final report

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Weed Research Delivery

To Producers Through Advisors

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Abstract

A package of information, resources and manuals have been developed (to draft form) to facilitate enhanced technical weed management information delivery to producers through advisors based on the 3-D principles – Deliberation, Diversity, Diligence.

The package is designed for training advisors on how better to deliver weeds management information to producers in a consistent and effective manner and also encourage emphasis on competitive pastures (and) as a basic premise of effective weed management.

An active delivery strategy is proposed, to be managed in partnership with other stakeholders in weed management delivery, to facilitate an initial training program for advisors followed by coaching advisors as they deliver weed management workshops to producers before releasing the revised package for general use.

Executive Summary

MLA has interests in enhancing significant improvement in weed management by livestock producers.

Based on a series of integrated projects to:

- understand the social issues associated with motivating producers to adopt better weed management strategies, as well as identifying barriers to undertaking effective weed management
- review success factors in extension strategies for technical communication and
- develop a series of best management practice information packages/guidelines and case studies for successful weed management in grazing systems

An active delivery strategy, resources and manuals have been developed for delivery to producers through advisors and based on the 3-D principles of weed management – Deliberation, Diversity and Diligence.

In essence the 3-D principles are framed as follows:

- **Deliberation** – identify, evaluate and map the weed status and risk across the property; prioritise paddocks for control (SWOT techniques – see below); research and evaluate alternative methods of control, containment or management;
- **Diversity** – plan and implement multiple appropriate methods of weed management to enhance overall effectiveness and minimise weed adaptation to a single weed control method (eg chemicals)
- **Diligence** – Adhere to, and persist with, routine practices at the correct time on an on-going basis and continuously look for and remove new incursions i.e. – “keep the foot on the throat”

The products and resources have been developed to draft stage as a basis to engage with other national, state and regional stakeholders with interests in improved weed management in pasture based agricultural systems to participate in an active delivery program on weed management.

The intention is to facilitate a series of workshops for advisors to educate them on the principles of weed control strategies, better assessment and advice on competitive pastures as a basic premise for successful and lasting weed management, introduce them to the resource materials that have been developed and educate them on strategies and tactics they can use in designing and running workshops for producers on weed management.

This would be followed by some limited coaching of advisors in workshop activities with producers and use the feed back from this process to revise the materials and resources for general release and use by others.

The expectation is that the livestock industries will benefit significantly through enhanced carrying capacity and reduced costs of weed management over the longer term and that producers will benefit from a better and more effective approach to weed management which is manageable and achievable.

It is also anticipated that there will also be considerable environmental benefits from this process including more effective weed control in native vegetation and reduced herbicide usage.

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1 Background

Meat and Livestock Australia, in partnership with Australian Wool Innovation (AWI), has facilitated development of:

- a range of information products on weed management
- a review on key motivators for producers in adoption of improved weed management strategies
- and review on effective extension tactics useful in weeds management contexts

These outputs are in addition to a range of existing MLA and AWI communication tools on weed management for Australian graziers.

This Project sought to capitalise on this effort by developing active delivery workshop plans, materials and activities aimed at training advisors to delivery improved weed management technologies and practices to producers.

The longer term objective is to educate and empower farmer advisors to encourage producers across southern Australia to improve their weed management.

2 Project Objectives

By 30 June 2007 develop and pilot a delivery program on best practice weeds management to at least 12 extension workers to equip them to deliver to producers.
The project will deliver:

- A reference group of producers
- A “Less Weeds in Pastures” publication
- Train the trainer resource kit including lesson plans, workshop delivery manual, training resources and technical materials.
- Piloted training workshop for advisors
- Identified new tools to assist in weed decision makers by producers
- A draft delivery strategy for training advisors to more effectively deliver weeds management best practice to producers

3 Methodology

The following tasks were undertaken:

Gather, evaluate and utilise existing information products, tools, reviews, manuals and training programs relevant to weed management in pastures from state agencies, CRC weeds, weeds task forces and MLA as background to the development of an MLA publication – “Less Weeds from Pastures”

Develop a “Less Weeds from Pastures” technical, “do-it-yourself”, weed management technical publication aimed at producers which describes the principles of weed management and assist with their on-farm decision making. The publication should be based on and consistent with MLA’s

"Making More From Sheep" template, have portability across pasture based agricultural systems and audiences and should contain:

- A decision tree based on the 3 Ds of weed management
- Within each 3 D category describe the essential principles of weed management relevant to producer decision making
- Critical "what to do" and "how to do" information necessary for producers to activate weed management activities based on the 3D approach
- Within each "what to do" action describe key principles, critical decisions and benchmarks important to move producers to action.
- Ensure the publication is consistent with MLA 's "Making More from Sheep" manual

Form a producer reference group containing 3 producers from the HRZ and 3 from the cereal zone and who are capable of articulating their decision making processes with respect to weed management and use this group to:

- Review the "Less Weeds from Pastures" publication
- Refine and develop the decisions and decision processes necessary for effective weed management on-farm in the publication
- Identify outstanding information or decision tools to be included in the publication in aiding decision making in weed management
- Identify gaps in information/tools available to help producer decisions that need to be developed

Revise the technical bulletin, test the updated document with the reference group and develop a final draft ready for graphic design.

Develop a pilot train the trainer workshop and supporting manual designed for advisors aimed at equipping them to deliver effectively to producers. This should:

- Draw on reports on producer motivators (UNE) and improved extension methods (Rural Enablers) to structure the advisor workshop and manual on the 3D principles of weed management and how to best deliver to producers
- Develop a delivery "resource kit" for advisors including lesson plans, resource materials, teaching tools and presentation for advisors to use as a base to customise their producer workshops
- Include a reference list to signpost where additional information can be obtained from such as bmps, case studies, manuals etc
- Utilise the technical bulletin developed in tasks 3,4 as a key resource for advisors to provide to producers

Pilot the training. Key elements should include:

- Organise and conduct at least 2 pilot workshops in different locations and to include a mix of weed advisors, commercial agronomists, council officers, CMA officers.
- An evaluation of the workshop from perspective of participants and deliverer. An author of the UNE report is recommended as an independent evaluator.
- Review feedback, revise training program and resources for wider delivery to advisors. Develop the manual and delivery "resource kit" to draft stage ready for graphic design

Prepare a draft delivery strategy for the advisor training outlining key target audiences, (who, where, when) and recommendations on delivery tactics and critical success factors

4 Results and Discussion

4.1 The Producers Guide – Less Weeds from Pastures

A manual designed for producers on effective weed control was developed to draft stage (Appendix 1) and has integrated three key approaches into a single instructive weed control manual:

- **The "3D" approach** to weed management developed by UNE (see WEED.120 Final Report)
    - The "3D" approach provides an organisational framework for evaluating, planning and implementing an effective weed control program:
        - **Deliberation** – identify, evaluate and map the weed status and risk across the property; prioritise paddocks for control (SWOT techniques – see below); research and evaluate alternative methods of control, containment or management;
        - **Diversity** – plan and implement multiple appropriate methods of weed management to enhance overall effectiveness and minimise weed adaptation to a single weed control method (eg chemicals)
        - **Diligence** – Adhere to, and persist with, routine practices at the correct time on an on-going basis and continuously look for and remove new incursions i.e. – "keep the foot on the throat"
- **The Weed Control Pathway** (Burton and Dowling) from the "Weed Removers : Pasture Improvers" EDGE course.
    - This provides a pathway to follow in applying the deliberation and diversity elements of the Weed Removers course. These include:
        - **Awareness** - Develop an awareness and list of both existing and potential weeds on or near the property as well as beneficial or desirable, competitive species
        - **Identification** – Learn to identify existing and emerging weeds; best with live specimens and at least at both seedling and flowering stages
        - **Life Cycles** – develop an appreciation of weed and pasture growth patterns; grass, broad leaf; annual, biennial, perennial; winter or summer active; timing and length of periods of germination, flowering and seed production; soft or hard seededness; growth habits. Develop a table of problem weeds to summarise these features.
        - **Ranking** - weed threats in terms of life cycle, ease/difficulty of control, toxicity for livestock, cost of control, potential feed value, impact on pasture production, competitive capacity.
        - **Mapping** – Develop a paddock by paddock map of weed infestations to target and prioritise actions and monitor progress in control or management.
        - **Status** – Assess weed and pasture status of paddocks. See the SWOT approach below.
        - **Pasture Composition Targets** – Determine pasture composition target ranges for each paddock in consideration of soil type, rainfall, slope, aspect, pasture type, animal production enterprise, seasonal growth patterns.
        - **Weed Risk** – Assess weed risk, paddock by paddock, based on the SWOT analysis and using an assessment template developed by Burge.
        - **Action Plan** –Place primary emphasis on fostering a competitive pasture and then assign a diversity of control measures to ensure success
        - **Methods and Actions**

- **Weed Removers** – First priority is declared noxious weeds which should be removed and their spread prevented; then invasive and unpalatable broadleaf weeds with selective herbicides when composition is >10% with care to minimise damage to legumes and to help desirable species compete; then undesirable annual grasses when composition is >20% using grazing, spay topping and winter cleaning strategies
- **Pasture Improvers** – Enhance competitiveness of desirable pasture species, particularly perennial species supported by appropriate grazing management and fertiliser strategies

▪ **Diligence** – adhere to routine practices at the correct times following a calendar of activities for each target weed

- **The SWOT approach** developed by Burge.
  - This provides a methodology to assess the risk associated with each paddock with respect to the competitiveness of existing pasture and what is required for effective weed management. It requires developing a paddock profile in terms of:
    - **Strengths** – capacity of the pasture to compete
    - **Weaknesses** – susceptibility to weed invasion
      - These two are evaluated in terms of:
        - Ground cover
        - Herbage mass
        - Perennials
        - Soil fertility
    - **Threats** – weeds most important to control based on an assessment of the weed species present, extent, invasiveness, presence of noxious weeds.
    - These three elements are considered in assigning a risk assessment score (see table next page).
    - **Opportunities** – available management strategies based on % perennial grass surviving and what is required to foster a pasture competitive to weeds.

- ## Paddock Weed Risk Assessment

Strengths (capacity of pastures to compete) & Weaknesses (susceptibility to weed invasion)	**Risk Score**	**Your Score**
Ground Cover		
• > 90%	**0**	
• 70-80%	**1**	
• < 70%	**2**	
Note: The preferred level of ground cover will vary according to the environment and potential weed problem. In sloping non-arable terrain of low fertility a target of 80 % may be more appropriate		
Herbage Mass		
• > 1500 kg DM/ha	**0**	
• 1000 – 1500 kg DM/ha	**1**	
• < 1000 Kg DM/ha	**2**	
Note: Where highly invasive and difficult to control weeds are a threat (eg serrated tussock) a target of 1 500 kg DM/ha is recommended		
Perennials		
• > 40% - score	**0**	
• 20-30% - score	**1**	
• < 20% - score	**2**	
Note: The target level of perennial species will vary according to environment, rainfall, pasture type and soil type. Seek advice for your location. If too dry stimulate early growth with the "green well" technique – see glossary.		
Fertility Status		
• High fertility in perennial pastures, > 40%	**0**	
• Low fertility in perennial pastures, >40%	**2**	
• Low fertility in 'annual' pastures, perennials < 20%	**1**	
• High fertility in 'annual' pastures, perennials < 20%	**2**	
Note: High fertility in pastures of low perennial grass content will encourage weed growth. Low fertility soils allows well adapted weeds to out-compete pasture species with higher nutrient requirements. This is a predictor of responsiveness of pastures to rainfall and capacity to compete with weeds.		
Threats – which weeds are the most important to control		
• **Declared noxious and perennial weeds** – eg Serrated Tussock, African Lovegrass, Chilean Needlegrass, St John's wort	**5**	
• **Invasive and competitive biennial and annual broadleaf weeds** – eg Silver Leaf Nightshade, Onopordum thistles, Fireweed, Nodding Thistle, Heliotrope, Ragwort	**4**	
• **Annual broad leaf weeds** – unpalatable and difficult to control – eg thistles, Paterson's Curse	**3**	
• **Annual broadleaf weeds** – palatable – eg Capeweed, Brassicas	**2**	
• **Annual grass weeds** which provide a useful feed source but may host soil borne disease for crops	**1**	
Risk Assessment – the higher the score, the greater the risk to weed invasion **Note:** The higher the ranking the greater the need to prioritise this paddock for effective management. The capacity of the pasture to compete with the weed must be assessed relative to the weed risk.		
Opportunities – key management strategies. Key indicator is the % perennial grass surviving. • **< 20%** - pasture degraded, needs re-sowing or renovation • **~ 20 - 30%** - de-stock for 12 months to allow to recover • **> 30%** - good basis for a productive, competitive perennial pasture. Need to be grazed strategically to allow plants to recover, regenerate carbohydrate root reserves and increase spread. Defer grazing in spring for 10-12 weeks		

4.2 The Training Manual For Advisors

A manual designed as a resource for Advisors in southern temperate Australia to use in planning and delivering education sessions to producers has been developed to draft stage (Appendix 2).

The purpose is to provide extension workers with sufficient knowledge and skills to effectively conduct producer training in the area of weed management. The emphasis is on producer group education activities but is applicable to one-on-one situations. The learning outcomes for candidates for the course are:

- Be able to plan and conduct group training aimed at specific weed or weed management strategies
- Understand and adapt the 3-D approach to weed control as an organising theme for planning and executing workshops as well as more general communication on weed management with producers
- Develop an understanding of some key sociological aspects of weed control and weed management which impact on inducing producers undertaking change on farm
- Understand the principles of adult learning to help tailor individual learning experiences with the characteristics of the learner.
- Develop an adequate knowledge of the principles of weed control and pasture management consistent with the self-help producer manual – “Less Weeds From Pastures”

The manual is designed to recognise different needs and learning styles of producers and recognises that producers need access to a range of learning approaches to accommodate their needs.

The course stresses the need for an integrated approach to weed and pasture management through encouraging competitive pastures in conjunction with well planned and implemented weed management practices.

Once again there is emphasis on the 3-D approach to weed management as the organising theme for developing and communicating the course objectives and key messages to producers. This is consistent with the producer guide.

The manual places emphasis on the following concepts:

- Weeds are a symptom of pasture decline and degradation.
- Weeds must be replaced by desirable, productive and competitive species
- There are no 'silver bullets' for weed control in pastures – just persistent endeavour.
- Weed control must fit within production, sustainability and whole farm planning targets.
- Good weed control does not reside in a drum of herbicide – a diverse range of integrated tactics provides the most efficient and cost-effective approach.
- Correct weed identification leads to the appropriate selection of control options and aids in effective and timely management.
- Weed management is an essential and integral part of the sustainable management of natural resources and the environment.

- Prevention and early intervention are the most cost-effective strategies that can be employed against weeds.
- Implementing the 3 D approach provides a framework for planning and implementing a lasting weed control program.

The manual has been structured into a range of segments:

4.2.1 Farmers and Weeds – the Sociology of Weeds

- Emphasis on understanding producer decision making processes with respect to adoption of new practices; evaluation of risk, uncertainty and learning needs; consideration of motivations and aptitudes, as well as barriers to adoption .
- Organisation of communication around a common theme – the 3 Ds – Deliberation, Diversity, Diligence
- Segmentation of producer characteristics according to attitudes towards management change as a means to identify motivators for change. Two approaches are offered – one focused on pasture management and the other on weed management.

Market Segments for Pasture Management (Barr and Cary, 2000)

Segment Features	
Committed	<15% - driven by production and profit, place high value on information, receptive to farm innovation and practice change
Pasture Part Timers	Motivated to improve productivity and income but constrained by other commitments
The Crop Focussed	In mixed farming zone; see pastures as a tool to improve crops and stock for stubble management; often negative toward grasses, particularly perennials
Belt Tighteners	Largest group (30-=40%); prefer conservative grazing strategies rather than innovation; risk averse; require trialling to influence attitude and practice change
Sceptics	10-20%; distrust promoted advantages of pasture improvement; often have scale to provide acceptable income at low stocking rates
Comfortable	20-40%; typically older; cattle for lower management needs; averse to increasing workload and risks; perception that they are secure
Retreatists	Absentee hobby farmers or rural residential dwellers; more interested in aesthetics; limited time to manage blocks

Market Segments for Weed Control (van der Meulen, et al 2006)

There appear to be at least three groups for which communication resources and strategies should be structured:

Segment Features	
Poor Weed Managers	Ineffective; unplanned; reactive; few methods of control; ad hoc. **Communication Tactics** • Visual communication aids – show weeds and thresholds • Emphasise early intervention saves on labour, money and time • Emphasise long term risk of lack of action • Publicise critical or timely weed management opportunities at appropriate times with recommended control tactics • Emphasise simpler weed management routines with a few uncomplicated methods deployed diligently.
Simple Diligents	Achieve reasonable weed control through diligent application of a small number of uncomplicated mechanical and chemical methods. Persistent; motivated by pride in property; concerned about pasture productivity; may be losing due to lack of recognition of weeds; awareness may lead to action; unlikely to respond to new weed control practices (current practices effective); largely reliant on herbicides; may slip to poorer weed manager as costs increase, new weeds appear, less labour is available, increase in herbicide resistance, producers age. **Communication Tactics** • Develop skills in identification of weeds (including grasses) • Publicise new and emerging weed problems • Promote newer weed control methods
Better Weed Managers	Younger; progressive; often mixed farmers; some off-farm commitments; internet savvy **Communication Tactics** • Promote on emerging weed threats, • Emphasise alternatives to herbicides, better pasture management, time-saving tactics • Promote diversity of management tactics • Provide easy access to relevant weed management information

- Understanding the adoption process for which readily adopted technologies are generally:
  - commensurate with other farm activities;
  - clearly profitable;
  - do not require a substantial capital or intellectual outlay;
  - involve little risk;
  - do not require a major change to farm management;
  - are simple;

        - can be adopted in parts;
        - are widely and uniformly supported by extension agencies, other farmers and farm literature; and
        - do not reduce farmers' flexibility.
    - Motivations for better weed management including:
        - Knowledge of weed life cycles and growth stages vulnerable to controls
        - Fitting weed control with existing farm operations
        - Time of year relevant to main weed control periods
        - Concerns over increasing weed levels or new invasive weeds
        - Concerns over production or product quality penalties although this may not motivate day-to-day decisions about weed control
        - Advice from agricultural advisors
        - Successful weed control by well-regarded producers
        - Weed management practices that save time, labour and costs over current practices
    - Barriers to adoption of improved weed management practices
        - Within management control – perceived lack of time, money or labour
        - Perceived beyond management control – drought, incursions from neighbours or public land
        - Difficult country to access for weed control
        - Dislike of chemicals and limited knowledge of alternatives
        - Inability to identify weeds and their importance
        - Perceptions that particular weeds have feed value
        - Lack of understanding of the value of competition from desirable pasture species

4.2.2 Facilitation Outline

This is a guide for advisors to prepare, plan and conduct a training workshop on weeds and include the following elements:

- Planning the physical aspects of the workshops – where, when, time, space, aids consistent with workshop purpose
- Using the 3 D approach as an organising theme for weed management training with particular emphasis on the messages, the audience and effective communication
- Defining workshop goals, objectives and outcomes.
- Developing a lesson plan around the key themes of deliberation, diversity and diligence

4.2.3 The Training Guide

This section provide a practical approach to developing an action plan for preparing for and organising the training delivery session and its follow up.

It provide a resource checklist for materials and resources that may be needed and an overview of the delivery methods that might be deployed for best effect and based on the "action learning cycle" of "action (do it) – observation (participant responses) – reflection (participant feedback) – change (modify to improve)".

4.2.4 The Workshop Lesson Plan

An indicative lesson plan for a weed management workshop is provided for customisation for local conditions and purpose. Sections include:

- Activity definition – listening, questioning, discussion, hands-on.
- Purpose
- Key messages
- Suggested approaches to be considered

Several elements for the workshop using this framework are suggested on:

- Plant (weed) identification
- Pasture assessment
- Diversity of tools and tactics that can be deployed
- Calendar of operations – when to deploy tools and tactics
- Conclusion and evaluation

4.2.5 Extension Methods and Strategies

This section offers advice on extension methods that may be used by weeds advisors for best effect with producers. They include:

- Aim to simplify weed management approaches through establishing routine practices deployed diligently
- Develop and disseminate regional calendars of recommended weed management actions
- Customise advice for local/regional conditions and enterprises
- Publicise un-seasonal conditions that indicate departures from routines
- Localised information sources are regarded as useful
- Publications from credible sources are valued
- One-to-one communication is valued by most producers while group activities are valued by those who appreciate this form of learning and sharing of experiences.
- Some do's and don'ts:

Method	Do	Don't
One-on-one	Develop relationship with producer and get to know his/her system Spend time going around the farm listening and observing Build trust and confidence by giving relevant, useful advice – start by dealing with simple problems first	Make assumptions without exploring the situation in detail Jump to conclusions or solutions
Demonstrations	Involve the host farmer and other local producers in setting up and managing the site Enlist the help of "Champions" to recruit other farmers and promote the	Make the demonstration too complicated (simple designs are best) Make the site and conditions too different to those of surrounding enterprises

	demonstration Ensure resources are adequate for all the activities required Ensure that the trial can be observed easily and results are scientifically robust and reliable	
Group activity	Use where peer support and sharing between participants is important Use where different perspectives and skills can improve the learning outcomes	See as a method for all occasions Use with people who are not comfortable in groups Run groups without facilitation training and skills
Field days	Use as part of integrated strategy for awareness raising Spend time and effort in planning Ensure comfort and safety Allow for different learning styles (eg visual, auditory, kinaesthetic)	Expect major practice change as a result Take too much time in presentations – let the participants explore and observe
Brochures and publications	Target for specific purpose (awareness or information dissemination) Integrate with other methods Make user friendly –simple and concise	Overload people with information Distribute indiscriminately – target the market – eg “point of sale”
Internet	Make site simple and easy to navigate – cater for low bandwidth and unskilled users Target specific market (eg competent users or service providers)	Do your own design – know what you want and employ a designer to get there Substitute this medium for others eg print

4.2.6 Group & Adult Learning Principles

This section has been adapted from the National Heritage Trust Introductory Weed Management Manual and provides insights into the principles of adult learning and group training and emphasises the principles of:

- Active learning – learn by doing
- Meaningful material – relate to existing knowledge
- Multi-sense learning – sight, hearing, touch, small, taste etc

- First and last impressions – prepare introductions and conclusions carefully for impact
- Practice and reinforcement – exercises to try and revise new skills and knowledge
- Feedback – encourage interaction and questions
- Reward - encourage

4.3 The Resources Kit

The resources kit is a work in progress aimed at providing advisors the tools, exercises and resources which they can customise for use within workshops.

