Karoonda Trial Site Walk

OUR VISION

*Dynamic, profitable and sustainable farming*

OUR MISSION

*Provide excellence in research, development and extension initiatives for the dryland Mallee of South Eastern Australia*

Project funded by

GRDC

Grains Research & Development Corporation
Mallee Sustainable Farming (MSF) Inc. would like to acknowledge W D Lewis and AWB as sponsors of the Karoonda Trial Site walk. MSF also acknowledges its Corporate Sponsors and thanks them for their on-going support.
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Site map
## Program

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<th>Speakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.30</td>
<td>Welcome – Peter Loller MSF SA State Reference Committee Chair</td>
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<tr>
<td>1.35</td>
<td><strong>KENTON PORKER, SARDI</strong> - Barley seed placement, herbicide solutions, varieties</td>
</tr>
<tr>
<td>1.50</td>
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<td>2.05</td>
<td><strong>CSIRO – GRDC Water Use Efficiency Project (WUE)</strong></td>
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<td></td>
<td>• <strong>RICK LLEWELLYN</strong> - EM mapping &amp; zoning for soil-specific management</td>
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<td></td>
<td>• <strong>ANTHONY WHITBREAD</strong> - Strategies and tactics for soil types, Yield Prophet &amp; Sulfur responsiveness</td>
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<td></td>
<td>• <strong>NEIL WITTWER, University of Adelaide</strong> – Variable rate fertiliser trial</td>
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<td>• <strong>BILL DAVOREN</strong> – Break options</td>
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<td>• <strong>MICHAEL MOODIE, MSF</strong> – Other on-farm WUE project activities</td>
</tr>
<tr>
<td>3.20</td>
<td><strong>THERESE MCBEATH, University of Adelaide</strong> – Phosphorus efficiency &amp; uptake</td>
</tr>
<tr>
<td>3.35</td>
<td><strong>RICHARD SAUNDERS &amp; BOB PEAKE, RSSA</strong> – Time of sowing by crop variety</td>
</tr>
<tr>
<td>3.50</td>
<td><strong>JAKE HOWIE, SARDI</strong> – Evaluating new medic strands for the Mallee</td>
</tr>
<tr>
<td>4.10</td>
<td><strong>LEIGHTON PEARCE &amp; JERMEY NELSON, SA MDB NRM</strong> – Mallee weather station network &amp; soil water monitoring online</td>
</tr>
<tr>
<td>4.20</td>
<td>Wrap-up – Peter Loller</td>
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</table>
Regional WUE focus paddocks

Michael Moodie

Mallee Sustainable Farming, Mildura

Six Water Use Efficiency (WUE) focus paddocks have been established to complement WUE research at core sites.

Yield Prophet is being used to track crop growth and yield outcomes for each throughout the year.

The use of technology such as Yield Prophet and Precision Ag can assist with making decisions such as whether to apply crop inputs.

About the Paddocks

The Mallee WUE project is undertaking research at core sites at Karoonda and Ouyen. To complement this research MSF has established six focus paddocks across the Mallee region. In each paddock, the farmer has applied trial strips and the WUE of each treatment will be monitored throughout the year across 2 - 3 soil types in each paddock.

The focus paddock locations and the treatments implemented at each location are shown below:

- Loxton: Fertiliser Strips (MAP) at 20, 40 and 80 kg/ha
- Paringa (Belah Soil Type): Fertiliser Strips (DAP) 0 and 45 kg/ha and DAP 45kg/ha + Urea @ 90 kg/ha In crop
- Lameroo: Variable rate UAN applications
- Ouyen: Nitrogen ‘Rich Strips’ at 48 & 24 kg N/ha
- Natya: Urea applied at sowing at 0, 15 & 45 kg/ha
- Millewa: Fertiliser Strips (16 N:19 P) at 0, 30 and 60 kg/ha

Monitoring paddocks using Yield Prophet

Yield Prophet is being used to monitor the focus paddocks throughout the season. The
program works by simulating crop growth based on soil type; starting soil conditions; agronomy; crop inputs and climatic conditions for the current growing season, then predicting crop yield and other performance outcomes based on historical climate data for the remainder of the growing period. At any point throughout the season, Yield Prophet can be used to determine a range of yield outcomes possible for that paddock and soil type. The range of yield outcomes for all paddocks at the 6th September is provided in a table at the back of the booklet. Up to date Yield Prophet reports can be accessed through www.msfp.org.au

**Note:** Yield Prophet does not account for yield limiting factors such as weeds, disease or nutrients such as phosphorus, sulphur and trace elements. Therefore yields generated by Yield Prophet are limited by either nitrogen or water availability. To reach the predicted yields, you would need to be implement practices that deliver high crop water use efficiency.

**Management decisions using Yield Prophet**

Yield Prophet can be used to assist with making in crop input decisions. For example, at the Lameroo focus paddock (see map and yield prophet reports over the page), the Yield Prophet yield predictions for the dune soil type shows there is a 50% chance of reaching 1.5 t/ha (solid line). However, if nitrogen was not limiting factor (dotted line), there is a 50% chance that the crop on the dune soil would yield 2.6 t/ha. Furthermore there is a 100% chance that applying nitrogen would result in increased yield on this soil type.

Conversely, is little difference between the nitrogen limited yield (solid line) and the nitrogen unlimited yield (dotted line) on the swale soil.
Therefore, you would expect that applying nitrogen to this soil type would not be of production or economic benefit.

The biomass production of this paddock was mapped using GreenSeeker. You can see that the biomass on the dune is lower than on the swale. You can also see that there are many other parts of the paddock that are also shaded orange to red that may also benefit from the application of nitrogen. However, the bulk of the paddock is shaded green to blue, which the corresponding Yield Prophet report indicates does not need additional nitrogen. Applying nitrogen to only the orange and red areas in the paddock would probably be the best bet management option.

From this example, Precision Ag technology (e.g. EM, Yield Maps, NDVI or GreenSeeker Maps) can assist you to make better management decisions. Furthermore, this technology allows you to better understand the risk or making or not making a management decision such as applying nitrogen to the crop.

Further information

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Karoonda Trial Site Walk

2010

[Diagram of grain yield outcome with probability (%) and yield (t/ha) graphs]

Dune

Swale

[Map showing different colored areas with labeled hectares]

- 0.87 - 0.82
- 0.64 - 0.66
- 0.51 - 0.60
- 0.48 - 0.55
- 0.40 - 0.48
- 0.21 - 0.40
- 2.00 ha
- 7.39 ha
- 10.17 ha
- 10.92 ha
- 7.27 ha
- 3.72 ha
Soil moisture monitoring

Jeremy Nelson

SA MDB NRM, Berri

Soil moisture monitoring tools are being used increasingly in broad-acre agriculture and the SA MDB NRM Board has sponsored a series of probes at the MSF WUE research site at Karoonda.

