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SARDI, Minnipa Agricultural Centre

# Pastures

## Powdery mildew resistant medics for the EP and Mallee

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**Searching for answers****Location:**Minnipa Ag Centre  
**Rainfall**

Av. Annual: 325 mm

Av GSR: 242 mm

2012 Total: 253 mm

2012 GSR: 185 mm

**Yield**

Potential: 5.5 tDM/ha

Actual: Est. 3-4.5 tDM/ha

**Paddock History**

2011: Canola

2010: Sown medic

**Soil Type**

Red sandy loam

**Soil Test**

pH CaCl 7.5, organic carbon 0.7%

**Plot Size**

5 m x 1.5 m x 3 reps

**Yield Limiting Factors**

Dry finish

**Location:**

Karoonda

Peter &amp; Hannah Loller

**Rainfall**

Av. Annual: 312 mm

Av GSR: 215 mm

2012 Total: 317 mm

2012 GSR: 231 mm

**Paddock History**

2011: Sown medic

2010: Cereal

2009: Sloop barely

**Soil Type**

Non-wetting sand, pH 8.1

**Key messages**

- **We have short-listed a small group of strand medics with resistance to powdery mildew which exceed our benchmark strand medic cultivars, Herald and Angel, by up to 30% for dry matter production and seed yield.**
- **If the agronomic performance of non-segregating lines can be confirmed at new and regenerating sites, there are excellent prospects for a future cultivar release.**
- **The lines also have tolerance to SU herbicide residues, aphid resistance and a larger seed size.**
- **Regeneration and hardseed breakdown studies indicate they behave similarly to Angel.**
- **Unexpected responses to Rhizobium inoculation confirm some grower observations of poor medic nodulation in the Mallee, but the reasons for this remain unclear.**

**Why do the trial?**

The main aim of this SAGIT funded project was to assess the potential of a group of early generation "multi-trait" breeders' lines for future commercial development. More specifically the project has:

- Evaluated the agronomic performance of 27 early generation strand medic lines (and subsequent re-selections) possessing various combinations of important new traits;
- Made in-situ field re-selections from segregating medic lines under evaluation at the field sites and multiplied seed of these for further testing.

**How was it done?**

As part of this project, field selections and glasshouse screening for traits that are still segregating, have been regularly undertaken. Based on the excellent performance at multiple sites in 2010 and 2011 (EPFS Summary 2010, pp 61-62; EPFS Summary 2011, pp 68-70), a set of 17 non-segregating (stable) strand medic hybrids with various combinations of powdery mildew (PM) resistance, SU herbicide tolerance, aphid resistance and large seeds, was shortlisted for sowing in 2012. This included daughter lines for field testing to ensure they perform as well agronomically as the segregating PM parent lines from which they were selected. Also included were five benchmark cultivars and parents and, in response to farmer feedback at field days and measures of poor nodulation in 2010 and 2011 field trials, we also included some additional rhizobial treatments.

#### Soil Test

Colwell P, 28 ppm; potassium, 110 ppm; sulphur, 2.4 ppm

#### Plot Size

4m x 1.2 x 3 reps

#### Yield Limiting Factors

Poor establishment in 2011 due to non-wetting, soil, dry finish, frost, low soil K, S

#### Location:

Netherton  
Lester & Kay Cattle

#### Rainfall

Av. Annual: 396 mm  
Av GSR: 290 mm  
2012 Total: 372 mm  
2012 GSR: 232 mm

#### Yield

Actual: 3 t/ha (rising plate meter est. 16/10/10)

#### Paddock History

2011: Oaten hay  
2010: Schooner barley  
2009: Oaten hay

#### Soil Type

Loamy sand, pH 6.7

#### Soil Test

Olsen P, 14 ppm; NO<sub>3</sub>-N, 12.3 ppm; sulphur, 4 ppm; organic matter, 1.4%; copper, 0.3 ppm; zinc, 0.3 ppm; manganese, 1.3 ppm

#### Plot Size

4 m x 1.2 m x 3 reps

#### Yield Limiting Factors

Lodging, dry finish, frost, low phosphorus, sulphur, trace elements (Cu, Zn)

#### Location:

Lameroo  
Trevor & Cath Pocock

#### Rainfall

Av. Annual: 330 mm  
Av GSR: 235 mm  
2012 Total: 275 mm  
2012 GSR: 197 mm

#### Paddock History

2011: Pasture  
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 m x 1.2 m x 3 reps

#### Yield Limiting Factors

Difficult establishment due to clay spreading and rough terrain, dry finish, frost, low soil P, K, S

In addition to regenerating sites at Karoonda and Minnipa two experiments were established in the Murray Mallee at Lameroo and Netherton, enabling further evaluation of dry matter production, disease tolerance and seed yield.

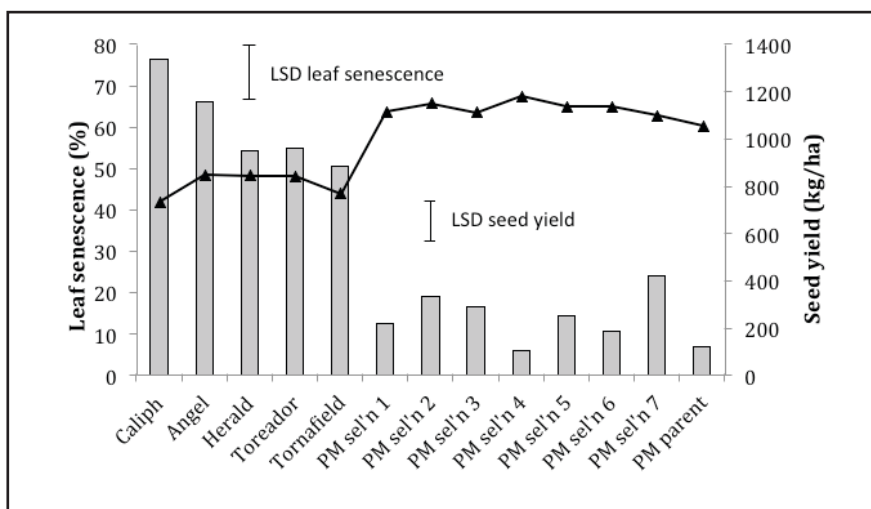
## What happened?

