Sowing serradella into sub-tropical pastures, a three-year rotation.

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Key messages

Serradella can be successfully established into a sub-tropical stand and supply a source of nitrogen to the perennial grass.

A good serradella seed bank is needed to endure a false break and a dry season.

When compared with conventional sowing, a dry season will impact serradella production more so when sown into sub-tropicals.

Aims

To evaluate the impact of perennial row spacing and annual legume seeding rate on establishment, winter growth and seed production of serradella.

To establish the survivability of serradella pod in a rotational cropping program in an established perennial pasture.

To determine if there is a yield penalty to a serradella stand when situated in an established perennial grass.

Method

A deep sandy soil was selected 20km south of Dandaragan that had a history of poor pasture and crop production. Even though the soil was non-wetting with low water holding capacity and poor nutrition it was well suited to establishing subtropical perennial grasses. In August 2012 a cone seeder fitted with DGPS (+/- 2cm accuracy), auto steer and modified scalping points was used to sow subtropical grass treatments at two row spacing's: 44cm and 88cm. The subtropical grass (a mix of Gatton panic, Rhodes grass and signal grass) established well over the next six months before summer sowing (February 2013) serradella treatments. Select® at 500mLs/ha was used in the winter of 2013. This selectively removed a large proportion of Rhodes grass and the perennial stand now is dominated by Panic.

In April 2013, serradella treatments were sown either alone or into the perennial pasture; these included Margurita(þ French serradella and an unreleased yellow serradella line YS_72.1a. All serradella treatments were sown with 10kg/ha of ALOSCA group S inoculant and GPS guidance was used to accurately place the serradella between the perennial rows. In 2014, barley was sown on both the perennial and non perennial plots. In 2015, serradella germination was measured on April 21 and July 29, perennial and serradella biomass cuts were taken on February, April and September. Pod was harvested in November to determine final seed production of serradella.

Results

The annual rainfall conditions in 2013 were a decile 9 and contrasted by 2015 with a decile 2, (Figure 1). The total rainfall for 2013 was 659mm, with 558mm of that falling in the annual growing season. Almost 200mm less (461mm) fell in 2015, 370mm of that in the growing season.

In 2013, a decisive break of 116mm in May allowed for ideal conditions for serradella establishment. This was followed up by a favourable seasonal finish, with 228mm falling from August to October. The serradella yielded a large seed bank to be set up for a rotational crop or permanent pasture. Barley was sown into the trial in 2014 and there was still a large seed bank left in 2015.

A false break of 27mm in April 2015 resulted in the serradella pod from the 2013 seed set to germinate. There was some germination in the control (nil perennial) plots, these survived and managed to gain a 'head start' on the later germinating serradella.

