Fertiliser management:

Growth response of *Danthonia* species to phosphorus fertiliser

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About 20 species of the genus *Danthonia* occur as native perennial grasses on the New South Wales tablelands. Grasslands containing *Danthonia* spp. occupy over 1.5 million hectares in this region (Garden, Dowling and Eddy, unpublished data). Field observations indicate that at least some *Danthonia* spp. appear to be able to respond to increased phosphorus (P) fertility (Garden *et al.* 1996). However, quantitative data on species responses to P are lacking. Our aim was to deter-mine the growth responses to P additions for a selection of eight *Danthonia* species.

Methods

Danthonia species were selected on the basis of being either common (*D. racemosa, D. pilosa, D. eriantha*), productive (*D. linkii* var. *fulva, D. duttoniana*), of low productivity (*D. carphoides, D. auriculata*), or commercially available (*D. richardsonii* cv. Taranna). The experiment was conducted in a glasshouse at 25/15°C day/night temperature and daylength averaged 14 h. Five plants of each species were grown in 16 cm diameter pots filled with 3 kg of sandy loam soil from Sutton, NSW with a Colwell P of 9 mg/kg soil. Phosphorus treatments were equivalent to 0, 6.6, 13.2, 26.4 and 52.8 kg P/ha as triple superphosphate mixed into the top 5 cm of soil prior to sowing. All pots received adequate levels of other nutrients. There were 5 replicate pots of each species × P level combination. Six weeks after sowing, whole shoots were harvested, dried (60°C) and weighed. Mitscherlich equations were fitted to data for the relationship between level of P applied and shoot dry weight. The maximum growth determined from these functions was used to convert absolute growth to relative growth, and Mitscherlich equations were then fitted to the relative growth data. Critical values were determined by solving the equations for the P application rate at 90% of maximum growth.

Results and discussion

Overall, the results demonstrate that there are substantial differences among *Danthonia* spp. in their response to P fertilisation. The species critical values for P fell into two distinct groups (Figure 1), one with critical values averaging 18 kg P/ha (*D. eriantha, D. richardsonii, D. linkii* var. *fulva, D. pilosa*), and another (*D. duttoniana, D. emosa, D. carphoides*) averaging 38 kg P/ha.

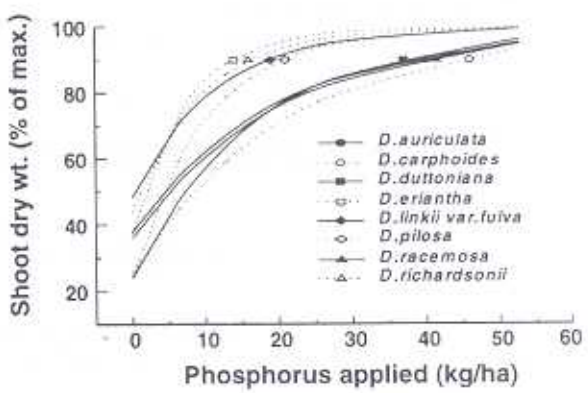

Figure 1. Relative growth of *Danthonia* spp. in response to level of applied P. Lines are the fitted functions. Symbols on the lines denote the critical P level (90% of maximum growth).

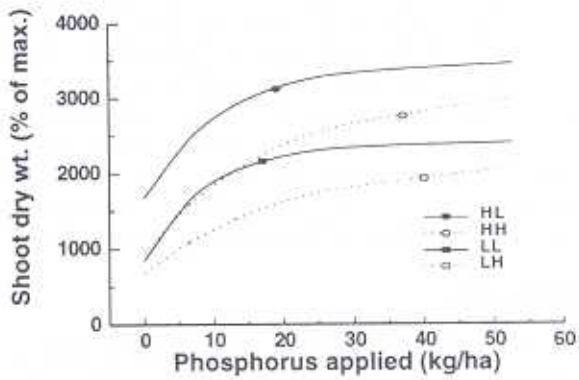

Figure 2. Growth response types for *Danthonia* spp.: high yield, low critical P (HL); high yield, high critical P (HH); low yield, low critical P (LL); and low yield, high critical P (LH). Lines are the fitted functions for the species (see text). Symbols on the lines denote the critical P level.

Within each of these two P response groups, species differed in plant size (on an absolute basis) resulting in four basic types of responses, as shown in Figure 2. *D. linkii* var. *fulva* was clearly different from the others, with a high yielding, but low critical P response (HL). *D. racemosa* and *D. duttoni-*

ana gave a high yielding and high critical P response (HH). Three species (*D. pilosa, D. richardsonii, D. eriantha*) gave a low yielding and low critical P response (LL). Finally, a low yielding, but high critical P response (LH) was exhibited by *D. carphoides* and *D. auriculata*.

The HL response is the ideal for a grazier, giving both a large and efficient response to P fertiliser. The HH response can give high yields, but higher levels of P are required to maximise growth. The LL response gives lower yield but is very responsive to P fertiliser additions up to the critical level. The LH response is neither productive nor responsive, and thus gives the least benefit from P fertilisation. Further work is required to determine how other *Danthonia* spp. may fit these response types, and how these responses may affect species composition and the overall productivity of native grass-based pastures.

Acknowledgments

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Reference

Garden, D., Jones, C., Friend, D., Mitchell, M. and Fairbrother P. (1996). Regional research on native grasses and native grass-based pastures. *New Zealand Journal of Agricultural Research* **39**, 471-85.