# Refining summer sowing technology to improve serradella establishment when sown into subtropical grass pastures

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## Key messages

Summer sowing proved to be a robust technology for introducing Margurita French serradella and an experimental line of yellow serradella 87GEH72.1a (pending release) into established perennial grass pastures; furthermore, overall performance of the two species was similar.

A pod seeding rate of 20 kg/ha of Margurita serradella is needed to obtain >100 plants/$m^2$ under good germinating conditions when summer-sown into perennial pastures. Other trials suggest that yellow serradella seeding rates need to be higher (around 30kg/ha) to compensate for a lower seed to pod ratio.

Reducing biomass prior to the break of season improves establishment success of serradella summer sown into perennial pastures; however, there was little additional benefit from herbicide suppression of the perennial base in winter.

## Aims

To determine the optimum pod seeding rate for Margurita[A] French serradella when summer-sown into subtropical perennial pastures.

To determine if herbicide suppression and/or defoliation of perennial grass improves establishment, pasture composition and seed set of serradella when summer-sown into subtropical perennial pastures.

To compare the performance of a potential new yellow serradella variety 87GEH72.1a with Margurita[A] French serradella when summer-sown at different pod seeding rates.

## Method

In 2011, the subtropical perennial grass Gatton panic was established on a non-wetting deep sandy soil, 25km west of Mingenew using precision guidance technology (DGPS +/- 2cm accuracy) and auto-steer. Gatton panic rows were sown at 44cm spacing's and, after establishment, the site was pasture cropped with a lupin/wheat rotation from 2012 to 2013.

On 20 February 2014, serradella pod was summer-sown between Gatton panic rows using a cone seeder (tines 22cm apart) fitted with precision guidance technology. Two serradella species were evaluated: Margurita[A] French serradella and an experimental line of yellow serradella 87GEH72.1a with a seed softening pattern favourable for summer sowing.

A criss-cross design was used to evaluate the interaction between seeding rate and perennial grass suppression. The pod seeding rate treatments (main plots, 1.5 x 20m) were a nil control; 5, 10, 20, 30 and 40kg/ha for Margurita[A]; and 10 and 20kg/ha for 87GEH72.1a. Only two rates were trialled for 87GEH72.1 as pod was limited. Suppression treatments applied at right angles to main plots were: nil (unmown control); mown prior to seeding in February and immediately after biomass assessments (21 May, 25 June and 7 August) to simulate grazing (height 6cm); and mown plus a grass selective herbicide (Select® 500mL/ha), applied on 4 July. Overall there were eight main seeding rate treatments by three suppression treatments and three replicates (i.e. 72 plots).

Serradella and perennial grass density were assessed by counting the number of seedlings along 1 m long rows at two random positions per plot on 15 May. Biomass production was assessed in May and August by cutting herbage within two (0.5 x 0.88m) quadrats per plot; and seed yield assessed in November by vacuuming pod from two (0.2 x 1m) quadrats per plot. Seed yields were estimated using a seed to pod ratio of 36% for 87GEH72.1a and 63% for Margurita[A].

## Results

*Serradella Establishment*

The criss-cross design allowed the effects of mowing prior to seeding to be evaluated. Pod was either sown into Gatton panic plots that were mown to a height of 6cm or unmown perennial plots (Image 1 & 2). At the break of season (25 April), there was 400kg/ha (dry weight) of Gatton panic biomass in mown and 800kg/ha in unmown perennial plots.

**Image 1 (left) Preparing to seed into an unmown perennial grass stand in February.**
**Image 2 (right) Seeding into a mown plot of perennial grass.**

There was a clear linear relationship between pod seeding rate and serradella establishment density; this was more pronounced for the mown plots (Figure 1). Mowing promoted significantly greater serradella establishment in summer-sown plots at higher seeding rates, but there was no apparent benefit at lower seeding rates.

Overall, Margurita[A] produced more seedlings per kilogram of pod sown compared to yellow serradella 87GEH72.1a. Yellow serradella has a thicker pod (or more woody tissue); consequently there are fewer seeds per kilogram of pod sown which should be accounted for when selecting a pod seeding rate for yellow serradella.