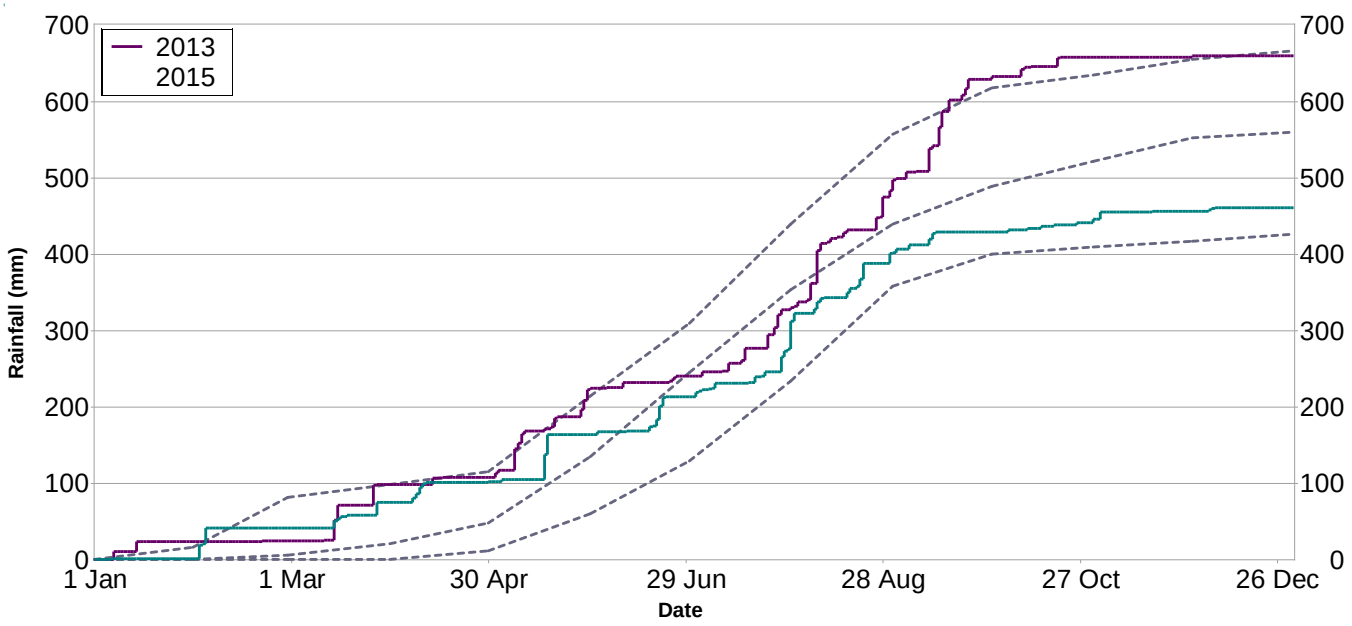

Figure 1 Shows the rainfall deciles at the Lake Nammen weather station in 2013 and 2015. The weather station is situated 11km west of the trial site.

Serradella Germination

The false break in April 2015, resulted in a large percentage of plants germinating while the sub-tropical Panic grass was still highly active and able to compete with the germinating annuals. The summer active Panic grass utilised most of this moisture and consequently the serradella seedlings died in the perennial plots. Serradella that was situated in the control (nil perennial) plots were able to germinated and survive the false break (Image 1 and 2).

Image 1 (left) and 2. The 2015 false break in April resulted in a 'carpet' of germinated serradella seedlings. Image 1 shows the seedlings dying at the cotyledon or one leaf stage when sown into perennials. The serradella seedlings in Image 2 are outside of the perennial plots and were able to pull though the false break and survived through winter. Both images were taken on April 21.

Fortunately, serradella seed set was very good in 2013 and this allowed for an effective reserve to be available for the more decisive winter break in May. A germination count was done on April 29 2015 to capture the false break and July 29 to measure viable seedlings that survived the false break or were part of a 2nd germination (Figure 2).

In 2013, serradella was summer sown in February before there was 74mm of rain in March 2013. Both YS_72.1a and Margurita(Þ seed pod require several months in the environment to break down ready for germination and this did not effect the serradella that was sown in February that year.

