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ENHANCING ESTABLISHMENT OF NATIVE PERENNIAL GRASSES IN THE COBAR AREA OF NSW

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INTRODUCTION

The NSW Agriculture-Natural Heritage Trust funded project 'Restoration of native perennial grasses using seed banks' was developed to trial low-cost ways to restore environmental values and productive capacity to native grasslands in the Western Division of NSW. One objective of this project was to demonstrate the effectiveness of fenced seed banks at strategic locations, combined with emplacement of branches and soil disturbance outside these seed banks, in enhancing establishment of new plants.

METHODOLOGY

Two sites were set up in the Cobar area in 1999, one in Mulga country on hard massive red soils ('Darling Downs' site), and the other on ridge crests with a Box-Pine-Mallee overstory, lighter textured soils and abundant *insitu* rock and quartz gravel ('Ula' site). Areas running along the ridge-tops were fenced to prevent grazing by domestic and native herbivores. Out from these fenced seed banks and running down slope four replicates, each with two treatments and a control, were emplaced. Treatments were 'Branches' consisting of branches cut from local turpentine shrubs and soil disturbance ('Disturbance') consisting of imprints cut by a 'crocodile'.

Monitoring was carried out on fixed quadrats, each 0.5 m^2 in size, established at set distances from the seed bank fence out to a maximum of 100 m. At each distance from the seed bank fence two quadrats were located, one on an area with already established perennial plants (High Stratum) and the other on an area with no or few such plants (Low Stratum). Times of monitoring were October/November 1999, August 2000, February/March 2001, July/August 2001 and February/March 2002. Numbers of new plants of perennial grass were calculated for the four periods between consecutive times of monitoring. Data were analysed with Asreml (Gilmour *et al.* 1995) using generalised linear models with log link and Poisson variance. Seasonal conditions during the study varied from excellent during periods 1 and 2, to poor during periods 3 and 4.

RESULTS

Results presented in this paper are restricted to the dominant palatable perennial grass on each site.

Ula site

The dominant palatable perennial grass on the Ula site was *Thyridolepis mitchelliana* (Mulga Mitchell grass). New plants of this species consisted of those arising from germination of seed and those arising from rooting down at nodes on the culms (Vegetative growth). As depicted in Table 1, following period 1, the number of new plants arising from vegetative growth, with only three exceptions, was higher than the number of new plants arising from germination of seed. During periods 1, 2 and 3, treatment was a significant factor in the number of new vegetative growth plants ($p<0.001$, $p<0.01$, $p<0.001$). During periods 1 and 3 the Branches treatments encouraged vegetative

Table 1 Number of new plants of *Thyridolepis mitchelliana* (Mulga Mitchell) per 0.5 m^2 at the Ula site. Grey shading indicates that treatment was a significant factor. The darker shading indicates the treatment with the highest number of new plants per 0.5 m^2.
SB = Seed bank, C = Control, D = Soil Disturbance, B = Branches.

	Germination from seed				Vegetative growth			
Period	SB	C	D	B	SB	C	D	B
1	0.87	0.91	0.89	0.93	0.00	0.00	0.04	0.15
2	0.10	0.27	0.26	0.11	0.30	0.95	1.35	0.57
3	0.23	0.19	0.64	0.35	0.10	0.41	0.45	0.63
4	0.00	0.12	0.05	0.03	0.10	0.05	0.15	0.07

growth, but during period 2 highest number of vegetative growth plants was in the Disturbance treatments. Treatment was only significant to numbers of new plants arising from germination of seed during period 3 when the Disturbance and Branches treatments were significantly higher than the Controls. Germinations from seed were highest during period 1 but very uniform over the Seed bank, treatments and Controls (range 0.87-0.93 per 0.5 m^2).

Darling Downs Site

The dominant palatable perennial grass on the massive red soils at Darling Downs was *Monochather paradoxa* (Mulga Oats). As depicted in Table 2 during all four periods, treatment was a significant factor in determining the number of new plants ($p<0.001$, $p<0.001$, $p<0.05$, $p<0.001$). During three of these periods the highest number of new plants per 0.5 m^2 germinated in the Branches treatments; this was especially true during period 1. During period 3, the highest number of plants germinated in the Disturbance treatments. Treatment by distance from the seed bank fence was a significant factor during period 1 ($p<0.001$, negative relationship). This was especially evident in the Disturbance treatments with number of new plants decreasing by approximately 80% over a distance of 50 m. During the three subsequent periods, distance remained a significant factor ($p<0.01$, $p<0.05$, $p<0.01$), but the relationship ranged from positive during period 2 (~ 43% increase in number of new plants for every 50 m) to positive and negative during period 3 (positive in Branches treatment, and negative in Disturbance and Controls), and negative during period 4 (~ 22% decrease in number of new plants for every 50 m in the Branches treatments, to 49% and 70% decreases for every 50 m in the Controls and Disturbance treatments). It is possible that the positive relationship between number of new plants of *Monochather paradoxa* and distance during period 2 was determined by the very high number of plants which germinated in quadrats in the first 50 m from the fence during period 1, thus exhausting the resources and preventing additional germinations in these quadrats during period 2. By period 4, some of these plants had died and thus resources may have again been available for germination in the 50 m out from the seed bank fence. Stratum was a significant factor during periods 2, 3 and 4 ($p<0.05$, $p<0.05$ and $p<0.001$); because Low and High stratum quadrats were selected on the basis of absence/presence of palatable perennial grasses, it is logical from the aspect of seed source that more plants would germinate on High stratum quadrats, but in contrast to this, during periods 3 and 4, in the Branches treatments, more plants germinated on Low stratum quadrats.

Table 2 Number of new plants of *Monochather paradoxa* (Mulga Oats) per 0.5 m^2 at the 'Darling Downs' site. Grey shading indicates that treatment was a significant factor. The darker shading indicates the treatment with the highest number of plants.

Period	Seed bank	Control	Disturbance	Branches
1	0.78	0.60	2.44	16.64
2	0.09	0.19	0.40	1.61
3	0.22	0.17	0.49	0.27
4	3.81	1.17	1.75	2.38

CONCLUSIONS

The results presented in this paper show that the effectiveness of seed banks combined with treatments outside the seed banks varied with site, seasonal conditions, species characteristics and treatment. On the massive red soils of the Mulga community, germination of *Monochather paradoxa* was strongly enhanced in the Branches treatments during good seasons and the poorest season, but during period 3 it was enhanced in the Disturbance treatments. On the lighter-textured soils of the Box-Pine-Mallee ridge, germination of *Thyridolepis mitchelliana* from seed showed a significant response to treatment only during the poor season of period 3, with the best response in the Disturbance treatments. Vegetative growth of this species was enhanced in two periods by the Branches treatments and in one period by the Disturbance treatments.

REFERENCES

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