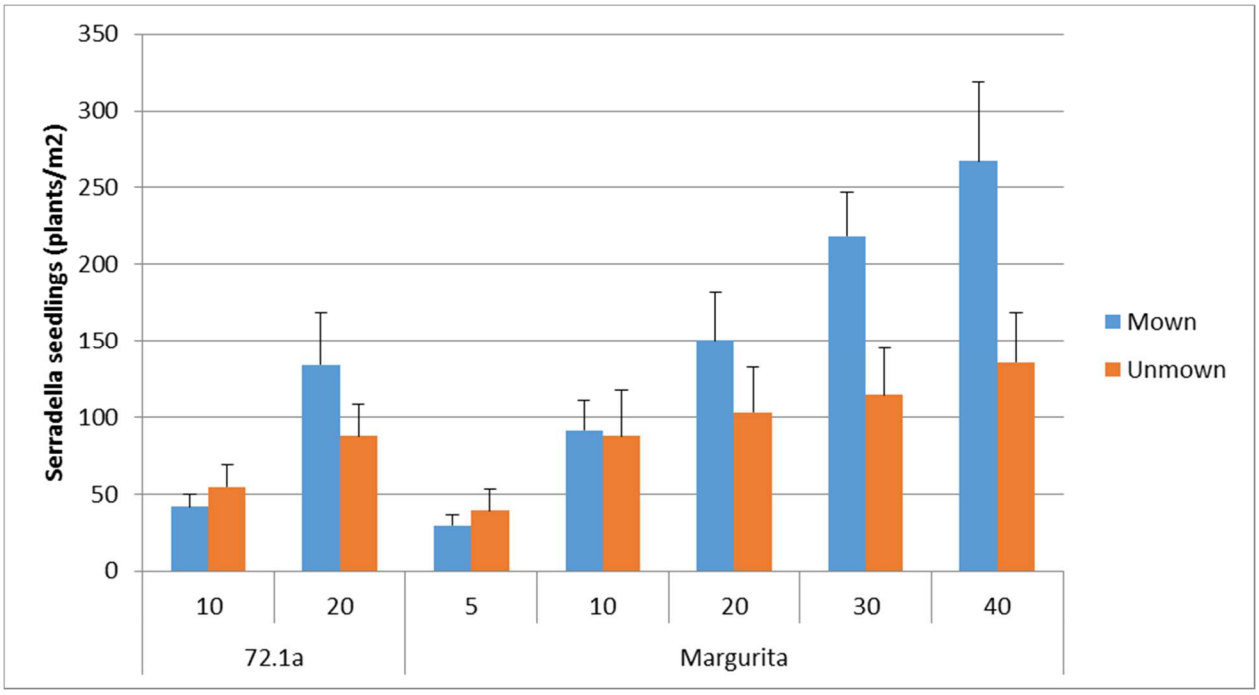


**Figure 1 Germination of French serradella (Margurita[A]) and yellow serradella (line 87GEH72.1a) when sown into mown (simulated grazing) and unmown perennial grass plots at different seeding rates (kg pod/ha).**

A target germination density of 100 plants/m$^2$ is considered acceptable when there is a low weed burden. Some of the treatments in this trial were similar to those evaluated at Dandaragan in 2013 (Valentine et al, 2014), although at Dandaragan, a seeding rate of 40kg/ha (Margurita$^A$ pod) was required to achieve a target density of >100 plants/m$^2$. By contrast, good opening rains at Mingenew in 2014 (19mm, 25 April; 33mm, 27 April; 54mm in May) produced higher than expected establishment densities.

*Pasture productivity - influence of seeding rate and defoliation*

Winter feed was doubled by summer-sowing serradella pod into Gatton panic pastures at rates greater than 10kg/ha; and mowing significantly increased legume content across all treatments (Figure 2). However, there was no significant difference between the total biomass across mown and unmown treatments. The most productive seeding rate treatment over winter was Margurita$^A$ summer-sown into perennial grasses at 30kg/ha: mown plots produced 2.9t/ha (65% serradella), and unmown plots 3.1t/ha (51% serradella). Interestingly, the higher serradella establishment densities achieved in the 40kg/ha seeding rate treatments did not lead to greater winter feed (and legume content). Thus, there did not appear to be any significant benefit from lifting summer-sowing rates above 30kg/ha.