Growers can access this information in addition to sites in the mid and southern mallee at the website:

Username: samdb
Password: mdbuser

The probes will be used to assess the soil moisture infiltration characteristics between a ‘stubble retained’ and ‘stubble removed’ farming system.

1) The probes are permanently installed below seeding depth at around 250mm below ground level, with a further removable probe sensor ‘plugged’ into the top soil layer.

2) Sensors at 10cm intervals provide a trace for soil moisture at each depth. The infiltration of rainfall events can be tracked through the profile displaying as independent rainfall episodes at the bottom of the screen.

Deeper probes have been used at the Waikerie site.

3) Plant roots extract soil moisture during the day but rest at night resulting in diurnal stepping on the graph.

4) The growth of roots down the soil profile can be monitored during the growing season. The
graphs provide a good indication of the recharge capacity of in season rainfall events and the reserves of deep moisture. At this time of year this is particularly relevant for managing post-emergent nitrogen applications.

5) At other SA sites, the variance of soil moisture infiltration has been observed between ‘stubble retained’ and ‘stubble removed’ treatments.

6) The application of soil moisture monitoring probes is better realised in each successive season as yields and opening and closing season soil moistures can be compared in conjunction with logged rainfall records.

7) Calibrations of probes to actual levels of soil moisture further enable growers to observe the effects of crop transpiration on stored soil moisture as depreciation of mm’s of stored soil moisture.

8) Weather data, which includes daily calculations of reference crop evapotranspiration, is also available for 33 sites within the South Australian Murray Darling Basin region. Of these sites 30 are situated within the Riverland and Mallee region.

To access these sites (including the Waikerie MSF core site and the new site at Lowaldie) go to: http://www.samdbnrm.sa.gov.au/and click on the weather link then looking at the directory listing next to the map of the Riverland/Mallee Region you can either access the Waikerie MSF core site by selecting Waikerie-Dryland...
under the “Riverland” listing, or under “Mallee” you can login into any of the 5 nominated sites, with the site at Lowaldie being the newest.

Training in the use of the soil moisture monitoring equipment is provided periodically by SANTFA as a FarmReady eligible course for groups of 6 or more growers. For more details, contact the SANTFA office on 8842 4278 or email admin@santfa.com.au

Training in the use, interpretation and application of the weather station data services is provided by the South Australian Murray Darling Basin NRM Board.

Further information

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Soil modification for increased productivity

Rebecca Tonkin¹

¹Rural Solutions SA, Murray Bridge

Adding clay to sandy soils can improve crop growth and ease of management.

It is important to get it right as adding clay is a permanent change to the soil. Too much clay or clay with high levels of lime, salt or boron can cause problems for crops.

Test clays before use and make sure rates are suited to your soil and rainfall.

A number of trials have been set up in the Karoonda area to show different clay spreading and delving treatments.

Background

The sandy soils of the Mallee often have problems with water repellence and low nutrient holding capacity. Adding a small amount of clay to the topsoil can overcome the water repellence and increase the nutrients held in the topsoil. Getting this right is important as clay cannot be removed once it has been added to the sand.

Clay Spreading and Delving

Clay can be added to sand by a number of methods. The most commonly used are:

- Clay spreading - where suitable clay is taken from a shallow pit close to the area and spread across the surface, then incorporated by discing, cultivating or spading.
- Delving - where suitable clay is brought to the surface using a heavy tined implement to dig into the clay layer and bring clay up through the profile, leaving some on the surface. This is then smudged across to cover the ground in between the delve lines and incorporated as for clay spreading. It has the additional benefit of ripping any hard pans
present and leaving clay along the delve lines enabling plant roots to travel deeper into the subsoil. However, the clay must be at the right depth (30 - 60 cm) below the sand so that the machine can reach it.

Clay spreading has been used in the Mallee with variable results. Problems have occurred where high rates of clay have been put on where clays have been incorporated poorly, or where clays used have had high levels of lime, salts or boron. On the other hand, claying has enabled production of crops in areas that previously would erode every year, resulting in them needing to be worked several times to overcome the non-wetting sand and weed problems due to staggered germination.

Delving is a recent practice in the Mallee and is not as widely used partly because it is still new and partly because the areas appropriate for delving are limited to those with suitable clay at the right depth. From trials in the Parilla area, delving can increase cereal yields by about 20% on average, if done correctly. Higher yield improvements have been seen. If too much clay is brought up however, water availability in late spring can be a problem and the crop can hay off.

The Trials

The trials being conducted by the Karoonda & Districts Ag Bureau aim to test the usefulness of clay spreading and/or delving on 5 farms around the district. As part of this they will also be trialling the spader, a machine capable of mixing and incorporating clay and organic matter down to 30-40 cm, which may be useful in mixing in over-clayed areas.

All 5 farms have a delving trial, with treatments of
- control (normal practice)
- delved (900mm delve spacing, farmer incorporated)
• delved and spaded (incorporated with a spader machine)
• spader (spader alone, no delve)

Two farms also have a clay spreading trial. They have 3 different rates using farmer methods for incorporation as well as the spader:
• light rate (~70 t/ha)
• medium rate (~140 t/ha)
• heavy rate (~210 t/ha)
• control (no clay)
• all with & without spading

Crop growth and performance will be measured and the yields of each treatment will be measured at harvest to see which performs best.

**Further information**

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This project is part of the Woolworths Landcare Sustainable Farming Program. This project is funded by the Woolworths Landcare Sustainable Farming Program, in partnership with Rural Solutions SA and the Agricultural Bureau of South Australia.

**Sponsors:**
Sulfur (S) is a macronutrient that plays a key role in protein structure and functioning and is important in grain quality.

On Mallee sands plant available soil S status is generally low, so there may be significant increases in yield and quality of cereals in response to fertiliser applications.

Based on dry matter cuts taken at growth stage 31, there were small differences between DAP and DAP+S treatments.

Introduction
Sulfur (S) is a macronutrient that plays a key role in protein structure and functioning and is therefore important in grain quality. On the sandy soils found in the Mallee, soil S status is generally low and there may be significant increases in yield and quality of cereals in response to fertiliser applications. While farmers do not routinely apply S in fertiliser at sowing, there are now several products available for application of N, P and S as sowing fertiliser.

Field trials in 2010
A trial was established to compare several S fertiliser sources applied to wheat (cv. Correll) sown 28 May 2010 at 6 kg/ha of S at sowing. The products compared included DAP+S sourced from IPL and HiFert, an experimental Triple Super Phosphate+S (TSPS) named UNE940. Other treatments applied DAP with additions of sulphate of ammonia or gypsum as comparisons (Table 1). Nitrogen (N) was balanced to 25 kg/ha N by additions of urea at planting and all plots received a topdressing on
August 20 of 25 kg/ha N as urea at growth stage 31 (first node).

