

The best results were obtained with the combination of carbetamide with chloramben and benefin with chloramben.

Further experiments would confirm these results and indicate the best combinations of benefin, carbetamide, and chloramben.

THE BARLEY GRASS PROBLEM IN THE MANIOTOTO DISTRICT

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The semi-arid Maniototo Plains lie at an altitude of 1,200-1,400 ft within the Otago Central Climatic District (Garnier, 1950), which is characterized by low rainfall, cold winters, and hot summers. Mean annual rainfall varies from 15 to 17 in. of which 12-14 in. falls between September and April. Nevertheless, because of high annual evaporation there is a large deficit of soil moisture during the growing season and production is particularly vulnerable to prolonged drought.

The soils are brown-grey earths mainly derived from schist or greywacke alluvium.

The farming is largely semi-extensive sheep grazing with nearly 30% of the area sown to lucerne; this may increase as climate, soils, and farming pattern are all conducive to its use.

Lucerne is normally sown in 7 in. drills and it may take 2 years to establish satisfactorily. Its growth is characterized by an extreme peak of production in October-November; this is conserved as hay and the stand is grazed more or less extensively for the remainder of the year. A stand may produce hay for 10 years, but can be grazed for up to 40 years. The carrying capacity is about 1.0-1.5 ewe equivalents per acre.

The combination of climate and management renders lucerne extremely susceptible to invasion by annual weeds, particularly barley grass. The species involved is principally *Hordeum marinum*, although it is now suspected that much *H. glaucum* is present (Allen, pers. comm.). On marginal salt areas *H. hystrix* is common with *H. marinum* apparently more salt tolerant, while *H. jubatum* occurs occasionally in damp, marginally salty areas.

Infestations are confined almost entirely to the lucerne areas. Encouraged by the management system, barley grass germinates easily in the interdrill spaces after late summer-autumn showers while constant grazing reduces lucerne

competition and aids survival of the weed until the stand is closed for hay in late spring. Much barley grass seed is viable by the time the hay is cut and is shed to perpetuate the infestation, or dispersed around the farm when hay is fed.

Elimination of barley grass is considered necessary mainly because of seed damage to sheep carcasses and pelts and because of the reduction of lucerne yields

Earlier herbicide research programmes in the area used 2,2-DPA for some years in the spring, but reductions in lucerne yield and re-infestation within a year led to the inclusion of residual herbicides as additives.

The herbicide 2,2-DPA or paraquat with simazine, diuron, and bromacil in late winter-early spring improved control of existing infestations, but were uneconomic and failed to prevent re-infestation for a full year. Later work showed that low rates of the residual herbicides terbacil, atrazine, and carbetamide applied alone during the weak establishment phase of barley grass in the early part or the middle of winter retained sufficient residual effect to prevent the occasional spring germination. Production increases recorded were sufficient to compensate for the expenditure involved; as yet, the implications of these findings have not been exploited on a large scale. It was noted that lucerne was exceptionally tolerant to carbetamide, compensating for the herbicide's poor residual effect.

Non-chemical control methods are now attracting attention, they include the suppression of barley grass by growing cocksfoot in alternate rows with lucerne, closer row spacing of lucerne, and the conservation of lucerne as silage.

It has been noted that ensiling lucerne and barley grass at the early green seed head stage produces valuable fodder, free of viable seed. Following the removal of the cut lucerne, the heat of mid summer suddenly penetrating to the base of the stand kills many barley grass plants; the remainder are stunted and eventually produce a small quantity of low viability seed in late autumn after the lambs are slaughtered. The re-infestation potential is reduced and, in the following spring, a previously infested stand carries only a small population of barley grass.