Lupin yield when pasture cropped over Gatton panic at different seeding rates

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Key messages

Lupin seeding rates may need to be higher for pasture crops to achieve the same target density as a standard crop (i.e. 45 plants/m^2); for lupin establishment density was 8-30% lower than controls (i.e. no perennial base) where crops were sown into perennial grasses.

Sowing lupin crops over subtropical perennial pastures can be profitable, but wide perennial rows (e.g. 0.8-1.0 m spacing) and higher seeding rates (>100 kg/ha) may be needed to minimise any yield penalty relative to a standard annual crop.

Pasture crops can be established with tined machines using precision guidance technology without damaging (pulling up) the perennial base.

Aims

To evaluate the impact of crop seeding rate and perennial row spacing on grain yield of pasture crops (Lupin in 2013) in the West Midlands region.

To evaluate the feasibility of using tine seeders fitted with precision guidance technology to sow annual crops into subtropical perennial pastures (offset to perennial rows) without damaging the perennial base.

Method

Background

Pasture cropping for grain (i.e. seeding an annual crop over a live perennial pasture) has proved to be viable at a focus site south west of Moora over the past 4 years (Ward et al. 2012); and herbicide options that control crop weeds without jeopardizing the persistence of the perennial base have been identified (Borger and Ferris 2013). However, information on other management issues, such as crop seeding rate, and options for growers without disc seeders are being sought by innovative growers to help refine pasture cropping systems.

Perennial pasture establishment

In August 2012, a new focus site was established 20 km south of Dandaragan on a deep sandy soil. The chemical properties of the soil (0-10 cm) were: pH ($CaCl_2$) 5.4, organic carbon 1.06%, conductivity 0.04 dS/m; and macro elements (in mg/kg) inorganic Nitrogen 5.3, Phosphorus 26, Potassium 19 and Sulphur 5.9.

Gatton panic (*Megathyrsus maximus*) was sown (August 2012) at 44 and 88 cm row spacing using precision guidance technology: DGPS (+/- 2 cm accuracy) and auto steer. Tines on the DAFWA cone seeder were positioned 22 cm apart, so some seeding boots were blocked off to achieve the required perennial row spacing. Leading tines (44 cm spacing) were modified to scalp away the non-wetting layer and form furrows into which coated seed was sown (4 kg/ha) and pressed in (<1 cm deep) with trailing press wheels. Perennial grass was not sown into

control plots. Plots were 7 x 15 m and there were three replicates per treatment in a randomized block design (Table 1).

Pasture cropping treatments

On 24 May 2013, a knockdown spray (Sprayseed 1 L/ha, Treflan 1.5 L/ha, Simazine 1.5 L/ha) was applied just prior to sowing crop treatments with the same precision guidance machine used to sow Gatton panic rows nine months prior (Table 1). Crop rows were sown 22 cm apart (narrow points) and offset to perennial rows. Super Potash (3:1, 160 kg/ha) was top-dressed prior to sowing Gunyidi lupin seed at two rates (100 or 150 kg/ha). The trial was sprayed with insecticide (Dominex 100 mL/ha and Talstar 200 mL/ha) on the same day. A grass selective herbicide (Select 500 mL/ha) was applied on 2 July to control ryegrass. This also had a big impact on the perennial pasture base and suppressed winter growth as expected. (*Warning* for mixed subtropical grass pastures - Rhodes grass is more sensitive than Gatton panic to grass selective herbicides and can kill many plants; see Borger and Ferris 2013).

Lupin and Gatton panic density were assessed by counting the number of seedlings along twin (lupin) or single (Panic) 1 m long rows at ten random positions per plot. Grain was harvested from two (1.54 x 12 m) strips per plot using a small plot header.