**Measurements**

- Deep cores pre-sowing combined samples from each replicate (i.e. 3 cores bulked x 3 reps).
- Emergence counts.
- Dry matter at GS31, anthesis and maturity (2 x 1m rows/plot).
- Grain yield (2 x 1 m rows + whole plot header harvests).
- N, P and S concentration in leaf samples from anthesis and grain samples at maturity. (Note: S concentration of 0.12% in grain is the critical level and an N to S ratio of 17 in grain is the critical ratio).

**Results (preliminary)**

**Soil tests**

Soil tests taken pre-sowing showed phosphorus (P) using the Colwell test to be 26 and 16 mg/kg in the 0 - 10 and 10 - 20 cm layers with Phosphorus Buffer Index of 9.6 and 18.8 in the same layers. This indicates adequate soil P concentrations for a cereal crop. Extractable potassium (K) using the Colwell test was 111 and 81 mg/kg in the 0 - 10 and 10 - 20 cm layers, which is in the moderate to high range for grain crops. Sulfur measured using the KCl-40 soil test was 1.7 and 1.6 mg/kg in the same layers which is very low.

**Dry Matter cuts**

Dry matter cuts were taken at GS31 on August 20, 2010. Visually there were no differences between Treatments 1 to 6 but treatment 7 was distinctly less vigorous and this was reflected in significantly lower dry matter yields (Table 2). This result may be due to a slightly lower rate of S (4.8 Vs 6 kg/ha S) and the predominantly Es form in that fertiliser.
Further information

Contact any of the authors at CSIRO on (08) 83038400.

Table 1. Fertiliser sources and N:P:S inputs. Elemental S (Es) and Sulphate (ss)

<table>
<thead>
<tr>
<th>T</th>
<th>Product</th>
<th>Rate (kg/ha)</th>
<th>N (kg/ha)</th>
<th>P (kg/ha)</th>
<th>S (kg/ha)</th>
<th>Es/ss (kg/ha)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>DAP</td>
<td>50</td>
<td>9</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
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<td>9</td>
<td>10</td>
<td>0</td>
<td>0.6</td>
</tr>
<tr>
<td></td>
<td>Sulphate of Ammonia Urea</td>
<td>25</td>
<td>5</td>
<td></td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Urea</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>DAP+S IPL</td>
<td>50</td>
<td>9</td>
<td>10</td>
<td>6</td>
<td>4:2</td>
</tr>
<tr>
<td></td>
<td>Urea</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>DAP+S HiFert Urea</td>
<td>50</td>
<td>8</td>
<td>9</td>
<td>6</td>
<td>4:2</td>
</tr>
<tr>
<td>5</td>
<td>DAP</td>
<td>50</td>
<td>9</td>
<td>10</td>
<td>6</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Urea</td>
<td>35</td>
<td></td>
<td></td>
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<td>DAP</td>
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<td>10</td>
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<tr>
<td></td>
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<tr>
<td></td>
<td>Urea</td>
<td>35</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>TSPS (UNE940)</td>
<td>48</td>
<td>25</td>
<td>10</td>
<td>4.8</td>
<td>3.8:1</td>
</tr>
<tr>
<td></td>
<td>Urea</td>
<td>55</td>
<td></td>
<td></td>
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Table 2. Dry matter (t/ha) at GS31 on August 20, 2010.

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<th>T</th>
<th>Fertilisers</th>
<th>DM (t/ha)</th>
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<tr>
<td>1</td>
<td>DAP</td>
<td>0.79ab</td>
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<tr>
<td>2</td>
<td>DAP + SoA</td>
<td>0.91a</td>
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<tr>
<td>3</td>
<td>DAP-S (IPL)</td>
<td>0.78ab</td>
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<td>4</td>
<td>DAP-S (HiFert)</td>
<td>0.71bc</td>
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<tr>
<td>5</td>
<td>DAP + Gypsum</td>
<td>0.87ab</td>
</tr>
<tr>
<td>6</td>
<td>DAP + 2 x Gypsum</td>
<td>0.92a</td>
</tr>
<tr>
<td>7</td>
<td>TSPS (UNE 940)</td>
<td>0.58c</td>
</tr>
</tbody>
</table>
Variable rate fertiliser trial

Neil Wittwer¹, Anthony Whitbread² and Bill Davoren²

¹University of Adelaide, ²CSIRO, Adelaide

To observe plant responses to variable rates of nitrogen and phosphorus across soil zones.

To determine optimum production inputs to maximise profitability for each soil zone.

To better understand N & P interactions by soil type and season.

Methods

Trials were established at 3 locations in the paddock - flat (swale), mid-slope and hill (dune). Each trial is comprised of 20 treatments with various rates of nitrogen and phosphorous in combination randomised and replicated 3 times (Table 1). Fertiliser treatments are all blends of triple super phosphate. Urea and gypsum were applied to all trials pre-sowing to avoid possible sulphur interactions and zinc was applied as a foliar spray post sowing. Plots were sown on the 27th of May with Correll wheat at 70 kg/ha. Fertiliser was placed below the seed. The split N treatment was applied in the form of granular urea at GS31 (20/8/10).

Further information

Neil Wittwer

The University of Adelaide.

This trial is also part of the Mallee WUE project funded by GRDC & CSIRO Sustainable Agriculture Flagship.

Contact any of the authors at CSIRO on (08) 83038400.
Table 1. Trial plan with plot numbers and treatments (kg/ha).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Plots</th>
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<td>2</td>
<td>14,37,48</td>
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<td>0</td>
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<td>3</td>
<td>2,21,54</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>9,27,56</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>17,24,44</td>
<td>40 + 40</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>10,34,51</td>
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<td>12,29,49</td>
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<td>8</td>
<td>1,26,47</td>
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<td>5</td>
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<td>9</td>
<td>16,39,53</td>
<td>40</td>
<td>5</td>
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<td>10</td>
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<td>11</td>
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<td>3,35,57</td>
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<td>7,22,60</td>
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<td>15</td>
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<tr>
<td>20</td>
<td>18,38,45</td>
<td>40 + 40</td>
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Soil-specific strategies and tactics for continuous cereal systems

Rick Llewellyn¹, Anthony Whitbread¹ and Bill Davoren¹

¹CSIRO, Adelaide

Identify the most profitable N strategies and tactical responses to seasonal conditions for a range of soil types and potential management zones.

Determine the most risk-effective tactics and strategies using a combination of field results and simulation for a wide range of season-types.

Identify optimal paddock zoning for long-term profitability and risk management: how many zones and where based on what information.

Methods

The trial uses a spatial approach with 150m long plots running across a wide range of soil types and production potentials. The trial will run for 4 seasons. To establish the trial area, Correll wheat was sown in 2009 using standard inputs across all wheat plots (2009 yield variation across the soil range is shown in Figure. 1).

In 2010, Correll wheat was sown on May 27. Different strategic treatments have been applied for the first time in 2010 (Table 1). The good conditions mean that the ‘positive spring’ tactical treatment (Tmt 6) was applied in 2010 but the ‘poor start’ (Tmt 8) and ‘poor spring’ (Tmt 7) tactical treatments were not applied.

