Botanical changes in a grazed native grassland with 'sub and super'

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An experiment was initiated in 1998 on a native grassland dominated by the native perennial grass wallaby grass (*Austrodanthonia duttoniana*), but with introduced annual grasses and legumes and other species present. Our aim was to determine the mechanisms by which increasing fertility changes the vegetation dynamics of these grasslands. The treatments were rates of superphosphate fertiliser (0, 62.5, 125 and 250 kg/ha) or fertiliser plus lime (250+Lime) matched by increased stocking rates (6-16 wethers/ha).

The composition in the Nil fertiliser treatment was stable over four growing seasons (1998-2001), with perennial grass comprising about 80% of total herbage, and only modest increases in the legume, annual grass and other components in spring. Additions of superphosphate fertiliser increased the legume content and, consequently, nitrogen (N) fixation and soil N mineralisation increased (Table 1). The application of fertiliser and increased stocking rate resulted in a decline in perennial grass and an increase in the legume and annual grass components. These effects became more pronounced as fertility and stocking rate increased, with the perennial grass declining to 20% over the period in the 250+Lime treatment. The basal cover of *A. duttoniana* remained stable over three years, at about 30% in the control, whereas by 2001 its basal cover had declined to 19, 14, 12 and 6 percent in the 62.5, 125, 250 and 250+Lime treatments, respectively.

The presence and persistence of a substantial perennial grass component is a key factor in maintaining critical ecosystem functions in native grasslands, and stability seems to be conferred by the low rates of N cycling. However, once soil mineral N is increased, there are likely to be increases in the proportion of annual grasses, which are better adapted to higher soil N status. Continued application of superphosphate and inputs of legume N may destabilise these native grasslands and result in the loss of the perennial grasses by competition from the annual species. Graziers should be aware of the consequences of applying superphosphate and high stocking rates to these grasslands and balance them against the economic gains which can be achieved.

Table 1. Effects of fertiliser and grazing treatments on legume and annual grass contents in spring, annual N fixation and soil mineral N in autumn.

Treatment	Spring legume content[1] (%)	Spring annual grass content[1] (%)	Annual N fixation[1] (kg N/ha)	Autumn soil mineral N[2] (mg/kg)
0	10	9	6	16
62.5	20	33	18	14
125	35	24	40	19
250	34	43	56	29
250 + Lime	35	42	62	25
LSD (p=0.05)	9	11	16	8

[1] Mean of 1998-2001

[2] Mean of 2000 and 2001