Serradella and perennial grasses lift pasture productivity on deep sandy soils

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Key messages

The productivity of deep sandy soils is marginal for continuous cropping but can be improved by establishing well adapted perennial and annual pasture species, especially subtropical perennial grasses and serradella mixtures. For this trial, biomass production over the winter growing season was 51% more in perennial grass plots with serradella as a companion annual legume than for perennial grass alone.

The anticipated benefit of suppressing the growth of perennial grasses when establishing serradella was not realized; possibly because the annual ryegrass population, that was resistant to clethodim (Select®), was more efficient than serradella at capturing resources which would otherwise have been used by the subtropical grasses.

Subtropical perennial grasses stabilize fragile sandy soils, lower the annual weed burden, increase ground cover, and extended the period of green feed. Collectively these benefits provide options to diversify the farm business to take advantage of any out of season rain and additional feed grown over summer and winter.

Aims

To compare the productivity of annual and perennial based pasture systems established on deep sandy soils in the West Midlands Region that are marginal for continuous cropping.

To evaluate the influence of perennial row spacing and grass suppression on the performance of serradella summer-sown into subtropical perennial-grass pastures.

Method

In 2014, pasture improvement treatments were established across Gatton panic or unimproved annual pasture plots. The trial site had been used to evaluate the viability of pasture cropping in the previous year; where lupin pasture-crop treatments yielded 1.7-2.2t/ha (Ferris and Valentine 2014). Yellow serradella line 87GEH72.1a (pending release) was summer-sown into some of the Gatton panic (*Megathyrsus maximus*) and previously unimproved plots. Seed was sown (30kg/ha of pod plus 10kg/ha of ALOSCA®) on 18 February using precision guidance technology (DGPS +/- 2cm accuracy) and auto steer. Tines on the DAFWA cone seeder were 22cm apart and aligned to sow between Gatton panic rows that had been established in 2012 (44 and 88cm apart). Super potash (3:1, 160kg/ha) was top-dressed across all plots prior to sowing.

There were eight treatments in total (with 3 replicates): five sown with serradella, two left as Gatton panic only and an unimproved control (Table 1). Three of the serradella treatment were also sprayed with a grass selective herbicide (Select® at 500mL/ha) on 1 July to suppress the growth of Gatton panic and control annual grass weeds. In addition, all plots were sprayed with Broadstrike® (25g/ha) in May to control volunteer lupin, and mown on 5 June and 9 July shortly after biomass assessments. Unimproved control plots were also mown on 19 August to reduce annual ryegrass seed set.

Serradella density was assessed by counting the number of seedlings along twin 0.5m long rows at 12 random positions per plot. Biomass production was assessed on 11 February (prior to sowing) and every 4-6 weeks during the growing season by cutting and drying herbage from two representative quadrats (0.5 x 0.88m) per plot. Seed yield was assessed by collecting pods within three random quadrats (0.2 x 1.0m) per plot and using a seed to pod ratio of 36%

Table 1 Pasture improvement treatments

Treatment*	Description
1	Unimproved annual control (i.e. no serradella, no Gatton panic and no grass suppression)
2	Gatton panic rows 44cm apart
3	Gatton panic rows 88cm apart
4	Serradella summer sown, plus grass suppression (i.e. no Gatton panic)
5	Serradella summer sown between Gatton panic rows 44cm apart, plus grass suppression
6	Serradella summer sown between Gatton panic rows 88cm apart, plus grass suppression
7	Serradella summer sown between Gatton panic rows 44cm apart
8	Serradella summer sown between Gatton panic rows 88cm apart

* Treatments form part of a low (1-3) and high (4-6) input, rotation trial that was established in 2012 (Gatton panic sown) and either cropped (1-6) or left as permanent pasture (7 & 8) in 2013. See Ferris & Valentine 2014 Crop Update paper

Results

The trial site was located 20km south of Dandaragan on a deep sandy soil; soil surface pH ($CaCl_2$) was 5.4 and organic carbon 1.06%. Total annual rainfall was 516mm with 406mm falling between May and September. The site had an early break of season with three favourable rainfall events.

Composition and plant density of pasture treatments

Four general pasture systems were evaluated: unimproved control, serradella alone, perennial grass alone, and perennial grass combined with serradella as a companion annual legume. Gatton panic plots had about 300kg/ha green feed in February just prior to summer sowing serradella pods into either dry crop residues (Lupin) or perennial grass plots. Gatton panic density was around 6 plants per metre of row (i.e. around 7 and 14 plants/m^2 for 44 and 88cm perennial row spacing treatments respectively).