Results

As the main treatments are only beginning to be applied in 2010, the results below are included to give an indication of the site characteristics and variation. Figure 1 shows the
increasing 2009 moving away from the constrained flats before yield is reduced on the exposed dune tops.

2010

Table 3 and Figure 2 indicate the variation in starting soil moisture and N in 2010, including the large difference in N contribution from the 2009 volunteer pasture (Table 2).

Further information

This trial is part of the Mallee WUE project funded by GRDC & CSIRO Sustainable Agriculture Flagship.

Contact any of the authors at CSIRO on (08) 83038400.

<table>
<thead>
<tr>
<th>T</th>
<th>Treatment</th>
<th>2010 Fertiliser rate</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pasture –cereal phase 1 - winter pasture (2009) followed by cereal (2010-2012)</td>
<td>8 7</td>
<td>40 DAP</td>
</tr>
<tr>
<td>2</td>
<td>Cereal-pasture phase 2 – cereal (2009) followed by winter pasture (2010) and cereal (2011-2012)</td>
<td>- -</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Control -Continuous cereal - district practice fertiliser inputs</td>
<td>8 7</td>
<td>40 DAP</td>
</tr>
<tr>
<td>4</td>
<td>Continuous cereal –no fertiliser</td>
<td>0 0</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Continuous cereal –high N inputs upfront</td>
<td>8 32</td>
<td>40DAP+54Urea</td>
</tr>
<tr>
<td>6</td>
<td>Continuous cereal – reactive to positive spring conditions</td>
<td>8 32</td>
<td>40DAP+54Urea</td>
</tr>
<tr>
<td>N inputs topdressed at GS31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Continuous cereal – reactive to negative spring conditions</td>
<td>8 7</td>
<td>40 DAP</td>
</tr>
<tr>
<td>8</td>
<td>Continuous cereal – reactive to poor starting conditions</td>
<td>8 7</td>
<td>40 DAP</td>
</tr>
</tbody>
</table>
Figure 1. 2009 wheat yield across the soil range; elevation also shown.

Table 2. Summary of 2009 soil and production across the soil range

<table>
<thead>
<tr>
<th>Position</th>
<th>EN03</th>
<th>Total Moisture content</th>
<th>Soil Nitrate</th>
<th>Grain</th>
<th>^2WUE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>EMv</td>
<td>0-1m</td>
<td>0-1m</td>
<td>Biomass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(mm)</td>
<td>(kg/ha)</td>
<td>(t/ha)</td>
<td>(t/ha)</td>
</tr>
<tr>
<td>May 12</td>
<td>May 12</td>
<td>July 17</td>
<td>Sept 23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Sand</td>
<td>38</td>
<td>79</td>
<td>38</td>
<td>0.33</td>
<td>2.3</td>
</tr>
<tr>
<td>2</td>
<td>42</td>
<td>82</td>
<td>38</td>
<td>0.52</td>
<td>2.6</td>
</tr>
<tr>
<td>3</td>
<td>55</td>
<td>107</td>
<td>52</td>
<td>0.66</td>
<td>2.6</td>
</tr>
<tr>
<td>4</td>
<td>104</td>
<td>174</td>
<td>64</td>
<td>0.84</td>
<td>3.6</td>
</tr>
<tr>
<td>5</td>
<td>144</td>
<td>156</td>
<td>100</td>
<td>0.98</td>
<td>3.3</td>
</tr>
<tr>
<td>6</td>
<td>133</td>
<td>183</td>
<td>105</td>
<td>0.78</td>
<td>3.0</td>
</tr>
<tr>
<td>7 Flat</td>
<td>136</td>
<td>220</td>
<td>203</td>
<td>0.89</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Note: ^2Crop lower limit (0-1m) on the sand is estimated to be ~71mm and on the flat ~201 mm resulting in between 9 and 19 mm of plant available water at sowing.

^2Water Use Efficiency is calculated as [grain/ (change in soil water between harvest and sowing + growing season rainfall - evaporation)]. Runoff and drainage was assumed to be nil, and soil evaporation was calculated to be 110 mm on all soil types.
Table 3. Soil nitrate (kg N/ha) prior to sowing 2010.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Flat</th>
<th>Mid</th>
<th>Sand</th>
<th>Flat</th>
<th>Mid</th>
<th>Sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>41</td>
<td>44</td>
<td>16</td>
<td>33</td>
<td>22</td>
<td>13</td>
</tr>
<tr>
<td>10-20</td>
<td>42</td>
<td>16</td>
<td>11</td>
<td>33</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>20-40</td>
<td>48</td>
<td>26</td>
<td>8</td>
<td>42</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>40-60</td>
<td>31</td>
<td>20</td>
<td>6</td>
<td>21</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>60-80</td>
<td>19</td>
<td>9</td>
<td>7</td>
<td>16</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td>80-100</td>
<td>18</td>
<td>16</td>
<td>6</td>
<td>18</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>199</strong></td>
<td><strong>130</strong></td>
<td><strong>54</strong></td>
<td><strong>163</strong></td>
<td><strong>89</strong></td>
<td><strong>48</strong></td>
</tr>
</tbody>
</table>

Figure 2. Total soil water prior to sowing 2010 across the range of soils from Sand to Flat.
Figure 3. Wheat biomass production August 30 2010 (Growth Stage 31)
Good levels of early biomass produced by cereal rye on all soil types, and by pasture and canola on the heavy flats.

Greater early growth in wheat following peas or pasture when on lighter soils.

Early ‘grazing’ of cereal rye in 2009 reduced rye grain yield by 30-50%.

Aims and methods
The aim of this work is to evaluate and demonstrate the short and long-term benefits of more diverse and flexible break options for positions along a dune – swale, i.e. sand, mid-slope and flat. At each of these positions, break crops (to be followed by wheat in 2010 - 2012), 5 wheat (sown to break crops in 2010) and a wheat only control were established in May 2009 (Table 1). Seed and fertilizer rates were kept the same across all soil types (Table 2) with all treatments receiving 50 kg/ha of DAP at sowing. With the exception of the legume treatments, urea was also applied at sowing at a 50 kg/ha. The emergence of mustard (Treatment 2) at the mid-slope and dune sites was very poor and mustard was resown on August 4 but again failed to emerge. Cereal rye was either grown to maturity for grain (T3) or cut on 4th August (T4, to simulate grazing or hay production) and allowed to regrow until maturity for grain harvest. The volunteer pasture treatment received no inputs.
Table 1. Break crop treatments imposed in 2009/10 and proposed treatments in 2011-2012

