

## The detection of weeds on Australian farms

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**Summary** The first step in controlling invasive weeds is successful detection. A large proportion of Australia is privately owned or managed by farmers and graziers who are dedicated to weed detection. Likewise, public officers in most States and Territories have a specified inspection function for weeds. Information on existing landholder and weed inspector search patterns and data management was collected through two national surveys to be better able to extend best and proven weed detection techniques. It was found that research and extension programs aimed at improving weed detection strategies will need to take into account considerable variation in strategies used across states and territories, climatic regions and landholder groups, and target specific groups appropriately.

**Keywords** Survey, farmers, weed inspectors.

### INTRODUCTION

Around 28,000 exotic plant species have been introduced into Australia since European settlement. More than 2770 of these have become naturalised, of which around 65% are considered a problem for natural ecosystems and about 35% a problem for agricultural systems (Sinden *et al.* 2004). Weedy species will continue to enter the country while existing species will continue to expand their range within Australia via various pathways of weed spread, particularly with changes in climate (Coleman *et al.* 2010). The first step in the control of such weedy species is their detection, and the sooner after introduction that this can be achieved, the more effective management strategies are likely to be.

There have been attempts to develop guidelines for professional surveying and mapping of nationally significant weeds (McNaught *et al.* 2006) and in national parks (Anon. 2005), weed spotting networks (Morton 2006, Smith 2006), and surveillance techniques for weeds that have already been detected in Australia such as branched broomrape (Correll and Marvanek 2006). However, a large proportion of Australia is privately owned or managed by farmers and graziers, and yet no one has undertaken a comprehensive study to ascertain current weed surveillance levels and practices amongst landholders or noxious weeds inspectors (or their equivalents in each state)

that already check agricultural properties for new and existing invasive plants.

Over 80% of graziers in southern Australia regularly check their paddocks for weed infestations, but only 10% either record infestations on maps or mark them in-field (Trotter 2007). Here then is an existing Australia-wide network of people interested and committed to the detection of weeds but whose rigour is assumed to be suboptimal. Likewise, public officers in most states and territories (for example, noxious weeds officers in NSW) have a specified inspection function for weeds but how the states compare in their effectiveness has not been explored.

The purpose of this research therefore, was to determine: (1) what the current inspection patterns are for weeds on Australian farms; (2) what steps landholders and inspectors take to report and obtain correct identifications of new species; and (3) which of these surveillance and reporting strategies are most effective at detecting, identifying and eradicating new invasions. This information will help to widely extend more efficient methods for surveying and eradicating emerging weeds.

### MATERIALS AND METHODS

The research instruments of the project were two national surveys, which were relatively quick, were able to reach all farm and property types, covered representative biogeographical regions, took into consideration ownership and management structures and provided analysable statistics. The first was a mail survey of 146 noxious weed inspectors and their managers. The second was a telephone survey of 568 respondent landholders across all states and territories of Australia. Data were analysed using Microsoft Excel and SPSS and included Chi square and Kruskal-Wallis tests of significance.

### RESULTS AND DISCUSSION

**Weeds inspectors** The surveillance strategies of inspectors are determined most notably by their own professional judgement, legislative guidelines and availability of resources. Target lists of weeds are used by the majority of inspectors when searching for weeds, and are particularly important in Victoria.

Respondents from Tasmania were relatively less likely to use target lists. Declaration of a new weed is viewed by a slim majority of respondents as a positive influence on farmer weed surveillance, although the intended visit of a weeds inspector is viewed as influential by over 75% of respondents, perhaps being a more direct 'threat' than declaration.

Inspectors are most likely to target 'high risk' properties, with known target weeds, a history of weed introductions, located near known infestations, or for which complaints have been received. Nearly all inspectors surveyed carry out frequent inspection of locations where weeds have been found previously. Less than one-fifth of inspectors inspect on an ad hoc basis. Victorian inspectors appear to be more thorough in their inspections of properties. The higher the number of properties inspected regularly, the greater the time usually between property visits.

