Workshop outcomes – a blueprint for research into the management of thistles

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Introduction

There are more than a dozen species of thistle in Australia and New Zealand that are weeds of pastures and crops, and several of these belonging to the genera *Carduus*, *Carthamus*, *Cirsium*, *Onopordum* and *Silybum*, are key weeds in particular situations. Considerable effort has gone into their control, but this has usually been done by a number of different organizations acting in relative isolation. In 1995, the CRC for Weed Management Systems was set up with the purpose of co-ordinating research and fostering collaboration between groups to promote more effective weed management. As part of this aim, the CRC sponsored this Thistle Management Workshop, held at CSIRO Division of Entomology, Canberra, on June 12 and 13, 1996. It brought together over 40 researchers from Australia and New Zealand, representing expertise in thistle ecology, grazing and pasture management, herbicide use and biological control, as well as extension workers involved directly in thistle control and end-users, such as landholders and representatives of Landcare groups. The target for this group was to establish a set of research priorities for the CRC to develop integrated approach to the management of thistles.

The first day was dedicated to a series of research talks on ecology / biology (including modelling), biological control, grazing management (including goats), herbicide use and the potential for herbicide resistance, and summaries of the expectations and needs of control practitioners and landholders for thistle management. These papers have been edited and are now presented in these proceedings.

Armed with the information provided in the papers, group discussions were held on the following day. Initially, workshop participants were divided into four groups, according to their particular expertise, to discuss specific areas of research; namely, ecology, grazing management, biological control and herbicides. The groups were asked to discuss and identify:

- gaps in our knowledge of particular areas of weed biology and current management practices
- specific research projects that would provide the knowledge required
- future directions for research.

Following a plenary discussion of recommendations from these groups, they were reformed in order to have participants from each expert group in four new discussion groups, and asked to:

- examine the feasibility of integration of the various management strategies
- identify any drawbacks associated with integration
- suggest specific research projects that might allow evaluation of the interaction and integration of control methods.

The end result of these discussions was a list of 31 proposals for different research topics. During the final session, workshop participants were given the opportunity to rate each proposal according their attractiveness (to what extent the results would improve thistle management) and their feasibility (the probability of actually achieving the results). Proposals were rated as low, medium or high for each category. The results were then averaged and graphed (feasibility vs. attractiveness) to produce a picture of the combined view of workshop participants. This graph provided a useful means of prioritizing the 31 proposals, and served as a tool for generating a series of recommendations for future research on thistle management.

Outcomes

One difficulty with defining the topic as 'thistles' is that this comprises over a dozen species in Australia. No attempt was made to prioritize species as targets for control, but from the contents of papers and recommendations for research it was clear that particular species are of greater regional concern. These include nodding (*Carduus nutans*), Scotch and Illyrian (*Onopordum* spp.), and saffron thistles (*Carthamus lanatus*) in New South Wales, spear (*Cirsium vulgare*) and variegated (*Silybum marianum*) thistle in Victoria, saffron thistle in Western Australia, and nodding and perennial (*Cirsium arvense*) thistle in New Zealand.

The majority of the 31 research proposals suggested by the discussion groups could be applied to any one species or group of thistles. Several were sufficiently overlapping to be combined, while some addressed general issues rather than specific research questions. Omitting these left a set of 24 recommendations for future research. The prioritization exercise (Figure 1) separated out these recommendations into four groups: highly attractive and highly feasible, attractive but with lower feasibility, highly feasible but not very attractive, and with low feasibility and attraction. Table 1 lists the recommendations according to these categories.

There was a general consensus amongst workshop participants that integration of different control methods was essential for the long-term management of thistles. This created an urgent need for improved transfer of existing and new technologies to the end-users, and this need is reflected in the fact that three of the four recommendations in the highest priority group concern the implementation of such extension programs for herbicide use, the delivery of biological control agents and training in the integration of control techniques.

The highest priority research proposal again reflected the workshop's desire to see more integration of control methods. This recommendation was to carry out experiments to clarify the interactions between biocontrol agents and grazing or herbicide use, to optimize the use of the former in an integrated approach to weed management. A need was also perceived for more information on interactions between thistle populations and other pasture species, particularly in the area of thistle seed bank persistence and germination dynamics.