It contains examples of fact sheets, workshop exercise guidelines, weed management publications and references to further reading.

A series of case studies and “Best Management Practices”

4.4 The Delivery Strategy

A delivery strategy has been suggested which seeks to train weed advisors to deliver to producers from the premise that competitive pastures are a starting point in the key to long term effective weed control and weed management strategies should be organised around the 3 D concepts.

The proposed strategy recognises that advisors to producers on weed management are often better informed on the weeds and direct weed control tactics (usually based on chemicals) of specific weeds than the important aspects of assessing and advising on competitive pastures as a key management tool in weed management.

The proposed next steps are to develop an active weeds management delivery program in partnership with relevant stakeholders such as the national weeds menace program, CMA’s and the relevant state and local government departments which have interests in weed management on-farm. It is proposed that the materials developed as part of this project would be made available to interested stakeholders to utilise and also integrated into EDGE courses facilitated by MLA.

The intention is to facilitate a series of workshops for advisors to educate them on the principles of weed control strategies, better assessment and advice on competitive pastures as a basic premise for successful and lasting weed management, introduce them to the resource materials that have been developed and educate them on strategies and tactics they can use in designing and running workshops for producers on weed management.

This would be followed by some limited coaching of advisors in workshop activities with producers and use the feed back from this process to revise the materials and resources for general release and use by others.

5 Success in Achieving Objectives

The objectives of this project have been met. A package of products, an organisational and conceptual framework and a proposed strategy have been developed to facilitate improvement in weed management, particularly for weeds of significance – Serrated Tussock, African Lovegrass, Chilean Needlegrass, Paterson's Curse, Silverleaf Nightshade, and Onopordum spp.

The resource materials – Producers Guide, Facilitators Manual and Resource Kit have been prepared to draft stage and now require graphic layout

6 Impact on Meat and Livestock Industry – now & in five years time

A recent review by Sinden et al (2004) of the economic impact of weed on the agricultural industries for the Weeds CRC indicated that for the livestock industries in 2001-02, the impact was $345m in direct control costs and indirect production opportunity costs of $1870m for a total of c. $2200m.

Based on this report, even a 10% reduction of these costs by influencing change on farm through partnerships with others with interests in weed management would equate to an industry benefit of some $220m per annum.

The scale of achievement of change on farm will depend on the extent to which MLA can engage with others to deliver firstly the training to advisors in delivery to producers and then encourage the advisors to competently deliver better weed management strategies to producers in such a way as to encourage positive change.

Ultimate success will be greater if there is an active management process rather than just making the package of products and resources available to others.

7 Conclusions and Recommendations

An innovative package of materials and resources has been developed to help facilitate a new communication approach on weed management for producers through advisors. The package has been developed for use both by MLA and other organisations and individuals with interests in influencing producers to improve weed management.

For success the following recommendations for an active delivery strategy are offered:

- Further develop the resource materials with appropriate graphic layout.
- Engage with DAFF, LWA, DPIs, local government authorities ,CMAs and other organizations who have responsibility and interests in weed management to offer the package for use in their weed delivery strategies to encourage consistency of approach and information provided to producers
- MLA (with other interested organisations or groups as stakeholders) deliver some initial training to advisors to introduce the package, educate them on aspects of assessing and

promoting competitive pastures as a basic premise for weed management and introduce the 3-D approach to weed management.

- MLA facilitate a mentoring program to coach advisors in developing and delivering workshops to producers using the materials and resources made available by MLA
- Use this experience to revise the package and in consultation with other weeds delivery stakeholders offer the package for general use in the pasture based grazing industries
- It is important to note that many advisors working in the field of weed control have only limited knowledge of integrated weed and pasture management and that this package of resource materials and supportive complementary training helps to address that fundamental knowledge gap. In doing so it helps to increase their skills, knowledge and, importantly, confidence which will ultimately enhance their effectiveness as weed control advisors."

8 Bibliography

Barr N and Cary J, (2000) Influencing improved natural resource management on farms: A guide to factors influencing the adoption of sustainable natural resource management practices. Bureau of Resource Sciences, Canberra.

van der Meulen A, Sindel B and Reeve I (2006) The Sociology of Weeds: Motivating, Building Capacity and Educating Grazers Who Fail to Control Weeds. Final Report Weed.120; MLA

Sinden J et al (2004) The Economic Impact of Weeds in Australia. CRC for Australian Weed Management Technical Series #8.

9 Appendices

9.1 "Less Weeds From Pastures" Producer's Guide

9.2 Weeds Train the Trainer Facilitator's Manual

9.3 Resource's Kit

Appendix 1
“Less Weeds From Pastures” Producer’s Guide

Prepared by: Stuart Burge

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1 Background

The “Less Weeds from Pastures” Manual is to be based upon three approaches to weed control.

- The 3-D approach developed by UNE
- The weed control pathway described in the Pasture Management for Weed Control book developed by Jeff Burton and Peter Dowling and which forms the basis of the Weed Removers: Pasture Improvers EDGEnetwork ® Course.
- The SWOT approach to weed control developed by Stuart Burge

In essence the 3D approach provides the (organisational) framework or structure for undertaking (planning and implementing) an effective weed control program. This includes:

Deliberation in the planning of weed control, and undertaking it in a strategic fashion that takes advantage of knowledge of the life cycles of weeds and desirable pasture species.

Diversity in the number of weed control practices used, and how multiple methods are used together to obtain better and more cost effective control; and

Diligence in adhering to routine practices, using them in a timely fashion and maintaining weed control as a high priority among all the other tasks competing for the farmer’s time and attention.

A pathway to follow in actually applying the deliberation and diversity components is that in the Weed Removers Course.

The SWOT approach has been developed to complement the weed control pathway and to help provide an assessment of the status of a paddock in terms of its weediness, its competitiveness and productive potential. In doing so it helps in selecting appropriate tactics or tools as well as helping prioritise paddocks for either weed control or pasture renovation.

2 Introduction

2.1 The 3D Weed Approach

A survey of landholders undertaken by the UNE on behalf of MLA and AWI has indicated that effective weed control can be achieved by adhering to what has been described as the "3D" approach to weed management. This involves:

Deliberation in the planning of weed control, and undertaking it in a strategic fashion that takes advantage of knowledge of the life cycles of weeds and desirable pasture species.

Diversity in the number of weed control practices used, and how multiple methods are used together to obtain better and more cost effective control; and

Diligence in adhering to routine practices, using them in a timely fashion and maintaining weed control as a high priority among all the other tasks competing for farmers' time and attention.

3 Deliberation

What is a Weed?

In the strictest sense and one which is commonly taught at school a weed is defined as "a plant out of place". That is, a plant growing where you or any landowner does not want it to be. As each individual landowner will have a different perspective regarding what is desirable – as influenced by personal land management goals – then so too will the definition of a weed vary from individual to individual. In other words "beauty lies in the eye of the beholder!" It is equally apparent that a plant may vary in its weed status throughout the year, again in accordance with our own personal management objectives. For instance annual grasses such as barley grass and Vulpia or native perennials such as Austrostipa (spear/corscrew grasses) provide useful grazing when they are in their vegetative (leafy) stage but may be regarded as undesirable weeds when they produce their awned seed heads during spring.

In short then a weed is any plant which is undesirable or unwanted at a particular point in time.

In order to better appreciate the importance or significance of what constitutes a weed it is equally relevant to consider what we regard as *desirable* plant species. By definition a desirable plant is one whose presence is consistent with and allows us to achieve our land management goals.

Within the context of agriculture a weed may be further defined as any plant which reduces our capacity to sustainably produce food or fibre while a desirable species is one which enhances our ability to do so.

At the same time due consideration must be given to the environmental status of plants which may also indirectly influence agricultural productivity over the long term.
In the process of planning and implementing a weed control program using the 3D approach it is useful to follow a step-by-step process of decision making.

The Decision Tree

The decision making process with regard to effective weed management should encompass the following step by step approach:

1. **Determine the weed status/risk** of individual paddocks using a SWOT analysis as outlined below
2. **Prioritise paddocks for control** based upon the results of the individual SWOT analysis
3. **Evaluate the various weed management tools** available and allocate according to the situation, economics and overall farm management goals
4. **Implement a plan** of action

3.1 Procedure 1

3.1.1 Weed Familiarity / Become familiar with Local & potential weed problems

What to Do / How & Why

The first basic step is awareness of both the existing as well as potential weeds which exist in the district or vicinity of the property. These may not necessarily be growing on your own property but they are already known to be present locally. It is useful also to become acquainted with emerging or potential weed problems which, while not yet present, may be growing in a similar environment or in reasonably close proximity.

Existing weeds: Compile a list of all the known weeds growing within the local area. At this stage do not differentiate between them in terms of importance or their weed status -this is just an exercise in familiarity with weeds growing in the local area. Such information will usually be readily available through the local government weeds authorities; state department of agriculture or primary industry; or local agribusiness stores. Alternatively other landowners within the district are an excellent source of information.

Emerging weeds or "sleeper" weeds. Using a similar approach to that above it is also important to list weeds which have been identified as potential threats to the immediate district or region. Most of these will be known by name only or indeed will never have been heard of.

A key aspect of this process is to become familiar with any 'declared noxious weeds' for the local area. A list of these can be provided from local weed control authorities.

At the same time find out if there are any Weeds of National Significance, a list of which is provided in the Appendix of this Manual. These will also (provide list in Appendix)

Declared noxious weeds and weeds of national significance are especially troublesome, invasive and difficult to control and therefore must always have the highest priority in any weed control program. A zero tolerance should be the aim for all landholders.

Key Message: Compile a comprehensive list of ALL potential weeds which may either already exist or threaten your property now or in the future, noting especially declared noxious weeds and weeds of national significance.

3.2 Procedure 2

3.2.1 Weed Identification / Learn to identify Existing and Potential Weeds

What to Do / How & Why

For both the existing and emerging weeds of the district listed above which are personally unknown to you the next essential step is to learn to identify them. In the first instance this can be undertaken using photos or diagrams, however effective ID is realistically only achieved by actually inspecting live specimens. Become proactive in seeking out locations where these plants are growing and become familiar with their growth habits and any key identifying features. Local farmers and weeds authorities are usually very obliging in assisting in this process.

Because weeds can vary significantly in their shape and morphology (form) throughout their life cycle it is important to be able identify weeds at various stages of growth. This is especially important when weeds are in their very young seedling stages because this is a critical time to control weeds. The flowering stages are equally important to identify in order to help prevent further seed production.

Remember experience suggests that most weeds become a problem through lack of familiarity and inability to identify them when they first appeared so this is of fundamental importance in the deliberation process.

Key Message: Gain confidence in being able to identify all potential weed problems at each critical stage of their life cycle, especially as seedlings and in the flowering stage. Seek help if unsure.

3.3 Procedure 3

3.3.1 Understanding the Life Cycle of Plants / Understanding How Plants Grow

What to do / How & Why

Developing an appreciation of the basics of plant growth is essential in planning an effective weed control and pasture improvement program.

Plants may either be categorised as grasses (what are scientifically described as monocotolydons) or broadleaf plants (dicotolydons).

While this may sound overly simplistic this basic difference is important especially when it comes to herbicide usage. For instance a ‘selective’ herbicide which controls broadleaf weeds will usually have minimal or no effect upon the grass family of monocotolydens. Similarly selective grass-only herbicides do not in the main affect broadleaf plants.

For this reason broadleaf weed control in a grass-only pasture using herbicides is more straightforward than say, controlling broadleaf weeds in a broadleaf based pasture such as one which includes lucerne, clovers or herbs.
(Note: This is a broad generalisation and before using any herbicide always seek technical assistance and read the label thoroughly).

Plants – whether grasses or broadleaved – may be further differentiated according to their life cycles into three broad categories - annuals; biennials (i.e. bi-annuals); or perennials.

Annuals are those which understandably complete their life cycles within one year or less. They may be “winter” growing or “summer” growing. Examples of winter growing annual plants include annual ryegrass, Paterson curse, barley grass, Capeweed etc while summer growing annuals include fat hen, Bathurst burr, sweet vernal grass, silver leaf nightshade etc).

Biennials as the name implies live for between one and up to two years and include plants such as Scotch thistle, nodding thistle etc

In some situations and in some more favourable environments annual plants may in fact behave as bi-annuals (or even short lived perennials) depending largely upon when they germinate and their capacity to survive from one year to another. Under such circumstances control is more difficult because you end up with what is effectively a “mixed infestation” and this restricts herbicide selection and efficacy. This is because there will be a mixture of smaller rosettes –which are easier to control – as well as larger more mature plants which may require a “stronger” alternative herbicide or a higher application rate.

Perennials are longer lived plants which, once established may grow for several and often many years. Weedy examples include serrated tussock, African lovegrass, blackberries while desirable perennials include phalaris, lucerne, perennial ryegrass, Microleana etc

From a weed management perspective it is important to emphasise a number of points relating to their lifecycles:

Firstly while all three categories of plants flower and produce seed each year as a part of their reproductive cycle, annual plants – and to a lesser extent biennials – are totally dependent for their longevity upon their capacity to produce viable seed and for that seed to be able to germinate and grow in the following year. Any management tool which in the first instance prevents or restricts these plants from being able to produce seed and secondly can reduce/restrict their ability to germinate and grow in the following year will reduce their population.

The period of flowering/seed set and germination/seedling establishment can therefore be regarded as the weak point or vulnerable stage of their life cycle, the knowledge of which can be targeted in any integrated weed control and pasture management program (see later).

The timing germination and flowering will depend upon whether the plant is predominantly a winter or spring growing. In southern Australia winter dominant rainfall environments the majority of annual species germinate in autumn/early winter and flower in late spring. Conversely in more northerly regions as well as coastal and tableland areas which receive more summer rainfall there is an increasing proportion of summer growing species, as well as biennials which in these more evenly distributed rainfall environments can carry-over from one season to another.

It is also worth noting that many annual plants (especially annual grasses) are relatively soft seeded - that is, their seed does not survive for long periods in the soil – so that if they can be prevented from growing for even a few years then their populations will quickly. Of course plants vary considerably in their level of "hard seededness" so this principal does not apply to all annual species. Sub clover is a good example of a species which varies considerably in its level of hard seededness in accordance with varietal differences.

Secondly, unlike annuals and biennials, perennial plants are not solely dependent upon their capacity to survive from one year to another by seed production and seedling recruitment. While perennials also produce seed each year given the right growing conditions, once a perennial plant becomes well established it will survive as an adult or mature plant from year to year continuing to produce annually. It is this characteristic which makes perennial weeds potentially so much more troublesome because once present they will be a component of the pasture for an indefinitely long period of time. Also perennials tend often to be larger and more deep rooted plants than annuals and therefore can be more difficult to control using normal control tools.

Key Message: Learn to understand the basic growth characteristics of plants – in terms of growth habit and seasonality of growth - and the relevance of this in terms of weed control

3.4 Procedure 4

3.4.1 Describing the Life Cycle of Local Weeds

What to do / How & Why

Using the information described above it is necessary now to apply that knowledge to the list of weeds outlined in Step 1. For each of the plants/weeds listed categorise each plant using the following criteria:

- Is the plant a grass or broadleaf plant
- Is the plant an annual, biennial, or perennial
- When does the plant germinate as well as when does it flower and set seed. Try and be as specific as possible in term of the months of the year rather than just broad seasons.

If in doubt seek advice as this is an important part of the weed planning and deliberation process.

TABLE 1 Include here a Table which includes: Weed name; grass/BW; Growth Habit; Life Cycle etc

Key Message: Describe the growth habit and life cycle of each weed listed in Step 1

3.5 Procedure 5

3.5.1 Ranking / Categorising the Weed Threat

What to do / How & Why

Taking into consideration all of the previous steps it is now necessary to categorise or prioritise each weed in terms of their weed status or weed "threat".

This will be influence by various factors including:

- the ecology of the weed (perennial v biennial v annual);
- ease and/or difficulty of control;
- toxicity to livestock;
- cost of control;
- feed contribution (ie palatability); and
- capacity of the weed to reduce production.

One way of helping to assess this is in terms of the opportunity cost of NOT controlling the weed i.e. what would be the effect on productivity and cost of control measures in the long term.

The categorisation of weeds will vary between environments but as a guide weeds may be ranked accordingly:

1. Locally declared noxious weeds and weeds of national significance; also perennial weeds which once established are long lived and therefore more difficult to control. This especially applies to perennial grass weeds which are difficult to selectively control in grass based pastures.
   (eg serrated tussock, African lovegrass, Chilean needlegrass. St John's wort)

2. Invasive and highly competitive broadleaf weeds which are difficult and expensive to control eg silver leaf nightshade, fireweed, *Onopordum (Scotch and Illyrian) thistles, nodding thistle, common heliotrope, Ragwort, any others ????????*

3. Annual broadleaf weeds which are unpalatable to livestock, and moderately difficult to control *eg thistles, Paterson's curse, any others ???????*

4. Annual broadleaf weeds which are more palatable to livestock and which are generally easier to control *eg capeweed*, *Brassicas any others???????????*

5. Annual grass weeds which provide a useful feed source when in the vegetative (leafy) stage

3.6 Procedure 6

3.6.1 Mapping Farm Weeds

What to do / How & Why

A complete picture of the overall weed status of your property will largely be provided by the assessment of pasture composition undertaken on a paddock by paddock basis.

However it is also useful to map any significant or noteworthy weed infestations. For instance any noxious weeds or isolated outbreaks of new weeds. The purpose for this is to assist in locating - or more importantly re-locating – any infestations so that they can be revisited again in the future.
By mapping or defining the weed outbreak it will assist in monitoring the rate of control.
The level of detail can vary according to your own preference from a detailed hatching of the perimeter of the weed population to a designated "x" on farm map In both instances it is useful to accompany the identification with a description of the size of the infestation, date first found, and any weed control practices undertaken.

A GPS is also preferable to assist with accurate location into the future.

It is important to keep a balance between trying to make an accurate map, the time needed to prepare it and the needs of the people who will use it. The goal is to have a map that is accurate enough to allow you to monitor your progress and so that others working on the site can find their way around and identify the locations of weeds and relevant features.
In many situations a simple hand drawn map is fine. If however you are involved in a larger situation that includes numerous infestations then more elaborate mapping may be required. In these more complex situations mapping may need to be carried out with appropriate local or state/territory authorities or perhaps contractors. For example many weed control officers now have GPS monitoring systems for identifying weed infestations which can be easily be superimposed onto farm maps.

3.7 Procedure 7

3.7.1 Where am I? Implementing the SWOT Approach

What to Do / How and Why

Armed with the broad knowledge about actual and potential weeds and having prioritised their potential threat we must now relate this to our own situation, to bring it home to our own property and our own paddocks.
In doing so we pose the question: Where am *I?* - that is, *me* personally?

While this is a key part of the planning process it also forms the basis of the implementation phase of a weed control program in terms of allowing us to consider the diversity of management and control options.

(Remember, developing an accurate assessment of the status of our pastures not only assists in planning weed control but also helps in overall pasture and livestock management. For instance in planning a fertiliser program or achieving livestock production targets).

The key to this is undertaking a SWOT analysis of each paddock on your property.

3.7.2 Paddock SWOT Approach

SWOT literally refers to "Strengths; Weaknesses; Opportunities and Threats" and a SWOT analysis is used commonly in many fields of endeavour to objectively assess a particular situation or activity.

With respect to weed management a SWOT analysis requires consideration of the following characteristics:

Strengths and Weaknesses

What is the current status of your pasture? This is assessed in terms of its level of weediness and susceptibility to weed invasion –that is, its "weakness"; as well as its capacity to compete with weeds – its "strength". This provides a guide to risk assessment.

The key to this process involves developing a "pasture profile" for a paddock. This includes assessing the pasture for its composition, listing all of the various pasture components including both 'undesirable' (ie weeds) as well as 'desirable species'.

It is also useful to determine the fertility status of the paddock as this influences the vigour of the pasture and therefore its susceptibility and/or resilience to weed invasion – that is its strength or weakness.

Opportunities

What are the management strategies available to me (ie opportunities) to enhance the competitiveness of my pastures and/or to address the potential weed problem. This leads to consideration of what (weed management) tools do I have?

