WATER USAGE AND DRY MATTER PRODUCTION OF PERENNIAL PASTURE SPECIES DOWN A DUPLEX TOPOSEQUENCE

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Abstract

Phalaris (cv. Sirosa) and lucerne (cv. Aquarius) were sown in July 1995 to compare their ability to use soil moisture, with existing pasture (cocksfoot, subclovers, grasses, annual weeds) on duplex soils, both in relation to the depth of water in the soil profile and position along the toposequence. From neutron probe readings, the lucerne showed the greatest ability to dry the soil profile at depth, indicating its potential for recharge control in this environment. Lucerne also showed the greatest productivity over the study period, however dry matter cuts indicated that phalaris may be less susceptible to the soil salinity gradient on site, with lucerne more suited to the less saline upper and middle slopes.

Keywords: Duplex soil, toposequence, soil moisture, lucerne, phalaris, cocksfoot.

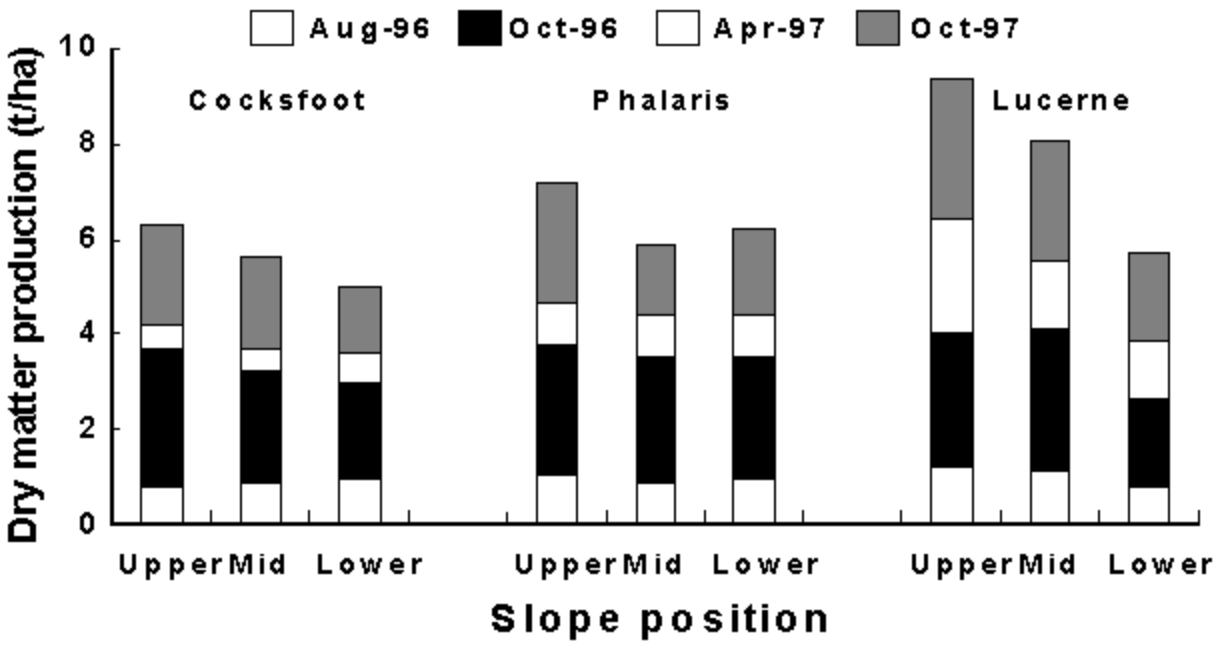
The aim of this study was to compare the water use and productivity of the perennials lucerne (*Medicago sativa* L.), and phalaris (*Phalaris aquatica* L.) with cocksfoot (*Dactylis glomerata* L.), a component of the existing pasture, at a site typical of much of the Mt Lofty Ranges (SA). Although perennial pastures are often advocated as a means of recharge reduction, few large scale studies have been carried out to address these issues in the Australian environment, and there is scant information on plant water use and productivity as a consequence of their position in the landscape.

Materials and methods

The experimental site is located near Keyneton in South Australia, 90 km northeast of Adelaide. Average annual rainfall is 540 mm, and the soils of the catchment are typical of many in the region, with a descending toposequence of red, yellow and grey duplex soils which are prone to waterlogging and dryland salinity in the lower landscape positions. There were two pasture treatments (lucerne based, phalaris based), with the control being the existing pasture comprising cocksfoot, sub-clover (*Trifolium subterraneum* L.) and annual grasses and weeds. Lucerne and phalaris plots were replicated at each of the three levels of the landscape, upper-, mid-, and lower-slope. Run on was prevented by physical barriers, with surface and subsurface drainage recorded through v-notch weirs in reverse interceptor drains. Soil water content was measured regularly with a neutron moisture meter.

Results

Dry matter production



Lucerne was more productive than phalaris or cocksfoot in the upper and mid-slope positions, but less competitive on the lower slopes. From Fig. 1, the summer growth component (Oct - April) advantage of the lucerne is apparent, whilst to some extent cocksfoot and phalaris act more like extended annuals than perennials in this environment. Analysis of variance showed species difference to be a significant factor in dry matter production ($P<0.05$), and toposequence position in this regard was highly significant ($P<0.01$).

Soil moisture

Stored soil water in the surface 50 cm, followed similar trends for all treatments, responding rapidly to rainfall events. In the subsoil, where change is more 'buffered', lucerne has dried the profile to depth in all slope positions (Fig. 2) whilst under the cocksfoot, soil water has increased. Phalaris is intermediate between these two, and the responses match root distribution down the profile (data not presented here)

Conclusions

Of the three perennials tested, lucerne showed the greatest potential to reduce soil moisture in this environment. It also produced consistently higher dry matter, at least in the upper and mid-slope regions, a factor that may influence its adoption as a management tool to reduce local degradation processes. The study emphasises the need for land managers to consider a range of options in their planning, not only as regards what they plant, but where in the landscape it may best serve its purpose, in this case the dual requirements of maintaining or improving production and aiding sustainability by reducing the incidence of waterlogging and subsequent salinisation.