides by expert committees including the Poisons Schedule Committee, the Pesticides and Agricultural Chemicals Committee, the Occupational Health Committee and the Environmental Health Committee.

The Poisons Schedule Committee (PSC)

The Poisons Schedule Committee examines all available scientific and toxicological data on the toxicity of chemicals, including pesticides, and recommends appropriate classification for inclusion under Uniform Poisons Regulations by which the availability, labelling, packaging, storage and sale of poisonous substances is regulated under State health legislation. The Poisons Schedule Committee recommends its deliberations to the NH&MRC for ratification.

Poisons Scheduling

The appropriate poisons schedule for a particular agricultural chemical is published by the NHMRC in a document "Uniform Poisons Standard. They are usually then incorporated in State Poisons Acts.

Agricultural and veterinary chemicals generally fall into one of the following schedules:

Schedule 4 - substances of preparations, the supply of which, in the public interest, should be available only on medical, dental or veterinary prescription

Schedule 5 - substances or preparations of a hazardous nature which must be readily available to the public but which require caution in handling, use of storage

Schedule 6 - substances or preparations of a poisonous nature which must be available to the public for domestic, agricultural, pastoral, horticultural, veterinary, photographic or industrial purposes, or for the destruction of pests

Schedule 7 - substances or preparations of exceptional danger which require special precautions in manufacture and use and for which special individual labelling and distribution regulations may be required.

The Pesticides and Agricultural Chemicals Committee (PACC)

The Pesticides and Agricultural Chemicals Committee examines scientific data submitted in accordance with a protocol of requirements in order to determine the levels of residues of chemicals in agricultural commodities and foods which are legally acceptable, safe and consistent with the needs of

Australian agriculture. These maximum limits for residues are based on extensive Australian and overseas experiments designed to determine the nature and level of residues resulting from the application of the chemical in accordance with good agricultural practices. The safety and acceptability of these residues is determined by comparison with extensive toxicological studies carried out on laboratory animals. These include both short and long-term studies on rats, mice, dogs and similar animals receiving known amounts of the chemical every day in their rations. Studies for carcinogenicity, mutagenicity, reproduction and development are also required. Subject to the approval of the Public Health Advisory Committee and ratification by the National Health and Medical Research Council, the recommendations of the Pesticides and Agricultural Chemicals Committee form the basis of legal maximum residue limits for residues of chemicals in food in State food and drug regulations.

They are published in the document "Standard for Maximum Residue Limits of Pesticides, Agricultural Chemicals, Feed Additives, Veterinary Medicines and Noxious Substances in Food".

It should be stressed they are not safety limits but legal limits, there being a large safety factor ranging from several hundred to several thousand times depending on the amount of data available .

National Chemicals Notification and Assessment Scheme and National Occupational Health and Safety Commission

The Australian Environment Council's National Chemicals Notification and Assessment Scheme and the National Occupational Health and Safety Commission can be expected to effect current assessment procedures although the extent of their involvement cannot yet be gauged.

Clearance of Agricultural Chemicals and Veterinary Drugs

In accordance with agreement reached in Australian Agricultural Council, the Technical Committees evaluate applications for clearance of new agricultural chemicals, veterinary drugs and livestock feed additives. These clearances are recognised as a prerequisite for registration by State authorities and thus provide a measure of uniformity which might otherwise be lacking in the regulatory control of these chemicals.

Figure I summarises the involvement of Federal and State organisations in the clearance procedures for agricultural and veterinary chemicals.