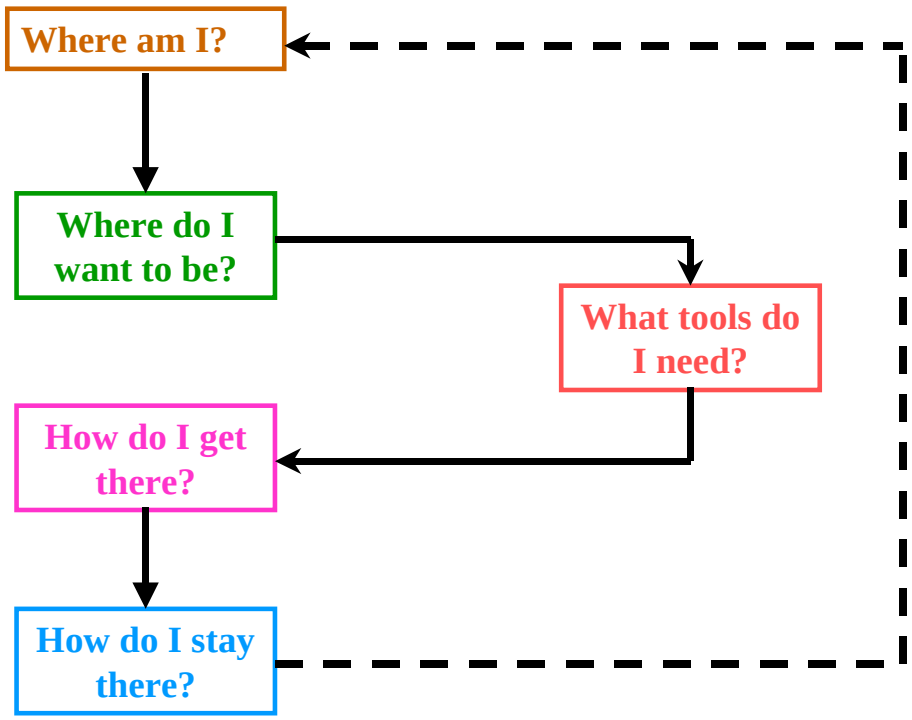
Threats

This involves categorisation of the potential weed threat and then prioritising paddocks for control.

For each paddock the potential weed threat needs to be determined in terms of the seriousness of the actual weed species. This will be influence by various factors including the ecology of the weed (perennial v biennial v annual); ease and/or difficulty of control; toxicity to livestock; cost of control and capacity of the weed to reduce production. One way of helping to assess this is in terms of the opportunity cost of NOT controlling the weed ie what would be the effect on productivity and cost of control measures in the long term.

This will have been previously undertaken for weeds in the local area in Step 5 above.

In order to better understand and implement the SWOT approach it is useful also to take into consideration the "weed control pathway" (see above). This pathway provides a framework for actually determining the Strengths, Weaknesses and Opportunities within the SWOT approach. Once this information is collated for each paddock then it is possible to prioritise paddocks for control ie to assess its potential 'Threat'.



3.7.3 Determining Paddock Strengths and Weaknesses

Developing a Pasture Profile
A "paddock profile" involves:

1. An assessment of its pasture composition
2. An assessment of its soil fertility

Undertaking Pasture Assessment

What to Do / How and Why

There are a number of techniques available for determining pasture composition and these are described in the xxxx section of this Manual. They are also demonstrated as an important part of the Weed Removers: Pasture Improvers EDGEnetwork ® course. Of these the end point approach is regarded by most producers as the easiest and quickest to use and which also ensures a high level of accuracy and objectivity. The transect method is very similar to the end point technique and probably allows for a higher level of repeatability when comparing results from one year to another.
It should be noted that both the end point technique and transect method are very simple and quick to carry out requiring in the order of about 10-15 minutes per assessment area.

Timing
Assessment of pasture ‘composition’ should be undertaken at least twice per year for the purpose of weed control.

1. The first is a more thorough and comprehensive assessment of individual pasture components undertaken in winter/spring. This assessment forms the basis of much of the decision making described in this Manual/Guide.

2. The second more rudimentary test –using the same basic technique - should be carried out on a routine monitoring basis during the summer period but especially in late summer /early autumn immediately prior to the autumn break. This is effectively undertaken to monitor the amount of bare ground and/ or ground cover ie the presence or absence of ground cover or bare ground on a percent basis. This is more of strategic test to assist with formulating management strategies at the autumn break. The significance of this test is explained below.

Undertaking a comprehensive assessment of pasture composition should be carried out when you can be confident that all of the different component pasture species (including both weeds and desirables) have germinated and become established. In most of southern Australia which experiences predominantly winter rainfall this is best done during winter and early spring. At that time you will be able to include in your assessment all of the autumn germinating annual species such as the annual grasses and broadleaf weeds. In those regions which receive year round rainfall then assessment again is best done in spring when conditions are favourable for the germination and establishment of most if not all species.

Irrespective of the actual date it is essential that assessment of pasture composition is undertaken at approximately the same time each year. In order to achieve this it is a useful idea to write in your diary a note to the effect of “assess pasture compositions” on a particular day or week, say on September 1 the first day of spring?

Determining Soil Fertility

Method 1: Based on Soil Test Results
An assessment of the fertility status of individual paddocks on your property should also be carried out. This is preferably based upon the results of soil test results which provide objective information about the level of nutrients, as well as soil pH and salinity. The MLA EDGEnetwotk Course Healthy Soils:Healthy Profits provides a comprehensive review of all aspects of soil health and fertility including taking and interpreting soil test results.

Because soil testing should similarly be undertaken at the same time (and place) each year, and because spring is also an optimum time to take soil tests, then it is recommended that soil testing and pasture assessment could be undertaken together.

Method 2: Subjective Assessment
Alternatively it is possible within the context of weed management to develop your own assessment of soil fertility. While this is more subjective, using your own knowledge of: soil type; fertiliser history and legume/clover content provides a useful guide.

Irrespective of the assessment method the next step is to categorise paddocks based upon their fertility status into: high; medium; and low fertility.

Developing a Paddock Profile:

We are now in a position where for each paddock on the property we have developed a "paddock profile" which includes an assessment of its pasture composition as well as its soil fertility

This pasture profile provides the basis for now undertaking the SWOT analysis – that is, to describe the comparative strengths and/or weaknesses of the paddock with regard to weed control. In doing so we are able to determine what management strategies are available (ie opportunities) to both address the potential weed problem and enhance the competitiveness of the desirable pasture species. The potential threat of the paddock will be largely influenced by the weed species which are present which will also help to prioritise paddocks for control

3.8 Procedure 8

3.8.1 Developing a Pasture Composition Target: Where Do I Want to Be?

What to Do / How and Why

The assessment of pasture composition is an important key starting point in developing a planned, integrated weed control and pasture improvement program. However the essential next step is to determine what is an appropriate composition target for the particular paddock? Any meaningful assessment of pasture composition can only be interpreted or evaluated relative to that target.

In doing so this also enables us to consider How Do I Get There ie how do I move from the current situation to the preferred? This leads us to consideration of the various tools which need to be used and how best to implement them (in other words *What Tools Do I Need?).* This importantly introduces the concept of Diversity and Diligence which will be discussed more fully in Segments X&Y

It must be emphasised that there is no such thing as a universal target for pasture composition.
The ideal composition will vary from paddock to paddock, farm to farm and from region to region, and is influenced by such variables as soil type, rainfall, slope, aspect and pasture type. It will also need to consider the management goals for the paddock taking into account the (animal) production enterprise.

Because it is impossible / unrealistic to specify a particular figure as such (with the exception of noxious weeds) a more realistic approach is to describe a preferred range between which a pasture component should fall / for each pasture component.

On this basis a preferred range for each of the main individual pasture components is described below. As mentioned there will be a need to refine your own targets for your own situation and environment using the information and advice of local agronomists and weed control advisors.

All figures are on a percentage basis and assume that the assessment has been undertaken during the preferred winter/spring period. The reason for this is that the various components will vary throughout the year. For example the amount of litter will increase during late spring and summer while many annual species will not be present outside their normal growing season of autumn /winter/spring.

It must also be stressed that these targets are related *specifically to weed control*. In those situations where weed control is not the major focus or priority for a particular paddock then these targets may need to be changed.

	Range (%)
Perennial grasses	50-70
Legumes	10-30
Annual grasses	< 20
Broadleaf weeds	< 10
Litter	< 10
Bare ground	< 10
Noxious Weeds	0
Total	100

Comments:
Perennial grasses: The amount of perennial grass provides a direct guide to the inherent “competitiveness” of the pasture or paddock to weed invasion. Aim for a minimum of 50% and ideally 60-70% where weed control is a priority.

Legumes: The amount of (annual) legumes will vary throughout the year according to season and the target level will be influenced by production goals for the particular paddock. The level of 10-30 % here relates specifically to subterranean clover based pastures in southern Australia. High levels of sub clover are associated with high levels of animal production but may lead to nitrogen build up and consequent invasion of nitrophilous (Nitrogen loving) weeds. These include barley grass and various thistles. This especially occurs where the level of perennials is in decline through inappropriate grazing management, for instance under continuous grazing at high stocking rates. High legume content pastures also is indicative of (excessively?) high levels of fertility. Annual legumes like sub clover require bare ground to germinate in autumn/early winter.

Annual grasses: Annual grasses may be regarded as both friend and foe. During winter they provide useful grazing and contribute well to the winter feed supply. However they can be troublesome to livestock and quickly lose palatability during late spring. A level of annual grasses up to 20% is regarded as acceptable while above this indicates that the pasture is “unstable” and susceptible to further weed invasion, especially broadleaf weeds and possibly noxious weeds. For this reason the amount of annual grass is a key early indicator of the potential weediness of a paddock and should be evaluated together with the level of perennial grasses. Annual grasses require bare ground in which to germinate during autumn and winter.

Broadleaf weeds: On the assumption that most broadleaf weeds are unpalatable and unproductive then an upper level of 10 % should be tolerated in pastures.
Like annual grasses, a higher level than this indicates that the pasture is in decline, the extent of decline being proportional to the amount of broadleaf weed.
Many broadleaf weeds are either annuals or biennials and therefore require bare ground in which to germinate.

Litter: Litter is best described as residual dead vegetative material, the level of which increases during spring and summer as plants die off (annuals) or senesce (perennials). Understandably therefore the level of litter – which may or may not be attached to the parent plant and anchored to the ground - will vary considerably throughout the year from a peak in late spring to a low during winter. The level of litter in winter provides a useful practical guide to stocking rates: high levels above ~ 1000 kg DM/ha indicate that the stocking rates have been too low.

Bare ground: The amount of bare ground will be lowest during winter/spring when the establishment of all other species should be at their maximum. If the level of bare ground is higher than 10 % during this time then the paddock would appear to be severely degraded and therefore extremely vulnerable to weed ingression.
Bare ground must also be monitored closely during summer and especially during late summer/autumn at the time of the autumn break. The level of bare ground should not exceed 30% and in more weed prone paddocks a target of 20 % should be the upper limit, and preferably much less.

Noxious weeds: A zero tolerance of noxious weeds should be the target of all land managers. Noxious weeds should be prioritised first in any weed control program.

<u>Strengths/Weaknesses</u>

The strength and or weakness will be determined primarily by the following:

- Perennial grass component (percentage)

  Long lived, deep rooting perennial grasses when vigorous and well managed provide competition to the invasion of weeds especially during the vital period when weeds are germinating and establishing. They also compete actively with weeds for the ‘essentials of life’ – moisture, nutrients and light. Being deep rooted they are able to retard flowering and reduce seed production of weeds.

- Ground cover/bare ground

  All weeds require bare ground as well as direct sunlight in which to germinate and establish. Maintenance of high levels of ground cover will reduce establishment of weeds especially if associated with vigorous perennial grasses. Conversely high levels of bare ground will encourage their establishment. Ground cover includes all plant components on the soil surface including living and dead material whether it be attached to the parent plant or detached as litter.

- Herbage Mass

  This relates to the total amount of feed in the paddock which is described in terms of kg of Dry Matter per hectare (kg DM/ha). The amount of feed available has more of an indirect affect on weed establishment by reducing light to the ground surface which can affect germination of some weeds. Also higher levels of Dry Matter are usually – but not always - associated with higher levels of ground cover.

- Fertility status

The importance of plant vigour in competing with weeds has already been noted above. Fertility plays a key role in terms of enhancing the growth and competitive capacity of perennial grasses as well as their ability to tolerate and recover from grazing and drought.

This information is used to determine the resilience or susceptibility of the pasture paddock to weed invasion. For each category above a pasture or paddock may be ranked accordingly:

- Percentage of perennial species - should be above 30-40-50% ???? *(if below score 1);*

Comment: The target level of perennial species will vary according to environment, rainfall, pasture type and soil type

- Amount of bare ground/ground cover- should be above 70 % ground cover (assessed using the simple end point technique – see glossary) *(if below score1);*

Comment: The preferred level of ground cover will vary according to the environment and potential weed problem. In sloping non-arable terrain of low fertility a target of 80 % may be more appropriate.

- Amount of herbage mass- should be above 1 000 kg D.M /ha *(if below score 1);*

Comment: Where highly invasive and difficult to control weeds are a threat (eg serrated tussock) a target of 1 500 kg DM/ha is recommended

- Fertility status - *if fertility low in perennial pasture (ie above 30-40-50%) score 1*; *if fertility high in ‘annual’ pastures (ie those with perennial content below30-40-50 % score 1*

Comment: as a predictor of responsiveness of pastures to rainfall and capacity to compete with weeds; high fertility in pastures of low perennial grass content will encourage weed growth

<u>Threats</u>

As mentioned above and described more fully

Categorisation of the potential weed threat.

For each paddock the potential weed threat needs to be determined in terms of the seriousness of the actual weed species. This will be influence/determined by various factors including the ecology of the weed (perennial v biennial v annual); ease and/or difficulty of control; toxicity to livestock; cost of control and capacity of the weed to reduce production.

One way of helping to assess this is in terms of the opportunity cost of NOT controlling the weed ie what would be the effect on productivity and cost of control measures in the long term.

The categorisation of weeds will vary between environments but as a guide weeds may be ranked accordingly:

Locally declared noxious weeds and weeds of national significance; also perennial weeds which once established are long lived
(eg serrated tussock, African lovegrass, Chilean needlegrass. St John’s wort) ….Score 5

Invasive and highly competitive broadleaf weeds which are difficult and expensive to control eg silver leaf nightshade, fireweed, *Onopordum (Scotch and Illyrian) thistles, nodding thistle, common heliotrope, Ragwort, any others ?????????.....* Score 4

Annual broadleaf weeds which are unpalatable to livestock and moderately difficult to control *eg thistles, Paterson’s curse, any others ??????? ……..* Score 3

Annual broadleaf weeds which are more palatable to livestock and which are generally easier to control *eg capeweed*, *Brassicas any others???????????* ……. Score 2

Annual grass weeds which provide a useful feed source Score 1

Opportunities

What are the management strategies available to me (ie opportunities) to enhance the competitiveness of my pastures and/or to address the potential weed problem.

A key indicator is the proportion of perennial grass measured in terms of percent ground cover.

As a guide, if the perennial grass content is:

< 20 % : the pasture is sufficiently degraded to justify a complete re-sow/pasture renovation program

~ 20 % ie 20-30% the best tactic is to completely de-stock the paddock for 12 months.

>20-30 % there is sufficient perennial grass to form the basis of a productive pasture. These paddocks should be strategically rested and grazed to allow perennial grass species to completely recover from drought, regenerate carbohydrate root reserves and increase basal area. It is especially important during spring to defer grazing for 10-12 weeks

It is now possible to undertake a SWOT analysis for each of your “problem” paddocks. A Table for completing this simple task is provided (include SWOT Table).

3.9 Procedure 9

3.9.1 Paddock Weed Risk Assessment

What to Do / How and Why

It is now possible to carry out a weed risk assessment for a paddock using the SWOT approach described previously. A (draft) Table for completing this simple task is provided.

This Table is designed to enable you to rank your paddock using a number of criteria which comprise the Strengths and Weaknesses of the paddock together with the actual weed Threat. You will observe that for each category you are required to undertake your own assessment or Score. At the end it is a simple process of adding the individual scores to determine the overall weed risk assessment.

The higher the ranking the greater the need to prioritise this paddock for effective management.

It must be remembered that the weed risk must be assessed relative to the capacity of the pasture to compete with the weed, that is the "Opportunities" presented.

Strengths (capacity of pastures to compete) & Weaknesses (susceptibility to weed invasion)	**Risk Score**	**Your Score**
Ground Cover • > 90% • 70-80% • < 70%	 **0** **1** **2**	
Note: The preferred level of ground cover will vary according to the environment and potential weed problem. In sloping non-arable terrain of low fertility a target of 80 % may be more appropriate		
Herbage Mass • > 1500 kg DM/ha • 1000 – 1500 kg DM/ha • < 1000 Kg DM/ha	 **0** **1** **2**	
Note: Where highly invasive and difficult to control weeds are a threat (eg serrated tussock) a target of 1 500 kg DM/ha is recommended		
Perennials • > 40% - score • 20-30% - score • < 20% - score	 **0** **1** **2**	
Note: The target level of perennial species will vary according to environment, rainfall, pasture type and soil type. Seek advice for your location. If too dry stimulate early growth with the "green well" technique – see glossary.		
Fertility Status • High fertility in perennial pastures, > 40% • Low fertility in perennial pastures, >40% • Low fertility in 'annual' pastures, perennials < 20%	 **0** **2** **1**	

• High fertility in 'annual' pastures, perennials < 20%	**2**	
Note: High fertility in pastures of low perennial grass content will encourage weed growth. Low fertility soils allows well adapted weeds to out-compete pasture species with higher nutrient requirements. This is a predictor of responsiveness of pastures to rainfall and capacity to compete with weeds.		
Threats – which weeds are the most important to control		
• **Declared noxious and perennial weeds** – eg Serrated Tussock, African Lovegrass, Chilean Needlegrass, St John's wort • **Invasive and competitive biennial and annual broadleaf weeds** – eg Silver Leaf Nightshade, Onopordum thistles, Fireweed, Nodding Thistle, Heliotrope, Ragwort • **Annual broad leaf weeds** – unpalatable and difficult to control – eg thistles, Paterson's Curse • **Annual broadleaf weeds** – palatable – eg Capeweed, Brassicas • **Annual grass weeds** which provide a useful feed source but may host soil borne disease for crops	**5** **4** **3** **2** **1**	
Risk Assessment – the higher the score, the greater the risk to weed invasion **Note:** The higher the ranking the greater the need to prioritise this paddock for effective management. The capacity of the pasture to compete with the weed must be assessed relative to the weed risk.		
Opportunities – key management strategies. Key indicator is the % perennial grass surviving. • **< 20%** - pasture degraded, needs re-sowing or renovation • **~ 20 - 30%** - de-stock for 12 months to allow to recover • **> 30%** - good basis for a productive, competitive perennial pasture. Need to be grazed strategically to allow plants to recover, regenerate carbohydrate root reserves and increase spread. Defer grazing in spring for 10-12 weeks		

4 Diversity

4.1 Procedure 10

4.1.1 Implementation – Developing a Plan of Attack / opportunities for Weed Control

What to Do / How and Why

Having prioritised our paddocks for weed control and determined which paddocks are the most needy of attention it is time to move to the planning and implementation stage.

This involves referring back to our pasture composition (*Where Am I?)* as well as consideration of the targets we have set (*Where Do I Need to Be?)* and posing the question *How Do I Get There?* This requires consideration of *What Tools Do I Use?*

Together these are collectively referred to as **Diversity -** diversity in the number of weed control practices used, and how multiple methods are used together to obtain better and more cost effective control.

The first step in this process is to determine the capacity of the pasture to compete with weeds, previously described in the SWOT approach as the "Opportunities" for weed control/suppression.
(Weed risk must be assessed relative to the capacity of the pasture to compete with the weed, that is the "Opportunities" presented.)

This is an important first stepping stone because it will largely determine what overall management strategy is adopted. For instance it will help to decide whether a pasture needs replacing (ie re-sowing) or whether it can be restored to a more competitive state. As mentioned previously a key indicator in this process is the proportion of perennial grass.

A target level of perennial grass should be a minimum of 50 % and ideally should be 60-70%.

Replace or Restore?

As a guide, if the perennial grass content is:

< 20 %: the pasture is sufficiently degraded to justify a complete re-sow or pasture renovation program. There is simply not enough perennial grass to provide adequate competition for weeds and the weeds will continue recurring from one year to another.

~ 20-30%: This is a borderline situation. A decision as to whether to re-sow or whether it can be adequately restored will be determined by the actual situation including the species present, the soil type/fertility and "recuperative" ability of the perennial species. As this is difficult to objectively determine, the best tactic in the short term is to completely de-stock the paddock for 12 months and then re-assess the situation in a year's time. This will be beneficial to the growth and recovery of perennial grasses while at the same time will avoid making a hasty and ultimately expensive decision.

>30 % there is sufficient perennial grass to form the basis of a productive and competitive pasture. Restoration: these paddocks should be strategically rested and grazed to allow perennial grass species regenerate their carbohydrate root reserves and increase basal area. It is especially important during spring to defer grazing for 10-12 weeks.

Once the decision has been made about the competitive ability of the pasture then it is time to plan and implement an appropriate control program. This must involve encouraging the vigour and competitiveness of the desirable components of the pasture as well as controlling and suppressing the weeds.

The three key features of a successful weed management program are:

- Encourage strong competition from desirable species
- Remove the weed or reduce seed set
- Reduce weed germination

There are a range of weed control and pasture improvement options available to help achieve these objectives. These may be categorised as either “weed removers” or “pasture Improvers”. These are comprehensively described in the EDGEnetwork course *Weed Removers:Pasture Improvers* and include:

Pasture Improvers
- Encourage strong competition:
Tactical Grazing Management
Ground cover retention
Fertilisers
Pasture establishment
Pest management
Soil pH management (liming)

Weed Removers
– reduce weed germination:
Ground cover retention
- remove the weed or reduce weed seed set:
Herbicides
Tactical grazing
Biological control
Silage/hay cuts
Slashing

4.2 Procedure 11

4.2.1 How to go about it

What to Do / How and Why

Planning an integrated weed control program cannot be prescriptive, especially one which addresses both the weed problem and also enhances the competition from the desirable pasture species.

Nevertheless the following broad guidelines should be followed:

Weed Removers

In almost all situations there will usually be a range of weeds present within the pasture, as has been determined by your pasture composition assessment. The questions therefore to be answered include Where do I start, What Order, What Tool ,and When?