Table 1 Annual crop, perennial grass and pasture cropping treatments

Treatment	Description
1	100 kg/ha Lupin (annual control)
2	100 kg/ha Lupin sown over Panic rows 44 cm apart
3	100 kg/ha Lupin sown over Panic rows 88 cm apart
4	150 kg/ha Lupin (annual control)
5	150 kg/ha Lupin sown over Panic rows 44 cm apart
6	150 kg/ha Lupin sown over Panic rows 88 cm apart
7	Panic rows 44 cm apart (permanent pasture)
8	Panic rows 88 cm apart (permanent pasture)

Results

Perennial pasture base

Very few perennial plants were damaged (i.e. pulled up by tines) when pasture crops were sown with a DAFWA cone seeder fitted with narrow points, DGPS (+/- 2 cm accuracy) and auto steer. The precision technology proved effective in placing crop rows offset to perennial rows (i.e. 2 crop rows between panic rows 44 cm apart, or 4 crop rows between panic rows 88 cm apart).

Gatton panic establishment was about 6 plants per meter of row (April 2013), i.e. 14 plants/m^2 for the 44 cm row spacing and 7 plants/m^2 for the 88 cm row spacing treatments. Perennial biomass (20 May 2013) just prior to the seeding the lupin crop averaged 720 and 1000 kg/ha for 44 and 88 cm row spacing treatments respectively. Panic growth was suppressed (all treatments) over the winter growing season (<350 kg/ha) in response to declining temperatures and the impact of knockdown (Sprayseed) and grass selective (Select) herbicides.

Lupin density and yield

Lupin density in the control treatments (i.e. no perennial base) was 43 plants/m^2 for the 100 kg/ha seeding rate and 60 plants/m^2 for the 150 kg/ha seeding rate. By comparison, crop establishment was 8-30% lower for pasture cropped treatments. Notwithstanding, the impact of the perennial base on lupin establishment appeared to be moderated by wide (88 cm) perennial rows.

Increasing seeding rate from 100 to 150 kg/ha increased grain yield across all treatments (10-23%). Grain yield for the control (no perennial base) seeded at 100 kg/ha was 2.3 t/ha; grain yield for pasture crops seeded at the same rate were 26% and 17% lower for crops sown over narrow (44 cm) and wide (88 cm) panic rows respectively. There was also a yield penalty for pasture crops sown at 150 kg/ha (19-22%)

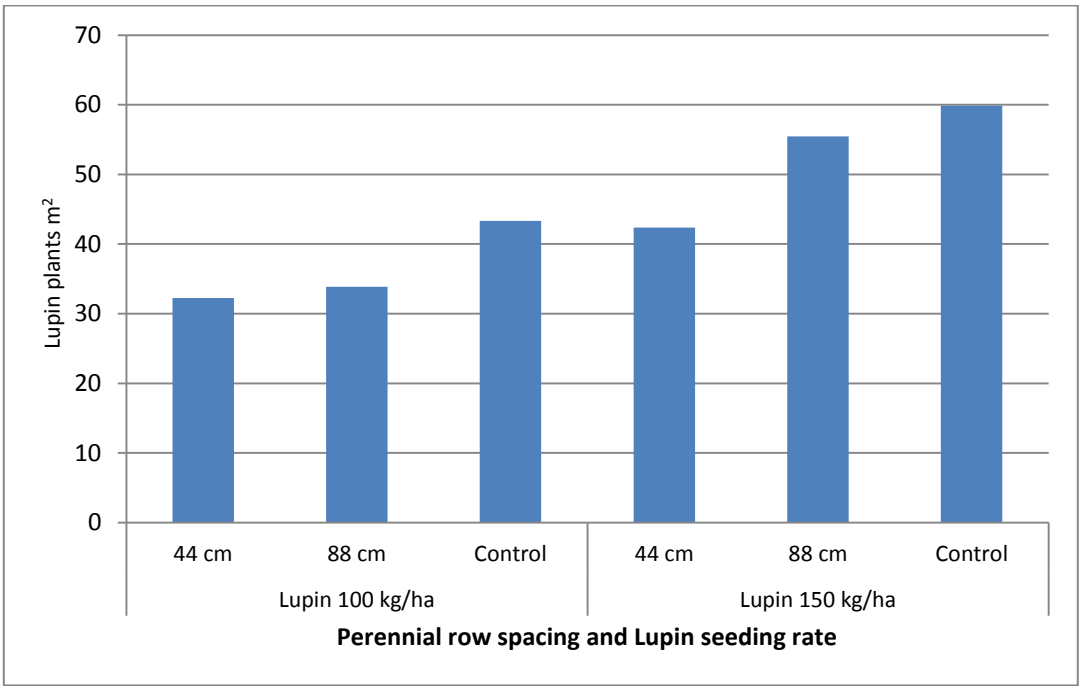

Figure 1 Lupin plant density for annual control and pasture crop treatments. See Table 1 for treatment descriptions. Lsd (5%) = 10.3