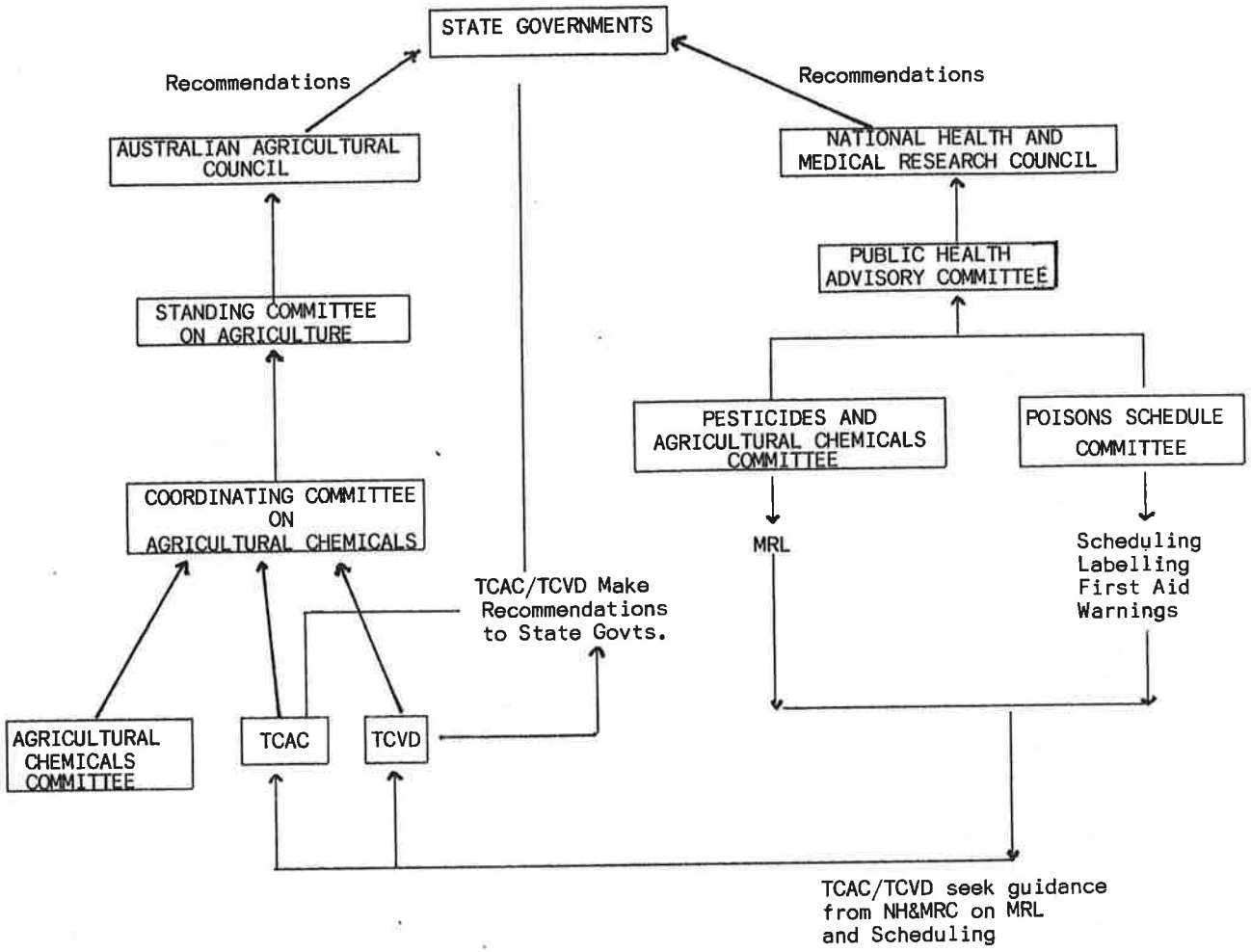


FIG 1. FEDERAL AND STATE ORGANISATIONS WHICH INFLUENCE THE CLEARANCE PROCEDURE

An extensive protocal of requirements is available to guide manufacturers in developing and presenting data. Until all relevant requirements are met and there is unanimous agreement between the Government authorities the chemical may not be registered and certainly not be offered for sale. The many inter-locking requirements, legislation and administrative procedures ensure a high degree of protection for the Australian public.

Absolute safety is the goal of society in all endeavours. It is never achieved in any, whether it be public transport, consumer goods or environmental management. An imperfect system is not to be condoned, but constantly improved, through experience and research, as rapidly as possible, within the limitations placed on the system by society itself.

There can be no doubt that Government regulation of pesticides has become very effective in protecting crops and animals, the environment and human health. Costs of this regulation to consumers are hidden in the increased costs of food natural fibres, ornamental plants and timber.

In some countries, Government regulation has created lengthy delays in registering and re-registering chemical pesticides. Moreover, it has caused higher costs of developing new chemical pesticides and of defending pesticides now marketed.

The situation in Australia is such that, in most cases, submissions are processed through the system within a reasonable time, bearing in mind the extensive volume of scientific information that needs to be evaluated and the diverse administrations with which we deal.

The overall requirements of the Committees have changed in the past 16 years. Advancing knowledge has resulted in a considerable increase in the demand for more detailed and complex data to support applications for Clearance. Greater concern and care is now exercised over issues relating to toxicology and residues in foods of plant and animal origin with the result that submissions have much more information to be evaluated.

Developments in technology, both in design of experimentation, specificity of action of chemicals against pests, analytical methodology and detection of residues etc have also added to the complexity of submissions and their evaluation and in the requirements of regulatory authorities. Further, the dynamic nature of legislation governing pesticides results in a continuing up-grading and expansion of requirements. This is reflected in the extent and complexity of submissions and in the attitude of Governmenht authorities to detail that would not have been considered ten years ago.

As a result, there has been a significant increase in the amount and nature of information covered in submissions.

Conclusions

There are potential problems with pesticide usage but the purpose of the large amount of research going into the generation of data for registration is to tackle the issues before they become problems. Registration and subsequent residue monitoring enables authorities to exercise control over use levels, claims, labelling, packaging and advertising thus ensuring that the interests of end users are well protected. Registration legislation provides a system under which the public's interest and manufacturers' rights are legitimately safeguarded.

In Australia pesticides have to be registered so members of the public are assured that the product on the shelf has satisfied the requirements of the law as to its effectiveness and safety when used according to the directions on the label. This qualification is important but necessary since no regulatory agency can guarantee against misuse.

Most pesticides, though potentially toxic if absorbed, are in fact not hazardous when used with reasonable commonsense by methods which avoid unnecessary contact. Occupational poisonings are uncommon. Such mishaps as do occur, are predominantly due to people accidentally, carelessly, or intentionally exposing themselves to large amounts.

Australia has systems for controlling the sale, distribution, labelling and packaging of toxic substances which have assured the public of a high degree of protection. There is a dynamic and flexible regulatory approach to respond to new situations as they arise.

Problems and publicity in other countries have prompted people in Australia to question whether pesticides pose a threat to public safety and to our natural environment. Much of this concern could no doubt be alleviated by a proper understanding of existing control processes.

For Further Reading

Manual of Safe Practice in the Use and Handling of Pesticides - Document PB 377 - Australian Government Publishing Service - 1980.

Requirements for Clearance of Agricultural Chemicals - Document PB 310B - Australian Government Publishing Service - 1985.

Withholding Periods, Maximum Residue Limits and Poison Schedules for Agricultural and Veterinary Chemicals - Document PB 431 - Australian Government Publishing Service - 1982.

ANNEX I : Flowchart for the Development of Hoechst Agrochemicals.

BLACKBERRY RUST - WILL IT ERADICATE BLACKBERRIES?

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Introduction

In the 80 year history of biological control no target species (weed, insect etc.) has ever been eradicated by biological control. Biological control is a process relying on natural enemies to limit populations of pests. Some of these natural enemies have narrow host ranges. Biological control does not eradicate weeds. Biological control of weeds is not a panacea; it is simply one of the options that should be considered when confronted with an important weed problem (Delfosse 1985).

Blackberry (*Rubus fruticosus*) may cause major economic costs in terms of potential production losses and control costs incurred by landholders and public authorities.

A survey in 1983 of shire councils in New South Wales indicated that 150,800 ha were densely infested with blackberry and a further 1.22 million ha were moderately infested. Scattered blackberry occurred over 4.38 million ha and threatened the productivity of vast areas of grazing country (Vere and Dellow 1984). On a state wide basis, the potential production losses in 1983 were estimated at between $17 to $20 million (Vere and Dellow 1984). In the Central Tablelands alone approximately $0.5 million was estimated to be spent by shire councils and landholders on chemical control of blackberry.