1. Noxious Weeds
When confronted with a range of weeds undoubtedly the top priority must always be the noxious weeds. A zero tolerance approach should be adopted so that the aim is to eradicate all noxious weeds.

Almost all weeds can be individually removed either physically (ie chipping or roguing individual plants) or using herbicides. In many situations the use of herbicides may be more practically convenient especially where the weeds are present in larger numbers. Despite this there is no doubt that landholders should always carry a hoe in their farm vehicles so that individual isolated scattered plants can be removed when they are found. Despite the best of intentions experience suggests the commitment or promise to return to spray a particular weed at some stage in the future may never happen…. Alternatively it is preferably suggested that a small knapsack containing glyphosate, perhaps mixed with metsulfuron (? Note Check this recommendation especially re comapatabilitya nd straoge life of the mix) (mixed with red spray marking dye) will help to remove most commonly found weeds.

On the basis that most noxious weeds of pastures are highly invasive and often difficult to control when present in large numbers then selective removal by spot spraying is the preferred option as this will cause least damage to the existing pasture. Avoid allowing these weeds to reach the stage where broadacre control is necessary. This is essential.

2. Broadleaf Weeds

Broadleaf weeds should be the second category of weeds to be prioritised for weed removal.
This is based upon the fact that most broadleaf weeds are unpalatable to livestock, compete actively with desirable species (including in this situation perennial grasses, legumes and annual grasses) for moisture and nutrients and are often physically a major nuisance. All these factors contribute to a significant reduction in productivity of grazed pastures.

In most pastures there will be a diverse range of broadleaf weeds and therefore the priority for control should be in accordance with your own personal prioritised list of weed ‘threats’ developed previously in Section X.

Due to the scale and diversity of most broadleaf weeds and especially in those situations where they occupy a significant amount of ground cover – that is above the target of 10% - then the preferred initial step is the use of selective herbicides.

Where the proportion of broadleaf weeds is still below 10 % then this level may be tolerated depending upon the particular weed and its perceived threat to your property.

In this situation the use of ‘broadacre’ herbicides may not be justified and instead a management approach based upon improving the vigour and competitiveness of the desirable pasture species may be adequate in reducing the level even further. This is described more fully under “Pasture Improvers”. Part of this approach will also involve reducing the establishment of the broadleaf weeds by ensuring higher levels of ground cover during autumn/winter when many annual broadleaf weeds germinate. The specific time period for each weed you will already have determined for all of the weeds on your property in accordance Step 4

However for those weeds which you ranked as Number 2 and Number 3 in Step 5, that is, described as being “ invasive and highly competitive broadleaf weeds which are difficult and expensive to control”; and “annual broadleaf weeds which are unpalatable to livestock, and moderately difficult to control” a (much) lower tolerance threshold may be required. For example, 2% and 5% respectively, or even zero tolerance with respect of the Number 2?

Another consideration with regard to broadleaf weed control using herbicides is that, while you may differentiate or prioritise between individual weeds, one herbicide will often control a range of different weeds. This fact was alluded to in Step 3. In the main most of the herbicide types which are registered to control broadleaf weeds in pastures will actually have efficacy over a range of weeds. In this situation and when you are presented with a variety of weeds select the herbicide which will be the most effective on your ‘worst’ weeds but which will also retard or weaken other troublesome weeds.

Remember that in doing so there is no such thing as a “magic bullet” when it come to herbicide use and that this tool is only part of an integrated approach to weed management. The role of herbicides is fundamentally to initially reduce the population of weeds in pasture or paddock. Once this is achieved then other management approaches – the so-called pasture improvers – are need as a complementary tool to prevent the weeds from re-establishing.

Specific advice with regard to the control of individual weeds using herbicides is readily available from a variety of reliable sources. These include agribusiness agronomists and resellers, government advisors, weed control authorities and private consultants. In all cases use only a registered herbicide and strictly adhere to the recommendations on the label.

Damage to legumes: When using broadleaf herbicides be aware that some of these herbicides may cause considerable damage to the legume component of the pasture.

As described in Step 3, while broadleaf herbicides cause little or no damage to grasses (monocotolydens) their purpose is to selectively damage or kill broadleaf plants (dicotolydens), including legumes and clovers. Other broadleaf plants such as herbs – chicory, plantain – also fall into this category or family. It should be noted too that there is also considerable variability between broadleaf herbicides in terms of their efficacy not only upon weeds but also upon the non-target species. This further highlights the need for careful herbicide selection and seeking specialist advice. It also emphasises the fact that herbicides should play only a limited role in overall weed management and that other tools are potentially more beneficial.

3 Annual Grasses

Annual grasses can be regarded as both friend and foe in a grazing operation. Within the context of pasture production, unlike cropping, annual grasses occupy a useful role in contributing to the winter feed supply in providing high quality feed. In spring however these species quickly run to head at which time they lose palatability and quality. Many produce troublesome awns which adversely affect animal production and wool quality.

Due to their positive contribution to overall pasture growth at a time when feed supply is at its lowest, annual grasses have the lowest priority from a weed management viewpoint *relative to other more troublesome and difficult to control weeds.*
(Note: In cropping areas annual grass control assumes a higher priority due to their competitiveness and capacity to carry diseases which can reduce crop yields).

For this reason a tolerance level of up to 20 % has been set. Even though a proportion of annual grass above this level will not significantly reduce pasture productivity, especially through winter, it indicates that the pasture is in the early stages of decline in which annual grasses have replaced other potentially more desirable and beneficial species such as perennials. Because annual grasses need bare ground in which to germinate during winter a high percentage of annual grasses suggests that the pasture has been degraded. This can occur through overgrazing or prolonged drought and it is important to address the fundamental reasons for this decline. The assessment of ground cover and bare ground over summer and autumn described in Tool X helps to predict the likelihood of invasion by annual grasses – as well as broadleaf weeds – in autumn.

The presence of high levels of barley grass and ryegrass (as opposed to Vulpia), also suggests raised fertility levels - especially nitrogen - in which case it is important tp monitor soil nutrient levels by soil testing .

When deciding upon an appropriate approach for annual grasses it is worth considering the following:

- Maintaining some annual grasses ie below 20 %, and certainly less than 10%, is acceptable in most grazed pastures so that adopting a zero tolerance level is unrealistic and unnecessary.

- Where the level of annual grasses is above 20 % it is preferable to initially use herbicides to help immediately get on top of the problem, while at the same time using other aspects of management to help increase the proportion of perennial grasses. In doing so there are two strategies which can be used:

  - “spray topping” where a sub lethal rate of the herbicides glyphosate or paraquat are used during flowering to reduce seed production; and

  - “winter cleaning” where appropriate registered herbicides are applied during winter to control a number or grasses

  Both of these techniques are more fully described in the Appendix. Again it is stressed that specialist agronomic advice is sought when either spray topping or winter cleaning.

- Where the level of annual grasses is below 20 % an integrated grazing management approach can be used which involves incorporating high density grazing pressure during the critical reproductive period in spring to reduce seed production. At the same time ensure that levels of ground cover are well above 80 % during autumn to reduce seedling establishment. This process is described more fully in the Appendix as well as in the Tip n Tool.

Irrespective of the method used it must be appreciated that with regard to annual grasses it is not necessary to focus upon eradication but rather a reduction in plant population to acceptable levels.

Ground Cover Retention
Complete

Pasture Improvers

Long term weed control can only be achieved by enhancing the competitiveness of the desirable component of pastures, the basis if which are the perennial grasses. While herbicides and other techniques are useful weed removal tools, in the long run it is the ability of the pasture to compete with and prevent the establishment of weeds.

As we have discussed previously the competitiveness of perennial grasses is related to their abundance in the pasture as determined by the number of plants as well as their size and vigour. Because it is often difficult to differentiate between individual plants (except perhaps when they are seedlings) within a mature pasture (especially more spreading, rhizomatous plants), the best way to assess this and other pasture components is by percent ground cover. The techniques for measuring pasture composition are described in Tool X

In established pastures, whether they are sown/introduced or native, it is difficult to increase the plant population or number of plants, for instance by seedling recruitment. This is despite the best efforts of graziers who consciously lock up a paddock to let it “seed down”. While there are exceptions, for instance ryegrass with its greater seedling vigour as well as some native grasses (for instance Austrostipa and Danthonia), on the main the number of new plants established by seeding is relatively low.

For this reason it is essential to ensure good initial plant establishment when sowing pastures and just as importantly to ensure that plant survival is high. This fact is reinforced when the cost of pasture establishment / sowing – or re-sowing – of up to $300/ha is considered.

There are however opportunities to increase both the size and vigour – and hence competitiveness - of the existing plants through a combination of sound grazing management and raised fertility.

This relates to those situations where your paddock assessment indicates that the level of perennial grass is above the threshold of 20 % ground cover regarded as the minimum to restore the pasture back to a productive and competitive level. Below this a replacement policy of re-sowing is the only realistic option, especially within the context of weed control

A full description of the role of grazing management in weed control is contained the Tip ‘n Tool “How Can I Best Use Livestock to Assist in Pasture Weed Management” –see Appendix and below:

Increase competition from Desirables

The capacity of a pasture to compete with weeds is related to the proportion and vigour of desirable perennial grasses.

Within the context of pasture weed management aim for the following benchmarks:

1. The proportion of desirable perennial grasses needs to be greater than 60 % of total herbage mass in order to begin to exert an influence on invading weed species.

2. The level of herbage mass must be maintained at least 1.5 – 2 t DM/ha on a year round basis.

3. The area of bare ground should also be kept to the bare minimum – aim for it not to exceed 10-20 % in most paddocks. While some bare ground is inevitable in any grazed pasture and is necessary to allow establishment of annual clovers always maintain ground cover above the critical minimum level of 80-90 % needed to restrict weed establishment. In exposed and more vulnerable areas of the property, in areas of high weed infestation or with highly invasive weeds which are difficult to control achieving complete ie 100% ground cover should be the goal.

Plant competition can be managed with grazing./or Grazing management is a very important tool in maintaining and encouraging the dominance of desirable species

Aim to have a strong vigorous pasture sward actively growing, or ready to quickly re-grow after grazing or an adverse season. In order to achieve this:

Maintain a commitment to adhering to the benchmarks above

On a year round basis implement a planned rotational grazing policy based around matching livestock intake with pasture growth rates and leaf appearance rates. Periods of grazing rest are beneficial to the growth of perennial species allowing them to set seed and increase crown size and root development. In doing so remember that there is a correlation between leaf area and root growth and development.

Introduce a strategic tactical rest specifically during spring-summer: defer grazing for 10-12 weeks in order to increase pasture biomass, root growth and ground cover. This will also provide competition for annual grasses and broadleaf weeds helping to reduce their seed production capacity.

After resting for 10-12 weeks, continue to graze the paddock through summer and autumn being sure to maintain adequate herbage mass and good ground cover at or above the threshold levels. This will help to depress the germination and establishment of weeds in the following autumn.

As part of an overall planned weed control strategy, time this rest period from mid-late spring onwards. This should occur immediately following a short period of strategic high density grazing in early spring which is targeted specifically at the annual grasses and broadleaf weeds as a means of reducing seed production.

Introducing a tactical rest at this time in designated priority paddocks is usually an acceptable part of farm planning as there is normally a surplus of feed at this time.

Where the proportion of desirable perennial grasses is very low and approaching the level of 20 % regarded as the minimum which can be restored successfully with strategic use of livestock, the best option is to lock up the paddock for a full 12 months. This will allow perennial grasses to grow in size, set seed and dominate the pasture, like that seen in fenced off wind breaks.

Reducing Competition from Weeds

Spell paddocks from grazing during the critical period of germination and seedling establishment. This strategy, to be implemented in tandem with maintaining high levels of ground cover from desirable perennial grasses and minimal bare ground, targets the most vulnerable stage in the life cycle of all plants. This applies to both annual, biennial and perennial weeds and usually occurs for most weeds during autumn.

Apply high density grazing pressure by livestock during the critical reproductive period to reduce seed production. This is best undertaken by:

- After the planned autumn rest, rotationally graze paddocks through the winter period making sure that the final grazing period occurs about 3-4 weeks before the end of winter
- Rest or defer grazing until mid spring in order to allow weeds to grow in an upright fashion which are more accessible and vulnerable to grazing and damage by livestock
- Use short term high density grazing aimed at the early reproductive stage of the targets weed(s) i.e. when the plant is running to head but before the emergence of seed heads
- Rest for 10-12 weeks as described above to increase competition from the desirable perennial grasses

5 Diligence

Diligence in adhering to routine practices, using them in a timely fashion and maintaining weed control as a high priority among all the other tasks competing for the farmer’s time and attention.

Up until this point we have focussed upon the important technical aspects of weed control and pasture management. However there is one essential characteristic of all land managers who undertake highly effective weed control programs: They are all diligent and conscientious in their endeavours and place weed control as one of their main priorities in farm management.

There is however more to being diligent then just attitude or / behaviour a behavioural response. This relates more to the way good weed mangers go about the business of weed control, how they go about actually implementing their weed management plan and *diversity* of management options.

The key to this fundamentally comes down two things: routine and timeliness.

Routine

Whether we like it or not, and like many aspects of farming and business in general, weed control must be regarded as part of accepted or normal “routine” practice. It cannot be put off until there is “nothing better/else to do” but instead should be afforded equal consideration and importance as other farm tasks. This becomes even more critical when we consider the cost of control when weeds “get away” and the potential significant losses of production “down the track”. Another way of considering this is contemplating the (opportunity) cost of NOT controlling weeds.

Remember that typical comments of most successful weed managers include invariably: “I wish I had got on top of this weed earlier … “ as well as, “I only wish I knew then (ie about the weed) what I know now ….”.

Always too take heed of the adage “one year’s seed: ten year’s weed” and, preferably, write this down on your kitchen fridge or office desk along with some photographs of your most potentially troublesome weeds.

One of the best ways of moving weed control from the ”thinking to doing” stage is to allocate a certain period (days/weeks) of the year when weed control practices are undertaken, in accordance with the planning or “deliberation” guidelines you already described in this Manual. The way to do this is actually include “weed control” in your diary or farm planner. More importantly and to bring about greater effectiveness, be specific about the actual weed control practice to be undertaken.
This brings us to the matter of timeliness.

Timeliness

Another feature of successful weed managers is that (the diversity of) weed control practices are undertaken at the right time.

Again like many aspects of farm management there is an optimum period during which the various key components of weed management should be undertaken.

This relates especially to herbicide applications and weed removal techniques, but equally to various other management factors such as applying grazing pressure, imposing rest etc. This relates to the fact that many of these practices are very strategic in their timing.

Implementing such activities outside the optimum/.ideal “window of opportunity” results in reduced performance or effectiveness.

Adhering to a small number of routine tasks and undertaking these at the optimum time will go a long way to achieving meaningful weed control.

This fact was highlighted in the UNE survey which indicated the importance of implementing a few simple tasks, and most importantly performing these at the optimum time is one of the keys to successful weed management and weed managers.

One important way of achieving this is to draw up a calendar of activities for each weed, based upon the tasks described in this Manual. For each weed it may be possible to categorise a minimum “must do” list of weed control activities, for each weed, also taking into consideration your weed priority rankings undertaken in Priority5.

While not downplaying the importance of an integrated approach at least this will help prioritise the absolutely essential activities for each individual weed. On the basis that you have already ranked each weed then it will be a simple next step to rank or prioritise all of your weed control activities which incorporates all weeds i.e. from top to bottom.

On the assumption that for many managers your time and/or resources for weed control are often limited then at least this will help improve your effectiveness in allocating time and capital and ensuring that the most important or essential activities are undertaken. In doing so it challenges you to question what are the implications of NOT doing something.

It also helps to identify any economies which may be saved and efficiency of weed control improved. For instance it may be more economical and a better use of your labour to employ somebody on a casual basis to address some essential (ie highest priority) activities rather than not doing them. This is especially important when a particular task is competing for your time and attention at critical times of the year This is especially important in mixed cropping areas.

The next vital stage is transcribe each of these individual tasks into your diary and farm planner and to be diligent in ensuring that they move from the “planner to the paddock”…

Appendix 2
Weeds Train the Trainer Facilitator Manual

Prepared by: Stuart Burge

Introduction

This training Manual is targeted specifically towards advisory officers working in the field of weed control throughout southern temperate Australia.

Its purpose is to provide extension workers with the appropriate background, knowledge and skills to conduct producer training in the area of weed management.

In doing so it is to be expected that weed advisory officers will become more effective in their endeavours to bring about lasting and more resilient weed control practices.

While the emphasis is upon group advisory activities it is intended that the information contained in this Manual will be equally applicable to one-on-one situations between weed control advisors and individual farmers.

This training course highlights the need to place as much emphasis upon the different needs and learning styles of individual producers as it does the technical aspects of weed control.
This is based upon the premise that farmers are not homogenous but are a heterogenous group of individuals and accordingly no one approach will be relevant or effective to all.

From a technical perspective the Course stresses the need for an integrated approach to weed and pasture management -that is, enhancing the competitiveness of pastures as it does upon actual implementation and recommendation of weed control practices.

A major focus of this training Manual is the reliance upon the 3 D approach to weed control which is used as an organising theme for developing and communicating Course objectives and conveying key messages specific to the needs of individual farmers.

The 3 D's of effective weed management are:

Deliberation, that is the planning of an integrated and strategic approach to weed control;
Diversity of weed control methods; and
Diligence in the use of those methods

Overall Goal:

To provide extension officers working in the area of weed control with a resource Manual which contains appropriate and relevant background information, knowledge and skills to equip them to be able to conduct producer training in the area of weed and pasture management.

Objectives:

As a result of absorbing the contents of this Manual, it is anticipated that weed control officers and advisors should achieve the following learning outcomes:

- Be able to plan and conduct a group training activity targeted towards a specific weed or weed management strategy
- Understand and use the “3 D” approach to weed control as an organising theme for planning your workshop as well as incorporating it as part of your normal extension work
- Become familiar with some of the key sociological aspects of weed control and weed management
- Understand the principles of adult learning and in doing use this knowledge to tailor a weed control program in accordance with the (personal) characteristics of the individual landowner
- Be conversant with the principles of weed control and pasture management, consistent with the approach followed in the companion self-help Producer Training Manual entitled “Less Weeds from Pastures”.

Background

Weeds in pastures are consistently rated the number one pasture issue facing farmers and graziers throughout temperate Australia. Weeds have been estimated to cost the grazing industries in excess of two billion dollars per year through lost production, impacts on livestock, cost of control and loss of grazing area through weed invasion. Similarly in the cropping industries weeds are estimated to cost in excess of 1.5 billion dollars annually through reduced yields and expenditure on weed control.

Management practices that sustain and revive the pasture resource and provide long-term solutions to weeds have been developed. However, adoption of these practices has not been widespread, and only a relatively small proportion of landholders achieve effective weed control.

As discussed later in this guide the delivery and content of a particular workshop will need to be tailored to the specific workshop objectives. However in delivering any training in the field of weed control the following concepts should be consistently emphasised:

- Weeds are a symptom of pasture decline and degradation.
- Weeds must be replaced by desirable, productive and competitive species
- There are no 'silver bullets' for weed control in pastures.
- Weed control must fit within production, sustainability and whole farm planning targets.
- Good weed control does not reside in a drum of herbicide – a diverse range of integrated tactics provides the most efficient and cost-effective approach.
- Correct weed identification leads to the appropriate selection of control options and aids in effective and timely management.
- Weed management is an essential and integral part of the sustainable management of natural resources and the environment.
- Prevention and early intervention are the most cost-effective strategies that can be employed against weeds.
- Implementing the 3 D approach provides a framework for planning and implementing a lasting weed control program.

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1 Segment 1

1.1 Farmers & Weeds: The Sociology of Weeds

1.1.1 Background

The temperate perennial pasture zone of southern Australia produces nearly half of southern Australia's sheep and cattle products. Weeds in pasture systems represent considerable costs to landholders and the community.

Management practices that sustain and revive the pasture resource and provide long-term solutions to weeds have been developed, but adoption of these practices has been slow and only a relatively small proportion of landholders control weeds effectively.

An understanding of landholders' decision making processes is necessary to influence change.

The adoption of an agricultural practice is not merely a technical process whereby a farmer will simply decide to adopt a better practice once they are made aware of it.

Rather, it is an ongoing process wherein farmers constantly re-evaluate adoption decisions. Risk, uncertainty and learning are important considerations in understanding adoption behaviour. High levels of uncertainty can negatively influence rates of adoption of an agricultural practice, and providing information to reduce uncertainty is a key consideration for weed orientated extension.

Innovations also vary in terms of risk and the amount of learning they involve, and this will influence adoption rates. The qualities of some innovations will appeal more to some farmers than others, depending on the physical and social context of the farm and the management goals (motivations) of the farmer.

The results of segmentation studies involving graziers in south east Australia have demonstrated the usefulness of grouping farmers according to attitudes towards management and change.

The use of such grouping techniques can be useful in identifying motivations, or triggers, that are likely to prompt different groups of graziers to adopt better weed management practices. Conversely it assists in addressing potential barriers or obstacles which need to be confronted.

1.1.2 The 3D Approach to Weed Control: a Unifying Concept

Inadequate weed control amongst many farm managers and landowners necessitates a new approach to weed extension.

Communication with graziers and other extension professionals needs to be organized around a common theme which helps you to identify the needs of graziers, and also helps graziers evaluate their own situation.

It is suggested that the "3Ds" of effective weed management can serve as such an *organising theme* as they are regarded as the three critical factors that lead to effective weed management.

The 3Ds of weed management are:

- **Deliberation** (planned, strategic and integrated weed control),
- **Diversity** (of methods), and
- **Diligence** (in application of methods).

Deliberation is the planning of weed control, and undertaking it in a strategic fashion that takes advantage of knowledge of the life cycles of weeds and desirable pasture species.