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Legume (peas)</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>2 Brassica (mustard)</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>3 Cereal Rye – grain</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>4 Cereal Rye – grazed</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>5 Volunteer pasture</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>6 Wheat (control)</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>7 Wheat</td>
<td>Brassica (canola)</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>8 Wheat</td>
<td>Cereal Rye – grain</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>9 Wheat</td>
<td>Cereal Rye – grazed</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>10 Wheat</td>
<td>Volunteer pasture</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>11 Wheat</td>
<td>Legume (lupins)</td>
<td>Wheat</td>
<td>Wheat</td>
<td>Wheat</td>
</tr>
</tbody>
</table>

Table 2: The following inputs were applied to the treatments established in 2009 and or 2010

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Crop/Variety</th>
<th>kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legume</td>
<td>2009: Peas cv. Kaspal</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>2010: Lupins cv Mandelup</td>
<td>90</td>
</tr>
<tr>
<td>Brassica</td>
<td>2009: Mustard cv. Sahara</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>2010: Canola cv. Hyola 50</td>
<td>5</td>
</tr>
<tr>
<td>Cereal – grain</td>
<td>Cereal rye cv. Bevy</td>
<td>80</td>
</tr>
<tr>
<td>Cereal – hay/grazing</td>
<td>Cereal rye cv. Bevy</td>
<td>80</td>
</tr>
<tr>
<td>Wheat (x 6)</td>
<td>Wheat cv. Correll</td>
<td>70</td>
</tr>
</tbody>
</table>
Results 2009

Sowing took place on 15 May after 38mm of rain had fallen between 25 April and 2 May. There had been low rainfall in the months prior to the season break resulting in very little stored soil moisture at sowing. Total growing season rainfall (from sowing to October) was 192 mm which is between a Decile 5 and 6. The long term average growing season rainfall (April to October) is 237 mm based on records obtained from the Karoonda met station. In the period from July 12 to August 23, crop growth and yield potential was detrimentally affected by low rainfall (~18mm) and warm daily temperatures. From August 24, there was good rainfall and excellent finishing conditions.

The biomass cuts taken on July 28 found little difference in biomass production of the crops across the dune–swale, but biomass of the pasture on the flats was much greater than on the hill or mid-slopes (Table 3). This was due to a difference in species composition with the flats being dominated by annual ryegrass and the sandier soils dominated by annual medics. The grain yields of peas was 0.5 t/ha over all landscape positions, while the un-cut rye, grain yield on the hill and mid-slope were more than double that on the flats. The effect of cutting the rye resulted in the grain yield being about half of the un-cut treatments. Mustard failed to germinate on the sandier soils of the mid-slopes and dunes but performed well on the flats.

Results 2010

Trials were sown in late May after approximately 20mm of rain. Rainfall until August was close to average and rainfall during August was 60mm (25mm above average). In 2010 for sampling purposes the mid-slope trial has been split into two sections (mid-top and
mid-bottom) due to the large variation in soil properties and as a consequence crop performance across this trial. Plant sampling in late July showed similar trends to 2009 with high pasture biomass in the flats dominated by annual rye grass. Cereal rye and canola have also produced high early biomass particularly on the heavier flats (Table 4).

Wheat growth following the break crops of 2009 shows wheat after either peas or pasture on the lighter soils has performed very well (Figure 1). This is likely due to increased N after the legumes but may also be in part due to lower incidence of disease particularly yellow leaf spot which has been a significant problem on the continuous wheat this season.

During the summer (March 2010), microbial activity in the surface (0-10 cm) soil was highest after mustard in both the flats and mid-slope trials and lowest after wheat crop. At sowing, microbial biomass and nitrogen mineralization potential were higher in soils after mustard and cereal rye and lowest after wheat. The incidence of Rhizoctonia disease in wheat was generally higher in the mid-slope trial than that in the flats. Disease incidence was lowest in wheat after Mustard in both the flats and mid-slope trials reflecting low inoculum and high microbial activity levels at sowing. There was no significant difference in disease incidence after cereal rye, pasture and wheat.

Further information

This trial is part of the Mallee WUE project funded by GRDC & CSIRO Sustainable Agriculture Flagship.

Contact any of the authors CSIRO (08) 83038400.
Table 3: Biomass cuts and grain yields of break crops, cereal and volunteer pasture treatments 2009.

<table>
<thead>
<tr>
<th></th>
<th>Rye 'grain'</th>
<th>Rye 'cut'</th>
<th>Peas</th>
<th>Mustard</th>
<th>Wheat</th>
<th>Pasture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill (sand)</td>
<td>1.58</td>
<td>0.44</td>
<td>Failed</td>
<td>0.74</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>mid</td>
<td>1.72</td>
<td>0.48</td>
<td>Failed</td>
<td>0.67</td>
<td>1.21</td>
<td></td>
</tr>
<tr>
<td>flat</td>
<td>1.58</td>
<td>0.58</td>
<td>0.45</td>
<td>0.90</td>
<td>2.28</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Grain yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill (sand)</td>
<td>1.4</td>
</tr>
<tr>
<td>mid</td>
<td>1.5</td>
</tr>
<tr>
<td>flat</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Note: The wheat biomass is from cuts in treatment 6 and the wheat grain yields are the mean of all wheat treatments planted in 2009 (T6-T11).

Table 4: Biomass cuts of treatments 2010.

<table>
<thead>
<tr>
<th></th>
<th>Rye 'grain'</th>
<th>Rye 'cut'</th>
<th>Lupins</th>
<th>Canola</th>
<th>Cont. Wheat</th>
<th>Pasture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hill (sand)</td>
<td>0.98</td>
<td>1.17</td>
<td>0.48</td>
<td>0.75</td>
<td>0.50</td>
<td>1.49</td>
</tr>
<tr>
<td>mid-top</td>
<td>0.99</td>
<td>1.01</td>
<td>0.45</td>
<td>0.88</td>
<td>0.35</td>
<td>1.67</td>
</tr>
<tr>
<td>mid-bott</td>
<td>1.45</td>
<td>1.33</td>
<td>0.60</td>
<td>1.46</td>
<td>0.56</td>
<td>1.99</td>
</tr>
<tr>
<td>flat</td>
<td>1.57</td>
<td>1.36</td>
<td>0.40</td>
<td>1.44</td>
<td>0.68</td>
<td>3.29</td>
</tr>
</tbody>
</table>

Figure 1: Wheat biomass (2010) cuts following break crop treatments of 2009.
Barley agronomy research update

Kenton Porker\(^1\) and Rob Wheeler\(^1\)

\(^1\)SARDI, Adelaide

Growers need to consider varietal coleoptile length when deeper sowing and seeding rates may need to be increased.

Care should be taken when sowing shorter coleoptile varieties in conjunction with coleoptile-shortening seed dressings and pre-emergent herbicides.

Good quality seed will aid in increased barley establishment at deeper sowing in no till systems.

