

Better medics update

Jake Howie, Ross Ballard and David Peck

SARDI, Waite

RESEARCH

Searching for answers

Location: Arthurton
Neville and Ashleigh Rowe

Rainfall

Av. Annual: 475 mm
Av. GSR: 363 mm
2011 Total: 453 mm
2011 GSR: 262 mm

Yield

Actual: 5 t/ha (estimated by rising plate meter)

Paddock History

2010: Cereals (various)
2009: Canola
2008: Lathyrus

Soil Type

Clay loam, pH 8.2

Soil Test

Colwell P, 68 ppm; organic carbon, 3.4%

Diseases

P. neglectus (RLN)

Plot Size

2 x 1.2 m x 4 reps

Yield Limiting Factors

RLN, unidentified root rot

Location: Netherton
Lester & Kay Cattle

Rainfall

Av. Annual: 396 mm
Av. GSR: 290 mm
2011 Total: 380 mm
2011 GSR: 194 mm

Yield

Actual: 4 t/ha (rising plate meter est. 7/10/10)

Paddock History

2010: Pastures
2009: Wheat

Soil Type

Loamy sand, pH 6.3

Soil Test

Colwell P, 26 ppm; 241 ppm;
sulphur, 3.3 ppm; organic carbon, 0.67%

Plot Size

4 x 1.2 m x 3 reps

Yield Limiting Factors

Powdery mildew, low pH/poor nodulation, low sulphur (& trace elements?)

Key messages

- We have identified a small group of material with excellent agronomic performance exceeding our benchmark strand medic cultivars, Herald and Angel, by up to and over 30% for dry matter production and seed yield.
- The lines are bred from a cross between Angel strand medic and a line originally selected for powdery mildew resistance. They also have SU herbicide tolerance, aphid resistance and larger seed size.
- If the level of agronomic improvement can be confirmed at regenerating sites, there are good prospects for a future commercial release.
- Unexpected responses to Rhizobium inoculation confirm some grower observations of poor medic nodulation in the Mallee, but the reasons for this remain unclear.
- Root lesion nematode number was substantially reduced following a season of medic growth.

Why do the trial?

The broad aim of this SAGIT funded project is to assess the potential of a range of multi-trait breeders' lines for commercial development.

In 2010 we evaluated in the field for the first time, the agronomic performance of 27 strand medic hybrids possessing various combinations of new traits (EPFS Summary 2010, pg 61-62). In 2011 we sowed three more field evaluation sites with a shortlist of the best lines identified from 2010 including seven "PM" lines with

powdery mildew resistance, SU tolerance, aphid resistance and large seeds.

In separate trials we are also trying to determine the benefit that *Pratylenchus neglectus* root lesion nematode (RLN) tolerance has on medic production and to measure the change in nematode populations after growing these medic lines.

How was it done?

Trial sites were selected on Yorke Peninsula (Arthurton) and the Murray Mallee (Karoonda, Lameroo and Netherton).

The Arthurton site was specifically selected for its variable levels of RLN (2 – 68/g soil) and used to compare the root health and growth of *Pratylenchus neglectus* tolerant and intolerant medic lines and assess nematode multiplication. At the Mallee sites, the short-listed strand medic entries plus a range of cultivar controls were assessed for dry matter production, seed yield and powdery mildew resistance (where it occurred) at Netherton and Karoonda. In response to farmer feedback at field days and measures of poor nodulation in 2010 field trials, we also included some additional rhizobial treatments (including 10 fold rate of inoculation).

What happened?

2011 sown trials – agronomic evaluation

Two trials were successfully established in the Murray Mallee at Netherton and Lameroo enabling further evaluation of dry matter production, disease tolerance and seed yield. The site at Karoonda had variable plant establishment as a result of non-wetting sands failing to wet up sufficiently with the opening rains.

Location: Lameroo
Trevor & Cath Pocock

Rainfall

Av. Annual: 330 mm
Av. GSR: 235 mm
2011 Total: 558 mm
2011 GSR: 197 mm

Paddock History

2010: Pasture
2009: Cereal rye

Soil Type

Loamy sand, pH 6.3

Soil Test

Colwell P, 20 ppm; potassium, 125 ppm; sulphur, 2.9 ppm; organic carbon, 0.89%

Plot Size

4 x 1.2 m x 3 reps

Yield Limiting Factors

Difficult establishment due to clay spreading and rough terrain, low pH/poor nodulation, low soil P, K, S (& trace elements)

(average 1100 kg/ha) for the PM hybrids and 30% greater than for Herald and Angel (Figure 1).

