many stock problems. These too can be much reduced by grazing heavily in spring.

Undoubtedly some volunteers that invade these annual pastures of south-eastern Australia are undesirable. Poisonous and prickly species could fit into this category. However, the economics of their control are a different matter and are usually difficult to determine. The papers reviewed suggest that control measures for removal of 'weeds' in annual pasture may be unwarranted and uneconomic.

COMPETITION BETWEEN *HELIOTROPIUM EUROPAEUM* AND DRYLAND LUCERNE

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The control of herbaceous perennial weeds in southern Australia through the establishment of competitive, cool-season pasture species has been well documented. The position with annual weeds is less clearly defined and other ecological factors such as the grazing strategies employed (e.g. Myers and Squires 1970), the pasture cultivars sown, changes in soil fertility, and so on,may assume increasing importance.

Common heliotrope (*Heliotropium europaeum*) is a summer-growing annual weed of Mediterranean origin which has become widely established on well-drained, texture-contrast soils in southern Australia, particularly in the Riverina of New South Wales. Crossbred sheep eating this weed are subject to the disease complex known commonly as toxaemic jaundice or 'yellows' and heavy mortalities can occur when these sheep are exposed to heliotrope for two consecutive seasons. The result is usually chronic copper poisoning, either separately or in combination with the liver damage resulting from heliotrope poisoning.

This weed was found to be controlled by certain pasture treatments sown originally in dryland pasture establishment trials on Cobram loam in the western Riverina. Species sown included annual medics (Cyprus barrel and Harbinger), Geraldton subterranean clover, lucerne, and Sirocco phalaris which were sown with and without a wheat cover crop at four seed rates (viz. 0.6, 2, 5, and 14 kg per hectare) (0.6, 2, 5, and 14 lb per acre). These trials were repeated over three consecutive years (1967-9) to provide seasonal replication where seasonal conditions ranged from a severe drought in 1967 (127 mm total annual rainfall) to

relatively humid conditions in 1969 (381 mm).

Complete control of heliotrope was achieved only where the lucerne had been sown at a seed rate of 2 kg per hectare (2 lb per acre) or heavier and in the absence of a wheat cover crop. Where the lucerne had been sown under such a 'smother' crop, lucerne establishment was significantly reduced and was ineffective in controlling the heliotrope. It has been assumed that competition for moisture is the critical limiting factor in these semi-arid areas, particularly during conditions of high potential evaporation which commonly occur during the summer. However, further work is required to substantiate such assumptions as well as to investigate other factors such as competition for light and nutrients.

The densities for lucerne (sown in May 1968) and heliotrope, together with the dry matter yields for the heliotrope obtained in March 1969, are shown in Table 1.

TABLE 1

Competition Between Dryland Lucerne and Heliotrope

(Autumn 1969)

Cover Crop	Lucerne seed rate (kg/ha)	Lucerne density (plants/ 0.75 m^2)	Heliotrope density (plants/ 0.75 m^2)	Heliotrope yield (kg/ha)
Without cover crop	0.6	16	1	13
" " "	2	42	0	0
" " "	5	55	0	0
" " "	14	58	0	0
With cover crop	0.6	2	11	226
" " "	2	8	11	204
" " "	5	8	8	123
" " "	14	9	6	130

The other perennial species used in these trials, Sirocco phalaris, which is more summer dormant than the commercial cultivar, and the annual species, were quite ineffective in controlling heliotrope. Average heliotrope yields for Cyprus barrel medic over all seed rates were 238 kg per hectare (238 lb per acre) with the cover crop and 193 kg per hectare (193 lb per acre) without a cover crop.