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COMMUNITY STRUCTURE OF SERRATED TUSSOCK (*Nassella trichotoma*) INFESTED GRASSLANDS

W. Badgery[1], D.R. Kemp[1], D.L. Michalk[2], and W.McG. King[2]

CRC for Weed Management Systems, Pasture Development Group

[1]University of Sydney, Faculty of Rural Management

[2]NSW Agriculture, Orange Agricultural Institute; Orange NSW 2800 Australia,

warwick.badgery@orange.usyd.edu.au

Abstract

Serrated tussock (*Nassella trichotoma*) is the most serious perennial grass weed in south-eastern Australia, extending over more than a million hectares. Previous control techniques using herbicides and oversowing with competitive pastures are no longer feasible in many of the lower fertility, infested areas. New management solutions need to be found, based upon a better understanding of the ecology of this species. A survey was done to determine the community structure of serrated tussock infested grasslands. Winter growing C3 grasses were closely associated with serrated tussock, while C4 perennial grasses appeared not to be. It is not known if this was due to C4 grasses resisting invasion from, or if they were poor competitors with, serrated tussock. Further research is needed to determine if judicious management of C4 species can effectively control invasion by this devastating weed.

Keywords: Weeds, dry matter yield, broad leaf weed, thistles, *Bothriochloa*, *Themeda australis*

Introduction

Serrated tussock (*Nassella trichotoma*) is a native South American grass, which in south-eastern Australia has become highly invasive and is the country's worst perennial grass weed. Jones and Vere (1998) reported an area of 0.9 m Ha is now infested with serrated tussock in New South Wales alone. Mature serrated tussock has a high fibre content (Campbell and Irvine 1966), which is unpalatable to stock. The carrying capacity of heavily infested grasslands can be decreased by as much as 90%.

The main techniques available for the control of serrated tussock have been the use of the herbicide flupropanate®, and the sowing of competitive pastures. The more competitive pastures have been based upon *Phalaris aquatica*. Sowing competitive pastures is uneconomic, except in higher rainfall, fertile areas where serrated tussock is less of a problem anyway. New management practices need to be developed to control serrated tussock. These practices need to be low cost and effective over the longer-term. Herbicide treatments rarely last more than 4-5 years and newly sown pastures often fail in the most heavily infested regions.

New management practices will need to exploit better knowledge of the ecology of serrated tussock. As a first step towards obtaining that knowledge, a survey was done of the community structure of serrated tussock grasslands to determine if there were any species that appear to more readily resist invasion by this weed. This paper reports the results of that survey.

Material and Methods

Eight sites were surveyed from serrated tussock infested areas across the central and southern tablelands of New South Wales (total area 7 m Ha). Sites were distributed across the infested area to sample different soil types and rainfall and each had a dense infestation where serrated tussock appeared to be spreading into neighbouring grassland. These grasslands are characterised by a mixture of native and exotic, naturalised species. In each case, there was a reasonable level of native perennial grasses still present in the uninfested parts of the paddock (>30%). The paddocks had not been sprayed with herbicide or fertilised in the last five years. The survey was done during the summer of 1999-2000. Winter growing species were identified from the residual seedheads.

At each site, a transect was surveyed from an area which had no serrated tussock to an area which had a heavy infestation – usually along a contour line. Ten samples were taken at a spacing of five metre intervals along the transect. A 50x50 cm quadrat, divided into 25, 10 cm^2 squares was used. Dry weight ranks of the 3 most abundant species, and the total dry weight of all species, were estimated for each 10 cm^2 subquadrat using Botanal procedures (Tothill *et al.*, 1992). Any additional species within the quadrat were also recorded and a visual estimate made of their dry weight. Dry weight estimates were then corrected using ten calibration cuts per site. The 25 subquadrats were averaged for the whole 250 cm^2 quadrat to give ten samples of community structure for each site. Preliminary analyses found that many species behaved in similar ways and the data were then amalgamated into functional groups. A hierarchical cluster analysis using Euclidean distances was then done on the data from all 80 quadrats to determine the general relationships among functional groups.

Results and Discussion

A wide range of species (70) were found across the sites surveyed. Many of these species were minor components and did not occur at all sites. After preliminary analyses to explore the interrelationships among species it was decided to amalgamate them into six functional groups. The largest group was the ‘other species’, which combined many of the broadleaf weeds, sedges, woody weeds and thistles.

Cluster analysis identified three main groups - winter growing species (*i.e*. C3 grasses, legumes and broadleaf species), C4 perennial grasses and serrated tussock (Figure 1). Separate analyses showed no significant relationship between all winter growing species, treated as one group, relative to serrated tussock *i.e*. they occurred in both tussock and non-tussock areas (data not shown). In contrast, C4 perennial grasses appeared to be independent of serrated tussock as they were most abundant in tussock free areas and *vice versa* (Figure 2). When both C4 perennial grasses and serrated tussock were present in a (250 cm^2) quadrat (70% of quadrats), one or the other was at a low level of abundance. C4 perennial grasses were nearly twice as likely to dominate a quadrat than C3 species (11% Vs 6% respectively).

The almost reciprocal association between serrated tussock and the C4 perennial grasses (*Bothriochloa* spp. and *Themeda australis*) could mean one of two things: that C4 perennial grasses are sensitive to invasion from serrated tussock and do not coexist well with it; or that, the C4 perennial grasses are competitive against serrated tussock, and have kept the serrated tussock at a lower level in areas where they exist. Further research will be needed to distinguish between these hypotheses. The effectiveness of any C4 species as competitors would depend very much on the grazing pressure being exerted. A high level of pressure was evident at most of the surveyed sites and this would have limited the ability of any species to compete.