An absence of deliberation is manifested by unplanned, reactive weed control, often reduced in effectiveness due to being undertaken at an inopportune time. Such an approach will, at best, provide only short-term weed relief from weeds, and at worst, waste time and money.

In some cases useful pasture plants will be killed through ad-hoc application of concentrated chemical, leaving space for weeds to occupy and dominate. In other cases, herbicide may be applied at insufficient dosage rates, or in weather that is not favourable for spraying, with the result that weeds will not be killed.

Diversity is the number of weed control practices used, and how multiple methods are used together to obtain better and more cost effective control.

Diligence is adhering to routine practices, using them in a timely fashion and maintaining weed control as a high priority among all the other tasks competing for the farmer's time and attention.

1.1.3 Understand your Clients: Oils Ain't Oils

A critically important step in planning an effective weed control strategy to be used as the basis of an effective training workshop is to *understand your farming clients*.

The premise here is that farmers are not homogenous. Farmers vary in innumerable ways, including: wealth; size of enterprise; age; stage of life; propensity to adopt new ideas; chemical preferences (e.g. organic farmers); and, most importantly attitudes towards risk and approaches to learning.

We can use these fundamental differences between producers in the way that they assess agricultural technology and extension strategies to help plan and refine our own training and communication or extension methods and, in this case our training workshops.

Based upon the diversity in farmer attitudes towards risk and uncertainty it is possible to group or characterize farmers into eight segments of farmers. This segmentation is based upon a survey by Barr and Cary (2000) examining farmers' attitude towards sowing and management of perennial pasture in south east Australia.

1.1.4 Market Segments for Weed Control

(Present this as a Table in a take-out box?)

The Committed:

This group usually represented less than 15 per cent of the population. Members of this group had a high proportion of their farm sown to exotic perennial pastures, and their pastures were regularly top dressed and grazed rotationally or strategically.

Members of this group were driven by production and profit and had a good understanding of their production system.

These producers placed a high value on information, and awareness of farm innovation generally lead to attitude change and then behaviour change.

The Pasture Part Timers:

This group comprised up to 15 per cent of the farm population surveyed. They had a smaller proportion of their farm under perennial pasture, often regularly top-dressed their pastures and practiced rotational grazing.

Farmers in this group were motivated by the desire to increase productivity and income, but were constrained by commitment to another business or work interest.

The Crop Focused:

These producers were found only in the mixed cropping zone. They saw pastures as a means to improve soil fertility for the next crop and sometimes as a means to maintain sheep until they were required to graze stubble. They often had a negative view towards grasses, particularly perennial pastures, with Lucerne tending to be the preferred fodder crop.

Belt Tighteners:

This was the largest group identified by the various studies, representing between 30 per cent and 40 per cent of farmers. This group generally claimed to have large areas sown to improved perennial pasture, and usually practiced set stocking.

Members believed that conservative grazing strategies would be more profitable than innovation in the long run.

These farmers were identified as risk averse, with a decision making style that flowed from awareness to action (trialing) to attitude change.

Sceptics:

Members of this group comprised between 10 per cent and 20 per cent of the sample. They distrusted the advantages described for pasture improvement. Many in this group believed strongly in the importance of low stocking rates.

They often had large properties and this may have enabled them to produce a living despite low stocking rates.

Comfortable:

This group represented the second largest group, making up 20 per cent to 40 per cent of the population. Many in this group claimed to have significant areas of perennial pastures, but did not see the need for re-sowing, top-dressing, or a change from set stocking.

These farmers were typically older, and often grazed beef cattle because of their lower management needs. They were not interested in increasing their workload or accepting additional risks, as they had sufficient income for the foreseeable future and recognized their children as unlikely to succeed them in the farm business.

Retreatists:

Mainly found around major population centers, this group was mostly composed of rural residential dwellers or absentee hobby farmers.

Pasture was chiefly judged on an aesthetic basis, and group members had *little time to undertake significant management tasks.*

Many of the studies reviewed did not include this group, as its members generally failed to qualify as farmers according to ABS criteria

While this segmentation is related to the adoption of pasture management practices it is not unreasonable to expect that a similar differentiation exists based upon farmers attitude to adopting weed control practices.

1.1.5 Market Segments for Weed Control

- Describing / Categorising / Segmenting / Grouping Farmers Using the 3 D Approach

Consistent with the approach described above for pasture management it is evident that there are also different groups of producers with respect to *how they are managing weeds* and what their needs might be in improving their weed management.

The nature of groups will vary from weed to weed and region to region, but there are at least *three groups* that will be reasonably universal, and around which extension strategies can be planned, using the 3 D approach.

Communication resources and strategies should meet the needs of the main grazier segments with respect to their current weed management practices and which path they need to take to improve their weed management further.

The main segments and their needs are listed below:

Poor Weed Managers

The first group of producers is those whose weed management is *not at all effective.*

Their management is likely to be unplanned, reactive, based on very few methods of weed control and carried out in an ad hoc fashion.

These are characterised by a lack of deliberation, diversity and diligence in their weed management.

They may believe they are prevented from improving weed control by factors such as lack of time, money and labour, or believe their efforts will be wasted because of the vagaries of the weather.

Communication Strategy / Extension Approach / Adoption Path

Poorer weed managers tend to use a few methods of control in a casual and reactive way.

Strategic and integrated weed management requires competence with a range of weed control methods, and there is little point in encouraging the poorer weed managers to adopt additional methods if they do not use these diligently.

For this reason, it is suggested that the major focus for improving weed management among poorer weed managers should be upon *more diligent use of a few well chosen methods.*

An adoption path for all weed managers should include, at least in theory, a combination of increased diligence, increased range of methods (diversity) and increased planning (deliberation).

In practice, a more planned, strategic approach to weed and pasture management will generally be beyond the physical, attitudinal and mental capacity of many poorer weed managers.

It requires as a prerequisite that the weed manager is competent in the use of a range of weed control methods. However the adoption of more planned, strategic approaches probably requires more than simple provision of information. It will also need educational support such as have been used with programs such as ProGraze, Triple P and Grazing for Profit.

This then leaves increased diligence and the use of increased range of methods as adoption paths for the poorer weed managers.

However, there is little point in adopting a wider range of control methods, unless they are applied diligently. This suggests that the best course of action to improve weed management by this group is to improve the diligence with which they tackle weed control.

In other words the poorer weed managers need to be encouraged to use one or two straightforward weed control methods diligently.

It is worth noting that weed levels are a trigger for action in this group and many may be waiting until levels are too high before taking action.

In addition, many may feel that their best efforts will come to nothing because of the vagaries of the weather. This is a potent justification for neglecting weed control among some personality types.

There are a number of ways simple extension messages can help overcome some of these barriers to diligence in weed control. Communication tactics for this group include:

Firstly, thresholds for action may be able to be lowered with visual communication aids including pictures or photographs indicating various levels of weed density. The message is along lines such as: “If [a particular weed] looks like this [picture 1] on your place then this is the time to act. Do not wait until it looks like this [picture 2] or weed control will become too difficult, time consuming and expensive”. This also addresses the three major barriers to weed control amongst the poorer weed managers – labour, money and time

Secondly, the concept of ‘one year’s seed, seven years weed’ or ‘a stitch in time saves nine’ is widely accepted among primary producers. There are a number of areas where this idea can form the basis of extension messages.

Thirdly, extension messages that emphasise options for weed control that arise in unusual seasonal conditions can be publicised when these conditions occur. (e.g. abnormal growth rates of weeds may require a different control method or herbicide choice). This not only raises awareness but increases effectiveness of weed control.

Lastly, extension messages can emphasise that, while livestock production and cropping is never simple, producers can make their weed control simpler by establishing a routine with a few straightforward methods and following it diligently.

‘Simple Diligents’

The second, fairly universal group of producers is those who are achieving reasonable to good weed control of the main declared and broadleaf weeds through the diligent application of a small number of straightforward chemical and mechanical methods.

These include the more traditional approaches/options such as spot spraying, boom spraying, and ‘chipping them out’.

However, they may still be losing production to lesser known weeds.

These graziers compensate for ‘imagination’ with persistence.

They are often motivated by a sense of ‘pride in property’ and are also concerned about the productivity of their pastures.

However, they may tend to focus on declared weeds and may not be aware of plants that are causing production losses on their property, particularly grass weeds. They may therefore be losing income through the impact of plants that they do not *recognise* as 'weeds'.

With these individuals it is likely that *awareness will lead to action*. That is, that once these graziers are aware that a plant is reducing farm productivity, they will include it in their regular weed control operations.

These graziers are less likely to respond to information on new weed control practices, since their existing methods, in combination with diligence, have so far proved effective.

It is worth noting that these producers are largely reliant on application of herbicides, and that they spend a large proportion of their time and energy controlling weeds.

It is likely that factors such as increased costs of herbicides, the appearance of new weeds, reduction in availability of labour, the development of herbicide resistance and the influence of aging may reduce their ability to control weeds, resulting in them joining the poorer weed management group.

Communication Strategy/ Extension Approach / Adoption Path

The extension focus for maintaining and improving the effectiveness of weed management in this group should be upon developing skills in the identification of the lesser known weeds (including grass weeds), alerting them when new weed problems emerge and increasing their awareness of the advantages of newer weed control methods.

For those who are already achieving good weed control, there is still the potential for technical innovation to bring further improvements, such as through solutions to herbicide resistance problems and methods of control that are more effective in the use of the farmer's time.

Better Weed Managers

These are more likely to be younger, more progressive, often mixed farmers and some have off-farm work commitments.

To assist this group to continue as effective weed managers, extension and communication should focus on detailed information about emerging weed threats, alternatives to herbicides including pasture management, and time-saving control practices.

This group will more readily access internet resources.

Assisting better managers to become better still

Graziers may achieve a high level of weed control though using a greater diversity of weed control methods in a more integrated fashion.

Such diversity of approach is typical of graziers in cropping systems with planned pasture rotations, where farmers are profit-driven and weeds are considered a source of lost income.

In the case of many younger farmers, off-farm work reduces the amount of time they have available for controlling weeds. The key in these situations may be to provide information on weed control options that require relatively little time and effort.

Increasing ease-of-access to information about weed control, and hence saving the amount of time and effort spent looking for it, is also likely to assist with weed control in these situations.

1.1.6 Understanding the Adoption Process

(Note Incorporate sections into "breakout boxes"?)

In order to bring about improved weed management it may be necessary to encourage farmers to adopt a new method of weed control or a technical innovation. However no matter how important or relevant some of these innovations may appear to a professional weed extension officer, their adoption may nevertheless be slow and frustrating.

Having an appreciation of some of the factors that lead to the adoption of an agricultural innovation can help to increase its uptake among farmers. It also allows for improvements in planning or formulating a weed control strategy i.e. as part of the *deliberation* process as part of this manual.

Qualities of innovations (Breakout box?)

There are qualities of innovations that may increase or decrease their adoption potential.
Adoption is unlikely if management strategies are not in the best interests of individual farmers. Some key considerations that affect the adoption of new farming technologies are as follows.

1. Complexity. Adoption probability reduces with increasing complexity.

2. Divisibility. Partial adoption is viewed as a form of trial adoption. Techniques that cannot be easily divided into manageable parts require farmers' total commitment to the new innovation before implementation, and so are less likely to be adopted.

3. Compatibility. Farmers are more likely to adopt innovations that are suited to their farm and personal objectives.

4. Economics. The more likely the economic benefit, the more probable an innovation will be adopted.

5. Expense. Much innovation requires considerable capital outlay, which many farmers may be unable to afford.

6. Knowledge requirements. Innovations with high additional learning needs are less likely to be adopted.

7. Risk and uncertainty. Most farmers are averse towards risk and uncertainty, so more risky strategies are unlikely to be adopted.

8. Conflicting information. Farmers receive information from numerous sources, which often contradict each other. This increases uncertainty and lowers the probability of adoption.

9. Perception. If farmers are aware that they are personally affected by land degradation, they are more likely to adopt appropriate management techniques.

10. Social context. Social networks of farmers have a crucial role in providing information about an innovation, and also provide social support for adoption or non-adoption of an activity.

11. Flexibility. Farmers prefer land management practices to be flexible, allowing them to change in response to market and climate conditions.

Taking the above characteristics into consideration it is evident then that the more readily adopted technologies (Vanclay and Lawrence (2002) are generally:

(Breakout box?)

- commensurate with other farm activities;
- clearly profitable;
- do not require a substantial capital or intellectual outlay;
- involve little risk;
- do not require a major change to farm management;
- are simple;
- can be adopted in parts;
- are widely and uniformly supported by extension agencies, other farmers and farm literature; and
- do not reduce farmers' flexibility.

1.1.7 Motivations and Barriers for Weed Control

Weed levels on farms represent a balance struck by managers between the barriers and difficulties they face, and how hard and how effectively they are prepared to work to overcome these barriers.

The effectiveness of weed control efforts is a function of the 3Ds described in the previous section, and the motivations that influence day-to-day weed control decisions.

1.1.7.1 Motivations for Effective Weed Management

The motivations to undertake weed control amongst farmers are wide ranging, reflecting knowledge and skills, attitudes towards weed control, and innovation behaviour.

- Among the more effective weed managers, weed life cycle events are a motivation for action.

- On mixed farming and grazing properties, fitting weed control in with farm operations as the opportunity arises is an important motivation for action, but the demands of mixed farming may lead to a lower priority being placed on weed control (in pastures).

- The time of year is a more important motivation among those who are only using a few weed control practices.

- Concerns about weed levels getting worse, or weeds being invasive are a motivation for action among the poorer weed managers.

- Concerns about weed impact on production or product quality motivates some graziers to take action.
- However it is worth noting that the motivation that is often the basis of extension communication – awareness of the impacts on productivity – is not regarded highly by the vast majority of landholders.
- Significantly, although many producers are well aware that weeds are costing them money, it is not necessarily this aspect that motivates day-to-day decisions about weed control.

- Pride in appearance of one's property, and pressure from weed authorities were rarely
- reported as motivations to take action.

A number of motivations that are demonstrably related to better weed control have been identified:

- awareness of the effects of weeds on livestock and the value of livestock products,

- awareness of the invasive and competitive nature of particular weeds, including those new to the district,

- advice from agricultural consultants, retailers and fertilizer and chemical company representatives (an important factor in the generally better weed control among those who are cropping),

- awareness that local well-regarded producers are successfully using a weed control method,

Many of those better weed managers using grazing-related weed control measures (which take longer to show improvements in the weed situation) regard persistence as important. These are therefore more inclined to be aware of the importance of perennial weeds and those which are longer lived.

The poorer weed managers

Undoubtedly the greatest concern amongst weed extension officers and weed control authorities relates to the poorer weed managers.

Poorer weed management appears to be associated with weed levels and time of year as motivations for weed control. Clearly, waiting until weed levels are high before acting is inconsistent with the 3Ds for effective weed management.

The association between time of year as a motivation for weed control and poorer weed management may reflect a tendency for some producers to undertake particular weed control operations routinely at a particular time of year, without paying too much attention to the life cycle stage of the weed or other factors important in the weed control decision.

However, weed control undertaken at particular times of year, with due consideration of other factors can improve the diligence of weed management efforts.

It must also be appreciated that it is the poorer weed managers who believe they are prevented from improving weed control by factors such as lack of time, money and labour – factors that may well be within their own management control.

This suggests that there will be situations where improving the standard of weed management will require first that overall farm management and profitability are raised to higher standards. In comparison, the better weed managers appear to be more troubled by spillover effects from adjoining properties.

Views about How Much Weeds Reduce Returns

There is widespread awareness of the costs of weed control and the loss in pasture production caused by weeds.

However, it is important to note that awareness of these costs does not necessarily lead to farmers improving their weed management.

There were no significant differences in perceptions of reductions in returns among the weed control groups – in other words, those who were doing relatively little to control weeds appeared to be just as aware of the costs of weeds to their grazing enterprises as those who were using a wide range of control practices.

If the rate of spread of a weed is relatively slow, the point in the future at which returns are seriously reduced may be well beyond the planning horizon of an older farmer.

1.1.7.2 Reasons for not Adopting Improved Weed Control Practices

Barriers reported to the adoption of improved weed management practices:

The barriers that farmers believed they faced in controlling weeds fell into two broad groups:

- those that are feasibly within management control, such as lack of time, money or labour; and

- those that are beyond management control, such as drought, neighbours with weeds, or weeds on adjoining public land.

- The most frequently reported was *lack of resources* including especially lack of time and lack of money as well as shortage of labour.

Significantly these are more likely to be reported by the *poorer weed managers* who believe they are prevented from improving weed control by factors such as lack of time, money and labour – factors that may well be within their own management control.

- Spread of infestations from neighbours was more likely to be reported by better weed managers.

- Difficult country and dislike of chemicals are reported as problems by significant numbers of graziers.

- Interestingly lack of information was not regarded as a major impediment to improved weed control practices.

A number of specific barriers demonstrably related to poor weed controls have been identified:

- inability to identify particular grass weeds,

- time and monetary constraints,

- areas on the property where topography makes access and control difficult,

- weeds that have, or appear to have some feed value at sometimes of the year, but which lower the productivity of pasture on the whole,

1.1.7.3 Barriers to Weed Control Diligence

A number of reasons have been identified for contributing to lack of diligence in controlling weeds.

Firstly, weed control has traditionally received little attention in grazing industries.

Unlike cropping where weeds have long been recognised as a threat to farm profitability and the subject of research and extension, the traditional approach to weed control in the grazing industries has been ‘something you can manage when you have time’.

Noxious, or declared weeds, are the obvious exception, as they bear financial penalties and must therefore be considered as affecting farm profits.

Plants that are not listed as noxious, but which potentially reduce income, are often not recognised as being important to control, except when their impacts are obvious, such as stock injury or poisoning.

This lack of recognition particularly applies to grass weeds that reduce productivity on the whole, but which provide, or appear to provide, feed at particular times of the year.

Raising awareness about less well known weeds will be likely to increase the effort spent controlling these weeds on properties where some priority is placed on weed control.

However, there will still be some graziers who place little priority on weed control, upon whom such activities would have little impact.

Lack of time is another factor reducing diligence, and can be related to priorities. This is particularly the case with graziers who have full or part-time jobs.

Any time that is available for farm work is spent on tasks that are perceived as being more urgent, such as feeding stock or controlling internal parasites.

For graziers in this situation, emphasis on time effective methods of control may lead to better weed control or perhaps the employment of casual labour.

Seasons are another important factor, particularly dry seasons. There is a tendency for graziers to regard weeds as useful for stock feed in dry times, as they are 'the only thing that hang on'. Limited finances, typically constrained in dry years, add to the temptation to defer weed control until a time when the finances are available.

There is also a tendency to regard some weeds as a temporary or seasonal problem, only affecting production at certain times or the year, or only appearing some years and not others.

The result is that weeds are only controlled occasionally, if at all, rather than as an integral part of routine farm operations. When weed control is carried out it is often *ad-hoc and poorly implemented*, with the result that pasture is damaged or at least that weeds are not reduced, which can discourage further efforts.

It should be noted that this emphasizes the importance of discussing the competitiveness of desirable species in most weed workshops

Finally, there are those graziers who are not interested in improving profitability, being content to earn a marginal income from their property.

This is particularly the case with *older farmers approaching retirement*, but with no heir to the property and therefore little incentive to improve farm profitability. Those in this situation may place more priority on weed control if they were made aware of the reduction in the value of their property due to the presence of weeds

This is noteworthy given that there is an aging farming population and a consistent trend towards less young people returning to the land.

2 Segment 2

2.1 Facilitat ion Outline

The following provides an outline of how to go about preparing and planning and conducting a training workshop in the area of weed management. It relies heavily upon the preceding discussions on the sociology of weeds and uses the 3D approach as the “organisational theme”.

2.1.1 Naming Your Workshop

By definition weeds are unwanted and undesirable and therefore in the eyes of most landholders are regarded as an aspect of landownership they would prefer not to have. Nevertheless, there exists – or should exist - either a physical, social, moral or legal incentive to control them.

Despite this attitude, weed advisory officers have a commitment to encourage and advise landowners about how to better manage their weeds.

In the planning of a workshop it becomes essential to make the workshop as appealing or attractive as possible. This is important because for most landholders weeds generally and understandably have negative connotations.

Furthermore it is also fair to say that that most aspects of weed management are seen to be rather dull, boring and uninteresting.

For these reasons choice of a suitable and appropriate name for the workshop can be critical to attracting a reasonable number of participants.

Always try and include a positive tone and one which entices farmers to “want” to attend. In other words we need to encourage farmers to respond to the workshop title by saying words to the effect of “that sounds interesting/good” or even better “I must go to that”.

In choosing a suitable title always therefore include positive or encouraging messages. For instance rather than running a workshop on “Controlling serrated tussock” a better and more appealing workshop title may be “How best to control serrated tussock” or “Success with Tussock”.

This will be more appealing and will be more inclined to motivate people to want to attend.
It is a useful tip to always try and put yourself in the shoes of your farming audience and ask the rhetorical question “Would this appeal to me” remembering that this is often the first point of contact that you have with your potential audience.

A noteworthy aspect of selecting an appropriate and appealing title is that it also helps in the actual planning of the workshop. For instance if the workshop was titled “Keys to success with fireweed” it provides some structure to planning the workshop as well as allowing you to define some important take-home messages.

2.1.2 Conducting Your Workshop – Where & When

Guidelines about how to go about actually planning the physical aspects of the Workshop are provided elsewhere in this Manual (see Segment on Group Training in Appendix).

However a few points are worthy of noting;

To maximise the effectiveness of conducting any training workshop – and especially those relating to weeds – it is important that it be run at the optimum time and place. This will largely be consistent with the overall aims or objectives of the workshop which will dictate when this should occur.