The cost of blackberry in Victoria is estimated to be in excess of $13 million and the total cost to the nation probably exceeds $40 million. Benefits from blackberry are no more than $0.7 million annually, about half occurring in each of Victoria and Tasmania (Field 1984).

Biological Control - Research

There are currently in excess of 18 programmes in Australia investigating biological control of weeds (Cullen 1981); one of which is blackberry.

Blackberry is of European origin and excluding insects which attack it, there are, in Europe, 15 fungi, one bacterium and one virus of which blackberry is the host (Amor and Richardson 1980). The European rust *Phragmedium violaceum* showed the greatest potential for biological control and its release in Chile in the 1970's aroused much interest. A joint project was undertaken in Victoria by the Department of Conservation, Forest and Lands and the Division of Entomology, C.S.I.R.O. to investigate biological control of blackberry in 1976.

There are currently 8 weedy blackberry species naturalized in Victoria. Unfortunately no definitive study has been made in New South Wales and the number and distribution of species is unknown.

In the late 1970's El Bruzzese (Keith Turnbull Research Institute, Vic.) was assigned to investigate biological control of blackberry.

Previous investigations showed that the rust fungus *Phragmidium violaceum*, was the most promising pathogen. In 1978 Bruzzese collected 40 samples of rust spores in Europe from the most commonly occurring blackberry species occurring in Victoria.

From these 40 strains, 15 were eventually selected for their virulence on all the strains of blackberry (8) occurring in Victoria (Parsons et al 1984).

In April 1983 the work in Europe (Montpellier, France) was completed and Bruzzese began preparing a case for blackberry to be approved as a candidate for biological control.

Unexpected Development

On 24th February 1984 the rust, *Phragmedium violaceum* was discovered in Victoria. Observations indicate that it was most likely deliberately introduced (Bruzzese 1984). The rust spread quickly during summer and autumn and is well established in all major blackberry areas of Victoria. It was particularly evident in areas along public roads and easily accessable areas to the public.

The latest report (personal communication, Dr. R. Field) is that the rust is continuing to spread although slowed down by the dry summer. It has not spread as fast as predicted but the infestations are much heavier than 1984. Young leaves are defoliated and also new regrowth is heavily attacked. With continual defoliation the reserves of the blackberry are gradually depleted.

The rust activity slows down with warm dry weather.

The current situation in Victoria is that the fruiting canes are defoliated, and the length of the canes is reduced. There is a reduction of overall fruiting and there is significantly less "tip rooting". The Victorian authorities still feel it is still far too early to confidently predict the eventual outcome.

The rust has been identified in northern New South Wales in autumn 1984, but did not re-establish in 1985 (deliberate release). Very recently the rust was positively identified on the far south coast.

There has been much activity by tablelands graziers visiting the "blackberry rust fields" of Victoria in search of the "crock-of-gold". Many New South Wales graziers have also felt rather snug (in their ignorance) thinking they have the much sought after rust on their property - generally the rust has not been the European blackberry rust but the common rust *Kehneola uredinis* which has most likely been present in Australia since the weed was first introduced. Graziers who did their "homework" collected the correct rust.

Implications of the premature release

- It is not known how the rust was released and also what other pathogens may have been released.
- Most importantly, the rust can attack 6 of 8 blackberry species naturalized in Victoria. One of these includes the hybrid blackberry species.
- The species of blackberry present in New South Wales and the remainder of the nation are unknown.

- The premature release of the rust may have a detrimental affect on the subsequent release and establishment of the 15 strains of rust the government authorities have investigated and collected.

- The efficacy of herbicides on rust affected blackberry is unknown.

The spread of the rust has been much slower than predicted. The seasonal conditions - extremely hot and dry summer 1984/85 was not conducive to the natural spread and establishment of the rust.

Likely outcome

The current situation in Victoria as in New South Wales is one of "wait and see".

Weed control authorities continue to emphasise that the rust will not eradicate blackberry. Integrated weed control must be adopted where biological control is combined with compatible herbicides, mechanical or cultural control techniques. Cultural control techniques such as livestock grazing and the use of grazing goats (biological control) should be considered high priorities.

What will the rust do?

* firstly, the rust spreads by windborne spores and will first show up on the top of bushes on young leaves.

* the rust is currently in the "overwintering" dormant stage and the high incidence of infection can be expected from Christmas time onwards.

* the rust causes tip die back of the canes.

* the incidence of "tip rooting" of the canes will be greatly reduced.

* the rust also attacks the calyx of the flower resulting in poor fruit set.

* the small seedlings are more sensitive and consequently higher seedling mortality can be anticipated.

* a heavily infected bush could be considerably reduced in vigour and with defoliation the bush should be much more open.

* the overall affect could be one of reduced vigour and the spread from "root tipping" and seedling growth will be reduced.

Current policy

The Department's current policy regarding blackberry control is unchanged despite the rust release and the euphoria which has accompanied it. The Director General, Mr Knowles, 1984 has clearly stated this policy.

"I urge graziers to continue their current control programmes" Mr Knowles said "otherwise they will be at a severe disadvantage in future years if the rust proves unsuccessful."

He said that many biological agents had brought about enormous economic benefits to the rural community, but it was difficult to predict the outcome of a biological control programme. Some programmes in the past met with little success. (eg. St.John's Wort).

Mr Knowles pointed out that until proven effective, biological control may not be regarded by local councils as an acceptable means of control under the noxious plant provisions of the Local Government Act.

As stated earlier, the current policy is one of "wait and see" and in the meantime control measure of the integrated and the conventional type must be continued.