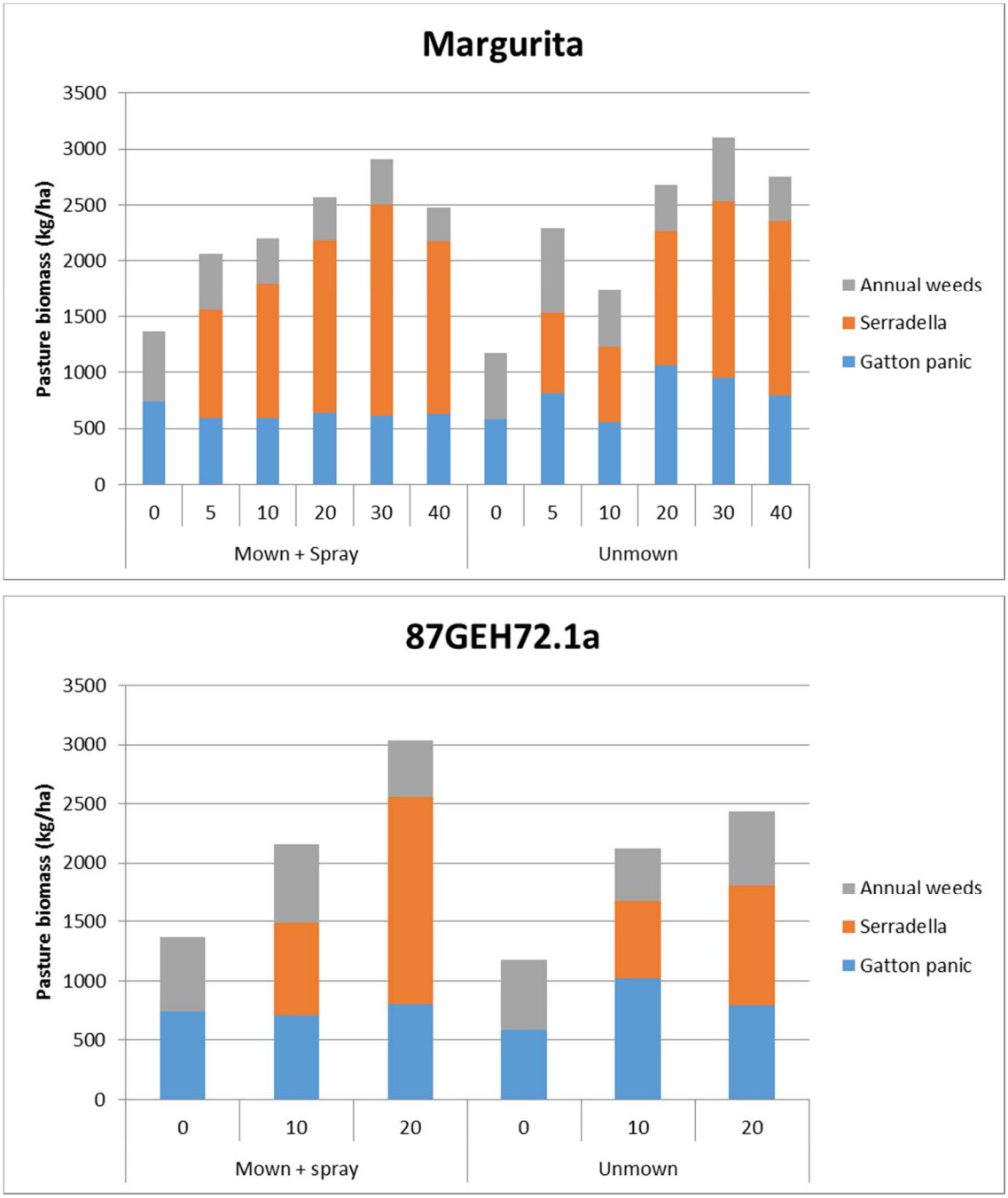


**Figure 2 Cumulative biomass production and pasture composition on 27 August for unmown and mown + herbicide spray treatments across different seeding rates (kg pod/ha): Margurita$^A$ (top) and 87GEH72.1a (below). Standard error (total biomass) = 300kg/ha.**

There was a clear increase in 87GEH72.1a biomass when increasing pod rate from 10 to 20kg/ha. When the perennial grass was mown, serradella biomass more than doubled with the higher seeding rate.

