SUBTERRANEAN CLOVER SEED BANK RESPONSES TO PASTURE MANAGEMENT

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Abstract

A rotation experiment was established by imposing pasture and cereal phases on an existing subterranean clover-dominant pasture. Management prior to cropping, particularly the method of weed control, had substantial impact on the size and persistence of the subterranean clover seed bank. This was partly due to differences in seed production from the pasture phase and exaggerated by differences in the persistence of seeds during the subsequent crop phase. Frequent use of spraytopping may lead to a rapid decline in the seed bank and may ultimately compromise the persistence of the legume resulting in the need for resowing.

Key words: Pasture management, seed bank, spraytopping, subterranean clover.

Annual pastures based on subterranean clover (*Trifol-ium subterraneum* L.) are a central element of ley farming systems in the Mediterranean climatic zone of southern Australia (4). Ability to regenerate from one pasture year to the next, and following a crop, is essential.

Grass control in the pasture phase leading up to a crop is a desirable management input due to root disease suppression and a reduction in the grass weed challenge in subsequent cereal crops. However, the widely adopted practice of spraytopping with a non-selective herbicide in spring can reduce the seed production of pasture legumes (2, 5). This study investigates the impact of pasture management on the size and persistence of subterranean clover seed banks.

Materials and methods

Aregenerating second-year pasture was selected in 1995 near Northam, Western Australia, which consisted of 72% subterranean clover (cvv. Geraldton and Dwalganup), 22% capeweed (*Arctotheca calendula* Levyns) and 6% grass. The existing subterranean clover seed bank was about 150 kg/ha.? One hectare plots were individually fenced and continuously grazed.

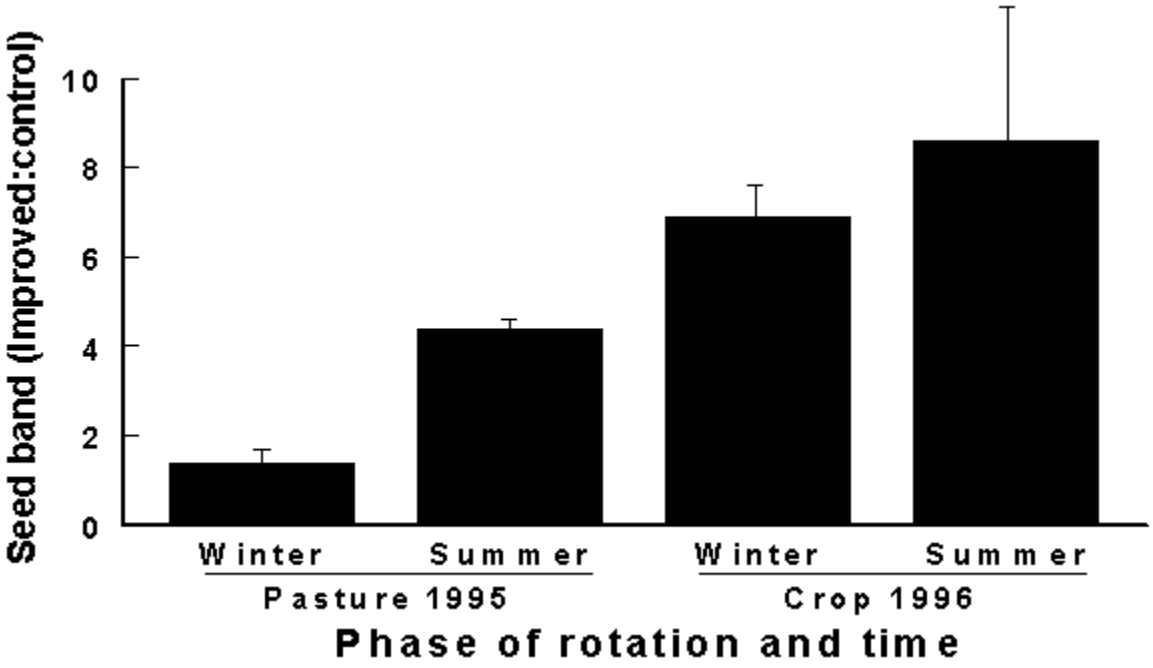
Two management packages were imposed on pastures in 1995. These are referred to as the 'Control' and 'Improved' treatment. The Control treatment had low management input: on 8 September plots were spraytopped with glyphosate (180 g a.i./ha) to control grass seed set; subterranean clover had been flowering for three weeks. The Improved treatment had greater management input: plots were top-dressed with lime-sand (2 t/ha), sprayed with a grass selective herbicide (72 g a.i./ha clethodim) in winter and sprayed with insecticide to control red legged earth mites (43 g a.i./ha omethoate) and aphids (200 g a.i./ha dimethoate). There were three replicates for each pasture management treatment.

In 1996, plots were sown (18 June) to Amery wheat following 'knockdown' of weeds (135 g a.i./ha paraquat + 115 g a.i./ha diquat). Herbicides were applied to control grass (200 g a.i./ha oryzalin + 200 g a.i./ha trifluralin) and broadleaf weeds (200 g a.i./ha bromoxynil + 200 g a.i./ha MCPA) within the crop.

Subterranean clover seed banks were assessed in winter and summer in both pasture (1995) and crop (1996) phases of rotation. In winter soil cores 84 mm in diameter (15/plot, 1995) or 125 mm in diameter (30/plot, 1996) were randomly sampled by hand. In summer soil cores 130 mm in diameter (30/plot) were randomly sampled using a tractor-mounted cyclone-coring machine. Samples were oven dried where necessary and sieved to recover free subterranean clover seed and burr. The burr was then threshed to extract seed. All seed was cleaned and weighed.

Results

Pastures of the Control treatment senesced rapidly after spraytopping, about three weeks before pastures in the Improved treatment. No damage was observed from grass selective herbicides. Subterranean clover seed production at the end of the pasture phase was significantly greater ($P<0.01$) in the Improved (685 kg/ha) compared to the Control treatment (52 kg/ha). Seed banks of the Improved treatment were four times larger than the Control treatment prior to the crop phase (Fig. 1). Pasture management also appeared to have an impact on seed softening dynamics of subterranean clover since the seed bank ratio (Improved:Control) continued to increase in the crop phase in which no new subterranean clover seed was set. Between January and August, 1996, seed losses were about 60% in the Control and 40% in the Improved treatment. At the end of the crop phase the subterranean clover seed bank in the Improved treatment was approximately eight times that of the Control (Fig. 1).



Discussion

It seems likely that the reduction in subterranean clover seed production in the Control treatment is a consequence of spraytopping in spring (2, 5). This is likely to be in part due to an artificially shortened grow- ing season (1). There may also have been some benefit to seed production in the Improved treatment from suppression of insect activity (6).

The increased difference between the subterranean clover seed bank of the Improved and Control treatment during the crop phase also suggests that seed produced following spraytopping has a higher level of soft seed. This was expressed as seed lost to germination from the seed bank during crop establishment. The effect of herbicides on seed characteristics has also been observ-ed in other plant species (3).

The practice of spraytopping the year before cropp-ing, may result in two successive years with little or no subterranean clover seed production. Frequent use of spraytopping may also lead to a rapid decline in the seed bank and may ultimately compromise the persistence of the legume resulting in the need for resowing.

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