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PRICKLY PEAR DESTRUCTION COMMISSION

G.E. (Garry) Ryan,
Commissioner,
Prickly Pear Destruction Commission

Headquarters: 3rd Floor, G.I.O. Building, 1 Fitzroy Street, Tamworth

Commissioner: Mr G.E. Ryan,
PO Box 547, Tamworth, NSW 2340

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Mr Mark Riggs
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Yarouah Street, MUNGINDI
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B. **TAMWORTH INSPECTORATE;**

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C. SINGLETON INSPECTORATE:

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Mr V. Waterhouse
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Supervisors:
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D. MUDGEE INSPECTORATE:

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E. DUBBO INSPECTORATE:

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PRICKLY PEAR DESTRUCTION COMMISSION

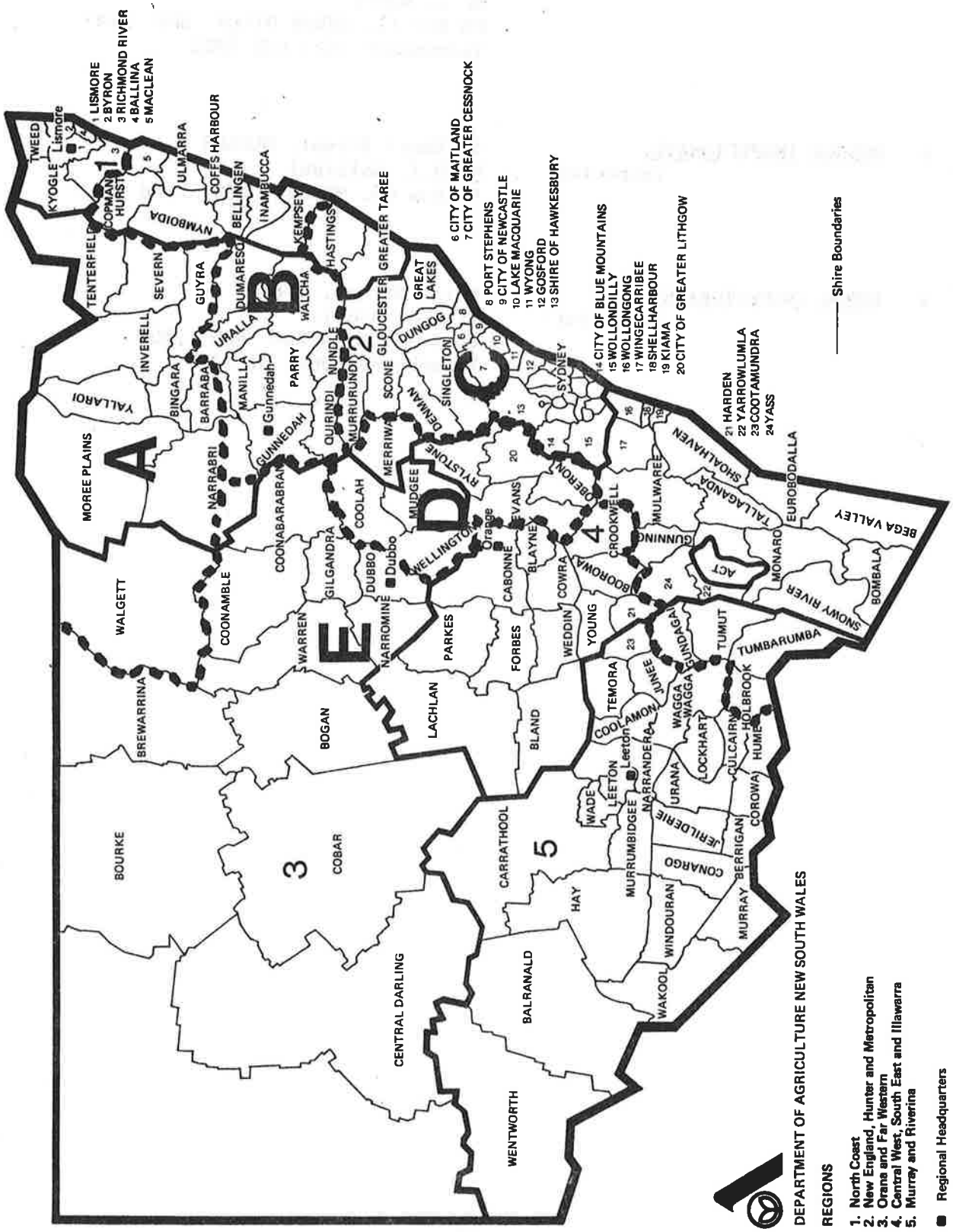
A = BINGARA INSPECTORATE

B = TAMWORTH INSPECTORATE

C = SINGLETON INSPECTORATE

D = MUDGEE INSPECTORATE

E = DUBBO INSPECTORATE



DOW TRIAL - FIELD TRIP INSPECTION

Anthony Feez,
Dow Chemical (Australia) Ltd.

Trial Title: Sweet briar (*Rosa rubiginosa*) control with GRAZON* Foliar Spray Herbicide and GARLON* 480

Author: Anthony M. Feez, Dow Chemical (Australia) Ltd., 100 Miller Street, North Sydney, NSW 2060.

Location: Sutton, Canberra

Co-operators: Warwick Roche, Yarrowlumla
Bill Cartwright, Grazier

Application Date: 12/2/85 Weather - fine and clear
Rainfall- low incidence

Weed Growth Stage: Sweet briar plants ranged in size from 1m high to more than 2m high (multistemmed). Plants flowering at application.

Formulation: GRAZON - 50g/L picloram as the tri-isopropanolamine salt and 150g/L triclopyr as the butoxyethanol ester.

GARLON 480 - 48g/L triclopyr as the butoxyethanol ester.

Application Method:

1. Drench Gun
   A modified drench gun fitted with a Cooper Pegler "Variable Spray" cone nozzle was used to apply 15mL shots (dependent on dose required) of a CHEMICAL DIESEL WATER mixture to the basal 25cm of the sweet briar stem. Two rates of GRAZON and one of GARLON were applied to a range of sweet briar plants.

   It is important when mixing that the chemical is added first, followed by the diesel and that the water is added last.

2. Basal Bark
   A mixture of GARLON 480 and diesel was applied to the basal 30cm of the sweet briar stem. The mixture was applied using a knapsack sprayer which was operated at 200 kPa, ensuring that the bark was thoroughly drenched.

3. Flood Jet
   A concentrated mixture of GRAZON was applied through a modified Phillips Duomatic 15 drench gun with a flood jet attached. Treatments were applied to

achieve a coverage of 20 droplets per square cm of leaf. A white titanium oxide (Bushranger trial) marking agent was added at 0.5% of spray volume to determine spray coverage.

