Establishing grass-legume pastures on rundown cropping soils of the Western Downs in southern Queensland.

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Abstract

Ley pastures are grown on cropping soils on the Western Downs to provide high quality animal feed and improve soil fertility for grain production. Three tropical legumes were planted in 50 m strips with mixed grass strips on either side or in sole stands on a brigalow/belah cracking clay soil. The yield of the legumes and grasses and the movement of the grasses into the legume strips were measured at intervals over 2 growing seasons. In the first season, lablab was the most productive (2.1t/ha) and in the second season, burgundy bean was the most productive (1.1 t/ha). The number of grasses established in the legumes in the first season ranged from nil in the lablab to 1.2 pl/m^2 in the burgundy bean, increasing in the second season to 1.6 pl/m^2 in lablab and 4.8 pl/m^2 in burgundy bean.

Key Words

Ley pastures, establishment, tropical legumes, clay soils.

Introduction

Soil fertility levels on the brigalow soils of the Western Downs in southern Queensland have declined from continuous cultivation, resulting in less profitable cereal production. Legume-based pasture rotations have long been used in southern Australia to improve soil fertility and physical structure, and as a fodder source for animal production. A number of new grass and legume species showing potential as ley pastures for southern Queensland have emerged from plant evaluation studies (1).

Mixed grass-legume pastures are found to be more suited to sustainable systems in terms of ground cover, organic matter additions, nitrogen (N)-fixation and N residual value (2). However, establishing mixed pastures on cropping soils under variable climatic conditions has proved difficult. An alternative method of pasture establishment was tested where separate strips of legumes and mixed grasses were sown to decrease the initial competition from grasses over legumes if sown as a grass/legume mix. Over time, the legume portion could decrease as the more competitive grasses spread into the legume strip to form a desirable mixed grass/legume ley pasture.

Methods

A trial was established in November 2000 near Miles (26?40’S, 150?9’E) on the Western Downs in southern Queensland on a long-term cropped brigalow/belah brown cracking clay soil with a pH of 8.7 in the 0-30 cm depth, becoming acid with depth, a total carbon content of <1% and available Colwell P of <6.6 mg/kg. The rainfall was 439 mm in the first season (October 2000 to March 2001) and 416 mm in the second season (2001/2002). Total rainfall was 505 mm and 535 mm for the years 2000 and 2001 respectively, which was lower than the long-term annual average of 600 mm.

Three tropical legumes adapted to clay soils, lablab (*Lablab purpureus* cv. Endurance), butterfly pea (*Clitoria ternatea* cv. Milgarra), and burgundy bean (*Macroptilium bracteatum* cvv. Cadarga and Juanita) were planted in 3 m x 50 m strips with a conventional combine planter in 3 replications. In 1 m rows on either side of the legume strips, a tropical grass mix of green panic (*Panicum maximum* cv. Petrie), bluegrass (*Dichanthium aristatum* cv. Floren) and creeping bluegrass (*Bothriochloa insculpta* cv. Bisset) was planted (1:1:1). These grasses are well adapted to clay soils and will spread from seed (green panic and bluegrass) and stolons (creeping bluegrass).

In the first season, legume populations were counted in 20 quadrats (0.25 m^2 each) and dry matter yields (DMY) were determined from cutting 5 quadrats (0.25 m^2 each) per plot. In the grass/legume strip plots, the population of grasses spreading into the legume strips was counted in 30 quadrats (0.3 m^2 each) along a centrally located 15 m area within each plot. The distance of the sown grass spread by stolons from the grass/legume interface was measured. In the second season, the number of sown grasses and legumes was counted and plot yield was calculated using the dry weight rank method of BOTANAL. The maximum distance of sown grass spread by stolons or seed from the grass/legume interface was again measured late in the second season.

The established legume plots were shield-sprayed with the residual herbicide Spinnaker? to control grass and broadleaf weeds in the first season. The plots were slashed to 20 cm late in the first season and grazed by cattle late in the second season. Both events followed plot measurements.

Results

In the first season, lablab produced the highest yield of 2.1 t/ha, followed by burgundy bean (2.0 t/ha) and butterfly pea (1.0 t/ha). In the second season, burgundy bean produced the highest yield of 1.1 t/ha followed by butterfly pea (0.7 t/ha) and lablab (0.2 t/ha).

In the first season, the population density of the sown grasses in the legumes was: grass plants in lablab 0 pl/m^2, in butterfly pea 1.0 pl/m^2 and in burgundy bean 1.2 pl/m^2 (Figure 1). The mean distance of rooted stolons of creeping bluegrass from the grass strips into the legume strips was 0.5 m; the longest distance was 1.0 m. No green panic or bluegrass occurred in the legume strips. In the second season, the population density of the sown grasses in the legumes was: grass plants in lablab 1.6 pl/m^2, in burgundy bean 4.8 pl/m^2 and in butterfly pea 1.8 pl/m^2. The grasses in the legumes occurred at a distance of 1.4 m, 1.0 m and 0.8 m for lablab, burgundy bean and butterfly pea, respectively.

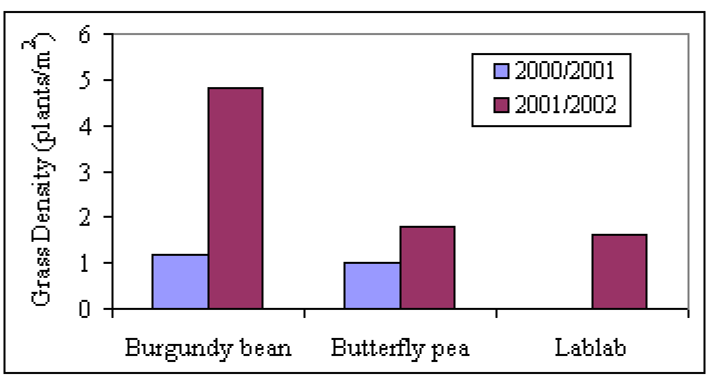

Figure 1. Density of sown grass in three legume treatments over 2 seasons.

Discussion

Initially, the rapid establishment of the weed-free legume stands maximised high quality pasture production, which was also likely to maximise N-fixation. By the second season, the population of desirable grasses that grew in the legume strips increased almost four-fold. Lablab was very competitive in the first year preventing any grass spread, but its poor persistence into the second summer opened up areas for grass and weed establishment. Burgundy bean and butterfly pea DMY decreased as the sown grass density increased in the second season and by the third season, it is expected that a mixed grass-legume pasture would maximise soil fertility benefits. Depending on rainfall in summer 2002/2003, a cereal crop will be established to assay the effect of the pasture treatments on grain production and N uptake. Effects on soil fertility (structural and chemical) will also be measured.

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References

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