Time of year appears to be the most important factor determining when inspectors look for new weeds, although this factor prompts respondents from SA, WA, NT and Victoria to look for new weeds more than it does for those from Tasmania, NSW and Queensland. Likely hospitable areas are generally targeted, though a random walk or drive is also commonly used, rather than specific transects. The average area of a paddock inspected overall is 62.8% but this varies between states. For example, Victorian respondents inspect almost twice the area in each paddock as SA respondents. The surveillance and detection strategies believed to work best include regular visual inspections of properties, responding to complaints and hearing word of mouth about new weeds, and education and extension activities. Overall, respondents are reasonably satisfied with their weed surveillance strategies. Victorians are the most satisfied while Tasmanians are the least satisfied. New weeds are most often found along roads, water ways, and where livestock are fed.

To identify a new plant, weeds inspectors mostly refer to weed identification books and brochures, consult with other local experts such as agronomists and send specimens away to herbaria and botanic gardens. Nearly half of the inspectors have no problem identifying plants. However, the most commonly indicated impediment to successful identification is insufficient experience.

Weeds inspectors appear to use a variety of procedures to record the occurrence of a new weed, although the most commonly indicated include using Global Positioning Systems (GPS) to record the weed's location, recording the location in a database, and marking it on a map. Recording software used includes various Geographic Information Systems (GIS) and mapping

packages, and tailored database packages. While the response group was ambivalent about whether there were impediments to standardised reporting, those who see such impediments believe that the main ones are inflexible or non-standardised reporting systems.

Over 74% of respondents have experienced hesitance on the part of landholders to report weeds because of the costs associated with weed control, fear of potential sanctions or enforcement, lack of interest, and insufficient knowledge. Respondents are relatively undecided overall as to whether information on the distribution of weeds on private property should be made publicly available.

Inspectors appear to undertake a range of responses upon discovering a new weed. The highest proportion carries out further searching to map the distribution of the weed. Overall, respondents have rated the level of coordination of response to weed outbreaks as being reasonably good, with this rating highest in SA and lowest in the NT. Stress and burnout amongst weeds inspectors appears to be more prevalent in Victoria and WA, and less prevalent in Queensland.

Inspectors consider that landholders have a moderate commitment to weed detection overall, with only about 10% believing that landholders have a high level of commitment. The main incentives committing landholders to weed detection and control are believed to involve landholder knowledge, while the main impediments to landholder commitment involve various 'costs' (financial, time, staffing). The landholders assessed as least committed to weed detection are part-time farmers (absentee landholders, lifestyle farmers and farmers with off-farm employment).

The most committed government agencies according to the inspectors include weeds authorities, and State agriculture and environment departments, while the least committed include State crown lands departments, roads authorities and the Commonwealth government.

Most (76%) inspectors believe that weed surveillance could be improved through supply of increased resources and personnel, community awareness and education, and through more of their time being devoted to in-field detection work. Although less critical, improvements to weed identification would involve weed identification training for staff, landholders, volunteers and the general public, as well as further developing dedicated weed identification resources.

Other suggestions for improving weed detection involve the themes of training and education of staff, landholders and the general public, increased government resources and funding, improving inspection techniques, and changes to legislation.

**Farmers** The great majority of farmers (84.3%) check for weeds on a regular basis although most (65.3%) do so while conducting other on-farm tasks.

Most farmers consider that weed declaration makes no difference to checking for weeds, though it does make a difference for a small majority of WA interviewees, suggesting more effective declaration strategy and promotion in that state. Only 4.8% of landholders indicate that the impending visit of an inspector makes them change their weed checking activity, which is in contrast to the more favourable perception of this impending visit amongst weed inspectors surveyed.

Farmers believe that weed authorities should focus on making sufficient information available to landholders on target plants rather than focusing on getting landholders to simply report suspicious plants to authorities, although 28.5% suggest that both strategies would be useful. More farmers than inspectors (65.3%) believe that weed distribution information on private property should be publicly available. However, NSW interviewees are less likely to agree with this than their counterparts, especially those in Queensland. Popular reasons for making the information available include that it makes landholders better informed and is in the community interest, although a relatively high proportion (15.0%) suggest that it is an invasion of privacy.

The majority (66.3%) of farmers concentrate on watered areas of the property, boundaries, traffic areas and previous known infestation areas when checking their farms for weeds. These are the areas where most new weeds are regularly found. Even when new weeds are rarely found in these areas, a high proportion of farmers believe that they are still worth checking. Few areas of a property were considered difficult to check.

