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RECOVERY OF AUSTRODANTHONIA ERIANTHA FOLLOWING ONE-OFF DISTURBANCES IN A HUMID DERIVED GRASSLAND

W. S. Semple and T. B. Koen

Department of Land and Water Conservation, PO Box 53, Orange, NSW 2800

INTRODUCTION

Changes in pasture composition may occur as a result of grazing, seasonal conditions and/or the occurrence of events such as fire, cultivation and application of fertiliser or herbicide. Where a population is killed by a devastating event, the effect may be prolonged, e.g. the decline of some *Austrodanthonia* (Linder 1997) species after cultivation (Garden and Dowling 1995). Further, some (perhaps all) *Austrodanthonia* spp. have low tolerance to glyphosate (e.g. Lodge and McMillan 1994). Whether populations of susceptible species recover from a devastating event depends on factors such as presence of a seedbank and the availability of regeneration niches. For example, populations of *Paspalidium* spp., which were killed by an application of glyphosate in December 1995, recovered following favourable rainfall and the absence of grazing during spring-summer 1996/97 (Semple and Koen 2000). In other cases, e.g. as described below, population recovery may be very slow.

Methods

One-off treatments (glyphosate at *c*.2 l/ha, cultivation, burning and nil) were applied, in eight replicate blocks, to a red grass (*Bothriochloa macra*) - *Austrodanthonia* (mainly *A. eriantha*) derived grassland on the Central Tablelands of NSW in September 1991. An exclosure has been maintained around four of the blocks since then, though the pasture has been slashed annually in spring. Foliage cover of major pasture species has been monitored annually in the four exclosed blocks in March/April using two or three throws of a 2 m x 0.5 m 100 point quadrat frame per plot, from 1992 to 2000.

Statistical analysis. The cover of *Austrodanthonia* was measured annually on nine occasions. Tests for ante-dependence (Kenward 1987) on log transformed % foliage cover data revealed third order dependence, implying data gained at a particular time point reflected those at the previous three times of observation. Significant changes in foliage cover were tested by analysing data from individual time points using the previous three time periods as covariates.

Results

In March 1992, six months after treatment, the cover of *Austrodanthonia* had declined to almost zero in both the cultivated and glyphosate treated plots. *Austrodanthonia* plants were not killed in the nil and burn treatments, and foliage cover increased over the next two years, mainly by increase in plant size, but has since fluctuated around initial levels (Figure 1). Assuming equal cover of *Austrodanthonia* before treatments were applied, cover in the cultivated and glyphosate treatments were lower than that of the burn treatment ($P<0.10$) and significantly lower ($P<0.05$) than the nil treatment after six months. Apart from an increase ($P<0.10$) in % cover in the nil and burn treatments after 2.5 years relative to earlier times of observation, cover in the cultivated and glyphosate treatments has remained significantly depressed ever since.

Discussion

Though very limited recruitment has occurred in the glyphosate and cultivated treatments (Figure 1), a major recruitment event has not taken place despite: (a) the occurrence of favourable seasons, (b) the presumed presence of a soil seedbank at the time the population was killed, and (c) presumed availability of seed from adjacent plots (nil and burn treatments) where *Austrodanthonia* plants have flowered at least once in most years. However, annual slashings, usually in October, may have prevented seed set after the spring flowering and, as noted by I. Cole (pers. comm.), seed production from a second flowering in autumn may have been inadequate in both quantity and quality.

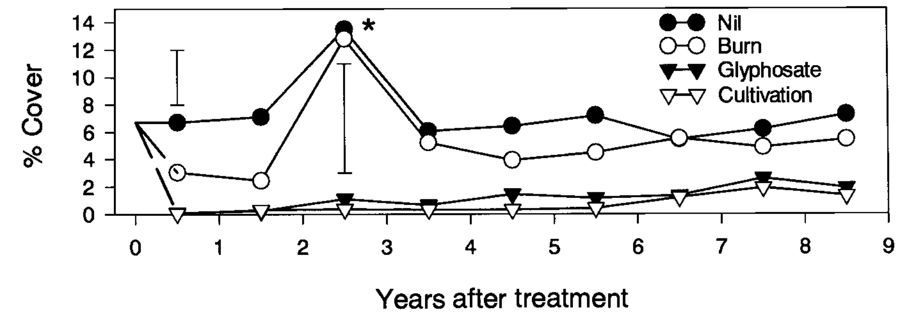

Figure 1. Back-transformed foliage cover (%) of *Austrodanthonia* spp., recorded annually following exclosure and the application of four one-off treatments in September 1991 (Foliage cover prior to treatment was assumed to be the same as the nil treatment six months after treatment). * indicates a significant change of the cover in treatments relative to the previous three observation times.

As initial gaps in the cultivated and herbicide treated plots were filled by *B. macra* (Semple *et al.* 1997), opportunities for further recruitment may also have been limited by lack of regeneration niches that would have been created by ongoing disturbance such as grazing.

Conclusions

After eight years, the lack of recruitment in subpopulations of *A. eriantha* killed by cultivation or the application of glyphosate in September 1991, suggests that some changes in pasture composition may be relatively permanent. Possible reasons for the lack of recruitment were the lack of regeneration niches within the exclosure and/or the failure of adjacent populations to produce viable seed.

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