**Onion weed: pest or perception?**

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**Summary** Onion weed is a widespread introduced unpalatable species of temperate and semi-arid areas in Western Australia, South Australia, Victoria and New South Wales. Community concern regarding the continuing expansion of this species and potential impacts to pastoral production and biodiversity has resulted in various research activities in South Australia. This paper provides a brief overview of research findings, including questionnaires to assess community views of impacts, vegetation and pastoral database analyses, and quantitative surveys on 38 pastoral properties in South Australia’s rangelands. Outcomes of this research highlighted considerable community concern about onion weed and common perspectives of impacts and management options, but failed to detect significant impacts to pastoral production (stocking rate) or biodiversity (species numbers). In addition, weed risk assessment places onion weed at a lower priority for control in relation to other pest plants in many infested areas.

With increased regional decision making through the introduction of Natural Resource Management (NRM) Boards, new NRM legislation in South Australia empowering NRM Boards to implement regulatory activities and emphasis on assessing triple-bottom line impacts, the influence of social perceptions in regional NRM decision-making is gaining momentum. The onion weed example provides an opportunity to explore the influence of social perceptions in the NRM decision-making process, and highlights the need for a prioritisation process incorporating social perspectives. Models for assessing and ranking the social impacts of invasive species in conjunction with environmental and economic impacts are required for regional weed prioritisation purposes.

**Keywords** Onion weed, *Asphodelus fistulosus*, perception of pest.

**INTRODUCTION**

Onion weed, *Asphodelus fistulosus* L. (Liliaceae), is an annual or perennial, unpalatable, drought-tolerant, grass-like herb that reproduces by seed only. It is native to the Mediterranean regions of southern Europe, northern Africa and the Middle East, extending through western Asia to India (Parsons and Cuthbertson 2001). It was introduced to Australia in the 1850s as a garden ornamental (Parsons and Cuthbertson 2001). It is unpalatable but of low toxicity to herbivores. Onion weed produces abundant, white-pink flowers in spring and summer, producing as many as 13,200 seeds per plant (Roark 1955).

Onion weed will germinate throughout the year, but usually after summer rainfall. It prefers light, disturbed, neutral to alkaline soils, particularly in areas where other vegetation is sparse or absent. In low rainfall areas it can be prominent in run-off areas such as roadsides, depressions, and creek lines. Figure 1 shows the approximate extent of onion weed in Australia.

**HISTORY OF CONCERN**

Onion weed was declared noxious in South Australia in 1897, in response to concerns regarding the spread of this species. However, declaration of this species achieved little in preventing further spread, although government records indicate considerable expenditure for onion weed control throughout South Australia in the 20th century. It became widely established...
as a weed of crops, pastures and native vegetation, progressively moving north into arid rangeland areas. Spread along roadsides was evident, but wind, water, people, agricultural produce and machinery, animals and livestock also contributed to the spread of onion weed across the landscape.

The advent of sulfonylurea herbicides, in combination with cultivation and competitive crops/pastures, has enabled control of onion weed in most cropping systems. However, in low input rangeland grazing systems and other non-cultivated areas, management options to control onion weed are limited to hygiene practices, reduction of total grazing pressure and chipping or spot spraying to prevent or delay new infestations. Onion weed is now a common component of vegetation in several pastoral districts and conservation areas such as the Flinders Ranges National Park.

RESULTS OF STUDIES OF ONION WEED
Continuing public concern regarding the ongoing spread and perceived impact of onion weed has resulted in several research projects. Carter (1950) looked at various biological and physiological characteristics, and put forward proposed control methods. Interestingly, this work included the comment ‘the effect of various herbicides has been considered but this aspect of control does not seem as promising as the ecological approach to the control of the weed’. Research by Roark (1955) also concluded that the competitive ability of onion weed was not great, particularly if the grazing of pastures by livestock and rabbits was limited.