After the break of season serradella density in the control treatment (i.e. no perennial base) was 152 plants/m^2; seedlings emerged at about the same time within perennial pasture plots but plant density was about 17% lower for both 44 and 88cm perennial row spacing treatments.

Productivity of four different pasture systems over time

The annual control pasture (which regenerated after a lupin crop the previous year) was primarily annual ryegrass. Individual plants were small, had few tillers and looked nutrient deficient. Collectively the annual ryegrass pasture produced about 700kg/ha biomass and numerous spikes before being mown (19 August) to control seed set (Figure 1a). The perennial pastures produced little growth (<500kg/ha) over the 2013-2014 summer due to limited rainfall (just 14mm in January); as expected growth slowed over winter but responded to warm conditions in spring. Overall, biomass production was similar for both perennial row spacing treatments (av. 1.3t/ha); and on 24 September, pasture composition was primarily annual ryegrass (av. 63%; Figure 1b). By contrast, summer sowing serradella into bare ground proved to be 33% more productive over winter than perennial only plots; moreover, plots had 59% legume content by spring (Figure 1c). Summer sowing serradella into perennial pastures was the most productive overall, in terms of total winter biomass (av. 2.1t/ha), legume content (av. 63%) and potential summer feed (Figure 1d).

Impact of perennial row spacing and herbicide suppression on the performance of serradella

Overall, the four companion annual legume treatments (5-8), which differed in perennial row spacing and grass suppression, showed similar growth trends. Panic growth was suppressed over the winter growing season in response to declining temperatures (all plots) and the impact of the grass selective herbicide (Treatment 5 & 6). By 24 September, cumulative serradella growth was 1.1-1.5t/ha and legume composition around 63% with slightly more overall growth in the wide perennial row spacing (88cm) plots (Figure 2). The annual ryegrass proved to be resistant to clethodim (Select®); consequently most plants survived the grass selective herbicide. Interestingly, more ryegrass was grown in plots without a perennial base (40%) and those where the perennial base had been suppressed (av. 28%) than unsprayed perennial

plots (19%; Figure 2). This suggests that in absence of competition from panic, ryegrass is more efficient than serradella at taking up resources that otherwise would have been used by perennial grass.