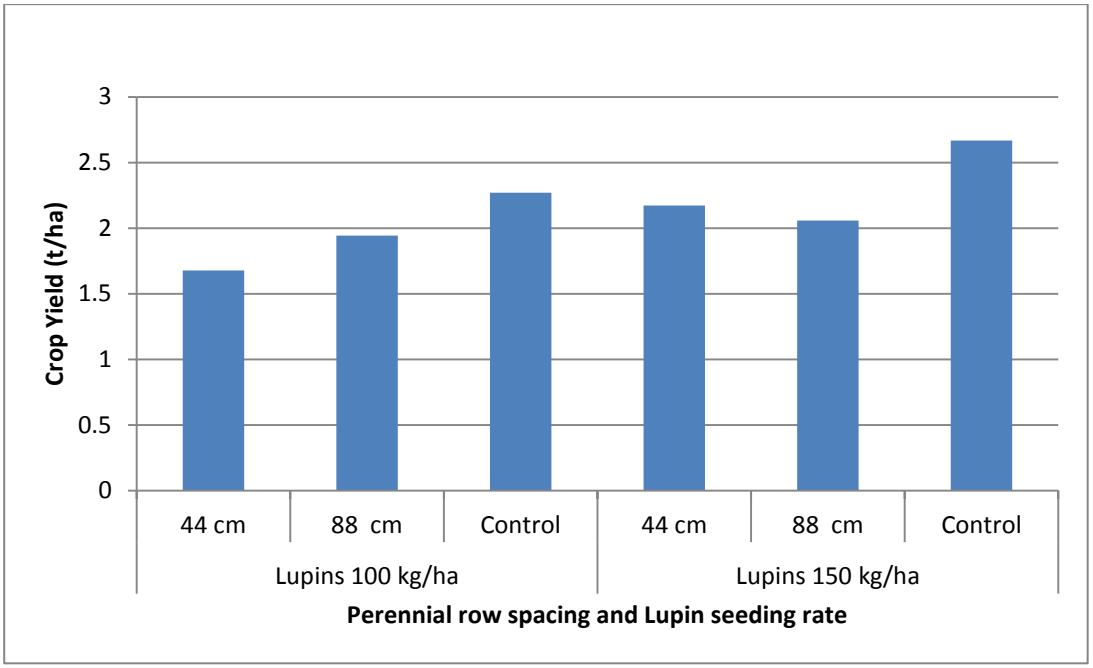

Figure 2 Lupin grain yield for annual control and pasture crop treatments. See Table 1 for treatment descriptions. Lsd (5%) = 0.53

Conclusion

Crop seeding rate and perennial row spacing both influence grain yield of pasture crops. Interestingly, crop establishment density and subsequent grain yield were similar for the annual control (seeded at 100 kg/ha) and pasture crop treatments seeded at 150 kg/ha. This suggests that lifting seeding rate of pasture crops might compensate for poorer establishment and, in turn, help to reduce any grain yield penalty. For this experiment and assuming lupin seed is $300/t, lifting seeding rate by 50 kg/ha ($15) helped to avert a 26% yield penalty and proved to be $165/ha more profitable overall.

Where growers do not own a disc machine but have invested in precision guidance technology it is feasible to use a tined machine to sow crops into perennial pastures without damaging the perennial base. However, forward planning is required so that Gatton panic pastures have been established with compatible guidance technology. Establishing wide perennial rows (50-100 cm) is recommended to help minimise any yield penalty and logistical issues with seeding a crop or companion annual legumes (e.g. serradella) into perennial pastures in the future.

Key words

Pasture cropping, Precision guidance, Subtropical grasses

References

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