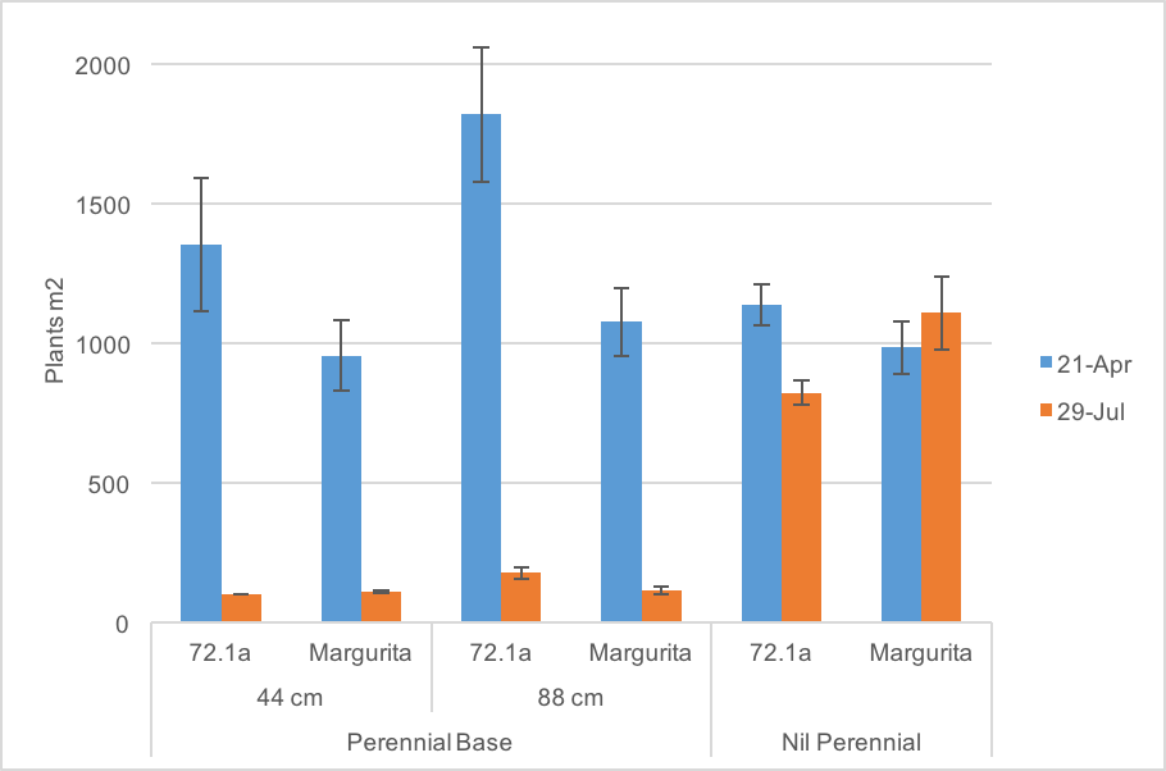

Figure 2. The impact of a perennial base and perennial row spacing on 2015 serradella establishment; measured April 21 and July 29. (Bars = SE)

A massive germination in April resulted approximately between 1000 to 1800 plants m^2 depending on variety and perennial spacing. There was almost 100% death of the serradella in the perennial plots with the wider 88cm perennial spacing not providing any improvement on survivability. All or nearly all plants that were measured three months later (July) were a second germination. There was though a significant decrease in density, down to 100 to 180 serradella plants m^2 in the perennial plots.

Contrasting this, most serradella managed to survive the false break and there was little change in the numbers of plants between April and July. From visual observations, some plants were a later winter germination, but most were the original germinating plants from April.

Six plots were not sown into barley in 2014 and instead left as Margurita(b) serradella to regenerate and add to the seed bank. As expected these plots had higher numbers of seedlings at both the 2015 April and July counts, yielding 30% more plants in April and 56% more in July (data not shown).

Biomass

The ability for the serradella in the nil perennial plots to survive the false break allowed for a developmental 'head start' on serradella sown into perennials. This can be seen in the results in Figure 3 which show that:

- Serradella did far better in the perennial plots in 2013 compared to 2015
    - When sown into perennials, the 2013 YS_72.1a produced 69% more biomass and Margurita(b) 66% compared to 2015.
- Serradella performed similarly in the control (nil perennial) in 2013 when compared to 2015
    - There was little biomass difference between 2013 and 2015 when established in a typical pasture without perennials.
- Serradella grown in perennials had a small to moderate biomass penalty in 2013
    - In 2013 when sown into perennials, there was a 23% biomass penalty in Margurita(b) and 42% in YS_72.1a when compared to serradella in traditional pasture.
- Serradella grown in perennials had a large biomass penalty in 2015
    - In 2015 when sown into perennials, there was a 68% biomass penalty in Margurita(b) and 80% in YS_72.1a when compared to serradella in traditional pasture.