Assessment Dates: 25/4/85

Plants were assessed for percentage necrosis. Final assessments will be taken 12 months post application.

Treatment Details:

	Treatment	Rate	Use Directions
1.	GRAZON/Drench Gun	1L GRAZON + 200mL diesel+ 800mL water. Apply as 15mL squirts.	One squirt/bush less than 1m high. Two squirts/bush 1m to 2m high (no more than 2 to 3 stems). Three squirts/bush 1 to 2m high (multistemmed). Four squirts/bush over 2m high (multistemmed).
2.	GRAZON/Drench Gun	500mL GRAZON + 200mL diesel + 800mL water. Apply as 15mL squirts.	As above
3.	GARLON/480 Drench	208mL GARLON 480 + 200mL diesel + 800mL water. Apply as 15mL squirts.	As above.
4.	GARLON/480 Basal Bark	1.24 (in diesel)	Application to 30cm of stem from ground.
5.	GRAZON/Flood Jet	1.10 (in water)	Overall foliage application.

Comments:

1. All treatments with the exception of No. 2 gave up to 100% necrosis of sweet briar plants two months post application. At this assessment most stems on treated plants were showing dieback.

2. Both Drench Gun and Basal Bark for GARLON and GRAZON application techniques are registered for use in NSW. Flood jet application is an extension of the now widely used low volume/high concentrate application techniques like CDA.

* Trademark of the Dow Chemical Company.

FERAL GOATS ON SERRATED TUSSOCK TRIAL

M.J. Keys
District Agronomist,
Department of Agriculture,
QUEANBEYAN

AIM: To determine stocking rates for goats necessary to control various densities of serrated tussock.

Established 17th May, 1984.
Four paddocks stocked at 6 goats per hectare
Paddocks of differing densities of tussock.

	Percentage Ground Cover			Available Dry Matter	
	Tussock	Phalaris	Clover	Tussock	Other Species
Paddock 1 25%	2%	14%	1.9 t/ha	1.0 t/ha	
Paddock 2 20%	10%	11%	2.3 t/ha	1	.8 t/ha
Paddock 3 35%	3%	12%	2.3 t/ha	0.7 t/ha	
Paddock 4 40%	5%	8%	4.1 t/ha	0.7 t/ha	

To date there has been a good spring and a reasonable autumn while the summer was dry.

At the stocking rate being used the phalaris is well grazed as are the other native grasses and thistles.

The serrated tussock is well grazed down in small patches only so for the good seasons experienced the rate may be too light.

It is too early to make any other comments at this stage except that the goats are grazing the serrated tussock.

FRENOCK RESIDUE TRIAL

M.J. Keys
District Agronomist,
Department of Agriculture
QUEANBEYAN

AIM: To determine safe plant back periods for successful pasture establishment on a soil where Frenock residues are reported to have caused pasture establishment failure.

The pasture was sown on the 17th May 1983. Half of the plots were sprayed on the 22nd February 1983 while the other half were sprayed on the 26th April 1983, i.e. there were plots not sown for 3 months after spraying while other plots (same treatments), were sown only 3 weeks after spraying.

There was 150 mm of rain between the early spraying and sowing and 60mm of rain after the late spraying but before sowing.

The soil was a podzolic fine sandy clay loam formed from sedimentary rock, not highly buffered and reasonably well drained.

Results (as of September, 1984)

Treatment		Serrated Tussock	Perennial Grasses
1 litre/ha Frenock	early spray	0.5%	15%
	late spray	5 %	25%
1.5 litres/ha Frenock	early spray	0	15%
	late spray	0	30%
2 litres/ha Frenock	early spray	0	15%
	late spray	0	25%
28 kg/ha 2,2-DPA	early spray	0	15%
	late spray	1.5%	25%
4 litres/ha Roundup	early spray	65%	2%
	late spray	6%	30%
1 litre/ha Frenock + 14 kg/la 2,2-DPA	early spray	0	20%
	late spray	0	25%
1.5 litre/ha Frenock+ 7 kg/ha Dalapon	early spray	0	20%
	late spray	0	30%
Control (nil)		75%	2%

Comments

The spraying is best done after the autumn break to control annual winter growing weeds and so enable good pasture establishment.

The 2,2-DPA or 2,2-DPA + Frenock combinations give a quicker knockdown of serrated tussock than Frenock alone.

Dr Malcolm Campbell believes 50 ml of rain will wash Frenock chemical residues out of the root zone. Thus residual problems were unlikely even for the later spraying in this trial. A further trial has recently been repeated under drier 1985 conditions but it is too early for any results as yet.

EAST COAST HELICOPTERS

Kelvin Jay Mitchell,
East Coast Helicopters,
CALOUNDRA QUEENSLAND

City and Country Helicopters Pty Ltd (trading as East Coast Helicopters) began operations in 1978. Today the network has expanded to include a dozen permanent field bases from Tasmania to Mt Isa and a staff of over 40 - all computer coordinated from head office in Caloundra, on Queensland's Sunshine Coast.

A fleet of 17 aircraft - including almost every Hiller UH-22E in Australia is operated on a variety of tasks and an impressive depth of experience has been obtained in fields which include

1. Agricultural operations
2. Mustering
3. Geological survey
4. Numerous Government contracts
5. The entire campaign against plague locusts in NSW, including an "on-loan" basis to the SA government to assist with their plague problems.
6. General charter
7. Flying training
8. Wild pig eradication
9. Helicopter sales and servicing.

As a pioneer in the field of aerial application by helicopter, East Coast Helicopters has developed techniques to the stage where the Department of Aviation both acknowledge and respect of professional dedication to such a specialised operation. This is particularly evident in the use of a helicopter at night - in an operation especially approved by DOA - to save millions of dollars worth of Queensland macadamia nuts from damage by frost.

This application is now a routine part of the East Coast Helicopters repertoire. Other agricultural operations which have regularly proven cost-effective include the aerial spraying of:

Avocado	Groundsel	Sugar Cane
Banana	General Weeds	Thistle
Bracken	Lantana	Tussock
Blackberry	Soyabean	Wheat (broadacre)

and the general application of fertilisers.