Overall, 80.2% of interviewees check for weeds on average every 3 months or less (at least four times per year). While year-round weed checking is not unusual amongst farmers, overall, 67.3% of farmers check for weeds at particular times of year, a practice relatively more common in SA and WA, presumably due to climatic conditions, such as the distinct break of rainfall in the Mediterranean climates of southern SA and WA. The spring months appear to be the most common time for weed inspection, although the pattern varies on a state and territory and property type basis, depending on when weeds are growing rapidly, such as after rain.

Farmers from Victoria check the largest percentage of their property overall (96%) while those from the NT check the lowest (71.6%). Of all property types, crop farmers check the highest overall (96.5%) and horticulturalists the lowest (86.1%). Approximately

half of the farmers believe their surveillance strategy is 'mostly effective' while the other half said that it was 'very effective'.

Having found an unknown weed, 74.8% of farmers will ask a local professional for identification advice, while only 26.6% will look the weed up in a book. Sending the weed away for identification is unusual behaviour amongst farmers. Curiosity, or wanting to know what the weed is, is the main motivation for having a weed identified, to a greater degree than concerns about spread, and possible economic losses.

When finding a new weed, 42.1% of farmers will mark the site in the paddock with a stick or pole, while 36.8% will make a record of it in a diary or notebook. The majority of farmers believe that impediments to reporting new weed discoveries include the cost of eradication, threat or fear of legal action, and concern over what other landholders might think. Most farmers will either remove a new weed upon finding it or spray it as soon as possible afterwards, with only about a fifth finding out how to control the weed.

Farmers in general believe that, compared with 'professional' farmers, hobby farmers or rural retreat farmers are less likely to check for weeds, followed by absentee owners. Factors likely to encourage landholders to check for weeds included subsidising costs such as spray (17.1%), awareness and advertising (16.4%), and research and publicity into weed cost and impact (14.8%). On the other hand, factors that discourage them from checking for new weeds include cost (39.4%), lack of time or labour (17.1%) and laziness and apathy (11.4%).

Over half of all farmers rated government commitment to weed control as 'low'. However, this percentage varies between states. For example, while 72.4% of Victorian interviewees and 68.2% of those from Tasmania rate the level of commitment as 'low', only 41.9% of interviewees from SA do so.

The largest proportion of farmers interviewed (22.2%) had no suggestions for improving on-ground detection of weeds. However, the relatively high proportion of respondents indicating education and awareness campaigns and improved communication between weeds authorities and landholders suggests that many farmers feel inadequately informed with regard to weed control (an opinion shared by many weeds inspectors). The largest proportion of respondents overall (over 19%) indicated that updated local information or weed notification was a worthwhile initiative. A significantly higher proportion of cropping farmers, compared with the overall response group, are happy with the information on weed detection currently available.

## CONCLUSIONS

On the whole, this research project has shown that Australian farmers are alert to new weeds, and have a reasonably high level of commitment to detection and control of such species, whether they be so called 'alert weeds', 'sleepers weeds', 'weeds of national significance' or simply weeds that are well established in Australia but spreading to new areas and properties. As a group, farmers therefore need to be encouraged, and equipped where needed, to be vigilant and effective weed spotters. This may be achieved through, amongst other things, training opportunities, greater extension and educational activities, increased resources devoted to weed detection, and greater cooperation between landholders and weeds authorities.

Weeds inspectors have also been shown to play a vital role in supporting and facilitating weed detection and control. While sometimes differing in opinion to farmers, e.g. on the value of an inspection visit on weed control, the legally sanctioned surveillance of weeds by inspectors complements the generally voluntary approach adopted by farmers.

While certain questions in the surveys specifically called for suggestions to improve on-ground weed detection, the assumption made here is that the predominant approaches taken by farmers and weeds inspectors are most likely to be the more effective or efficient on-farm weed detection strategies. This assumption is based on the fact that, due to their long history of involvement with weeds, many farmers and inspectors will have determined the best management practice for weed detection.

There was often considerable variation between states and territories, and property types in relation to weed spread detection and reporting. Some states and territories, and landholder types were considered to perform better than others, although geographic and climatic differences, as well as enterprise differences, accounted for some of the variability. Research and extension programs aimed at better weed detection strategies will need to take into account such variation and target specific groups appropriately.

Overall, there was seen to be a low level of government commitment to weed detection. Given the high environmental, social and economic impact of weeds, this situation needs to be remedied, since early detection is more cost-effective than later cure.

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