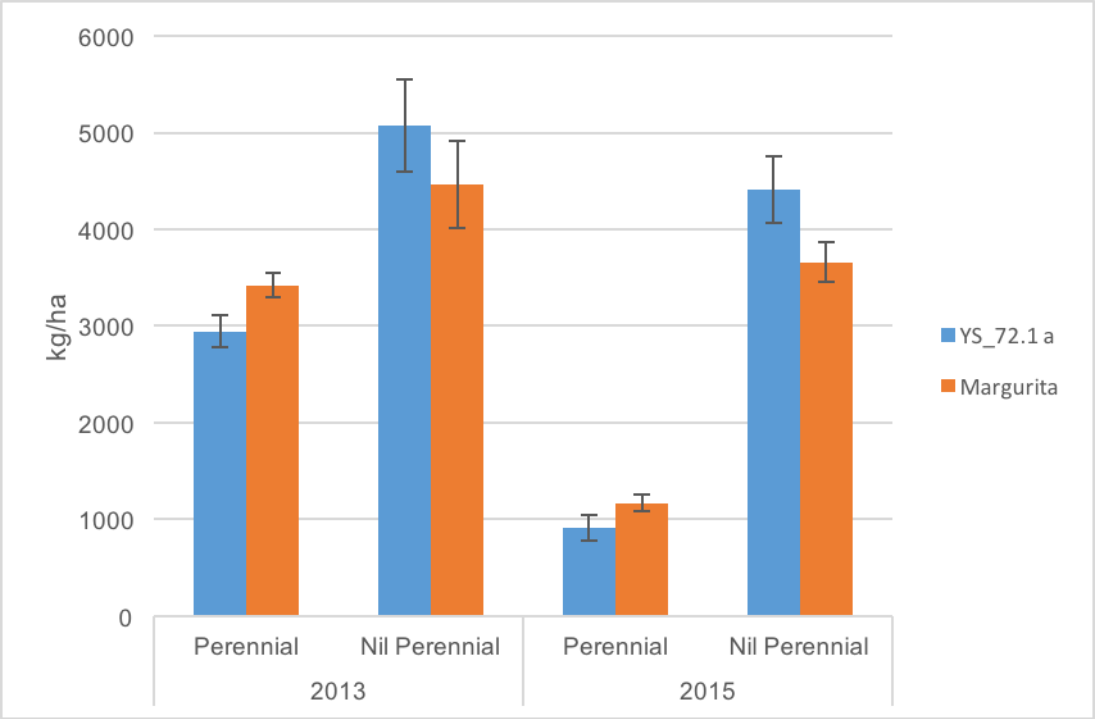

Figure 3 The impact of a perennial base and season on the biomass of Margurita℗ and YS_72.1a yellow serradella. (Bars = SE). As there was little difference between perennial row spacing and serradella biomass, the chart displays these as an amalgamated result. Perennial biomass data is not shown, for 2014 perennial performance at this site see (Ferris et al. 2014).

Panic growth slows in winter to effectively become dormant in the cold months and provides little competition. Select® was sprayed at 500mLs on July 2 2013 to control ryegrass. This further suppressed the perennials and had the effect of halting nearly all winter growth. Select® was not sprayed in 2015, so the added suppressive effect on perennials was not realised. The effect of perennial suppression by a grass selective can be seen in Image 4.

Image 3 and 4. August 2015 biomass (left) and August 2013 biomass. Serradella production in perennial pasture, left half of image 1 compared to production as a traditional pasture. The 2013 serradella production in perennials is much more advanced. The suppressive impact of the grass selective herbicide can be clearly seen in image 4.

Serradella Harvest

Figure 4 shows seed weight in kg/ha and includes seed that was grown and harvested in 2013 and 2015. In 2013, sowing serradella into a perennial grass reduced Margurita℗ seed yield by approximately 25% and YS_72.1a yield by 43%. However, perennial row spacing made little difference to seed yield (not shown).

Biomass has been a good predictor of seed yield, even with the harsh cut off of the 2015 season. The false break in 2015 initially depressed seedling numbers, but the serradella was able to rebound from seed stores and produce a large bank of seed. In 2015, Margurita(b) yield was reduced by 58% and YS_72.1a 67% when sown into perennials.