For the skeptics, it was only the timely intervention by East Coast

Helicopters aircraft which saved thousands of acres of NSW wheat from "stripe rust" damage during the 1984 season when fixed-wing agricultural aircraft were unable to operate from rain soaked ag-airstrips.

Apart from our agricultural interests, East Coast Helicopters are one of the largest cattle-mustering operations in Australia, with established clients covering a major percentage of Northern and North-Western Queensland. This facet of business has also involved hundreds of hours of flying for the Department of Primary Industry and has extended from the deep south of NSW to the Kimberley ranges in far North WA.

The Hiller UH-12E was chosen as the work-horse of our fleet because of its superior long-carrying capability and overall reliability. This is particularly useful in the aerial application role.

Max weight	3100 lbs
Empty weight	1759 lbs
Useful Load	1341 lbs
Max speed	96 mph
Cruise speed	68 mph
Range	146 miles

By establishing permanent bases we ensure customer contact at all times. Our staff live and work within the community they service and are always available for advice or information. In this way we hope to maximise the level of proficiency and customer satisfaction. If, for some reason our local office is unattended, customers are free to call our Caloundra office at any time and the message will be forwarded as soon as possible.

For agricultural operations our bases include:

NSW	Phone No.
Bathurst	063-361016
Tamworth	067-664328
Casino	066-633219
QLD	**Phone No.**
Caloundra	071-914600 or 914718
Cooroy	071-476600 or 476843
Gatton	075-622082
TAS	**Phone No.**
Devonport	004-248064

All our staff are professionals, trained and regularly assessed at a very high standard. We, as an organisation aim to provide a very high professional standard and service to our clientele and look forward to an on-going commitment to the agricultural industry.

INNOVATIVE IDEAS COMPETITION

Derek Brown,
Noxious Plants Advisory Officer,
Department of Agriculture,
TAMWORTH

This competition is held every two years in conjunction with the Biennial Noxious Plants Conference with the winner being awarded the Dupont Shield, a perpetual trophy donated by Dupont (Australia) Ltd. The competition is open to council weeds officers.

The award was introduced to acknowledge weeds officers' innovations and ideas in weed control practice.

The conditions are:

* The idea must be practical, labour saving and easy to apply.
* It must be innovative.
* It can be used by weeds officers in general.
* It can be anything or idea applicable to noxious plant control.

There were five entries this year, with the winner being Ken Hayes of Coffs Harbour Shire Council with an "Employee Instruction Manual". Ken received the Dupont Shield from Mr Jim O'Shea, Dupont's Regional Product Manager for New Zealand and Australia.

Following is a list of all the entries together with the comments of the judges.

INNOVATIVE IDEA'S AWARDS

1. Employee Instruction Manual - Pesticides Storage and Use: Ken Hayes, Coffs Harbour Shire

   The idea is excellent because it fits in well with the requirements of all councils to comply with current Pesticide legislation and Health regulations. It is something that all councils should emulate.

   The "Directions to Operators" on pages 1 and 2 of the handbook is a commendable initiative. All councils should develop and utilise a similar format.

2. Operators Aid; Ed Gregory, Hay Shire.

   This is an essential concept for all spray units, the concept is very commendable. Although the unit has been well thought out it was felt that wood might not be sufficiently durable and it may be subject to penetration by herbicide. The panel felt that space should also include room for a First Aid Kit. Again all councils should develop and utilise this idea to meet their own requirements.

3. Swivel Reel: Gil Bush, Yass Shire

A very good and cost effective idea that can easily be utilised by weeds officers who have a need to modify their own static hose reels.

4. Low Slung Tanker and Roll Bar: Ken Hayes, Coffs Harbour Shire

A good idea which is specific to areas of steep terrain. In these situations operator and equipment safety are of paramount importance.

5. Remote Starting Control for Spray Unit: Kev Nelligan, Cowra Shire.

The concept is very good and points to the requirements for all new weed units to be remote controlled from the vehicle cabin. This would also include solonoid controls for the total operation of the weed spray unit.

Summary

The judging panel comprised senior peer members of Weeds Officers drawn from throughout the state. They were Clive Wilmot, Moree Plains; Ron Baker, Narrabri; Kevin Waters, New England Tablelands County Council; Jack Daley, Hawkesbury River County Council, with Derek Brown, Department of Agriculture, Chairman.

The panel felt all entries were of a high and practical standard and in reaching their final determinations voting was very close indeed. The comments of the panel are given with each entry.

The only criticism the panel expressed was that there were insufficient entries. Upon talking to delegates at the conference they found that the entries from Weeds Officers could have doubled. In future Weeds Officers should not continue to "hide their light" under a bushel but be prepared to promote their ideas more positively. It is also encumbent on all N.P.A.O.s to be aware of and effectively promote the ideas of Council Weeds Officers.

"ORDER OF THE THISTLE"

THISTLE IDENTIFICATION COMPETITION

THIRD BIENNIAL NOXIOUS PLANTS CONFERENCE

CANBERRA 1985

J. Dellow,
Special Agronomist, Weeds
ORANGE

A series of 16 potted thistle specimens - listed below, mainly as large rosettes was presented to the conference delegates as an identification competition.

The plants were grown at the Agricultural Research and Veterinary Centre, Orange by Jim Dellow (Special Agronomist, Weeds) Orange, and Peter Gray (Noxious Plants Advisory Officer, Dubbo).

The prize was the book "Plants of Western New South Wales" and the "Order of the Thistle" shield (designed, made and donated by J.J. Dellow). The prize was presented by Peter Milthorpe - one of the authors of the book, at the conference dinner.

The competition was enthusiastically received and created much favourable comment and discussion. The competition showed how important and also how difficult seedling weeds are to identify. However, the standard of the entries was extremely high and professional. There were 70 entries.

The results were as follows:

The winner: JOHN KERRISON (now "THISTLE" KERRISON) of Wingecarribee Shire.