For example if the particular workshop has as a focus the identification of a particular weed then the workshop should be run at a time and location which enables participants to achieve this. This should also be linked to key or critical stages of both life cycle of the weed as well as stages of growth which are optimum for control.

It should also be stressed that often it is not possible to find a location or time where it is possible to achieve all of your planned objectives. In this instance you may need to organise a fall-back position. For example if the purpose of the workshop is to "improve your skills and ability to identify the top ten weeds of the district' then there is almost certainly a need for you to collect specimens from elsewhere and bring them to the workshop. Alternatively you may have potted specimens that can be brought along.

In doing so it is worth stressing that identification of weeds – or indeed any plant – is best achieved by inspecting a live specimen, ideally at different growth stages. Pictures in books, no matter how good they may seem to the experienced advisor, are not nearly as effective as being able to touch and smell the real thing.

In the "Less Weeds from Pastures Producer" guide that accompanies this Training Course the importance of being able to identify both weeds and desirable species is emphasised as a critical and fundamental stage in any weed control program. The important point here is that to maximise the effectiveness of any weeds related workshop it is essential to plan well ahead.

2.1.3 Planning you Workshop – the 3D Approach

A broad overview of the steps in actually planning a training workshop including developing an appropriate format or structure has been comprehensively described in Segment X on Group Learning in the Appendix.

The following comments therefore relate specifically to how you might best go about conducting a workshop specifically relating to weed control/management. In doing so it gives consideration to and incorporates the principles mentioned in Segments XYX.

As mentioned previously the "3Ds" of effective weed management provide an appropriate common *organising theme* which helps you to identify the needs of graziers, and also helps graziers evaluate their own situation.

It is recommended that the 3Ds approach should be used too as the basis of planning your training workshop in terms of both developing your Lesson Plan and as a vehicle for conveying/communicating your key messages.

The 3 D's also provides the basis for understanding not only some of the barriers to adopting better weed control but also some of the motivators.

The 3Ds of weed management are:

- Deliberation (planned, strategic and integrated weed control),
- Diversity (of methods), and
- Diligence (in application of methods).

When preparing for an information session there are three key areas to keep in mind:
1. What is your message?
2. Who are you presenting to?
3. What is the best way to get your message across?

2.1.4 Identify Your Goal(s)

The basic first starting point in conducting a training Course/Workshop is to come to clear understanding of what it is that you hope to achieve i.e. to define your overall goal.

For example the overall goal may be to improve the control of a particular weed in a particular locality.

The goal should be at the forefront of your thinking when planning all aspects of your workshop. However do not confuse your goal with your specific workshop objectives or outcomes which are described below.

The overall goal should be described to participants at the start of the workshop.
In the process of defining your goals and objectives (see below) give careful consideration to the training needs of farmers.

However one of the biggest traps we can fall into is assuming that an extension worker, no matter how experienced, will always know what are the needs of the farming community.

In reality the needs may be quite different to those we presume. For this reason it is useful to identify the needs of the people to whom you may be presenting. This can be done quite simply by ASKING members what they would like to know and what they believe are their needs. This should be done ideally before the workshop but also should occur at the commencement of the workshop during an introductory session, especially if the audience is unknown to you. This process not only helps you in your workshop planning but also if the needs/expectations of participants are described at the outset then you can cross check at the conclusion to ensure that their needs have been satisfied.

2.1.5 What are the Workshop Objectives & Outcomes

Having defined your overall goal the next step is to establish a series of objectives or outcomes which you hope to achieve during the workshop.

They must be quite specific and 'measurable' and should address such aspects as:

What do you want your participants to achieve?

What knowledge and/or skills should they have by the end of your session?

The development of the objectives should be designed so that they will understandably contribute to the achievement of your overall goal.

List your objectives and outcomes for your training workshop under your overall Goal. Again these should be presented to the group at the beginning of the workshop so that participants have a clear understanding of the workshop content.

Listing your objectives will also provide an important role in helping to develop your workshop session plan and designing activities for your session. Think about the key information or messages that you wish to share with your audience. Again always put yourself in their shoes by posing the question "What is it that I want my audience to be able to achieve by participating in this workshop?"

Another way of looking at it is to pose the question "What does success look like?"

By way of example a Workshop may be titled: *Serrated Tussock Control – the secrets of success!*

Overall goal: To improve the effectiveness of serrated tussock control
Objectives: As a consequence of participating in this workshop participants should achieve the following learning outcomes/objectives:

1. Learn to identify serrated tussock with confidence
2. Understand the life cycle of S.T, including any weak or vulnerable stages
3. List all of the control methods at my disposal
4. Develop a plan of action for my own property

It is useful to try and list the objectives in chronological order or sequence, as this helps in preparing your lesson plans.

<u>Remember</u>: the overall goal and objectives, together with your session plan, must be developed in accordance with the particular weed(s) in mind - that is, it must be individualized to the specific weed (as well as the farmers' needs, see later). There is no such thing as a universal approach to all weeds.

2.1.6 Developing Your Lesson Plan

Having described your overall goal and established key learning outcomes and objectives to help achieve that goal, the next stage is to develop your lesson plan.

The lesson plan is effectively the nuts and bolts as to how you will actually go about the instructing/teaching process presented in a logical sequence. It includes a description of what you the trainer will do as well as any activities the participants will perform.

The process by which you go about developing the lesson plan is well described in Segment X on Group and Adult Learning in the Appendix.

However in developing your lesson plans it is essential to take into account some of the messages derived from the UNE and Rural Enablers reports as described in Segments XYZ. This includes especially the critical importance of tailoring extension strategies to the weed problem on hand.

1. This careful design of the fit between the problem and solution involves consideration of:
2. the nature of the weed and its behaviour in the agricultural production system,
3. the technical options for control,
4. the nature of weed management that is currently occurring or not occurring,
5. the reasons for ineffective weed management,
6. the capacity of farm businesses to support improved or changed weed management,
7. the distribution of costs and benefits of improved or changed weed management, and
8. the most appropriate and effective way to bring about these improvements or changes, given the incentives and disincentives for action resulting from distribution of costs and benefits.

When preparing for an information session there are three key areas to keep in mind:

1. What is your message?
2. Who are you presenting to?
3. What is the best way to get your message across?

Each of these three things will vary according to the particular workshop, the particular weed and, most importantly the individual group of people.

2.1.7 "Deliberation"

Deliberation is the planning of weed control (in a proactive way).

There are various aspects of the deliberation process from the viewpoint of conducting a weed control workshop. This includes firstly addressing the physical aspects of the production/weed management system; as well as coming to terms with the characteristics and needs of the weed managers themselves.

Physical Characteristics of the Weeds

"Communication and extension efforts focusing on production losses should be very specific about what plants cause the losses, and make sure that graziers are able to recognise these plants in their pastures." UNE Report

It is not unreasonable to assume that most weed control workshops will focus on one or more specific weeds or groups of weeds.

While in some situations a range of indirect more general weed control practices or control methods will be described and discussed in some level of detail during the workshop, usually these are associated with a particular target weed or weeds in mind. Indeed the effectiveness of learning is always enhanced if they can be related back by way of example to weeds with which the group may be familiar.

For example if your aim is to explain the use of herbicides then this is best explained in terms of their efficacy against particular weed species.

Furthermore aspects of management are usually objectives or outcomes of a workshop and are best achieved under an overall goal of addressing a target weed.

For example the overall goal of the workshop may be to increase the effectiveness of control of Paterson's curse of which one of your designated learning outcomes is to become familiar with the use of appropriate herbicides.

Having identified a specific weed or group of weeds as being the primary focus it is important at the outset to come to terms with the physical nature of the weed itself and its behaviour in the agricultural production system.

In your preparation for the workshop this can be addressed by *posing a series of questions.*

Ensure you have a live sample of the weed(s) to help with answering some of these questions. Ideally have specimens at different growth stages, including at the vegetative and flowering stage. This is most important not only because it is vital that farmers be able to identify plants throughout their different growth stages but because control options will vary accordingly.

These questions can also be presented and discussed with the group as part of the workshop process.

They should include:

What is the weed or group of weeds we are concerned about and attempting to control?

(Try and put the weed into context i.e. fireweed is a member of the "daisy" family which also includes fleabane; Serrated Tussock and Chilean Needlegrass are both of the genus Nassella and are closely related to the Stipa group of native Australian grasses. This often puts some aspects of weed control into perspective, for instance the challenge of finding safe biological control agents)

What are its main physical characteristics?
This includes a physical description – what are key distinguishing features to be used to assist with identification (relate to the live specimens).

What are its growth characteristics?
Is it an annual v biennial v perennial?
What is its life cycle?
When does it germinate, grow and flower/seed and when is its most active growth period.

(Try and be as specific as you can to the months rather than a broad period or season. This allows you to be more prescriptive when you come to defining the diversity of control options.)

How does it spread?
The method of spread can be quite important not only from the physical control perspective but also planning weed control over a broader region i.e. planning regional weed control strategies. Also concerns about weed levels getting worse, or weeds being invasive are a motivation for action among the poorer weed managers.

Consistent with the approach to group learning as described in Segment X in the Appendix, always in the first instance encourage the group to answer the above questions for themselves. This undoubtedly contributes to more effective learning. This is discussed in more detail under Segment Diversity.

After consideration of the above, you should now identify any weak or vulnerable stages in its life cycle as well as conditions favouring or constraining reproduction and spread which can be used to target in developing a weed control strategy

Alternatively, consider what are the strengths of the weed which allows it to grow, invade and dominate in the environment or pasture system? Is its presence telling us anything either about the weed itself or about our management system or the capacity of our pastures to compete with the weed(s).

This raises the leading question: *Why is the weed there?* and *What is the weed telling us (i.e. about our management system)?*

Note: At this stage of the deliberation process do not go into too much detail about the diversity of control options – this will come later. The purpose is too familiarize participants with important physical characteristics of the plant.

Remember that one of the major barriers to control of weeds for ALL categories or segments of farmers is identification.

This included not only the poorer managers but even the better managers and so-called simple diligents who, though they are achieving reasonably good control of most weeds with which they are familiar, may nevertheless encounter problems with those they don't know. This includes new and emerging weeds as well as grass weeds.

2.1.8 Physical Characteristics of the Current production System; Assessing Pasture Composition

While our emphasis to now how been primarily upon the weed itself, it is equally important to come to terms with the pasture system itself with a focus upon the capacity of the pasture to compete with weeds. This requires consideration of the various pasture components as well as their density and vigour and should also incorporate the management system being imposed.

Demonstration of techniques for assessing pasture composition should be a mandatory component of almost all weed control workshops. The need to develop skills of landholders in assessing pasture composition helps in both determining the current situation as well as setting appropriate composition targets.

In doing so it is emphasized that pasture assessment includes all components of the pasture including weeds.

There is a need therefore in many weeds related workshops to include a training segment on both:

- How to Assess Pasture Composition
- Setting Pasture Composition targets

Understanding and explanation of the results is a key component of the deliberation process.

It is especially crucial in being able to provide an objective assessment of both the level of weed infestation i.e. for each particular weed or group of weeds, as well as the inherent competitiveness of the pasture.

Developing this skill and knowledge is a vitally important preliminary step in helping formulate an appropriate weed control program in terms of selecting from the diversity of weed control methods.

Also it should be stressed that one of the main motivators for the poorer weed control managers relates to level of weed infestation (together with identification, method of spread and time of year). Becoming confident in using a simple and effective technique in objectively assessing the level of weeds will prove to be of immense benefit in encouraging landholders to commence weed control programs before they get away.

Techniques and guidelines for assessing pasture composition are provided in the Appendix.

Facilitating a discussing on pasture composition targets is essential to ensuring that the results of the composition assessment are relevant and meaningful. While undertaking an assessment of the various components of the pasture is a useful starting point, especially in terms of prioritizing paddocks for weed control or pasture renovation, it is important that equal consideration is also given to establishing a target to work towards.

The discussion of pasture composition allows you to describe the various components of the pasture and what role they have in both controlling or suppressing weeds as well as enhancing the competitiveness of the pasture to weed invasion. The various pasture components which are assessed can be tailored to the individual situation, consistent with the overall paddock goals and should include at the least:

- Desirable Perennial Grasses
- Legumes
- Annual grass “weeds”
- Broadleaf weeds
- Noxious weeds
- Litter
- Bare Ground

Each if these categories may be further broken down into sub-categories. For instance you may wish to differentiate between particular species of legumes, grasses or broadleaf weeds depending upon the overall goal and objectives of the workshop.

The recommended approach here is the same as that you have already been through for the specific weeds.

The difference here is that now you need to go through a similar process for each of the desirable species, remembering that the concept of “desirable” within the context of weed control has more of a focus upon being able to compete or alternatively reduce/prevent the invasion and germination of weeds. This is further explained in Segment X *Diversity* of weed control methods.

This will therefore necessitate progressing through the same step by step process and posing the same questions as those outlined for weeds.

The actual process will be dependent upon the situation and overall workshop objectives. If you are deliberately conducting the workshop in close proximity to a particular chosen paddock which contains certain focus weeds, then you can describe the individual pasture species present within that paddock. (This of course also is the paddock in which you have demonstrated the techniques in pasture assessment).

If however this is not possible then it is suggested that you relate the technique/procedure to the common pasture species in the district. In doing so it is strongly recommended that you bring live specimens of all of the desirable species – as well as the focus weeds – on the basis that developing skills in identification of the desirable species is just as important as being able to identify the undesirable weeds.

This approach is especially relevant to the better weed managers who are motivated by developing an integrated approach to weed and pasture management.
(Note: it takes time to collect these plants – which must be done the day before to keep them fresh - so again this reinforces the need for adequate preparation and planning. Alternatively grow a series of potted specimens to be used specifically for this task.)

It needs to be emphasized that developing an appreciation and understanding of how to identify the desirable species of the pasture is just as important as the undesirable or weeds species. This particularly relates to the growth habit (perennial v annual) and life cycle of the desirable species in terms of when is their active growth period, as well as when they germinate and set seed. Using this information is used to help identify the strengths of the desirable species so that they can be utilised to target the weak or vulnerable stage of the particular weed(s).

For example, it is recognized that serrated tussock and Chilean needlegrass, as well as many annual grasses and broadleaf weeds (i.e. Paterson's curse) germinate mainly in autumn / winter. Therefore it is important to stress to participants the importance of maintaining high levels of ground cover at this time. Similarly the vigour and competitiveness of the perennial grasses and clover should also be encouraged at this time. This is achieved through strategic spelling as well fertilizer application.

Note: A more specific and comprehensive description of this process is contained in the "Less Weeds From Pastures" guide developed by MLA to accompany this training Course. A number of MLA Tips n Tools also are useful technical guides.

NOTE: It is essential when running the workshop that you spend time highlighting the key periods in the growth stage of weeds and desirable species when certain activities should be carried out. This especially relates to the life cycle of the weeds.

This relates to the fact that one of the characteristics of the poorer weed managers – and even the simple diligents – is that they tend to follow a routine. It is essential that this routine is undertaken at the optimum time in accordance with weed control measures and that they be undertaken diligently.

Also the two identified motivators for weed control among the poorer weed managers are "weed levels" and "time of year". This again reinforces the need for you to stress the optimum time to undertake weed control. This fact is even more important when you recall that the poorer weed managers describe lack of time and labour as amongst their major barriers to undertaking weed control. It is important therefore that their time is used as cost-effectively as possible.
These are important messages to convey in all weed control workshops.

"The association between time of year as a motivation for weed control and poorer weed management may reflect a tendency for some producers to undertake particular weed control operations routinely at a particular time of year, without paying too much attention to the life cycle stage of the weed or other factors important in the weed control decision. However, weed control undertaken at particular times of year, with due consideration of other factors can improve the diligence of weed management efforts."

The association between time of year as a motivation for weed control and poorer weed management may reflect a tendency for some producers to undertake particular weed control operations routinely at a particular time of year, without paying too much attention to the life cycle stage of the weed or other factors important in the weed control decision." (UNE Report).

Current Management

The next focus of your attention amongst the group should be consideration of the current management system which is being undertaken. This should include discussion of the weed management practices being implemented as well as grazing management and fertilizer regime.

Coming to terms with these aspects of management can provide valuable insight into the reasons for effective or ineffective weed control. This exercise is especially valuable in a group workshop because it provides interaction and an opportunity for farmers to share management tips and opinions. This is especially important because it helps to gain insight into the techniques should be promoted. This also provides a useful insight into behavioural attitudes as part of the market segmentation approach.

2.1.9 Target Your Audience

Equally important in the deliberation/planning process of your Workshop is the need for categorization or segmentation of your target audience into various groups. Grouping farmers in accordance with attitudes towards management and change is useful in identifying motivations, or triggers, that are likely to prompt different groups of graziers to adopt better weed management practices.

It also allows you to tailor a message or recommendation to that particular market or target audience.

This is based upon the fundamental premise that farmers are nor homogenous but vary in many ways, including not only in terms of their physical characteristics (such as size of enterprise, soil types and fertility, vegetation cover, topography, climate, and weeds present); but also most importantly in terms of their propensity to adopt new ideas and accept change. Farmers will also differ in their opinions about the desirability of a plant.

Understanding how these kinds of factors influence weed management is obviously crucial to promoting improved management of weeds.

Having accepted the importance of this approach how do we actually go about it?

Unlike a one-on-one situation, the need to categorise or segment farmers will understandably be quite difficult in a group training environment unless of course the participants are well known to you as deliverer.

Where possible try and gain some insight into the background of participants before the workshop. This may be achieved by doing some "homework" i.e. by asking other farmers or perhaps other extension officers and advisors.

Alternatively it is a good idea and a highly recommended practice to send out a questionnaire to participants well before the workshop.

This should include some “leading” questions to help gain some insight into the current management systems as well as their attitudes towards weed control. This survey can be sent out on the premise that you wish to gain some advance feel for their expectations from the workshop and identify any issues of concern. This survey serves two purposes – it helps you to prepare properly but also helps to make the workshop relevant to their specific needs and tailor your messages and strategies to the individual’s requirements.

The overall ‘description’ or segmentation of farming participants to some extent can be developed in accordance with the overall goal and objectives of the Workshop.

At the basic level and in most workshop situations it may suffice simply to describe participants as being “poor weed managers”; “simple diligents” or “better weed controllers” in accordance with the previous descriptions in the UNE Report.

Alternatively – and depending upon your goal – a further breakdown into more defined segments will help in your delivery in allowing you to be more specific in tailoring your recommendations and advice.

The segmentation approach as described by Barr et al with regard to the way farmers approach pasture development and improvement has considerable worth and has been found to be equally relevant to the way farmers manage their weeds.

This includes the so-called Committed; Pasture Part Timers; Crop Focused; Belt Tighteners; Sceptics; Comfortable; and Retreatists.

Also because of the importance of pasture management in weed control and increasing the competitiveness of the desirable pasture species then this further emphasises the usefulness of this categorisation of landowners.

Note: Even if you do not actually go the is level of differentiation, an understanding of these categories and what drives or motivates them may suffice.

It should be further noted that it may not be necessary to absolutely categorise each individual landowner per se but rather to gain an insight into the overall representation of different segments amongst the group members.

Also to some extent it is possible to predict the breakdown of attendees at a workshop depending upon the subject. For example it is fair to assume that a field day on grazing management and weed control will appeal mostly to the better weed control managers with little representation of the poorer weed controllers.

(Note This re-emphasises the need to give careful consideration to the title of your Workshop to attract as many participants as possible, if this is your aim).

With the exception therefore of these very specific and targeted workshops it could be argued that amongst any group there will probably be representation from each segment or group of farmers. In other words we assume that all groups will be represented and therefore we develop our extension approach or strategy on this basis in the expectation that a message will be picked up by the individual based on their perception of relevance to their own situation.

2.1.10 Diversity of Tools and Tactics

Diversity relates to the range of weed control practices used, and how multiple methods can be used together to obtain better and more cost effective control.

It is evident from our previous discussions that the selection of a weed control practice or management tool by an individual farmer will vary according to the reasons previously described. Namely that farmers are by no means homogenous and vary enormously in terms of their physical environments and capacity and interest in adopting new ideas, including even what constitutes a weed.

It should be stressed that this is probably where many traditional extension campaigns and approaches have tended to fall down. That is on the assumption that all farmers think and act alike and therefore will automatically seek out and adopt “best practice”. However this is by no means the case.

In developing and recommending which of a diverse range of practices should be recommended we should take into consideration not only the characteristics of the tool or technique but also the requirements of the individual landowner. This should also allow for the motivations and barriers to adoption.

(Our approach here then is basically to describe the various tools and then to try and allocate or target these to the individual group, taking into account their attitudinal constraints as well as any barriers and motivations to adoption.)

Process:

In a workshop situation this can be undertaken by encouraging participants to describe various weed and pasture management tools in accordance with the three key objectives for weed management in pastures, namely:

- **Remove** the weed or **Prevent** weed seed set.
- **Reduce** weed germination.
- **Encourage** competition to weeds from desirable productive species

This can done by facilitating a brainstorming session whereby participants each individually develop there own suggestions and then share these with the group.

For each management tool proposed, ask the group to allocate it to one –or more – of the above objectives based upon what is its key purpose. These are transcribed onto butcher's paper.

For example, "herbicides" are categorised under the heading of "remove the weed/prevent seed set" while "fertilisers" come under the heading of "encouraging competition from desirable species".
Ask members of the group to also describe each management option according to the following leading questions.

- What is the principle, method, or technique of the option?
- Why is it applied?
- When is it applied?
- What are the potential outcomes – both desirable and undesirable?

The purpose of this approach is several-fold. It allows the participants to develop a sense of ownership of the process; it encourages interaction, especially if you allow the group themselves to answer the leading questions (making sure you address any uncertainties or correct any technical deficiencies); it provides some insight into the level of knowledge of group members and in doing so allows you to form an opinion about market segmentation.