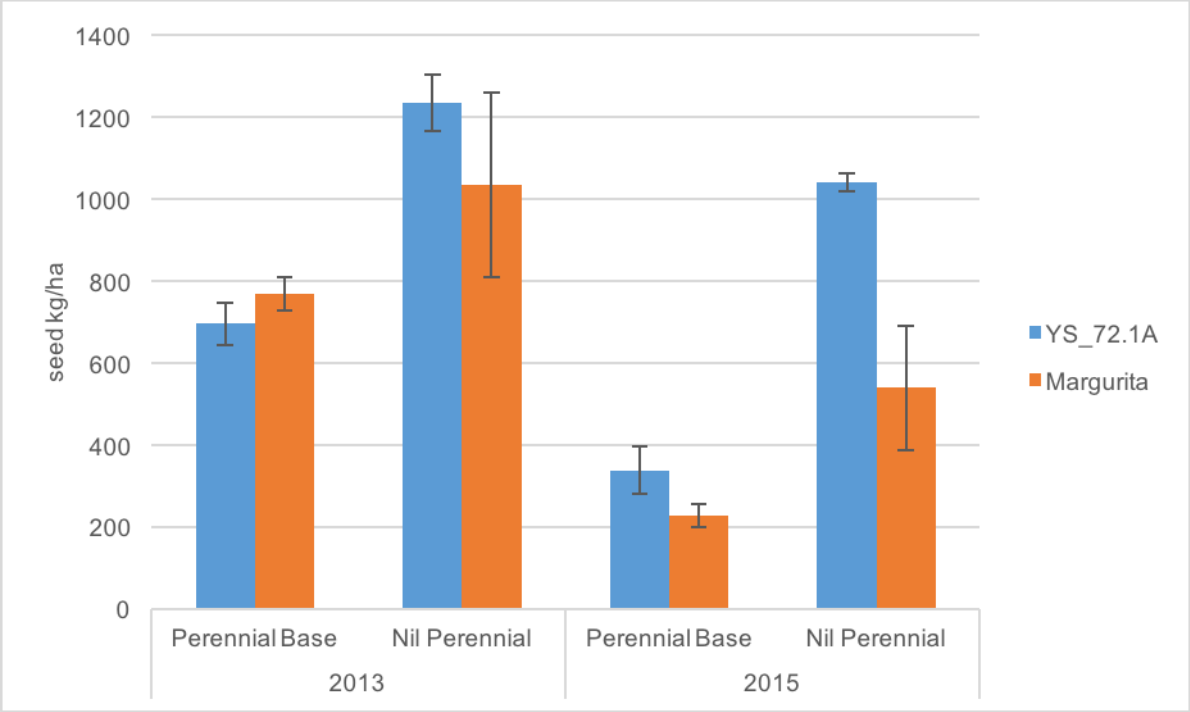

Figure 4. 2013 and 2015 serradella seed harvest. (Bars = SE). Serradella pod was harvested and Seed yields were estimated using the seed to pod ratio of 36% for YS_72.1a and 63% for Margurita(b).

Conclusion

Legumes are an important tool in a perennial sward to supply a nitrogen source and maintain production. Serradella can be successfully established and persist in an established perennial pasture; this includes persisting as part of a crop/pasture rotation in perennials.

In the more favourable year of 2013 serradella biomass and pod production was higher. There is a yield penalty for serradella when sown into perennials, the penalty though will vary depending on the seasonal conditions. Perennials are still actively growing in March and April before the cooler weather starts to suppress their growth and they become less competitive. An indecisive Autumn break can allow active perennials to deplete moisture reserves that would normally allow germinating serradella to survive. These results clearly demonstrate the advantage of a successful early germination and establishment, although an indecisive break and low rainfall year will exaggerate the yield penalty when serradella is sown into perennials. Additionally, the suppressive effect of a grass selective on perennial growth may reduce competition with annual pasture species and can be used as a tool to increase annual legume production.

Key words

Perennial, Sub-tropical grass, Subtropical grass, Serradella, Margurita(b), Pasture, Pasture Cropping.

References

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