Funding provided through the Eastern Districts and North-East Pastoral Soil Conservation Boards resulted in research by Turner (1999), who reviewed the problem of onion weed in cropping and pastoral districts in central South Australia. This work provided a comprehensive review of the biology and ecology of the plant, perceived impacts and control options. Noting there was limited scientific literature on onion weed, Turner undertook a postal survey of 939 landholders to gauge perceptions of impacts and desired future management of onion weed. A total of 268 responses (28.5%) were received from landholders, of whom 86.4% had onion weed present on their property.

Results of the Turner (1999) survey identified considerable concern regarding existing and potential impacts of onion weed. For example, 83.4% of respondents indicated they were moderately to extremely concerned about onion weed. Perceived impacts identified (in order of importance from greatest to least) were: lost grazing capacity; risk of spread into new areas; loss of income; negative impact on native vegetation; decreased land value; increased grazing pressure elsewhere; and loss of certain pasture species. Seventy-four percent of respondents reported that onion weed had an economic impact on their grazing enterprises, averaging 16.1% net income loss across the study area. The highest perceived loss due to onion weed was 60%. Almost one third (29%) of respondents also noted some positive attributes of onion weed; however, over 90% were in favour of introducing biological control for this species with >50% prepared to contribute funds to a biological control program.

The outcomes of the Turner (1999) survey were largely based on subjective assessments and did not seek evidence to support landholder claims. However, it provided a useful profile of respondents’ views. The survey had very few replies linking onion weed to grazing pressure, yet it is a weed that appears to be commonly associated with disturbed situations, such as where overgrazing has removed competing plants (Parsons and Cuthbertson 2001). The final report made several recommendations for further research, including the investigation of biodiversity impacts, a cost/benefit analysis of onion weed control in rangelands and to begin the process of initiating a biological control program for onion weed.

In 2002, the Central and North East Farm Assistance Program (CNEFAP) co-sponsored further research with the Department of Water Land and Biodiversity Conservation (DWLBC). This research aimed to address recommendations of Turner (1999).

Three research activities were undertaken as part this project:
1. Statistical analysis of current rangelands vegetation data sets to identify environmental and management factors associated with onion weed invasion and to quantify the impacts of onion weed on agricultural productivity and biodiversity;
2. Thirty eight on-property surveys to compare site and management factors and stocking rates between paddocks of varying onion weed density; and

Analysis of extensive pastoral and native vegetation data sets did not provide evidence of a negative correlation to biodiversity in terms of native plant species numbers (Virtue and Pitt 2006). There appeared to be a small impact of high levels of onion weed on the density of other plants, but more detailed data analysis found this was not statistically significant. Property surveys indicated no significant difference in stocking rates at low, medium and high densities of onion weed over a five-year period (Virtue and Pitt 2006),
with no strong negative correlation with either grass or medic densities on these properties (which would have indicated plant competition). Overall, results from this project did not provide evidence of significant detrimental impacts from onion weed to pastoral production or biodiversity in the South Australian rangelands. This meant that the need for biological control of onion weed could not be readily justified.

Further research was funded by the SA Rangelands INRM group, with the objective of developing a national onion weed impacts profile. This was achieved by collating responses from 25 weed or land management advisors from onion weed infested areas in Victoria, New South Wales, Queensland and Western Australia. An unpublished report by Feuerherdt (2005) included the following observations:

- The majority of people consulted did not believe that onion weed caused significant impacts;
- Onion weed appears to have reached its ecological limit in some areas but continues to spread in others, including northern South Australia;
- Onion weed has some positive attributes including the stabilisation of soils;
- Onion weed establishes easier and has more impact in grazing country. Intensive cropping practices keep it under control;
- Chemical trials have been undertaken in some States and metsulfuron-methyl appears to provide the most effective control, but is not cost effective for rangeland areas; and
- There is strong support in WA and NSW for biological control of onion weed.

