(1990). However, in eastern Australia this successful method of treatment may not be applicable as flowering of *C. lanatus* can occur over 30–60 days at Canberra (Groves and Kaye 1989) and about 60 days at Wagga Wagga (Forcella and Wood 1986). This could be due to the higher summer rainfall which may permit treated capitula to recover or new capitula to form as the treatments are usually only causing severe damage to the capitula and not to the remainder of the plant structures.

Conclusions

The many studies on thistles both in Australia and overseas indicates that considerable variability does exist. The relevance of this to successful control strategies has not been fully investigated but could be a direction for any further research. More effective chemical application may be achieved by a better understanding of the behaviour of herbicides in combinations with the numerous additives that are now available. In addition some knowledge would be useful as to what effect the cuticle layer and other external structures on the leaf surface in the numerous thistles is having on the movement of herbicides into the plant.

The exploitation of the height difference between thistle and pastures may be utilized by more research into the techniques using wiping as a method to apply the herbicide.

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Practical problems with existing thistle control: Where is more research needed?

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Summary

Many practical problems exist with current thistle control techniques. Integrated control/management programs are necessary on properties, as well as continued research into alternative control methods. This paper summarizes problems with current thistle management, viewed from the perspective of a regional noxious plants control authority, and discusses some steps that are needed to improve the situation.

Introduction

The Southern Slopes Noxious Plants Authority (SSNPA) was established in 1992 and incorporates the Shires of Harden, Young, Yass and Boorowa in south-eastern New South Wales. The control area is located at Boorowa. The main objectives of the Authority are to:

- control noxious plants on all council lands
- enforce noxious plant control on privately owned land, reserves and crown lands
- advise and educate landholders
- initiate control programs for landholders
- provide a contract spraying facility.

One of four levels of control categories may be placed on declared noxious plants:

W1 – presence of the weed on land must be notified to the Local Control Authority and the weed must be fully and continuously suppressed and destroyed,

W2 – must be fully and continuously suppressed and destroyed,

W3 – must be prevented from spreading and its numbers and distribution reduced,

W4 – action specified in the declaration must be taken in respect to the weed.

Four species of thistle are currently declared noxious throughout the SSNPA area; scotch (*Onopordum acanthium*), Illyrian (*O. illyricum*) and stemless (*O. acaulon*) which have all been placed in the W3 category, and nodding (*Carduus nutans*) which has been placed in W2. Thistles are the most widespread of all the declared noxious weeds in our area with scotch and Illyrian thistles being the most prevalent. The Harden Shire, which takes in Jugiong, is heavily infested with these, and that is the reason for their W3 categorization. Stemless and nodding thistle are less abundant in the area.

Current control methods and problems in their application

The following control methods are used in the battle against thistles:

- herbicide spraying
- cultivation
- grazing / spray grazing
- pasture sowing as competition
- biological control.

A combination of several, if not all, of these methods are used by property owners to attempt to stop the spread of thistles. Unfortunately once the scotch / Illyrian thistles become established, it is difficult and expensive to eliminate them and programs are reduced to halting their further spread into clean country.

Practical problems with herbicide control
One potential problem is resistance to herbicides. Thistle control chemicals need to be rotated to avoid resistance build up by thistles, and new and improved chemicals are necessary to combat this. The application of herbicides on a broadacre scale to control thistles can be very expensive for the landholder. At an average cost of approximately $10 per hectare this can amount to a substantial sum on a large cropping/grazing property.

A third problem is the possibility of pasture damage. If not applied early in the season, the herbicides necessary for control of thistles can be very damaging to clovers and legumes. Finally, the chemicals used are environmentally hazardous. Although not classified as dangerous herbicides, the continual application of thistle control chemicals can cause soil residues and in turn livestock residues. Research in the areas of herbicides that do not require withholding periods and are more user friendly is possibly necessary.

Practical problems with spray grazing
High stock numbers, up to five times the normal rate, may be required to successfully use a low rate of herbicide and induce stock to graze thistles. This is not practical on a number of properties where paddocks are too large or livestock are not part of the operation. Overgrazing can also occur with this control technique which can be detrimental.

Practical problems with pasture establishment
Pastures are difficult to establish in steep, rocky terrain. In contrast, thistles thrive in these areas due to their remoteness and difficulty in growing pasture for competition. Stock are also selective in their choice of forage, and thistles are not their first choice for grazing unless spray grazing techniques are used. Research into compounds or supplements that could be applied to pasture to increase the palatability of thistles could provide an alternative to spray-grazing. Overgrazing can be a major problem, for the temptation of increasing stock numbers and maintaining stock numbers during dry periods can open up pastures, which allows thistles and general weeds to germinate and become dominant.

Practical problems with biological control
There appears to be a problem with agents adapting to extreme climatic conditions. From practical experience with the release and monitoring of biological control agents, it appears that the majority of agents released tend to control the target weeds in the immediate vicinity of release. From this point they seem to have difficulty in multiplying and spreading to new areas. The introduction of breeding cages with the scotch thistle agents has improved the breeding cycle, though there does still seem to be a problem with the agents adapting to the extreme climatic conditions such as frost and drought, resulting in a very slow build up of agent populations.

The interaction of agents with cropping and grazing programs needs to be investigated. When released on a mass scale over whole farm areas, will the agents survive the cropping rotations and transfer from uninfested to infested paddocks each year? How will the agents interact with herbicide application and continuous grazing of pastures?

The monitoring of biological control agents is also critical. At present, a number of organization staff and landholders monitor the progress of agent release sites and breeding cages throughout New South Wales. In the SSNPA area there are three separate organizations that establish and monitor agent releases. This process is ideal for release of agents and allows for interaction of organizations and landholder with hands on involvement. However, I feel that it would be beneficial if an officer from the Weed Management Program of CSIRO were to continually monitor all release sites. In so doing, accurate information would be obtained and practical problems with the agents would be readily discovered, allowing for rapid changes to sites and/or pinpointing areas that required further research.

Alternative control methods research

Research into alternative control measures for thistles may lead to the reduction in chemical application. The combining of products would cut down on application costs; for example, a pasture topdressing, superphosphate, could contain a herbicide additive that is released for the control of thistles. Chemical applications in the form of supplements or urea might have the same effect as MCPA and Lontrel in improving the palatability of thistles for spray-grazing purposes. Thistles that were allowed to grow to maturity could possibly be used as an alternative fuel source.

No doubt research is being carried out, with funding being a major factor. Government assistance is lacking, and there is insufficient funding for research and education. This will always be a problem with regards to thistle control and noxious weed control in general, as it is seems not to be considered a priority area of agriculture.

Funding for media releases and education programs directed at landholders is required. At present, if a cutback in spending is required on a property then noxious weed control is often the first targeted. Property owners need to be further educated in the implementation of long-term thistle control programs. Possibly more incentive should be given to Landholders to control thistles and noxious weeds.

A state-wide approach to thistle control programs is necessary involving co-operation and a further combining of resources between Departments such as ours and Landcare and NSW Agriculture.

Conclusions

Practical problems will always exist with regard to thistle control. This can be said for all aspects of agriculture. Continued research and education programs are imperative if landholders are to be successful in the battle against thistles. Coupled with this, a pooling of Government resources such as CSIRO, NSW Agriculture, Rural Lands Protection Boards, Noxious Weed Authorities and Landcare organizations is necessary to provide expertise, solutions, and assistance to landholders with thistle and general noxious weed problems.