The Southern Barley Agronomy project is continuing to be funded by GRDC for a further three years and is working with ‘farmer driven’ farming system groups (eg Hart, YPASG, LEADA, MacKillop, and MSF). Funding is directed at research in all environments to investigate management issues such as grazing potential; weed competition; nitrogen; canopy management; planting date; seeding rate and, fungicide responsiveness across a range of barley varieties. The focus of trials in 2010 are to validate previous years trial results together with new trials focusing on maximising early vigour, plant establishment and weed competition within modern farming systems.

**Maximising Barley Establishment In The Mallee:**

Patchiness within barley crops in modern no till systems is becoming a common feature particularly in the Mallee district and is often associated with rhizoctonia damage. However, rhizoctonia cannot explain all incidents of reduced establishment as seeding depth; pre-emergent
herbicides; seed dressings; seed quality and other factors also may be involved. Three trials have been established in the Mallee at the Karoonda site in 2010 aimed at investigating the interactive effects of agronomic practices (sowing depth; pre-emergent herbicides; seed dressings and, differences in seed quality) on early vigour, plant establishment, and disease incidence in new barley varieties.

**Varietal differences in Coleoptile length:**

Coleoptile length is an important characteristic in barley, as it contributes to the maximum depth that a variety can be sown. Varieties with short coleoptiles (i.e. less than 60mm) may fail to emerge in situations where the internode cannot elongate enough to bring the crown close to the soil surface and allow the first leaf to emerge through the soil surface. Varietal differences in coleoptile lengths may be a secondary factor contributing to variable barley establishment in reduced tillage systems or where growers are sowing deeper seeking moisture. Recent research conducted by Dr Neil Fettell from the NSW I&I has highlighted the large range of genetic differences in coleoptile lengths among the new barley varieties (Figure 1). Hindmarsh has been found to have a short coleoptile, while Fleet has a relatively long coleoptile. This work highlights the need for growers to consider varietal coleoptile length when contemplating deep sowing and as a result growers may need to consider increasing seeding rates when deep sowing varieties like Hindmarsh.

**Seed Quality:**

Results from Karoonda and Turretfield in 2010 have highlighted that good quality seed, with high germination
and vigour, is essential to push the coleoptile up through the soil at deep sowing (Figure 2). Screening seed or sourcing good quality seed to obtain larger plump seed for sowing can negate some of the problems associated with shorter coleoptile varieties. Selection of varieties with longer coleoptiles coupled with good quality seed will aid in increased establishment at deeper sowing.

Seed Dressing & Herbicide effects on Coleoptile Length:

In addition to varietal differences, many other factors can influence the length of the coleoptile. In some situations, fungicide seed dressings such as the triademinols, may reduce coleoptile length, which could lead to poor emergence particularly if short coleoptile varieties or deep sowing are used. Coleoptiles shortening may also result from use of dinotroaniline herbicides (trifluralin; pendimethalin; oryzalin). Preliminary results from the 2010 Karoonda trial show that the common seed dressing Baytan® (triadimenol based) will significantly reduce plant establishment at deep sowing (80mm) because of its effect on shortening coleoptile (Figure 3 & 4).

However, the seed dressing Advance®, which contains the active ingredient Carboxin (known growth enhancer), increased coleoptile length and improved plant establishment in Hindmarsh at deep sowing, compared to Baytan® and control.

As a result care at sowing should be particularly taken when shorter coleoptile varieties are used in conjunction with coleoptile-shortening seed dressings and pre emergent herbicides; particularly where it is difficult to obtain good depth control of herbicide incorporation and
seed placement, such as in sandy soils.

Further information
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Should we change our wheat variety depending on time of seeding?

Richard Saunders

1Rural Solutions SA, Loxton

Effect of variety to time of sowing is well known. Varieties respond to different times of sowing according to their maturities.

Time of seeding is one of the keys to optimising water use efficiency.

Average yield losses from delayed sowing are about 200kg/ha/week.

A suite of crop varieties with different maturities will reduce risk from events such as frost and disease as well as giving more management options for weed control.

Current Knowledge

At the 2009 GRDC update Glenn McDonald et al in his paper ‘Time of Sowing’ reviewed the current knowledge in the literature and showed the general pattern for cereal yield with time of sowing, as shown in Figure 1.

This graph includes results from a range of time of sowing trials. It shows a small rise in yield from early sowing in April to a peak in May and rapid decline in yield to August. Following that peak in May the yield loss is about 200 kg per hectare per week.

From long experience Mallee growers know and understand this general pattern and this graph reflects well the Mallee situation. Given favourable seeding conditions – soil moisture and weed control, most northern Mallee growers all aim to sow at the optimum time in order to give the crop the best chance to develop and maximise crop potential. They
know that delays beyond mid May are costly in terms of yield and sometimes quality. We have all seen examples of what seeding delays of just a few days to a week as a result of dry conditions, machinery breakdown, weather, or other, have done to crop yields.

Recent Developments

Technological developments and increases in seeder and tractor capacities have seen a dramatic increase in the capacity of growers to sow large areas when conditions are optimum. As a result we have seen strong and consistent improvements in water use efficiency through better targeting of seeding.

Trials in 2009

Time of seeding trials at Karoonda in 2009 showed that Yitpi was the best of the varieties across all times of sowing. There were varietal responses in the other varieties, Axe and Gladius, but Yitpi out yielded all other varieties at all other times of sowing with the exception of Axe at Time Of Sowing (TOS) 2. For Yitpi the best time of sowing was the TOS 2 on June 12. All treatments produced
low water use efficiency figures but Yitpi TOS 2 produced the best of 7.1 kg grain/mm of effective rainfall.

**Controlling Weeds**

Weed control is all about saving water for the crop and along with time of sowing is critical in optimising water use efficiency. Time of sowing can be used as a weed control strategy - to upset and reduce weed populations.

Steve Powles, the director of the WA Herbicide Resistance Initiative and significant weed researcher, has a mantra that goes “When you are on a good thing, don’t stick to it”. Weeds will find a niche in any consistent seeding strategy and then seek to dominate the situation. If you do the same thing every year, for example, spray then sow, you are still selecting for weeds, they may be different or harder to kill weeds. By mixing up time of seeding strategies (for example in one paddock – sow early one year, late the next) you can effectively disrupt the normal weed cycle. A simple strategy of employing different seeding times can be a useful tool in combating weeds and thereby improving water use efficiency. This is a method being successfully used by Allan Buckley at Waikerie in his cropping strategy.

**Further information**

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SARDI is evaluating a range of new strand medic hybrids for low rainfall, neutral/alkaline, sandy/loam soils.

Plant numbers drive early and total dry matter production which in turn drives biological nitrogen fixation – build up your soil seed reserves when you can.

This South Australian Grains Industry Trust funded trial is one of three sister trials sown this year in SA, the others being at Minnipa (EP) and south of Kulpara (YP).

The broad aim is to assess the potential of a range of advanced multi-trait strand medic breeders’ lines for commercial development.