2011 regeneration of 2010 Karoonda site

Despite severe predation of pods and seeds by mice over summer, rains in March resulted in a very early germination which survived in sufficient numbers to the onset of winter rains for the best plots to produce > 3 t/ha by the end of July. By the time of the MSF field day (31 August) the best plots had produced an estimated 4 t/ha of dry matter and although there were no differences between entries at this stage, the PM hybrids all demonstrated adequate regeneration and good dry matter production.

Powdery mildew resistance – field observations

Netherton - a natural powdery mildew infection occurred which affected > 80% of leaves of most lines except the PM lines which displayed negligible powdery mildew symptoms. Premature leaf senescence resulting in severe defoliation is a typical expression of severe mildew infection and we observed significantly less leaf drop on the PM lines (12-24%) than Herald and Angel (54-70%).

Karoonda - a natural powdery mildew infection occurred on the

2010/11 regeneration in early spring and the shortlisted PM lines showed much lower levels of infection (12-34% leaf infection) than Herald and Angel (52-66%). Naturalised Harbinger medic at the site showed severe infection and defoliation and this may have implications for pasture rotations still reliant on old cultivars.

This is the first opportunity we have had to observe the impact of powdery mildew on the PM lines in the field and we are very encouraged in that so far they support our results from greenhouse studies and field observations at the Waite Campus. However it is important to note that research is needed to identify the severity and prevalence of different races of powdery mildew (if more than one) in SA. At this stage we don't know how strain specific our PM resistance is.

Nodulation

Assessments of nodulation were made at Netherton, Lameroo and Karoonda where several additional rhizobia inoculation treatments were applied. Large responses to inoculation in terms of nodule number (2-fold increase) and early shoot growth (+67%) were measured and improvements in legume vigour was generally observed at the sites.

Once again we were very encouraged with the agronomic performance of the PM lines with respect to growing season dry matter (DM) production and seed yield (Netherton data only - Lameroo still being processed). As a group the early DM production at Netherton was 20–40% greater than the benchmark commercial cultivars, Herald and Angel (Figure 1). A feature of the hybrids was increased early season vigour, probably a benefit of the larger seed size of the original PM resistant donor parent. Seed yields, which provide a critical measure of potential pasture persistence, were also excellent

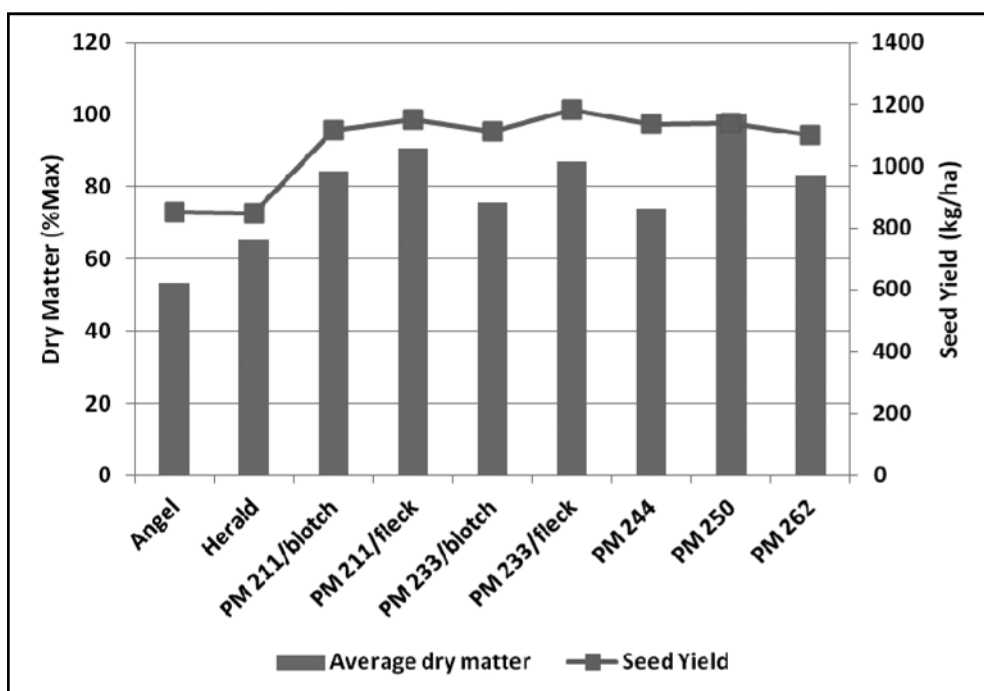


Figure 1 Relative dry matter production (3 scores from winter to spring - average % site maximum) and seed yield (kg/ha) of advanced "PM" lines compared with Herald and Angel strand medic at Netherton, SA, 2011. LSD ($P=0.05$) for seed yield = 164 kg/ha.