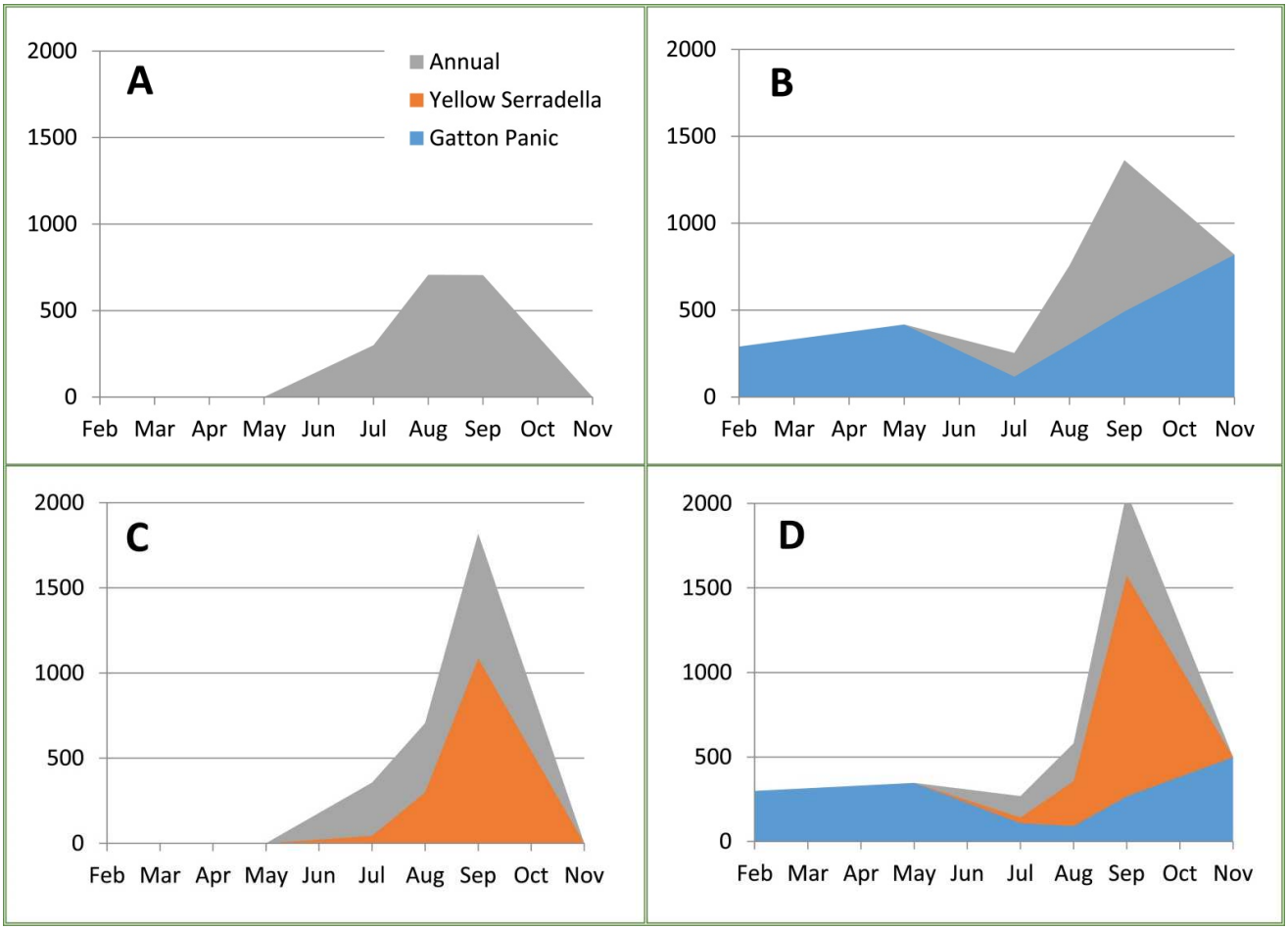

Figure 1 Pasture production (kg DM/ha) and composition of green feed over time for different pasture improvement treatments: (A) unimproved control, (B) subtropical perennial grass, cv. Gatton panic (C) summer-sown yellow serradella (D) serradella summer-sown into Gatton panic.

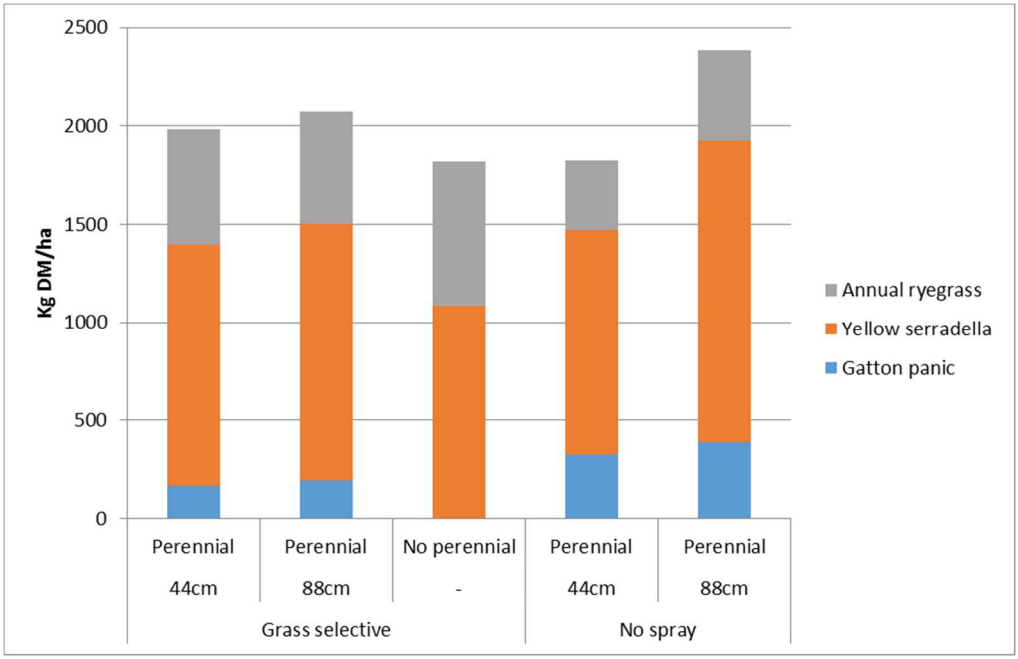

Figure 2 The impact of perennial row spacing (44 & 88cm) and herbicide suppression on pasture production (kg DM/kg) and composition. Cumulative growth up to 24 September. Lsd (5%)=518

In this situation—where ryegrass proved to be highly resistant to clethodim—serradella seed production was not increased by suppressing the perennial base as anticipated (Figure 3). Rather, seed production was greatest in unsprayed perennial plots especially those with a wide-row spatial arrangement (i.e. 42% greater yield than narrow row spacing). Notwithstanding, all treatments produced over 400 kg seeds/ha which has set up a large seed bank from which to self-regenerate in subsequent years.