While you should encourage the group to "answer" the questions for themselves, you need to be proactive to ensure that participants all come away with a very clear understanding about the use of each of the various tools and techniques. This necessitates you having already prepared thoroughly for this component of the training well before the workshop.

Use the questioning techniques as described in Segment X under the principles of adult learning.
Also encourage the participants to be as specific as possible when describing the particular tool or control method so that all participants have a clear and accurate interpretation. Again for example, if a respondent says "use of herbicides", ask for a more detailed description of the particular herbicide.
The point to be mindful of here is that this process is of fundamental importance as it allows you to "fit" or tailor each management tool to the various weed control group, whom you may or may not have previously identified. Furthermore it helps you to utilise the main motivators for weed control while also addressing any barriers.

Note also that in planning your overall outcomes/objectives of the training workshop you will of course be familiar with this process and can ensure that the Course objectives are being addressed.

Example 1: It is to be expected that the poorer weed managers and the simple diligent group will be more inclined to mention herbicides as a preferred control option. This is obviously quite valid and understandable. By posing the series of leading questions you can ensure that they are familiar with what is the best herbicide for the particular weed; when it should be applied – and at what rate; and also address any issues relating to its use, including any detrimental effects. Because the key to this group is to ensure that they adhere to a small number of tasks (including herbicide use), and undertake them diligently in a routine fashion and at the optimum time then it is a straightforward task to convey this message.

Example 2: The simple diligent group are already achieving satisfactory level of weed control with their existing or current weed problem(s) however they are vulnerable to the encroachment of new weeds with which they are unfamiliar.

On this basis you can use this workshop approach to identify any issues relating to identification and awareness of new and emerging weeds and then ensure facilitate a discussion of various weed control options.

Example 3: The competent weed mangers are driven by developing an integrated whole farm approach to weed control and pasture management which not only achieves satisfactory weed control but also increases pasture productivity. The process described above allows these participants to achieve an understanding of how this can be achieved.

Note: One major benefit of this facilitated group approach using the principles of adult learning as described in Segment X (which should be used throughout this training workshop) is that participants *learn from each other*. Within any group of farmers there exists a wealth of practical knowledge and experience which you – and other group members – can take advantage of. Remember, farmers learn best from each other. Your role is to facilitate the learning process, provide direction and contribute any technical support as required.

(NB This is consistent with one of the key findings from the UNE Report relating to extension methodology, that"effective extension requires social interaction between graziers and professionals, either in one-to-one or groups situations""

In doing so, and while we may have grouped individuals into different segments based on their previous history of weed control, as a consequence of the interaction of participants it is not to be unexpected that members may move from one group to another. That is, ideally is from being one of the poorer weed controllers progressively into being a simple diligent and then to a highly effective weed manager. While this is the ideal, we should never lose site however of the fundamental characteristics of the individuals who comprise these groups. In the long term our goal should be the adoption of long term sustainable weed control.

3 Segment 3

3.1 The Training Guide

3.1.1 Preparation

The key to conducting an effective and successful training activity is prior preparation. Always "expect the unexpected" and plan for any possible eventuality. This not only ensures a positive learning experience for participants but also gives you as deliverer a greater sense of confidence.

The action plan as described below is specific to the actual physical conduct of the workshop itself. It does not relate to "technical" preparation. This will require additional preparation in accordance with your own level of competency and experience. If there are aspects of the technical delivery of the workshop with which you are uncomfortable it is strongly suggested that you co-deliver – at least initially – with another professional colleague. This might include an agronomist for example who will tackle the issues relating to pasture management or plant growth.

Time Action	
8 weeks prior	• Select workshop date. • Book venue and check for any clashes of events. • Ensure the venue is close enough to a suitable paddock – that is, one which contains relevant weed and pasture species. • Arrange a co-facilitator or additional resource people if required. • Advertise and send out invitations to landholders if appropriate
6 weeks prior	• Confirm date and venue. • Book catering if needed. • Inspect the paddock to familiarise yourself with any new weeds or desirable species (with co-facilitator if using one). • Source any local weed and pasture information – (eg speak to local agronomists, other regional weeds officers, CMA staff, researchers etc) • Arrange some local case studies on subjects relevant to the Course with local landholders who have credibility in the eyes of other landholders and a “good story” to tell • Arrange for course material (notes, handouts and resources) to be provided and sent from the relevant suppliers.
3 weeks prior	• Ensure supply of relevant materials and practical equipment. • Re-visit the paddock – become familiar with relevant issues including especially both weeds and desirable species. If unsure about identification seek assistance. • Collect and pot any specimens for identification sessions if necessary. • Increase advertising campaign as you get closer to the event
2 weeks prior	• Confirm room, equipment and catering bookings. • Conduct a briefing session with co-facilitator or resource people – outline tasks, structure etc.
1 week prior	• Notify caterers of numbers or, if not catering, ensure participants are aware of eating arrangements. • Revise your delivery session(s) ensuring that you are well prepared on all technical aspects of the Course, including especially those areas in which you may be less experienced • Give careful consideration where possible to the participants who are attending including especially their individual learning styles and levels of skill/knowledge
2 days prior	• Collect all materials and training aids. • Do a test run of the workshop with co-facilitator.

1 day prior	• Access and set up the workshop venue, checking all materials. • If necessary, collect plant samples including both weeds and desirable species and store in a cool place overnight to ensure freshness of samples
WORKSHOP DAY	• Be early, prepare coffee, tea etc. • Complete registration forms and any other paperwork • Collect and receipt course fees. • At the conclusion of the workshop, collect evaluation forms and clean up.
Within 1 week	• Pay any invoices (venue hire, catering etc). • Collate feedback from evaluation forms • Send forms, registration sheets and assessment results to appropriate organisations. • De-brief on the workshop and make improvements to notes, structure and lesson plans. Give thought to "what worked and what didn't". This is most important !

3.1.2 Resources Checklist

When conducting a workshop ensure that you have access to the following resources:

☐ A good, comfortable, well lit and ventilated room, with tables; ensure adequate heating in winter and cooling in summer. Participants in your workshops will not be able to concentrate sufficiently if they are uncomfortable.

☐ Location should be in close proximity to a suitable paddock with a range of weed and desirable species that are consistent with the overall aims and objectives of the workshop i.e. representative of the district and topical to the participants

☐ Suitable cool storage for food and drink (fridge or eskies)

☐ Tea and coffee facilities

☐ Sunscreen and insect repellent

☐ Blackout facilities on the room (if required)

☐ Laminated plant labels (functional groups and species)

☐ Camera

☐ Business cards

☐ Overhead projector and screen

☐ Spare bulbs for overhead projectors

☐ Whiteboard

☐ Whiteboard pens and eraser

- ☐ Table cloths
- ☐ Extension cords and power boards
- ☐ Overheads and projection equipment to suit your planned presentation
- ☐ Name badges for participants
- ☐ Evaluation sheets
- ☐ Registration sheets
- ☐ Prizes (lollies, chocolates etc), if appropriate
- ☐ Paper towel
- ☐ Spade
- ☐ Permanent markers
- ☐ Backing board for field use
- ☐ Plastic bags
- ☐ A range of coloured pens and highlighters
- ☐ Pasture assessment tools including “rod points” (end point rods) and quadrats
- ☐ Case studies and local examples
- ☐ Plant specimens for plant identification, including both weeds and desirable species (particularly for high priority potential weeds)
- ☐ Photographs illustrating key weeds
- ☐ Relevant local plant identification resources

3.1.3 Workshop Delivery

There are four main criteria for delivering an effective weed control / management workshop:

- An ability to facilitate group discussion, draw out participant knowledge, have a rational approach to problem solving and integrate key weed management principles. There should be an emphasis upon you as the facilitator to stimulate and engage the participants. There is a strong need for the group to share knowledge rather than rely on pre-arranged lessons or presentations. Remember that amongst the group there will be a wealth of practical wisdom when it comes to weed and pasture management. It is important that you harness that knowledge and draw it out of participants. Spend as much time in preparing this aspect of your delivery as on technical content of material.

- A capacity to 'think on your feet' and respond to the needs and questions identified by participants by providing timely and relevant learning activities is essential.
  'Thinking on your feet' can be confronting to some people. When placed in this situation, a common response can be to simply present the theory associated with the topic in a 'stand and deliver' presentation.

This will be required in some circumstances (eg presenting new material), but participants should be encouraged to engage in discussion in order to discover an appropriate solution themselves.

Effective delivery of any workshop relies on a variety of delivery methods – some 'doing' activity, some theory, some consideration of application, and some reflection – what does this mean for me? Facilitators must also be perceptive in identifying the level understanding and experience within the group, and modify the presentation as a result. Addressing this need in terms of the segmentation of farmers into various target groups is a recurring theme in the planning and preparation of this workshop.

It is suggested when preparing for delivery of the workshop to try and "visualise" the needs of the group in terms of their potential knowledge and experience. In other words try and put yourself in their shoes.

- The deliverer should ideally have local knowledge and access to local weed research trial data, experiments, case studies etc for presentation and delivery to participants. While broad generic information or knowledge can be useful in making a point or explaining a principal, where possible local data should be obtained and formatted in a suitable medium for presentation. This adds to the relevancy and effectiveness of the workshop.

- The 'action learning cycle' should be used throughout the delivery of your training Course. This is explained in greater detail in Segment X in the Appendix.

Action – The exercise
Observation – How participants coped with it
Reflection – What participants say about it
Change – How it can be modified for the future

For example, an 'action' would be the participant's trialled in the paddock with some of the pasture assessment tools for determining pasture composition. The facilitator 'observed' how the participants coped with the tools and asked them to 'reflect' on what they found easy or difficult. If the participants were then asked what they thought could be improved or done differently next time (change), the action learning cycle would be completed.
Action learning does not always need to start with 'action'. The cycle can begin at any one of the four stages.

4 Workshop Lesson Plan

4.1 Introduction

The Lesson Plan will be dependent upon the overall goal and objectives of each particular workshop. The following is an indicative plan for a workshop which is aimed to improve the weed control of a particular weed and/or weeds using a range of control methods.

4.1.1 Introduction

Activity

- Listening
- Questioning
- Discussion

Purpose

- Welcome the participants and set the scene for the day.
- Introduce participants.
- Outline the objectives, format and content of the workshop.
- Establish some ground rules for the group.
- Establish the participants' expectations from attending the workshop.

Key messages

- Welcome the participants to the workshop.
- The format of the workshop.
- Outline all relevant health and safety issues or hazards the participants need to be aware of and explain how to avoid these issues.
- State that the workshop places emphasis on practical learning.
- Active participation, questioning and discussion are encouraged throughout the workshop.

Suggested approach

- If the group is new or you are new to the group – complete an introduction exercise. This should be quick and to the point.
- Describe the format for the day (break and finish times etc) and write this up on butchers' paper so that is can be displayed to one side throughout the workshop – to help keep to times.
- Outline the venue facilities (such as tea and coffee, location of toilets and any other necessary instructions).
- Introduce the Workshop Goal and Learning Objectives, so the participants can see and understand what they may get out of the workshop.
- Present an overview of the workshop program and explain the process and what the outcomes of each session will be.

- Ask the group to outline their expectations of the course; record on butchers' paper – this should be reviewed during the final session.
- Present any key point or learning outcome at the outset; this may be in the form of a rhetorical question to get the group thinking

4.1.2 Plant Identification

Activity

- Paddock walk or identification of live plant specimens of weeds and desirable species

Purpose

- Introduce a key component of the deliberation process i.e. as part of the 3D's
- Identify weed(s) and desirable species (if applicable
- Discuss the features of weeds and desirable species.

Key messages

- Weeds can be identified a number of ways.
- Pasture plant identification is the first step to determining weed problems and provides information that is necessary for decision-making.
- It is essential to be able to identify weeds at various stages of their life cycle, including especially those times which are critical for weed control
- Weeds can vary in their seriousness (impact and control).
- Some weeds are declared noxious requiring action by law.

Suggested approach

- Lead the group on a paddock walk to identify key plant species. These plants should ideally have been previously identified with a stake or marker to assist in finding them on the day.
- If undertaking a paddock walk is not possible or not feasible, lead a "pretend" paddock walk "inside" by inspecting the live plant specimens which you have previously collected. Take care not to spread dirt which may contain weed seeds; or seeds attached to a flowering/seeding plant.
- For each plant identified ensure that you ask the group to categorise them into the following functional groups:

Weeds	Desirable species
Annual grasses	Annual grasses
Perennial grasses	Perennial grasses
Annual broadleaf	Annual broadleaf
Perennial broadleaf	Perennial broadleaf
Legume	Legume

- As you progress through each plant, facilitate a brief discussion using the following questions as a guide.

  Weeds

  - What is it?
  - Is it a declared noxious weed?
  - What are the key identification features?
  - What is its lifecycle?
  - Are there any weak points in its lifecycle?
  - Why/when is it a weed?
  - At what level can the plant be tolerated in a pasture or crop?
  - Why are the weeds there? Do they indicate anything?

  Desirable species

  - What is it?
  - What are its key identification features?
  - What is its lifecycle?
  - Are there any strengths in its life cycle which may be taken advantage of in a weed control program
  - Why are they desirable?
- Where the plant has several common names, outline the botanical name for clarification and mention any other closely related species or family members.

4.1.3 Pasture Assessment (Optional depending upon the course or training objectives)

Activity

- Demonstration
- Group activity
- Presentation and discussion

Purpose

- To demonstrate, practice and compare different methods of sampling pasture species composition in the paddock.

Key messages

- Pasture assessment is an important part of determining the extent and severity of the actual weed problem
- Pasture assessment is also important in determining the competitiveness of the pasture in terms of the proportion of desirable species
- Pasture assessment is a vital stage in the *deliberation* process as it provides objective information in which to consider the *diversity* of weed control options
- Sampling needs to be undertaken annually at the same time.
- Consistency in method/technique is important for accurate results.

Suggested approach

- Facilitate a discussion on why assess pastures – what assessment can reveal.

  Assessment acts:

  - As a trigger to undertake weed control
  - To develop appropriate strategies i.e. *diversity* of control methods.
  - To determine changes in pasture composition.
  - To determine the success of management or weed control strategy
  - To prioritise paddocks for weed control

- Ask the group what assessment techniques have they used and discuss their responses.
- Provide a demonstration of at least two pasture assessment methods. It is suggested that these be the “rod point” (or “end point”) technique and the transect method.
- If time allows separate the participants into two groups. Assign each group one of the two assessment methods and ask them to trial it in the paddock. Ask them to record the information.
- Upon completing the task, ask each to present their results on butchers’ paper or whiteboard
- Discuss any variation in the results and ask the group to discuss the pros and cons of each method. In doing so decide on the pasture species composition of the paddock.

4.1.4 Diversity of Tools and Tactics

Activity
- Brainstorm
- Discussion

Purpose
- To identify and discuss the potential weed and pasture management options available to landholders.

Key messages
- There is a diversity of cost-effective weed control strategies available. Each method will appeal to and should be directed towards each of the three "groups" of farmers –that is, the poorer weed controllers, the simple diligents and better weed managers.
- There are three key objectives for weed management in pastures:
  - Remove the weed or reduce weed seed set.
  - Reduce weed germination.
  - Encourage competition from desirable species.

Suggested approach
- Lead a brainstorming session on weed and pasture management options.
- Draw up a table with the following titles and ask the participants to brainstorm pasture and weed management tools into each of the categories:
  - **Remove** the weed or **Prevent** weed seed set.
  - **Reduce** weed germination.
  - **Encourage** competition to weeds from desirable productive species etc.
- As options are mentioned by the group, record them in the appropriate category
- Ask members of the group to describe each management option according to the following (use probing questions). Lead the discussion if necessary.
  - What is the principle, method, or technique of the option?
  - Why is it applied?
  - When is it applied? (Link this to the life cycle of the plant)
  - What are the potential outcomes (positive and negative)?

Note: Ensure in doing so that each participant has a *clear understanding* of each technique or control tool, especially with regard to the *optimum time to apply the method*.

Emphasise the importance of diligence. That is the need to apply the technique as part of normal routine practice.

4.1.5 Putting it all together; Calendar of Operations

Activity

- Example and explanation.

Purpose

- To present and explain how to integrate the diversity of weed management strategies.
- To develop an annual calendar of operations for each weed management and pasture management strategy

Key messages

- Use and integrate a range of options that reduce weed seed set, reduce weed germination, and encourage competition from desirable species
- Herbicides are only one of a diversity of tools. While they are useful to initially reduce weed numbers other tactics must be used to ensure long term control.
- Where desirable species are at very low numbers the best option may be to re-sow the paddock.
- A clearly described calendar of operations assists in efficiency of weed control and optimum use of time and labour. This a vital aspect to improving the diligence of weed control.

Suggested approach

- Have some worked seasonal examples (similar to the MLA Tip and Tool format) as demonstration strategies that cover a range of both grass weeds and broadleaf weeds. Examples must be used that are important in the local area and to the group. Source local examples where possible, alternatively use the Tip and Tool examples.
- Outline the key points of each strategy or management technique
    - Why use these series of tactics?
    - How do they compliment each other?
    - How are they integrated?
    - What is their effect on the pasture species composition?
    - When is the technique applied or used
- Discuss which tactics satisfy the three key objectives:
    - Remove the weed or prevent weed seed set
    - Reduce weed germination
    - Encourage competition
- After you have completed this process for the “example weed”, ask the group to develop a similar procedure for the weed (or weeds) which is the particular focus of your workshop. Outline the key points of each strategy, as described above.
- Once you have collated this information and fully explained the various strategies ask the group formulate a *calendar of operations*.

- Encourage the group to undertake this approach for a paddock of their own and offer to help individuals in the process, perhaps be undertaking a farm visit.

4.1.6 Conclusion & Evaluation

Activity
- Discussion
- Filling in evaluation forms.

Purpose
- To conclude the workshop.

Key messages
- Review learning outcomes.
- Identify any relevant additional workshops or information sources.
- Give feedback to the group regarding their progress, knowledge and enthusiasm.

5 Appendix

6 Segment 5

6.1 Extension Methodology / Weed Extension Strategies

The development of weeds extension strategies should incorporate the following considerations:

Strategic analysis is needed to identify, for a particular weed in a particular region, what is leading to ineffective weed management and to determine the institutional requirements to support extension programs to address the problem.

There are a number of types of weed managers depending on the extent to which they used deliberation, diligence and a diversity of methods in their weed management.

For the poorest weed managers, the path to better weed management might be via the 'simple diligent' stage – the adoption and diligent application of a few straightforward herbicide-based control methods to some of the more serious and easily recognized broadleaf weeds.

This step on the adoption path could be encouraged in extension communication by emphasising that, while livestock production and cropping is never simple, the farmer and grazier can make their weed control simpler by establishing a routine and following it diligently.

Appropriate routines need to be region specific and developed in collaboration with weed and pasture agronomists.

The production and dissemination of regional calendars of weed control activities would assist those moving from ineffective reactive weed management to a routine, and provide timely reminders for those following weed control routines.

A necessary part of extension communication for the 'simple diligents' is to publicise via local radio and newspapers when unseasonal conditions necessitate departures from the routine followed in most years.

Those who are diligently following fixed routines and are achieving good weed control may also need to be alerted to emerging issues, such as new weed threats or particular weeds becoming resistant to herbicides.

There is a substantial difference in the management of grazing-only properties and those with both crops and livestock.

The latter have an inherent diversity which lends itself to the use multiple weed control methods in an integrated fashion. However, as noted above, the many tasks competing for the farmer's attention and the need for timeliness in cropping operations can result in weed control in pastures taking a low priority.

For those in this situation, extension communication that emphasises the weed control opportunities generated by other farm operations may be of value. In addition, as those with mixed crop and livestock enterprises can be younger and possibly working off farm, any information about more time-effective weed control methods is likely to receive consideration by those in this group.

6.1.1 Extension Messages

- Communication and extension efforts focusing on production losses should be very specific about what plants cause the losses, and make sure that graziers are able to recognise these plants in their pastures.

- Dislike of using chemicals may hinder weed control on some properties, suggesting more effort in research and extension of alternatives to herbicide application.

- Awareness of the costs of weeds does not necessarily lead to farmers improving their weed management. When the vaguely sensed costs of productivity loss at some time in the future are weighed against the very specific and immediate costs of chemical purchase, doing nothing is an attractive option. Quantification of productivity loss in realistic farm situations is essential to influence those for whom economic considerations are uppermost in weed control decisions.

- Information sources that are regarded as useful by the better weed managers are local in nature.

- Fact-sheets and booklets from government departments and field days and workshops stand out as ways of communicating information about weeds that are widely regarded as very useful.

- The electronic media – radio, TV and Internet – are regarded as not useful by large proportions of respondents. However, the Internet is a rich source of information about weeds and their management, and is often used by younger graziers. It is also likely to become increasingly important in the future as older graziers retire and the younger generation take over.

6.1.2 Communication of Information

Field days and fact sheets and booklets from government departments are widely held in high regard as a means of communication of weed information, particularly among the better weed managers, reflecting an active approach to information.

Radio, TV and newspapers are held in less regard, but are more likely to be viewed favourably by the poorer weed managers, reflecting their passive approach to information.

The electronic and print media have an important role to play in elevating the priority placed on weed control among the poorer managers, as well as in alerting those, who are effectively controlling weeds with a few methods diligently applied, about new weed problems.

6.1.3 Extension Method

The effective extension of weed information and more general capacity building:

- effective extension requires social interaction between graziers and professionals, either in one-to-one or groups situations,

- extension via the internet would meet the needs of only a small proportion of graziers,

- printed fact sheets, while not considered as useful as extension methods involving social interaction, are nevertheless valuable for raising awareness and

- one-to-one extension was found to be particularly valued among mixed farmers. This group is more likely to be using consultant agronomists. The trust and credibility afforded to consultant agronomists by mixed farmers makes the former an important channel for the extension of weed information.