Recent analysis of pest plant species in the SA Arid Lands NRM region occurred as part of the development of a pest strategy for the region. Pitt et al. (2006) applied a weed risk management model (Virtue 2004) to 38 potential or existing regional pest plant species across seven bioregions. This process enables comparison of relative weed risk (rated on invasiveness, impacts, potential distribution) and feasibility of control (including consideration of control cost, current distribution and persistence). Outcomes of the weed risk assessment process proposed containment or preclusion of onion weed in only two of the bioregions, and rated this species below many others for the region.

**DISCUSSION**

Conjecture regarding the impact of onion weed continues and the ongoing spread of this species is likely to stimulate further community concern. Roadsides are often associated with plant invasions. Christen and Matlack (2006) discuss the impact of roadsides on long-range and local dispersal mechanisms for non-native plant species. Contributing factors to the spread and establishment of onion weed in South Australia include wind generated by passing vehicles, road maintenance activities, modified water flow and soil disturbance, movements of stock and stock feed by trucks, and potential inadvertent movement of seed by wildlife and people. The development of onion weed on roadsides has been readily visible to all passers by.

Aspects of high visibility probably contribute to community concern and perceptions of impact. Anecdotal evidence suggests that pest plant authorities receive most enquiries and reports of onion weed during summer and late autumn. This period coincides with high germination rates, flowering time and a period of the year when onion weed remains green while many other ground-storey species dry off. However, onion weed will also appear prominently over extensive degraded or disturbed areas at all times of the year.

It is expected that those who have noted the spread of onion weed across the landscape with perceived impacts to pastoral production or property values, degraded aesthetics or the potential loss of other environmental, social or economic values will continue to lobby relevant authorities to control this species. Landholders who do not yet have onion weed on their own property, or who invest time and money in maintaining their property onion weed free are likely to be particularly concerned.

Researchers have consistently recognised the link between competitive vegetation, total grazing pressure and onion weed invasion and persistence, but conveying a balanced view of this relationship that is acceptable to landholders and the wider community is a challenge. While many landholders have an understanding of the dynamic nature of invasive unpalatable species, the Turner (1999) report indicated that many make the reasonable assumption that the common occurrence of an unpalatable species will significantly impact on their net income. However, the community must also understand that invasive species such as onion weed are not necessarily an indicator of current inappropriate land management. They may simply be an introduced species well adapted to occupy an otherwise unoccupied niche.

Scientific results to date suggest a need to educate all stakeholders to accept onion weed, remove it from declared listings and target other species that have greater environmental and production impacts. Unfortunately, this level of community understanding takes time to achieve and must be based on strong objective data that is not always available. It also discounts the social impact aspect of triple bottom line accounting. People are entitled to an opinion and, ultimately, public
opinion must be canvassed because the final decision on which pest species to control is a political one (Amor and Twentymen 1974). It is also possible that ecological or other ecosystem impacts or benefits of onion weed are not yet discovered.

Objective data on pest plant ecology and impacts is often limited. This paucity of data is characteristic for many rangeland pest species. Where community understanding is limited, the introduction and spread of invasive species such as onion weed presents a no-win situation for land managers, who are primarily responsible for pest control, authorities, who may wish to assist, but cannot justify the economic input, and regulators, who are empowered to enforce legislative requirements. These last two roles are the responsibility of regional NRM Boards under the South Australian NRM legislation.

Research has attempted to identify impacts of onion weed and community concern persists regarding the presence and continuing spread. Increasing emphasis on the use of triple bottom line (economic, environmental and social) accounting and reporting in NRM decision-making adds importance to social perspectives of pest problems. In theory this is useful, but in practice the ranking of less tangible factors such as public opinion for regional NRM decision-making is difficult. Tools are now required to assist the equal weighting consideration of economic, environment and social impacts. This presents a decision-making challenge for regional NRM groups in northern South Australia regarding onion weed, but also for all such groups grappling with the management of a wide range of invasive species throughout Australia.

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REFERENCES