*Seed Yield - Influence of seeding rate, defoliation and herbicide suppression*

There was a soft finish to the season at the trial site with 84mm of rain falling in September. Unfortunately, peak biomass was not measured at the end of September; rather, seed yields were used as the ultimate measure of establishment success. The soft finish in spring along with consistent autumn and winter rain resulted in all serradella treatments producing >300kg/ha of seed (Figure 3).

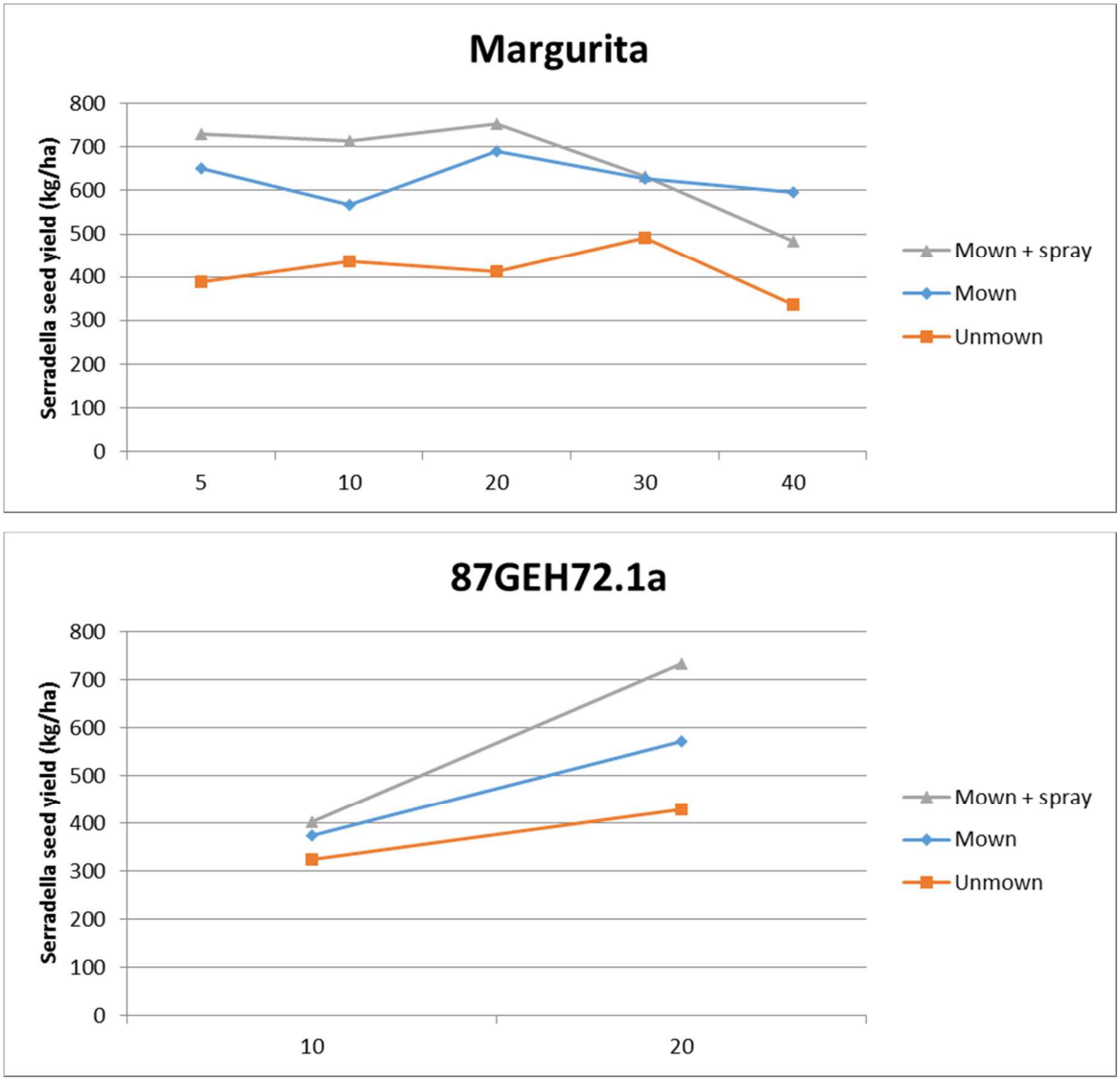


**Figure 3 The effect of perennial grass suppression (using herbicide spray and/or mowing) on serradella seed yield across different summer-sowing rates (kg pods/ha) for Margurita[A] (above) and 87GEH72.1a (below). Seed yields were calculated from pod harvest weights and adjusted using a seed to pod ratio of 63% for Margurita[A] and 36% for 87GEH72.1a. Standard error = 90kg/ha**

Serradella seed yield was more responsive to mowing than seeding rates. Overall, mowing perennials increased serradella seed-set by 45%. Surprisingly, low seeding rate treatments for Margurita[A] (5 and 10kg/ha pod) set similar amounts of seed as higher seeding rate treatments. The wet spring and low competition from annual weeds must have enabled individual plants to grow larger in size with more pods to compensate for lower legume density. These results concur with a similar trial at Dandaragan in 2013 where lifting Margurita[A] sowing rate from 20 to 40kg pod/ha did not result in greater seed yield (Valentine et al, 2014).

Mowing removed approximately 500kg/ha of serradella and 300kg/ha of Gatton panic biomass through winter. The loss in serradella biomass from mowing appears to have been offset by reduced competition from the perennial base with Margurita[A] seed yields increasing by 130 to 340kg/ha in the mown plots.

## Conclusion

On-farm demonstrations and agronomic research in the Northern Agricultural region over the past four years have built up the knowledge base on logistical issues and strategies to successfully introduce companion annual legumes into subtropical perennial grass pastures using summer-sowing technology. Companion legumes, such as Margurita[A] French serradella, lift overall productivity and feed quality of subtropical pastures by producing extra feed in winter and supplying fixed nitrogen to perennial grasses.

This seeding-rate by grass-suppression trial has helped to refine rules of thumb for summer-sowing serradella into perennial grasses:

Seeding rate: At least 20kg/ha of Margurita[A] pod is recommended. The maximum seeding rate trialled for 87GEH72.1a was 20kg/ha although previous trial work (Valentine et al, 2014) indicates a higher seeding rate of 30kg/ha may be optimal to account for a lower seed to pod ratio. Notwithstanding, successful establishment is possible with lower rates when there is a decisive break of season, hard grazing of the perennial base prior to germination, and a low annual weed burden; collectively these factors appear to have a greater influence on establishment success than robust seeding rates (>20kg/ha pod).

Grass suppression: Strategic grazing (defoliation) of perennial pastures (i.e. before seeding, before seedling emergence and early winter before serradella flowers) reduces competition from perennials and increases serradella seed set. Herbicide suppression (e.g. Select®) can provide additional benefits if seedling densities are low (<100 plants/$m^2$) but only where the annual weed burden is also low.

Species: Margurita[A] French serradella is currently the most suitable companion annual legume for subtropical perennial grasses in the Northern Agricultural Region. Yellow serradella experimental line 87GEH72.1a (when released) is likely to be a hardier alternative particularly for pasture cropping systems as it: flowers earlier, allowing non-selective weed control in spring; sets up more persistent hard seed reserves; and produces pods less prone to budworm damage.

Sowing time: Sowing dormant pod segments in summer is generally as effective, or better, than sowing scarified seed after the break of season. Pod segment should be sown in February or early March to allow sufficient time for seed dormancy to break down naturally in response to diurnal temperature fluctuations.

Sowing method: Shallow burial of pod segments is essential, especially for yellow serradella. Disc machines cut through mixed subtropical grass pastures best but sowing with tines is possible using precision guidance technology where perennials have also been established with guidance technology. Broadcasting pods and trampling by stock is not efficient or reliable.

Perennial row spacing: Establish new perennial pastures with a wide row spacing (0.8-1.0m apart). This makes it easier to summer sow serradella into perennials, and improves establishment density and seed set of companion legumes.


## Key words

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


## References


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.



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