Such data could feed in to an iterative modelling / experimentation approach to test combinations of control methods and implement best bet strategies. While this latter approach was highly attractive, it was recognised that success would require considerable work input and

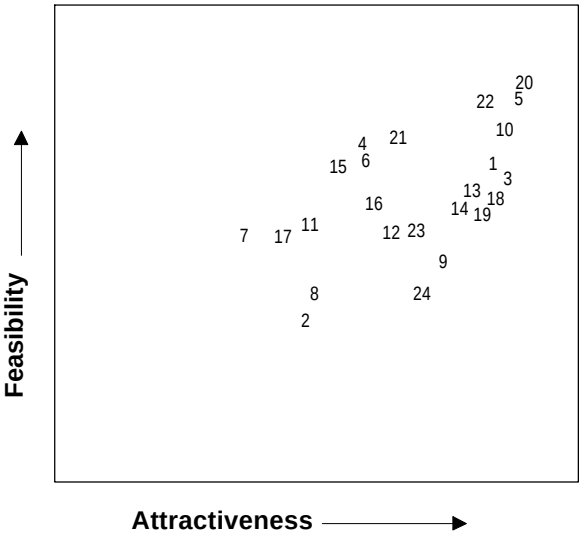

Figure 1. Ranking of research proposals with respect to their attractiveness and feasibility.

collaboration. A simpler proposal that could provide useful information in the shorter term would be to survey the cost and efficiency of current control practices and use the collated data to evaluate best-practice strategies.

One group of proposals were considered to be highly feasible, but were not as attractive, most likely because they addressed quite specific research questions, e.g. the use of spray / graze on *Onopordum* and *Carduus* thistles, the identity of populations of *Onopordum* and saffron thistles and technical aspects of herbicide use for *Onopordum*.

A basket of proposals were considered to have both low attractiveness and low feasibility. This does not necessarily mean that they should be dismissed as issues by the CRC. For example, even if it is considered 'dry' work and difficult to obtain the data there is an imperative to produce economic evaluations of weed problems and of the strategies developed to control them. Economic assessment not only provides an important measure of success or failure, but it is the measure most valued by decision-making and funding bodies. Some of the other lower priority ratings may also form part of wider projects aimed at integration, e.g. the effect of herbicides and grazing on pasture composition or the manipulation of pasture cover and thistle seed banks. While broad spectrum pathogens has been placed in the 'too hard basket' at the moment, they should not be dismissed from the potential range of control options in the long-term. A study of the problems that need to be overcome, such as legislative restrictions, the economics of commercial vs. cottage-industry production and non-target safety issues could help make an informed decision on their eventual suitability.

Some general issues to emerge in the discussions were that for any management strategy to work it would need to be geared to the specific requirements and practical limitations of the end-users. Farm practices that needed changing for integrated management to work would need to be identified, and the control of weeds would need to operate as part of a whole-farm management plan. Finally, it was strongly emphasised that whatever management models were developed, this would need to be done hand in hand with the extension links required for its implementation.

Table 1. List of individual proposals to improve thistle control and achieve integrated management.

No.	Research recommendation
	High attractiveness – high feasibility
20	Education of integrated control through simple messages to farmers
5	Improvement of herbicide extension
10	Development of a structured extension program for biological control
22	Timing of herbicides / grazing to aid biological control agents
	High attractiveness – low feasibility
1	Relationships to predict thistle impact on pasture production and composition
3	Seedbank maintenance and germination dynamics
13	Collation of data on cost and efficiency of current control practices
14	Evaluation of best-practice strategies identified by proposal 13
18	Iterative modelling / experimentation to test combinations of control methods
19	Implementation of best-bet strategies produced by proposal 9
	Low attractiveness – high feasibility
21	Spray / graze demonstrations for *Onopordum* and *Carduus*
4	Taxonomy of *Onopordum* and *Carthamus*
6	Timing, rates and types of herbicide needed for *Onopordum*
15	Timing of spray-topping / grazing etc. vs. seed predators
	Low attractiveness – low feasibility
24	Economic evaluation of strategies developed for different pasture systems
9	Potential synergy or antagonism between control agents
23	Manipulation of seed banks to reduce their seed
12	Manipulation of pasture cover and litter in perennial and annual systems
16	Effect of herbicides and grazing on pasture competition / composition
8	Investigation of potential for broad spectrum pathogens
2	Succession dynamics and niche overlap of thistles
7	Use of blanket wipers to reduce seed set
11	Relative palatability of thistles and pasture for different stock
17	Tactical application of fertilizers on pasture competition and control agents