We hope to capitalise on the promising outcomes achieved in earlier projects (Ballard, Howie et al) where medics with good tolerance/resistance to a range of biotic and abiotic constraints were identified and hybridised (Peck et al) with elite parents (e.g. Angel and Herald strand medic). Several crosses, cycles of selection and seed multiplication have resulted in the availability of 25 medic lines which possess various combinations of the following new traits:

1. *Pratylenchus neglectus* tolerance – the nematode is present in almost all cropping soils and can cause severe damage to medic seedlings. Yield losses of up to 20% have been measured in the field. Hybrids have been generated whose tolerance to the nematode has been confirmed in growth room studies but field tolerance is still to be demonstrated.
2. **Rhizobial promiscuity** - the level of nitrogen fixation by strand medic is largely determined by the population of rhizobia that resides in the soil. Many populations of rhizobia form sub-optimal symbioses and cannot be displaced. A promiscuous medic that is better able to form effective symbioses was identified and the trait has been successfully incorporated into several of the new medic lines.

3. **Powdery mildew (PM) resistance** - damage is being increasingly reported in the field with heavy infections capable of causing defoliation. A source of resistance has been identified and used to develop several medic lines. They have already demonstrated excellent field resistance at the Waite Institute.

4. **SU herbicide tolerance** – sulfonylurea herbicides are used extensively in the cereal-livestock zones of temperate Australia. However their residues persist beyond the cropping year into the following season and can cause greater than 50% reduction in productivity. The benefits of the SU tolerant cultivar Angel have already been well demonstrated and the trait is present in many of the hybrids under test.

**Why do the trials?**

First and foremost we want to:

- Evaluate the agronomic performance of 25 advanced medic lines possessing various combinations of important new traits in low rainfall Mallee environments;
- If possible, we’d like to determine the benefit *Pratylenchus neglectus* root lesion nematode (RLN) tolerance has on medic production (this is being done on YP using +/- nematicide treated plots);
- Make in-situ field selections from segregating medic lines under evaluation at the field sites.
**How are we doing it?**

- We have established three replicated trials: Kulpara (21\textsuperscript{st} May – dry sown), Minnipa (31\textsuperscript{st} May) and Karoonda (1\textsuperscript{st} June). These have 32 - 36 entries including cultivar checks.
- We will monitor dry matter production and pod and seed yield.
- We aim to let at least one or two sites regenerate in 2011 so we can get some 2\textsuperscript{nd} year establishment data and thus get a handle on the hardseededness of these lines.
- We may also crop over one site and try to get a regeneration assessment following a cereal (more typical rotation) in 2012.

**What’s happened so far?**

Establishment at Kulpara and Minnipa has been very good helped by some solid rain shortly after sowing. Unfortunately the establishment here on the Karoonda site has been quite patchy with an incredibly staggered germination. We have observed at least 4 distinct germination events, I assume as a result of patches of non-wetting sand failing to wet up thoroughly with the many small rainfall events and exacerbated by having to sow shallow (2cm). NB In June & July there were 28 rain days (as recorded by the very handy NRM weather station) for only 49mm rainfall, the largest event being 6mm (14\textsuperscript{th} July).

It is early days yet but the main surprise so far for us this year has been the good performance at both Kulpara and Karoonda of a set of powdery mildew (PM) resistant hybrids. They have shown better early vigour and more consistent growth so far. Given that there hasn’t been any powdery mildew observed we can only assume that some of this performance is coming from the PM parent and of course assisted by some excellent glasshouse selection!
The other thing we are curious about is the apparent response to inoculation of one of the Herald treatments and whether this indicates an insufficient nodulation response by the other (uninoculated) treatments. Ross Ballard is chasing this up.

Acknowledgements

Many thanks to the Hannah & Peter Loller and CSIRO for having us on their site and to SAGIT for enabling this work to occur.

Further information

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Management of Rhizoctonia disease risk in cereals – Karoonda and Waikerie field trials

Gupta, V.V.S.R.¹, A. Mckay² and K. Ophel-Keller², R. Llewellyn¹, R., A. Whitbread¹ W. Davoren¹ and D. Roget

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Higher frequency of below average rainfall in recent years has resulted in higher Rhizoctonia inoculum levels before sowing and higher levels of disease.

Crop rotation affects inoculum levels: levels were lowest after canola compared to that after wheat and cereal rye.

Inoculum levels are generally reduced over the following summer however the extent of reduction is dependent on the amount of summer rainfall.

The incidence and severity of Rhizoctonia bare patch in cereals depends on the pathogen inoculum level, soil microbial community activity and crop/root vigour.

Rhizoctonia bare patch is a disease of seedlings caused by Rhizoctonia solani Kühn AG-8. It decreases root length resulting in reduced plant growth and yield losses. Recent estimates indicate that it causes significant losses in wheat, $59 million pa across southern Australia (Murray and Brennan, 2009). Although this disease is considered more of a problem in lower rainfall regions (<350mm) and in lighter soils it occurs across the entire southern Australian wheat belt. The adoption of minimum tillage practices has resulted in an increase in Rhizoctonia in a wider range of cropping environments. This fungus grows on soil organic matter and produces a hyphal network in the surface soil.
While previous research has found the risk of yield loss can be reduced by management practices that increase seedling vigour, it remains a difficult disease to predict and control. Currently there are no effective chemical or biological control measures and limited or no plant genetic resistance against Rhizoctonia disease.

The incidence of Rhizoctonia bare patch has increased in recent years due to the higher frequency of drought years and in particular below average rainfall in spring and summer. This has resulted in higher inoculum levels before sowing. The overall lower level of microbial activity for long periods during and following dry periods favour the growth of the Rhizoctonia fungi.

The incidence and severity of Rhizoctonia bare patch depends on the amount of Rhizoctonia inoculum, composition and activity of the soil biology community (inherent suppressive activity), available soil N levels over summer and at seeding as well as constraints to root growth. The complex relationship makes this a difficult disease to predict and manage. Developments in DNA-based (inoculum and communities) and biochemical (catabolic diversity) techniques help us better measure and link the various factors to disease incidence.

As part of a GRDC funded project on Rhizoctonia (CSE00048) and the CSIRO-MSF WUE project, we investigated the changes in inoculum, especially over summer, as influenced by environmental factors and soil biological activity under different rotation and tillage systems. This work aims to develop better prediction and management options based on a better understanding of the changes in inoculum levels especially over summer and its
interaction with soil microbial community and crop.

What we found?

Inoculum and disease development

Field trials at Karoonda and Waikerie, in the SA Murray Mallee revealed that:

• Rotation affects Rhizoctonia inoculum levels.
  i. At Waikerie, levels were lowest after canola, medic pasture and fallow and highest after wheat. Soil microbial activity also increased during summer following canola. These differences were correlated with the amount of disease in the following wheat crop during 2009.
  ii. At Karoonda, levels were lowest after mustard compared to wheat, pasture and cereal rye both in mid slopes and flats. Inoculum levels were generally higher in soils from flats.
• Reduced inoculum levels following canola, medic pasture and fallow were associated with increased yield on Eyre Peninsula but not in the Mallee.
• Cultivation prior to sowing reduced inoculum levels but the inoculum levels in the Waikerie trial levels were still in the high disease risk category.
• Inoculum levels are reduced by summer rainfall in weed free plots but can increase during long dry periods.
• The reduction in inoculum over summer was also observed in grower paddocks.
• Microbially mediated disease suppressive activity in intensive crop rotations is clearly important in avoiding major crop loss.

