At the present rate of increase a true indication of this insect's value should be apparent at this site within the next two summer seasons.

CONTROL OF PASTURE WEEDS BY GRAZING MANAGEMENT

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Herbicides have long been used to restore the balance between sown pasture species and weedy invaders. The long-term implications of this practice are not known but it is certain that alternative, non-chemical methods should be sought. In this paper we consider the ecological approach to weed control using as examples four common weeds of irrigated pastures.

Barley grass (*Hordeum leporinum*) was controlled by grazing management in irrigated annual pastures at Deniliquin, New South Wales. Deferment of grazing for 20 days after the opening autumn irrigation was followed by continuous stocking with Merino wethers at 8 sheep per acre. Density of barley grass seedlings was reduced from 2,080 per sq metre to 37 per sq metre within 12 months. The contrasting germination behaviour of barley grass and subterranean clover and the diet selectivity of sheep (as determined by oesophageal fistulae) were exploited to control the barley grass (Myers and Squires, 1970).

Thistles are commonly troublesome in irrigated annual pastures based on subterranean clover. In a grazing experiment at Deniliquin we observed that thistles (*Cirsium* spp.) invaded plots set stocked at low levels (5 sheep per acre). Areas set stocked at higher rates (7 or 10 per acre) were free from serious invasion. The sheep at the higher stocking rates were observed to graze the thistle after senescence and reduce them to woody stumps.

Rushes (*Juncus* spp.) can be a serious problem in irrigated permanent pastures based on *Paspalum dilatatum* and *Trifolium repens*. An established pasture was set stocked at high rates in summer (November-March) and lightly stocked in winter

(April-October). The stocking rate sequences were 20/8, 20/12, 24/8, 24/12, 28/8, and 28/12 (the first and last figures being the summer and winter rates respectively). Rushes were dense over much of the site when grazing began in spring 1964 but were completely eliminated on those plots grazed at 12 sheep per acre in winter. The summer stocking rate was less influential. Density was reduced on all plots after 2 years' continuous grazing and even the lowest stocking rate (20/8) resulted in substantial improvement in the balance between the sown pasture and the weed.

Docks (*Rumex* spp.) were found to be suppressed on paspalum-white clover pasture grazed by sheep in a sequence of 18 per acre in summer and 6 per acre in winter. No measurements are available but photographic records of the fence-line effect provide evidence of the efficiency of continuous grazing in the control of this species.

In all the examples mentioned above there was control of weed species by grazing animals. Continuous as opposed to rotational or intermittent grazing seems to be the key to success. Farmers tend to graze pastures intermittently with emphasis on condition of animals rather than on the pasture. The result is that most irrigated pastures in southern Australia are more or less seriously infested with weeds. In warm-season perennial pastures there is a tendency to de-stock in winter. Again, it is clear that this encourages rushes and docks. Heavy continuous grazing in winter is the simplest and cheapest way to control these weed species. An advantage over chemical methods is that there is no loss of pasture production associated with herbicidal injury to less tolerant pasture components. In addition many weed species, e.g. barley grass, provide useful fodder in the early vegetative stages.