Quo vadis?

Thistles clearly comprise some of the most widespread and damaging weeds in temperate Australia. This workshop has drawn upon the expertise of Australasia to define current knowledge and future directions needed to improve their management. Both extension and research issues were viewed by workshop participants as important and we have grouped the overall recommendations into a number of categories for these two areas. The CRC for Weed Management Systems has been formed to tackle these problems. It has already recognised the gap in education and extension by establishing a program specifically addressed to the adoption of weed control technology.

Extension programs must initially be based on the current limited knowledge, but should subsequently include new information as it becomes available from the research projects listed in Table 2. While the appointment of two CRC positions, based in Canberra and Frankston, to co-ordinate biological control agent release networks goes part way to meeting the objectives, it is recommended that the CRC Adoption program look at mechanisms that will improve extension in all three areas. Finally, it is recommended that the Perennial Pastures Program of the CRC incorporate projects that address the three research areas. Success in tackling these particular issues should lead to substantial improvements in the long-term management of weedy thistles.

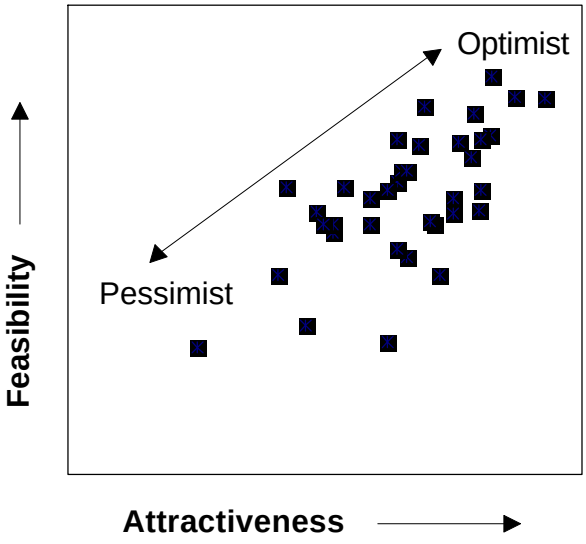

Figure 2. Ranking of individual workshop participants according to their assessment of the set of research proposals.

Postscript

The priority setting exercise permitted an interesting look at the psychology of people concerned with the problems of weedy thistles. By averaging all the responses for each survey, individual profiles could also be plotted on a graph summarizing their overall feeling as to whether the set of recommendations was attractive or feasible (Figure 2). This clearly showed a range from the very pessimistic to the highly

Table 2. Recommended areas of research and extension that need to be tackled to improve the management of thistles.

Area	Particular issues
Research	
Integrated practices	integration of grazing, biological control, herbicides and fertilizer usage into strategies for thistle management survey of current practices and evaluation of better-bet options specific studies on interactions between control agents and grazing, herbicides or the manipulation of pasture cover
Ecology	plant population dynamics (including modelling) thistle vs. pasture competition and seed bank dynamics the impact of specific biological control agents
Bioeconomic modelling	economics and modelling of current thistle management practices evaluation of better-bet strategies used by producers
Extension	
Integrated practices	education of land managers on integrated management practices through simple messages
Biological control	distribution of biological control agents and advice on their management
Herbicides	promotion of effective use of herbicides, including spray-graze demonstrations on *Onopordum* and *Carduus*

optimistic. Most participants, though, were optimistic that more can be achieved in the management of thistles. Hopefully, the sharing of these views at the workshop has presented a realistic, but challenging set of research objectives for the CRC.