Seedling assessments revealed sowing early reduced damage to the seminal roots however the crown roots were often severely affected, especially in no-till systems. This is probably
due to the crown roots emerging into cold soil and hyphal re-establishment following soil disturbance at seeding.

**Implications**

An improved understanding of the factors influencing Rhizoctonia inoculum levels will assist growers and advisers to better utilise diagnostic information to select options and requirements for improved management of Rhizoctonia disease. To reduce risk of yield:

- Control summer weeds to stop build-up of inoculum
- Encourage early seedling vigour, sow early
- Cultivate deep and sow shallow (avoid disc seeders)
- Canola can help reduce inoculum for a following wheat crop
- Barley and wheat are the most intolerant crops
- Minimise N deficiency at seeding by deep banding N and minimise stubble incorporation at seeding, particularly if summer rainfall has been low.

**Further information**

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GRDC Factsheet March 2008
Phosphorus fertiliser efficiency under wet and dry conditions

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Preliminary results suggested that dry conditions decreased fertiliser uptake at a phosphorus deficient site but did not affect a site that was not phosphorus deficient.

This year we have 8 experiments in the field under rain-out shelters where we are directly measuring the uptake of phosphorus (P) fertiliser under wet (Decile 7 - 8) and dry (Decile 2 - 3) conditions. Our 8 experiments are at Karoonda (2 soil types), Wanbi, Halidon, Langhorne Creek, Wharminda, Minnipa and Horsham.

We added P fertiliser containing a radioactive tracer that gives the fertiliser a unique ‘fingerprint’ so that we can track the uptake of fertiliser into the plant. We then watered the plants to simulate Decile 2 - 3 vs. Decile 7 - 8 conditions. This was quite difficult for the Decile 2 - 3 treatments due to the prevalence of subsoil moisture. These plants were grown until Zadok’s 47 (head in the boot) and harvested by hand so that we could measure dry weight, P content and fertiliser content using radioactivity. Plants had to be harvested at this stage due to the decay of the radioactivity only enabling an experiment to run for 12 weeks however this closely coincides with the growth stage where P uptake via roots slows down and P in the plant tends to focus energy on supporting the developing head.

We have only preliminary results at this stage. At Wanbi, which is a P deficient site (CDGT-P 30, threshold 60), the
addition of P increased dry weight and the higher level of water (Decile 7 - 8) increased the amount of the added fertiliser that was utilised by the crop plant. When we finalise this data we will be able to determine the exact amount of P utilised. At this site the Decile 2 - 3 treatment worked quite well with marked water stress which also led to increased symptoms of cold stress and transient iron deficiency. Karoonda (mid-slope) was not a P deficient site (CDGT-P 241, threshold 60) and so we did not observe any response to fertiliser addition. We also did not measure a difference between the simulated low and high rainfall treatments. We think this is because the roots were able to readily access subsoil moisture and so the topsoil watering treatments did not have an effect.

Acknowledgements

The authors acknowledge funding from South Australian Grains Industry Trust and Australian Research Council (LP0882492). Thanks to Colin Rivers and Caroline Johnston for technical support and Sean Mason for DGT analyses.

Further information

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New research on perennial grasses and pasture cropping

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New field research that forms part of the Evercrop project is starting at the Karoonda site this year to investigate the performance of perennial grasses and options for pasture cropping in the Mallee.

New work will include evaluating regenerating native grasses as a feed source, low-cost ground cover and potential base for pasture cropping.

Results are yet to come but will hopefully point to viable options for improving farm productivity and NRM outcomes.

Pasture cropping is attracting interest in several cropping regions of Australia and may be a viable option for marginal cropping soils in the Mallee. It involves opportunistic sowing of a winter crop over a winter dormant perennial pasture, exploiting the different growth patterns of the two. The advantages of the technique are attributed to its year round ground cover and the potential production of both grain and summer feed.

Originating from northern NSW and now being trialled in WA, pasture cropping has hardly been investigated in the Mallee region. The Evercrop project (Future Farm Industries CRC) is now planning to investigate the major challenge of establishing a successful perennial base. In this trial, the aim is to first test a set of promising commercially available perennial grasses (both sub-tropical and temperate) for their establishment, production and persistence potential. The best performing species will then be
taken further in a subsequent pasture cropping trial.

The species to be trialled includes:

- Panicum maximum cv Petrie
- Panicum coloratum cv Bambatsi
- Chloris gayana cv Katambora (Rhodes grass)
- Digitaria smutsii cv Premier
- Setaria incassata cv Inverell
- Dactylis glomerata spp. Hispanica cv Uplands (Spanish cocksfoot)

The pasture characteristics that will be evaluated in the first instance include establishment, biomass production and quality, persistence, botanical composition, and tolerance to grazing (regrowth). In the pasture cropping phase of the trial, attention will be paid to the potential effects of competition between the crop and the pasture.

In addition to the perennial grass and pasture cropping trial, we will look at regenerating native grasses on a couple of farms in the Mallee. The aim of this work is to answer questions on their potential as a feed source through assessments of biomass production and quality; seed bank characteristics; regeneration; botanical composition, and tolerance to grazing.

**Further information**

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<th>GSR mm</th>
<th>Variety</th>
<th>Sowing Date</th>
<th>Nitrogen applied to date</th>
<th>Treatment</th>
<th>Soil PAWC mm</th>
<th>Start Soil Moisture mm</th>
<th>Start Soil Nitrogen kg N/ha</th>
<th>80% XtraaN</th>
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<td>127</td>
<td>Gladius</td>
<td>8&lt;sup&gt;th&lt;/sup&gt; May</td>
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<td><strong>Loxton</strong></td>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; June</td>
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<td>31&lt;sup&gt;st&lt;/sup&gt; May</td>
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<td>Variable Rate UAN</td>
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- Treatment listed in italics has been used for Yield Prophet predictions
- PAWC is the Plant Available Water holding Capacity of the soil type selected in Yield Prophet
- Yield probability based on Yield Prophet reports and is the yield prediction when only water and nitrogen are considered. Yield Prophet does not take into account weeds, disease or other nutrients such as phosphorus and sulphur. Full reports can be viewed at [www.msfp.org.au/](http://www.msfp.org.au/)
- Xtra N is the Yield prediction when nitrogen is not limiting. Applying additional nitrogen is required to achieve that yield.
MSF would like to acknowledge and thank the above organisations for their on-going support.