- John got two thistle identifications wrong as did Graham Matthews (Bellingen), Tony Lawler (Muswellbrook), Ron Rowe (Holbrook) and Dennis Hillier (Gunning).

- The majority of delegates got between 3 and 6 thistles wrong.

Only two entrants "guessed" all correct - Hugh Milvain (NPAO, Yanco) and Peter Boatwright - Weeds Officer, Tasmania. These two entrants were however considered ineligible and in any case the prize was not allowed to go "overseas".

Finally, the competition proved to be very popular and it showed the importance of being able to identify weeds at the "early rosette" stage. The standard of the entries showed the professional approach of the weeds inspectors.

Common Name	Botanical Name
Common Sowthistle	*Sonchus oleraceus*
Hardhead Thistle	*Acroptilon repens*
St. Barnaby's Thistle	*Centaurea solstitialis*
Star Thistle	*Centaurea calcitrapa*
Black Knapweed	*Centaurea nigra*
Saffron Thistle	*Carthamus lanatus*
Spotted Golden Thistle	*Scolymus maculatus*
Black Thistle	*Cirsium vulgare*
Perennial Thistle	*Cirsium arvense*
Nodding Thistle	*Carduus nutans*
Slender Thistle	*Carduus pycnocephalus*
Variegated Thistle	*Silybum marianum*
Scotch Thistle	*Onopordum acanthium*
Stemless Thistle	*Onopordum acaulon*
Illyrian Thistle	*Onopordum illyricum*
Artichoke Thistle	*Cynara cardunculus*

INKATA PRESS BOOK DISPLAY

Cyril Jarram,
Inkata Press Pty. Ltd.,
4 Longbourne Avenue,
NORTH CLAYTON VIC 3168

Insect Pests of Fruit and Vegetables in NSW — **Hely, Pasfield, Gellatley**

This comprehensive manual for primary producers, students and extension officers describes 90 per cent of all significant agricultural insect and mite pests of New South Wales.

$45.00

Honey and Pollen Flora — **Alan Clemson**

A fully illustrated guide to honey and pollen flora of south-eastern Australia. More than 300 of the most important plants for bees and honey production are described with their times of flowering, distribution and apicultural value.

$45.00

Field Guide to Weeds in Australia — **C. Lamp and F. Collett**

An excellent identification manual for all involved in weed control. Over 350 colour illustrations make this book an essential reference tool. A description of typical methods of reproduction and disposal is followed by a guide to identification.

$25.00

Noxious Weeds of Victoria — **W.T. Parsons**

This comprehensive illustrated guide is an invaluable aid to anyone involved in the control of noxious weeds. Full details are given on each of these plants including methods of control. This book will be of value to workers throughout Australia.

$30.00

Garden Weeds and Their Control — **R.J. Chancellor**

A fully illustrated guide to the most common weeds that trouble the home garden. Each of the weeds is shown, many in colour, with full details of its form, methods of reproduction and spread and finally control. A valuable reference for anyone interested in their garden.

$17.95

Common Weeds of Sydney Bushland — **R.A. Buchanan**

Many areas of Sydney's bushland are threatened by the encroachment of weeds. While some are attractive garden escapes all disturb the naturally occurring vegetation. The book provides clear drawings and short descriptions of some of the more common weeds and will prove invaluable to those who are involved with the restoration of this balance.

$ 9.95

Field Guide to Eucalypts Volume 1 — **M.I.H. Booker and D.A. Kleinig**

The first volume of the most complete and comprehensive guide to the eucalypts yet published. 1000 colour plates, descriptions of species and a lavishly illustrated introduction reveal the individual character of more than 240 members of this complex Australian genus. The area covered includes New South Wales, Victoria, South Australia, Tasmania and Southern Queensland.
$45.00

CONFERENCE ODE

How to Work and Learn and Live Without Sleep

In 1985 the word went out,
we've tried the rest, now try the best.

We'll head down to the roundabout,
We'll gather at the A.N.U.

And so on Sunday 4th May they all turned out.
The greeting was "Hello Mate" or "Who are You"
depending how long they'd been about.

On Monday morn we had a court to show the way
And as is usual when undefended,
Council had its day.

But when the cocky fronts the court,
It was shown, the whole show is quite a laugh.

You can gather facts until your sure
But your case the beak will, cut in half,
Unless your facts are stronger than a fort.

Des Thwaites (and here we should thank the sponsors),
Told us how to motivate the team, (this eve decided)
Applied mainly to the Seniors.

To some this is simply but a dream

The boys at night were prone to drink,
And talk and joke and then to think,
All the while they picked the brains of those they could,
And hid the stubbies in the drains.

And so the week wore on,
Tuesday night we were told,
How our grants were won.

On Wednesday the bus to look around,
Some absconded to see the sights, which do abound,
While Graham told us how we'd cooked our goose,
And Stan, told how, our super, not to loose.

Then they gathered Thursday night,
To drink and eat throughout the night,
'Twas there we said farewell,
To two good mates and wished them well,
They go we hope, to better things,
Where fish bite well, and summer sings.

On Friday then with eyelids heavy,
They all turned out, a sorry bevy,
To hear the last and plan the next
And some to swallow heaps of Bex.

All would voe in two years time,
They would train and be in their prime.

To Peter and the boys, we gave our thanks,
For a good time on "Burley's" Banks,
And headed home to ply our trade,
With zest and vigor of which our men are made.

I wish you luck my friends and
Hope to see you all 'ere in two years time.

With apologies to Clive Wilmot, Harvey Baker,
Dr Leon Smith and the raffle winners
Who all deserved mention
but time and space etc.....

A. Sprayer

Editors Note: Any officer unable to make rhyme or reason in the above should drink three fosters stubbies and try again. It will then make sense.

