



**THE ECOLOGY AND PRODUCTIVITY OF NEW
CULTIVARS OF SUBTERRANEAN CLOVER**
(Trifolium subterraneum L.)

by

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ABSTRACT

The breeding, selection and release of new subterranean clover (*Trifolium subterraneum* L) cultivars is warranted if genotypes are limiting production: however, often pasture management and grazing management factors are the major constraints to production. In this thesis, two research priorities are identified and studied, viz. (i) the pasture and/or grazing management required to maximize herbage and seed production during the growing season and (ii) the effects of grazing management on seed survival over the summer-autumn period.

These research priorities were addressed in four experiments as follows:

1. Small-plot density experiment

The density experiment examined herbage and seed production of subterranean clover (hereafter referred to as sub clover) using the cultivars Yarloop, Trikkala, Esperance and Clare at six sowing rates (1, 4, 16, 64, 256, and 1024 kg/ha pure germinable seed) in the field at the Waite Institute. Two sowing times were used: Early = 17 May 1985 and Late = 7 June 1985). The main conclusions were: (i) Dry matter production is strongly related to plant density early in the season (i.e. the greater the plant number the greater the yield. (ii) Differences in the herbage yield of cultivars late in the season were due to differences in maturity. (iii) Seed production was positively correlated with herbage production at low and medium densities: however, high density swards (e.g. 14,000 plants/m²) which were undefoliated had lowered herbage production and seed production and subsequent regeneration. (iv) Differences in the ability of cultivars to suppress weeds only occurred at high plant densities.

2. Grazing experiment

This paddock-scale experiment at the Mortlock Experiment Station, Mintaro, South Australia (hereafter MES) involved continuous grazing of sub clover pastures at three stocking rates (7, 11 and 15 sheep/ha) during two seasons 1986 and 1987. Five cultivars: Nungarin, Dalkeith, Trikkala, Junee, Clare and a mixture comprising all five were sown at two rates (10 and 200 kg/ha). The main findings and conclusions were: (i) low-density swards (e.g. 150 plants/m²) had low productivity and could support only low stocking rates (7 to 11 sheep/ha) throughout the growing season and the summer-autumn period, whereas high-density pastures (1,500 to 2,000 plants/m²) were more productive and could be grazed at higher stocking rates (e.g. 15 sheep/ha) during the growing season and at the beginning of summer. (ii) Changes in botanical composition were rapid and were influenced by initial sub clover plant density and further modified by stocking rate. (iii) Under grazing, cultivars did not show any differing ability to suppress weeds. (iv) Seed yield of some cultivars (e.g. Nungarin and Dalkeith) were significantly reduced if the initial sowing rate was 10 kg/ha compared to 200 kg/ha.

3. Summer-autumn seed intake experiment

The aim of the summer-autumn seed intake experiment was to identify and quantify the main effects of sheep on the seed reserves and the consequent seedling dynamics of sub clover-based pastures. The impact of sheep grazing dry sub clover pasture residues (comprising a mixture of five sub clover cultivars) was examined over a period of 70 days. The main findings were: (i) Sheep are efficient harvesters of sub clover burr and seed during the summer-autumn period. First they select the largest burr, containing the most seed and the largest seed leading to a progressive decline in burr weight, seeds/burr and seed size. (ii) Seedling emergence from faecal pellets was poor and would not contribute significantly to the regeneration of sub clover pastures in Mediterranean climatic zones. (iii) An estimated 1% (hard) seed of the total sub clover seed ingested survived passage through the digestive tract of sheep grazing dry pasture residues. These

results indicate that summer-autumn grazing should be carefully managed and that the quantity of seed on the surface and in the top 2.5cm of the soil be monitored to ensure that there is sufficient seed to ensure regeneration of a high-density pasture.

4. Animal house feeding experiment

The animal house experiment involved the feeding of intact burrs from each of the cultivars used in the mixture at MES and the summer-autumn seed-intake experiment. The burrs of Nungarin, Dalkeith, Trikkala, Junee and Clare were fed at to individually-penned sheep fitted with faecal-collection harnesses at the rate of 50g (except Clare 40g) of burrs in a standard sheep diet. The main findings were: (i) The survival of seed in faeces was higher (2.9 to 5% hard) than the survival of seed ingested in the summer-autumn field experiment (1% hard). These differences possibly reflect the higher-quality feed in the animal house and consequent greater rate of passage. (ii) The percentage viable seed found in the faeces of pen-fed sheep did not differ between cultivars.

Overall, the findings from the research described in this thesis support the view that management factors have far greater impact than differences ascribed to various cultivars of sub clover.