There is a strong preference among producers considering adoption of weed control methods for ‘people sources’ such as agricultural consultants (particularly among croppers) and field days and workshops. The level of preference for written sources is lower, although fact sheets, weekly newspapers and industry newsletters are regarded as useful by a large majority of landholders.

This suggests that in the overall scheme of extension programs, the motivation for action may have to come from trusted and credible 'people sources', backed up by readily available, appropriately pitched, written resources that can be drawn upon once a producer is involved in changing their weed control methods.

6.1.4 Extension Methods Do's and Don'ts

A set of actions that might contribute to success or failure of extension methods has been developed and is shown below.

Table 3 "Do's and don'ts" for extension

Method Do		Don't
One-on-one	Develop relationship with producer and get to know his/her system Spend time going around the farm listening and observing Build trust and confidence by giving relevant, useful advice – start by dealing with simple problems first	Make assumptions without exploring the situation in detail Jump to conclusions or solutions
Demonstrations	Involve the host farmer and other local producers in setting up and managing the site Enlist the help of "Champions" to recruit other farmers and promote the demonstration Ensure resources are adequate for all the activities required Ensure that the trial can be observed easily and results are scientifically robust and reliable	Make the demonstration too complicated (simple designs are best) Make the site and conditions too different to those of surrounding enterprises
Group activity	Use where peer support and sharing between participants is important Use where different perspectives and skills can improve the learning outcomes	See as a method for all occasions Use with people who are not comfortable in groups Run groups without facilitation training and skills
Field days	Use as part of integrated strategy for awareness raising Spend time and effort in planning Ensure comfort and safety	Expect major practice change as a result

	Allow for different learning styles (eg visual, auditory, kinaesthetic)	Take too much time in presentations – let the participants explore and observe
Brochures and publications	Target for specific purpose (awareness or information dissemination) Integrate with other methods Make user friendly –simple and concise	Overload people with information Distribute indiscriminately – target the market – eg "point of sale"
Internet	Make site simple and easy to navigate – cater for low bandwidth and unskilled users Target specific market (eg competent users or service providers)	Do your own design – know what you want and employ a designer to get there Substitute this medium for others eg print

7 Segment 6

7.1 Group Learning / Adult Learning

Source: National Heritage Trust / CRC for Weed Management

7.1.1 Introduction

The aim of this segment is to provide ideas and techniques that will assist you to present information to small groups of landholders as well as individuals. It is included in this *Training Guide* to assist in the communication of weed management information and will be especially beneficial to those of you who have not had the opportunity to develop presentation skills.

These guidelines will help you prepare effective sessions for small groups and better communicate weed management principles to others.

7.1.2 Preparing your Information Session

When preparing for an information session there are three key areas to keep in mind:
1. What is your message?
2. Who are you presenting to?
3. What is the best way to get your message across?

Before designing your information session, it is important to identify the needs of the people to whom you will be presenting. A chat with group members to find out what they know, and would like to know more about, will help you to decide what needs to be covered.

7.1.3 What are your Objectives and Outcomes

The content of your presentation will depend on the training need. When you have determined what the participants need from the information session, think about the objectives and outcomes of your session. What do you want your participants to achieve? What knowledge should they have by the end of your session? It may help you to write down a brief checklist of your objectives and outcomes for your session. This will help you with writing your session plan and designing activities for your session. Think about the key information or message that you wish to share with your audience.

Consider how the information that you are presenting addresses the identified need of the audience. The closer the match, the more relevant and effective your session is likely to be.

To help you to get started with your information session consider the *What*, *Where*, *Why*, *How*, *When* and *Who* aspects of any session you may be looking to run.

The following table sets out how you might look at these.

What
What is the topic and content?

Where
Where will the session be held?

Why
Why are you doing this?
What are the benefits for the participants?

How
How will you achieve your objective?

When
When is it scheduled?

Who
Who will facilitate the session?
Who will you be presenting to?

Start by jotting down your ideas as this will help you to clarify the basic information about your session. The “What” and “Why” questions are most important at this stage. The answers to the “How” question will take shape as you progress through this guide.

7.1.4 How can you help the participants learn

Adults often experience a number of feelings or thoughts when they are first in a training situation, especially if it is in a group. The feelings could be fear, embarrassment or anxiety and may be because they are concerned about things such as their level of confidence ('Will I make a fool of myself?'), the pace of the training, age, interaction with others in the group etc.

It is important for you, as the presenter, to demonstrate and use positive approaches that enhance the learner's opportunity for learning. The 'principles of active learning,' listed below, will help you to provide this positive learning environment that will help your participants to learn.

Principles of active learning:

1. Active learning
2. Meaningful material
3. Multi-sense learning
4. First and last impressions
5. Practice and reinforcement
6. Feedback
7. Reward

Active learning:

Participants learn more quickly and effectively when they are actively involved in the learning process **we learn by doing**. You can help the learning process to be active by:

• asking questions
• using exercises in sessions
• using discussion and other small group methods
• providing practical work.

Meaningful material:

'Participants learn more effectively when they can relate new material to their existing knowledge':

• train at the person's/group's level – not yours
• use a definite form or sequence
• use examples, illustrations, comparisons
• teach from the known to the unknown
• check what learners already know…ask them.

Multi-sense learning:

'Learning methods which use two or more senses will be more effective than those which use only one sense.'

When planning a session, use activities that combine the **use of a range of senses** – sight, hearing, smell, touch, taste' – in the learning process.

You could:
• combine telling and showing
• provide audio visual aids
• make sure everyone can see and hear – ASK THEM!
• where possible, allow participants to handle the real thing.

First and last impressions:

People tend to recall best those things they have learnt first and last in a sequence. Remember the saying – '**first impressions are lasting**':
• always give a preview of the session
• emphasise key points in conclusion
• prepare your introductions carefully
• give lots of small introductions and conclusions during lengthy sessions.

Feedback:

'Effective learning is encouraged when trainers and learners share feedback with each other.' To do this, you can:
• encourage questions
• test frequently
• use your body language
• discuss and correct errors rather than criticise
• give learners immediate feedback of their progress.

Reward:

'Learning that is rewarding is more likely to be retained':
• give feedback immediately to learner responses
• provide for early successes in the course (nothing succeeds like success!)
• prevent mistakes as much as possible
• use problem solving approaches rather than information giving.

Practice and reinforcement:

Frequent revision can help learners to retain knowledge and practical skills. Learning is supported by frequent opportunities to practice and apply new skills and knowledge. You can help learners by:

• allocating adequate time for them to practice new skills in your session planning
• at the beginning of a session asking them to summarise the previous session
• providing exercises which encourage them to recall and apply previous learning
• asking questions frequently
• using case studies, problem solving, hypotheticals and other methods to apply new knowledge.

Be aware that there may be different levels of ability in your participants. Try to show them that you are concerned about meeting their particular needs. You will need to incorporate these principles of learning when you are developing the learning activities for your training session plan.

7.1.5 How to Design a Session Plan for an Information Session

Session plans are basically notes about what will happen in a session that are sequenced in a logical order. These plans include the topic, outcomes and the steps taken towards achieving the outcomes (what the trainer will do and what the participants will do).

Session plan structure

A session should be made up of three parts:
1. **Introduction** – participants interest will be high at this point
2. **Body** – the interest is likely to drop away during this stage
3. **Conclusion** – when the interest will pick up again.

The introduction

With a new group, spend a little time talking to the participants about yourself and establish a friendly atmosphere. You may have a short statement you can say about yourself, and the experience you have had with the topic being presented. You can make changes and adapt your introduction to suit the group you are presenting to.

The body

The body part of a session plan contains more detail. Information sessions have a 'thinking' feel to them. At the end of a theory session the participants have to use their knowledge and skills to **THINK** or **SPEAK**.

For example, participants may be expected to:
• Identify the life cycles of weeds
• Appreciate why understanding the life cycle of a weed is important for good weed management.

Because participants have to learn information, many may think that theory sessions will be boring and will not involve anything active – they will just listen to the trainer. But this doesn't have to be the case. (Remember the active learning principles?)

The body of the information session is divided into three major steps:
1. Explanation
2. Activity
3. Summary.

Step 1: Explanation

• Give an overview first, and then the details in small steps
• Provide information in a logical sequence
• Use examples to illustrate your points

• Use questions to check the knowledge and understanding of your participants
• Use training aids to emphasise key points.

You may now find it helpful to develop a point form introduction for your session. This can be presented on an overhead transparency, whiteboard or flip chart or just read out.

Step 2: Activity

Providing an activity allows participants to apply the information or concepts from the explanation stage. Some ideas for activities include:
• Brainstorming
• Questions to the group
• Problem solving exercises
• Case studies
• Field trip.

Applying new knowledge to a practical situation, whether real or simulated, reinforces learning and increases motivation. Activities should be simple to organise and facilitate and should have direct relevance to the content covered. The activity not only maintains the involvement of participants, but it also provides you with feedback about the participants understanding of the content you have covered in the explanation stage. If you find that participants' are having difficulty applying new information you will know that more explanation is required before moving on to the next step of learning.

Step 3: Summary

When the participants have applied the information to the activity, and achieve the necessary results you are ready to summarise the key points. For example 'You have done a great job with describing the life cycle of weeds, now lets summarise what we have covered so far.'

Key points may be reinforced using an overhead projector, flip chart, board or powerpoint slides. If you are out in the field you can simply state 'These are the key points…', and then state them. The idea is to help people remember the most important information.

The conclusion

The conclusion part of the training session gives the trainer the chance to:

1. Remind the participants of the training **outcomes** they covered in the session
2. Give participants some constructive **feedback** about how they went during the session. For example, highlight strengths of the group or activities that were achieved well
3. Show the participants how the information and skills in this session relate to the future, whether relating to a **future** training session, future organisational plans etc.

7.1.6 Learning Resource Materials

Almost anything can be used as a learning resource – equipment, pictures, people, weed management guides and so on. In addition to these suggested resources there are particular items of equipment that many trainers use when conducting their sessions in a training situation. These include powerpoint presentations, slide projectors, whiteboard, overhead projector, computers, flip charts, video players, and so on.

Note that it does *not* have to be hi-tech to be effective as simple methods work fine.

List the equipment you are most likely to use in your session.

Always check your resources prior to the session.

7.1.7 How to Deliver & Review Your Training Session

By this stage the session plan is developed and your content is organised and planned. It is now necessary to consider the following areas:

- the training environment
- presenting skills and Training Aids
- feedback
- asking questions
- review of training sessions
- keeping training records

Training Environment

Learning is more likely to occur if the learning environment is a positive one. Ensure where possible that the physical aspects of the venue are conducive to learning. OH&S guidelines should be followed ensuring a safe environment is provided. Attention to the simple things is important. For example, is lighting adequate, can it be turned down/off easily during the use of visual aids, is the area quiet and so on.

An atmosphere of mutual respect can be created by recognising the vast range of experience, knowledge and skills present in a group of adult participants.

Presenting Skills

When talking to a group, there are a number of things to keep in mind. These include:

- Plan thoroughly. Know exactly what you want to achieve, and more importantly what you want the group to achieve in the session.
- imagine the scene – visualise yourself conducting the session.
- Practice – conduct a trial run some anxiety or nervousness is usual in everyone before they do a presentation however, if you have practiced, it will flow better and you will feel better prepared.

- Personal presentation; try to engage each group member individually using eye contact; be confident in your delivery style and speak with authority (this will come if you are well prepared and well practiced); speak clearly with an interesting conversational tone and ensure that everybody can hear you

Training Aids

Training aids include resources or items that assist you with your session. They may include items such as:

- charts
- overhead projector
- examples of weeds, either actual or good images
- handouts (notes)
- equipment used in weed control or weed mapping.

Preparation and planning are an essential part of the effective delivery of a session. If you plan and prepare adequately, your session is more likely to go smoothly and, more importantly, the learners will be more likely to achieve the learning outcomes. Ensure that all equipment and resources are available for your use at the appropriate time.

Make sure that you know how to use it ahead of time and that, if possible, know how to fix it (or have an alternative) or when things go wrong.

7.1.8 Giving and Receiving Feedback

Participants are usually interested in knowing how well they are doing. It is part of your role as a presenter to know how and when to give constructive feedback. When giving feedback it is necessary to give it in such a way that it will not be threatening to the other person and not increase their defensiveness. All feedback should be constructive – meaning we give it so the person can use it to build themselves up and move forward.

Examples of feedback given during a session:

Positive feedback *'That's good. You have done that very well*.'
Positive constructive *'That plan looks good. All the major issues are covered, it's nice and short and easy to understand. Well done.'*
Negative feedback *'That plan is terrible. What went wrong? It's awful*.'
Negative constructive feedback *'I notice you're having some trouble selecting which weed treatment to use. It can be confusing when there are so many options to choose from. Let me go through the issues again with you. Do you want to have another go?'*

When you are asked or expected to spend some time giving feedback to an individual participant after a training session, the following four-part model is helpful:

1. Ask the participant what they think/feel they did well.
2. Ask them what they would do differently next time.
3. Add constructive feedback about the things not covered by the participant, both positive and negative.
4. End on a positive note.

By using these strategies during and after your training sessions you will be creating a learning environment where people feel at ease with each other. It is important to create an atmosphere of mutual trust and openness in the group. This will help everyone feel more comfortable about giving and getting feedback.

Receiving feedback

Even though we might feel nervous at the idea of it, we all need to know other people's versions of how we come across – this can help us to improve the effectiveness of sessions we run. A few points that can help when receiving feedback:

- thank the giver and respect their openness (and courage)
- value their comments and their point of view
- clarify it with them by paraphrasing or repeating it without being defensive
- reflect on the feedback and whether you think it is reasonable
- check it out honestly with others, rather than relying on this one source only
- if it is reasonable, act as soon as you can to deal with the problem
- if it is not reasonable, work through the issue with the giver
- learn from the experience
- model this process for your participants.

7.1.9 How to Review & Evaluate your Information Session

There are two main questions that you can consider when evaluating your sessions:

1. Did the participants achieve their goals or objectives?
2. Were the techniques and activities you used in your session the most effective ways to help participants achieve the required outcomes?

To answer the first question, you will need to look back at the original needs. Work out whether the knowledge of the participants after the session is closer to the objective (or participants expectations) than it was before the session. It is important to gather feedback from participants, colleagues and others so that you can improve the techniques, activities and delivery of your training sessions. It is also useful to gather feedback at the end of each session from participants so that you can think about whether you need to make any improvements.

Feedback can be obtained in a number of ways. You might prepare a simple form that has questions about how useful the presented material was, what participants would like to see added or changed and any other general comments that participants might like to make. Of course, you can just ask the group at the conclusion of the session the same questions, although people may be less forthcoming verbally in a group.

It will also be useful to conduct your own self-evaluation of the session and consider how well you think the session went and what areas may need to be changed.

Asking questions

Questioning is an essential skill for presenters to use. There are lots of reasons for asking questions. These days they are not used just for testing someone's knowledge. They could be used:

- to focus attention on a certain topic
- to encourage interest
- to promote activity
- to check on and extend the participant's understanding
- to slow down or speed up the pace of a training session
- to challenge the participants to think more deeply
- to assess the participants progress

The questions a presenter asks are either thought up in advance of the session (pre-set) or arise during the session.

There are two types of questions that trainers use during their sessions:

1. closed
2. open

Closed questions

Closed questions are usually answered with **YES** or **NO** or a very short statement. Be careful when you use this type of question with participants who are a little shy or feel anxious. They may not feel confident to add anything further to their simple answers and you might never find out the real depth of their thinking. The speed and tone of voice are very important with these short, closed questions because it is easy for nervous participants to interpret them as being abrupt or even rude.

Examples:
• *Have you used this equipment before?*
• *Do you know how to undertake pasture assessment?*

Open questions

Open questions **cannot** be answered with **YES** or **NO**. They are used to encourage the participants to give a more detailed answer usually containing their own feelings or opinions. They are very useful with a new group because they bring out a wide variety of responses and can get a group discussion started.

Examples:

- *What do you know about pasture assessments for weed management?*
- *What are the advantages and disadvantages of using herbicides?*

When asking questions

- be brief and clear
- keep it simple
- allow for time for response (silence is okay)
- show honest intentions (no trick questions)
- give praise and encouragement
- avoid sarcasm
- avoid slang, colloquialisms, confusion.

7.1.10 Techniques for Answering Participants Questions

When participants ask questions in a session you can respond in a number of ways depending on the situation:

- If you think the participant has done quite a bit of thinking about the question before asking it, you can **encourage them to try to answer it themselves**.
- If you think another participant in the group should have a pretty good chance of handling it, you can **redirect the question to another participant**.
- If it's a question that you want all the participants to focus on you can **redirect the question to the whole group to answer**.
- If the answer is fairly simple, you can **hint at it**. The extra clues may stimulate all the participants to think more broadly and possibly come up with an answer.
- You can give an answer that provides factual information, expresses your own opinion or lets the participants know that you don't have an answer but are happy to look further into it with them later.

7.1.11 Records

Records are an important aspect of managing your training program because they provide the details that people may need to refer back to in the future. It is helpful to record minimum details of your training session including the date, location, participants, topic, organisation and facilitator. Your evaluation of the session is also useful to keep in case you run a similar session at a later time.

7.1.12 Putting it all together

1. Is the venue appropriately set up considering activities, participant numbers, safety requirements and accessibility.
2. Introduction: Provide an introduction to the session, including introduction of self and participants, details of learning objectives, linking of training to previous knowledge or training, outline of training delivery methods and competency requirements.

3. Body of the information session: Use appropriate strategies and techniques to facilitate the learning of knowledge.
4. Conclusion of training session: Review the learning objectives with participants providing relevant feedback, and linking to further training opportunities.
5. Consider your presenting skills, training aids, and how you will give and receive feedback.
6. Review and evaluate the session, using self-evaluation and feedback from participants and their supervisors and measuring outcomes against training objectives.
7. Keep appropriate records.

Appendix 3
Resource's Kit

Prepared by: Stuart Burge

Weeds Train the Trainer
Reference List (to be incorporated with "Resources Kit")

The following Resource Kit / Reference List includes key recommended references to help in the preparation and delivery of a Workshop relating to weed control and as such should be regarded as a valuable asset to complement the Weed Training Manual for extension officers.

The resource kit/reference list incorporates three components: those resource documents and information relating specifically to weed control; another which focuses on information relating to pasture management while the other important stand alone document is the companion Producer Guide "Less Weeds from Pastures".

Several references address both aspects of weed management and pasture management.

It should be emphasised that the references here described are those which are regarded as being a fundamental necessity. There are also many other useful references which may also be beneficial in value adding to those mentioned. Those listed are also readily available and inexpensive.

Weeds Information

The information contained in the following recommended references is understandably quite general in providing overall management guidelines.

Where possible this should be complemented by localised information, research and especially case studies in order to ensure that the workshop is as relevant and meaningful as possible. Where this may not appear to be immediately available, always remember that in any group of farmers there exists a wealth of practical useful information which should be harnessed as part of the workshop.

It should also be noted that the internet provides an extraordinary amount of useful information relating to both specific weeds and weed control practices. A number of recommended websites have also been provided in this Resource Kit to assist in this process, but simply using the "google" search drive for a subject or weed of your choice will almost always prove fruitful.

State government agencies also provide numerous valuable resource documents and information sheets relating to a range of relevant, important weeds and these too should be accessed where possible.

Meat and Livestock Australia (MLA) Ltd. 2007 (draft) Less Weeds in Pastures MLA Publications. Locked Bag 991 North Sydney 2059. www.mla.com.au.

Burton J. and Dowling P.M. 2004. Pasture Management for Weed Control. NSW Agriculture, Orange NSW.

Taylor U. and Sindel B.M. 2000.The Pasture Weed Management Kit. CRC for Weed Management Systems, University of Adelaide, Glen Osmond, South Australia.

Meat and Livestock Australia (MLA) Ltd. Tips and Tools - Various Titles. MLA Publications. Locked Bag 991 North Sydney 2059 www.mla.com.au

Meat and Livestock Australia (MLA) Ltd EDGEnetwork® "Weed Removers-Pasture Improvers" Workshop Notes. MLA Publications. Locked Bag 991 North Sydney 2059 www.mla.com.au.

Meat and Livestock Australia (MLA) Ltd and Australian Wool Innovation (AWI) Ltd Weeds Best Management Practice Fact Sheets and Case studies – MLA Publications Locked Bag 991 North Sydney 2059 www.mla.com.au.

Meat and Livestock Australia (MLA) "Toward Sustainable Grazing", eds Mason W, Warn L, Cahill G. Chapter 5 "Managing Weeds in Pastures" MLA Publications Locked Bag 991 North Sydney 2059 www.mla.com.au.

Meat and Livestock Australia – series of Fact Sheets on best management practices and case studies for:

- Serrated Tussock
- African Lovegrass
- Chilean Needlegrass
- Paterson's Curse
- Silverleaf Nightsade
- Onopordum spp

Pasture Management Information

Meat and Livestock Australia (MLA) Ltd. Prograze® Manual. ed Bell A et al MLA Publications. Locked Bag 991 North Sydney 2059 www.mla.com.au

Meat and Livestock Australia (MLA) "Toward Sustainable Grazing", eds Mason W, Warn L, Cahill G. Chapters 3,6,7&8 MLA publications Locked Bag 991 North Sydney 2059 www.mla.com.au.

Meat and Livestock Australia (MLA) Ltd EDGEnetwork® "Weed Removers-Pasture Improvers" Workshop Notes. MLA Publications. Locked Bag 991 North Sydney 2059 www.mla.com.au.

Websites:

www.weeds.crc.org.au

www.mla.com.au

www.wool.com.au

www.dpi.nsw.gov.au

www.dpi.vic.gov.au

www.pir.sa.gov.au

www.dpi.qld.gov.au

www.dpiw.tas.gov.au

www.agric.wa.gov.au