REGISTER OF ATTENDANCE

CITY COUNCILS

Blue Mountains *Graham Ware*	PO Box 189, *Noxious Weeds Officer*	Katoomba	2780	047 821333
Dubbo *John Wyatt* *Brian Bywater*	PO Box 81, *Deputy Engineer* *Noxious Plants Inspector*	Dubbo	2830	068 822211
Goulburn *George Nowak*	PO Box 164, *Parkes & Garden Supervisor*	Goulburn	2580	048 211444
Grafton *John Hoade*	PO Box 24, *Noxious Weeds Inspector*	Grafton	2460	066 422266
Kiama Municipality *Ken Miller*	PO Box 75, *Weeds Officer*	Kiama	2533	042 321122
Maitland *Alex Marciniak*	PO Box 220, *Weeds Officer*	Maitland	2320	049 336200
Queanbeyan *John Rosewarne*	PO Box 90, *Weeds Officer*	Queanbeyan	2620	062 980211
Shoalhaven *Ian Borrowdale*	PO Box 42, *Weeds Officer*	Nowra	2541	044 216011
Wagga *Doug Ebert*	PO Box 20, *Weeds Officer*	Wagga	2650	069 211088

COUNTY COUNCILS

Castlereagh-Macquarie *Ainslie Chun* *Ross Slack-Smith*	PO Box 31, *Chairman* *Chief Weeds Officer*	Walgett	2385	068 281337
Central Murray *Jack Atley* *Robbie Cheetham* *Keith Shelton*	PO Box 60, *Chief Weeds Officer* *Weeds Officer* *Weeds Officer*	Deniliquin	2710	058 812422
Central Northern *Roy Swain*	PO Box 115, *Weeds Officer*	Quirindi	2343	067 461755
Far North Coast *Don Armstrong* *Neville Akehurst* *John Perkins*	PO Box 378, *Chief Weeds Officer* *Noxious Plants Inspector* *Noxious Plants Inspector*	Casino,	2470	066 622396

Far North Western Slopes	PO Box 93,	Warialda,	2402	067 2922/16
Vern Lewis	*Chairman*			
Allan Burgess	*County Clerk*			
John Mason	*Chief Weeds Officer*			
Hawkesbury River	PO Box 75,	Castle Hill	2154	02 6340111
Ralph Kluin	*Alderman*			
Kevin Sloan	*County Clerk*			
Jack Daley	*Chief Weeds Officer*			
Mid Western	PO Box 138,	Mudgee	2850	063 721940
Jack McEwen	*Councillor*			
Cliff King	*Inspector*			
Greg Walsh	*Inspector*			
Val O' Brien	*Secretary*			
New England Tablelands	PO Box 94,	Armidale	2350	067 722361
Kevin Waters	*Chief Weeds Officer*			
Upper Macquarie	7 Lee Street,	Kelso	2795	063 314200
Tom McPhillamy	*Noxious Plants Inspector*			
Jill Coomer	*Noxious Plants Inspector*			

SHIRE COUNCILS

Bega Valley	PO Box 492,	Bega	2550	0649 21088
Alan Smith	*Noxious Plants Inspector*			
Bellingen	PO Box 117,	Bellingen	2454	066 551027
Graham Matthews	*Noxious Plants Officer*			
Bland	PO Box 21,	West Wyalong	2671	069 722266
Neville Kelly	*Ordinance Inspector*			
Bogan	PO Box 221,	Nyngan	2825	068 321503
Col Cluderay	*Health Inspector*			
Bombala	PO Box 105,	Bombala	2632	0648 83555
Alby White	*Weeds Inspector*			
Boorowa	PO Box 96,	Boorowa	2586	063 853303
Des Corcoran	*Weeds Officer*			
Cabonne	PO Box 17,	Molong	2866	063 623799
Ron Nalder	*Chief Weeds Inspector*			
Michael Frame	*Weeds Inspector*			
Carrathool	PO Box 12,	Goolgowi	2652	069 6511/4
Tom Reko	*Weeds Officer*			
Kevin Woods	*Weeds Officer*			
Coffs Harbour	PO Box 155,	Coffs Harbour	2450	066 522555
Ken Hayes	*Senior Noxious Plants Inspector*			

Cooma-Monaro *Mike Steinhaeuser*	PO Box 714, Cooma *Noxious Plants Inspector*	2630	0648 21177
Cootamundra *Barry Grace*	PO Box 420, Cootamundra *Weeds Inspector*	2590	069 422744
Cowra *Kevin Nelligan*	PO Box 342, Cowra *Noxious Plants Inspector*	2794	063 421488
Crookwell *Ray Bremner* *Jack Fahey* *Eric Croker*	PO Box 10, Crookwell *Councillor* *Weeds Officer* *Assistant Weeds Officer*	2583	048 321022
Dungog *Ian Dent*	PO Box 95, Dungog *Weeds Officer*	2420	049 921224
Eurobodalla *Graham Bruce*	PO Box 99, Moruyu *Noxious Plants Inspector*	2537	044 741000
Great Lakes *Chris Hopton*	PO Box 450, Forster *Noxious Plants Inspector*	2428	065 546277
Gloucester *Bruce Redman* *Warren Ellis*	PO Box 11, Gloucester *Dept. Engineer* *Noxious Plants Inspector*	2422	065 581601
Gunnedah *Greg Collyer*	PO Box 63, Gunnedah *Noxious Plants Inspector*	2380	067 420422
Gunning *Dennis Hillier*	PO Box 42 Gunning *Weeds Officer*	2581	048 451312
Harden *Damian Minehan*	PO Box 110, Harden *Weeds Officer*	2587	063 862305
Hay *Ed Gregory*	PO Box 141, Hay *Weeds Officer*	2711	069 931003
Holbrook *Ron Rowe*	PO Box 99, Holbrook *Weeds Officer*	2644	060 362155
Jerilderie *Frank Ham* *Dick Honeyman*	PO Box 96, Jerilderie *Councillor* *Noxious Weeds Inspector*	2716	058 861200
Junee *George Sainsbury*	PO Box 93, Junee *Noxious Plants Inspector*	2593	069 241766
Lachlan *Ian Yeomans*	62-64 Molong St. Condobolin *Weeds Officer*	2877	068 952377
Maclean *David Gairns* *John Hardy*	PO Box 171, Maclean *Deputy Engineer* *Weeds Officer/Ordinance Inspector*	2463	066 452266

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Brian Abra	*Operator*			
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Anthony Lawler	*Weeds Officer*			
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