The work has confirmed that frequent grower reports of poor nodulation in the Mallee should be taken seriously and more effort is needed to understand why this is occurring. Contrary to general practice, the findings show that medic should be inoculated to ensure good establishment and early vigour when sown on Mallee soils, even where there has been a recent history of medic in the paddock. Further work is planned for 2012.

Multiplication of Root Lesion Nematode (*Pratylenchus neglectus*)

Effects of medic growth on nematode number were made where nematode level at sowing was low (2), medium (16) or high (42). The different nematode levels had been manipulated the previous year using different cereals as part of a GRDC project on *P. neglectus* supervised by Dr Alan McKay (SARDI). Changes in nematode number after the medic pasture were insignificant where nematode number was initially low. However, where numbers were moderate or high at sowing, they were reduced by 45% and 70% respectively after the medic pasture (Figure 2). Both medics

(Herald and RH1) resulted in a similar level of reduction. Medics being developed using RH1 as the nematode tolerant donor parent (based on reduced root damage in the presence of nematodes) should also continue to reduce nematode levels in the farming system.

Root rot at the site prevented differences in root damage and growth between *Pratylenchus* tolerant and intolerant medic lines being measured.

A similar trial will be established in 2012 at another site where nematode levels have been manipulated.

What does this mean?

The second year of field evaluation has so far confirmed our initial findings.

- We have identified a small group of material which exceed our benchmark strand medic cultivars, Herald and Angel, by up to 30% for dry matter and seed yield.
- The hybrid lines have powdery mildew resistance, SU herbicide tolerance, aphid resistance and larger seeds.

- Further selections have been made and there are good prospects for a future commercial release as a result of this project.
- Unexpected responses to inoculation confirm some grower observations of poor medic nodulation in the Mallee, but the reasons for this remain unclear.
- Root lesion number was substantially reduced after medic growth.

Subject to the final analyses of the 2011 data, we intend to sow a further shortlisted selection of the best lines at additional sites in 2012, as well as monitoring regenerating sites from 2010 and 2011 for hardseed breakdown data and additional agronomic performance data.

Acknowledgements

We gratefully acknowledge the funding by South Australian Grains Industry Trust; technical assistance from Jeff Hill, SARDI; and collaborators: Neville Rowe, Arthurton; Peter & Hannah Loller, Karoonda; Lester & Kaye Cattle, Netherton and Trevor Pocock, Lameroo.

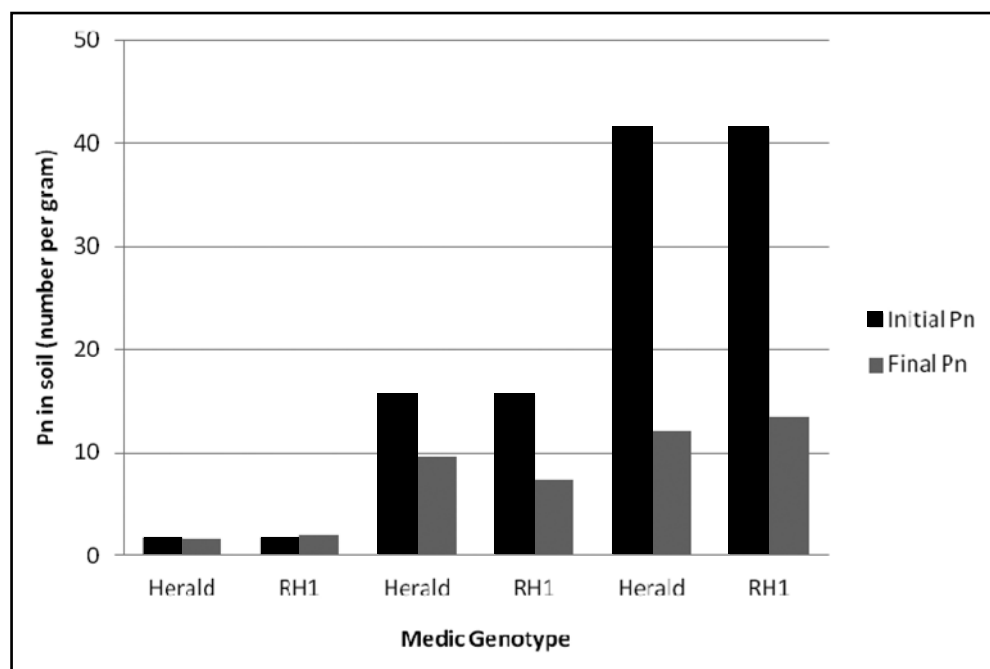


Figure 2 Root lesion nematode (*P. neglectus*) number measured before sowing (initial Pn) and after a season of medic growth (final Pn) by medic lines Herald and RH1