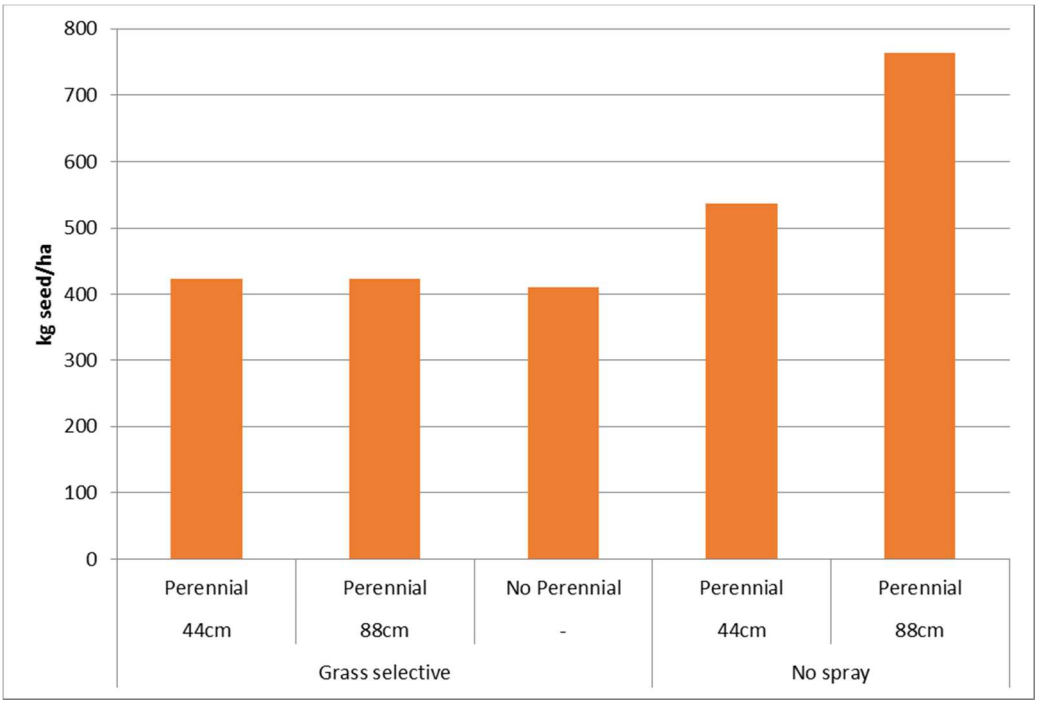

Figure 3 The impact of perennial row spacing (44 & 88cm) and herbicide suppression on serradella seed yield (kg seeds/ha). Lsd (5%)=109

Conclusion

EverCrop research reported in this and previous Crop Updates (2010-2014) has built up a sound knowledge base on the viability, performance and economics of pasture cropping and companion annual legume based systems for fragile soils in the Northern Agricultural Region that are marginal for continuous cropping. Collectively, trials at Mingenew and Dandaragan over the past two seasons (2013 & 2014) have demonstrated that subtropical perennial grass pastures lift the overall productivity of deep sandy soils, extend the period of available green feed, convert summer rainfall into feed, reduce the winter and summer weed burden, and increase ground cover.

Key words

Subtropical grass, Summer sowing, Companion legume, Gatton panic, Serradella

Reference

Ferris D and Valentine C (2014). Lupin yield when pasture cropping over Gatton panic at different seeding rates. Agribusiness Crop Updates 24-25 February, Crown, Perth.

Valentine C, Ferris D and Moore G (2014). Summer sowing of serradella into established subtropical perennial grasses. Agribusiness Crop Updates 24-25 February, Crown, Perth.

Acknowledgments

Thanks to Daisy and Peter Negus for hosting the trial, the DAFWA Geraldton Research Support Unit for sowing and managing the trial and West Midlands Group for their collaboration with extension activities. This research was funded by DAFWA in collaboration with the MLA Feedbase project and GRDC's EverCropIII project: Developing new mixed farming options

GRDC Project Number: CSA00044

Paper reviewed by: Geoff Anderson, DAFWA