### 2012 sown trials – agronomic evaluation (Lameroo and Netherton)

Once again we were very encouraged with the agronomic performance of the PM lines with respect to dry matter (DM) production, seed yields are currently being processed and analysed. At Lameroo the top five PM lines (range: 84–95% of maximum site yield (MSY); average 89% MSY) significantly out-yielded the benchmark strand medic cultivars, Herald, Angel and Jaguar (range: 55–71% MSY; avg.

66%). At Netherton the top five PM lines (88–95% MSY; avg. 91%) similarly out-yielded the strand medic cultivars (70–81% MSY; avg. 76%).

A feature of the new lines was increased early season vigour, possibly a benefit of the larger seed size inherited from the original PM resistant parent. Seed yields, which provide a critical measure of potential pasture persistence and future productivity, have been harvested and are currently being processed. The harsh spring finish should provide a good test of their ability to produce seed and persist under adverse conditions. In previous years they have been excellent; for example at Netherton 2011 the PM resistant lines averaged 1100 kg/ha, 30% greater than Herald and Angel (Figure 1).



**Figure 1 Leaf senescence (%) associated with the development of powdery mildew symptoms (bar), and kg/ha seed yield (line) of annual medic cultivars and PM-strand medic selections at Netherton, SA, 2011 (LSD P=0.05)**

### 2012 regeneration of 2011 Karoonda site (powdery mildew resistance – field observations)

Despite the poor establishment at this site last year due to areas of non-wetting soil, there was enough seed-set to enable an adequate regeneration after early season rains in March. Although experimentally quite variable, this site as a whole responded very well to winter rains with the best plots

producing an estimated 4 tDM/ha. At the time of the Karoonda MSF Field Day (GRDC GroundCover #102, p 14) the PM lines were still fresh and showing no signs of powdery mildew infection whereas Herald and Angel, although also growing well, were developing a heavy PM infection in the understory.

This is the second year we have been able to observe the impact of powdery mildew on the PM lines in the field (Netherton, 2011, Figure 1.) 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 more fundamental research regarding the identification, pathogenicity and prevalence of different races of powdery mildew (if more than one) in SA is needed so that appropriate breeding strategies can be developed to ensure that the excellent levels of resistance in the current set of PM lines will be maintained.

### 2012 regeneration of 2010 Minnipa Agricultural Centre site

After growing very well in 2010, this site was sown to canola in 2011 and regenerated successfully in 2012, enabling two dry matter assessments to be made in August and September. As this was our first site regenerating after crop, it was pleasing to note the good performance (relative to the strand medic cultivars) of the parental PM lines which had subsequently been progressed (via their selected non-segregating progeny) into later trials.

### Hardseed breakdown studies

Pods of short-listed PM lines and both parents (Angel and PM parent) were harvested from the Netherton 2011 site and taken back to the Waite Campus for hardseed breakdown studies conducted over 12 weeks from February to May 2012. At the end of the study Angel's hardseed content had declined from 99 to 88% and PM parent from 97 to 91%. The PM hybrid lines declined in hardseededness from 96-100% to 87-91% (i.e. very similar to both parents). This coupled with the Minnipa 2012 regeneration data, provides us with confidence that this material possesses an appropriate level of hardseededness for persistence in a ley farming system.

### Nodulation responses in the field

Assessments of nodulation were made at Netherton, Lameroo and Karoonda where several additional rhizobia inoculation treatments were incorporated into the trial and demonstration plot designs in response to previous measures of inoculation response.

Large responses to inoculation in terms of nodule number were measured at Lameroo and Karoonda and improvements in legume vigour observed at the sites. The work again confirms that frequent grower reports of poor nodulation in the Mallee should be taken seriously and some work will continue to determine 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. Particular attention will be paid to ensuring PM medic lines are well inoculated in future trials to ensure their potential benefits are not limited by symbiotic constraints.

### What does this mean?

The third 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 (cf Herald and Angel).
- Further selections have been made and there are excellent prospects for a future commercial release.
- Unexpected responses to inoculation confirm some grower observations of poor medic nodulation in the Mallee, but the reasons for this remain unclear.

Pending final harvest results from 2012 we will analyse all available data and further shortlist the PM daughter lines for final cultivar selection work in 2013-15, pending availability of future funding. These will be further seed increased at the Waite in 2013 to enable future cultivar developmental work.

### Reference

RA Ballard, DM Peck, DL Lloyd, JH Howie, SJ Hughes, RE Hutton and BA Morgan (2012). Susceptibility of annual medics (*Medicago* spp.) to powdery mildew (*Erysiphe trifolii*). Proceedings of 16th Agronomy Conference 2012. University of New England, Armidale, NSW 14-18th October 2012. <http://www.regional.org.au/au/asa/2012/pests>

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