The mechanisms underlying competition between grass species have been the subject of much research over many years. Wedin and Tilman (1996) and Wedin (1999) have argued that the more competitive species are those that can reduce soil nutrient levels, particularly nitrogen, to a lower level than that required by their competitors. They suggest that C4 species can survive at lower soil nitrogen levels than can C3 species. Serrated tussock is a C3 species and hence infested grasslands could provide a suitable test of that mechanism. If correct, it would support the view that better control of serrated tussock could be exerted by encouraging and maintaining competitive C4 grasses, especially in lower fertility sites.

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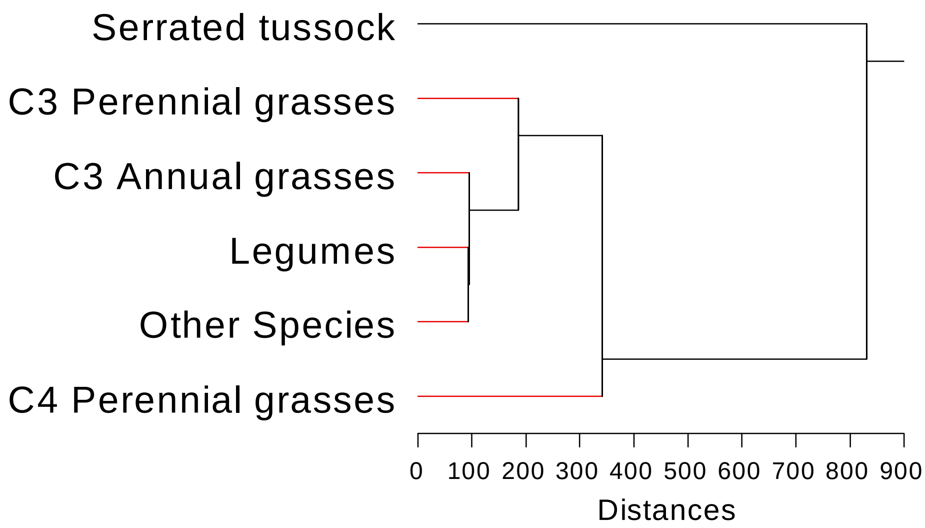

Figure 1 - Hierarchical cluster analysis of plant species functional groups from a survey of eight sites across the central and southern tablelands of New South Wales that were infested with serrated tussock.

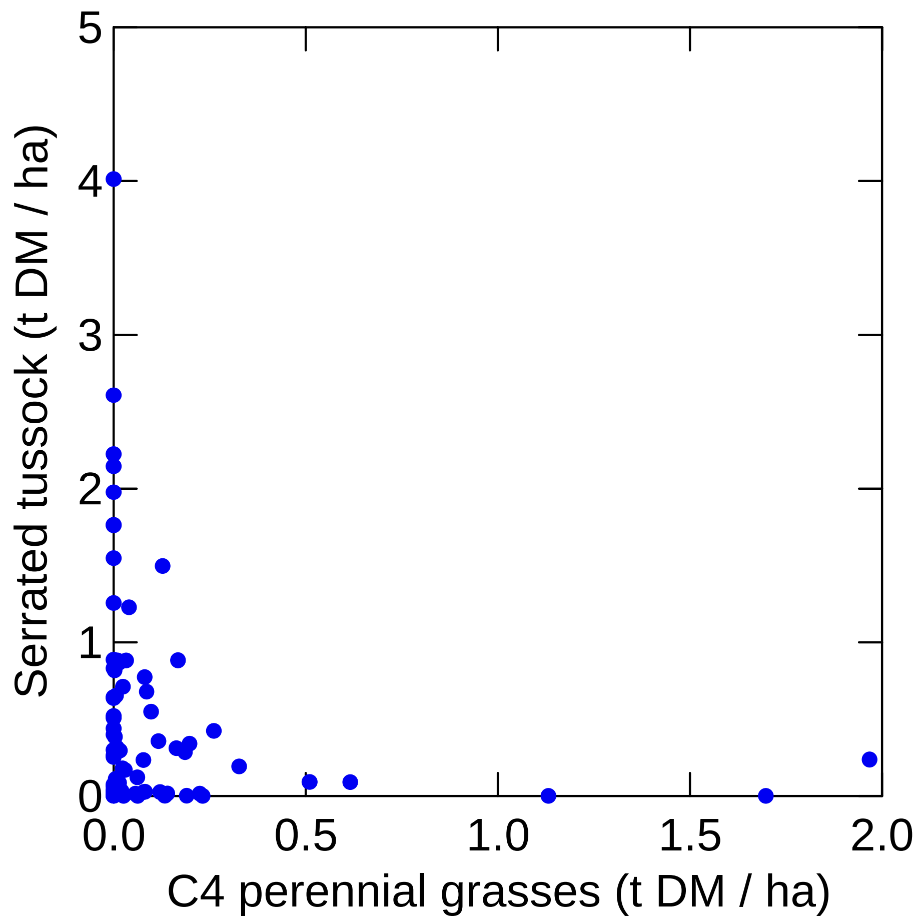

Figure 2 - The relationship between serrated tussock and C4 perennial grasses herbage mass in naturalised grasslands. Data from 80 quadrats sampled across eight field sites in central NSW.