EM38 paddock zones and resultant grain yield and quality responses, Meribah, 2009

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Meribah

Key messages:

- Determining paddock zones using EM38 with soil testing and 'Your soils potential' model highlights the levels of production potential in paddocks.
- Zoning allows development of management prescriptions e.g. fertiliser, seeding rate etc. in order to optimise production from these areas.
- Application of fertiliser according to a prescription using variable rate technology over a zoned paddock is providing a gross margin increase over a flat rate in most situations.
- Economic benefits were demonstrated in very low rainfall years.

Aims:

- To investigate the grain and any differences in grain quality from the different EM38 zones in the paddock.
- To use Precision Agriculture technologies, especially Variable Rate to reduce risk and maximise return in continuous cropping systems.
- Use EM38 and 'Your Soils Potential' soil testing service to map subsoil constraints.
- Combine previous MSF work on subsoils and soil nutrition to help farmers manage land to its potential.
- To demonstrate and extend the benefits of precision agriculture technology to SA Mallee growers.

Background:

This work is the Precision Agriculture component of the 'I*ncreasing Adoption of Sustainable Farming and Risk Management in the SA Mallee*' project. Since 2005 this work has clearly demonstrated the benefit of using EM38 mapping in conjunction with zoning, 'Your Soils Potential' and variable rate seeding technology to improve paddock gross margins in the majority of situations. Whilst we have seen significant differences in grain yield, we have never seen the effect, if any, on grain quality. In this trial we examine the effect of paddock

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zoning on grain quality i.e. protein, test weight, screenings and thousand kernel weight.

Work undertaken by Rural Solutions SA in creating the 'Your Soils Potential' soil testing service has shown the benefit of understanding subsoil constraints and their influence on plant available water. When combined with EM38 it was found that there was a strong correlation between Crop Lower Limit (CLL) and EM38 in the SA Mallee. In the following discussion Zone 1 is the lightest textured soils grading down to the last zone which has been a heavy textured flat, with toxic levels of salt or boron or sodicity.

About the trial:

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This trial was setup in 2005 to examine the effect of three tillage treatments (no-till, direct drill and a conventional tillage practice of work-up work-back and sow) and two fertiliser inputs (high: 65 kg/ha DAP, and standard 45 kg/ha DAP respectively) on crop yields. The trial has two replicates with treatments running north-south (Figure 1.).

The paddock has always been difficult because of its fragile soil types, and consequently until the trial started was only ever sown to cereal rye or barley because of the high erosion risk.

Rotation to date:

- 2005 Cereal Rye
- 2006 Wheat
- 2007 Canola
- 2008 Wheat cv. Wyalkatchem
- 2009 Wheat cv. Yitpi

Seeding Machines used in 2009 were:

1. No Till - 40' SeedHawk 12" spacing with Flexicoil 1330 Seed box
2. Direct Drill - 50' Seeding bar with 12" spacing and deep 4" narrow points, Flexcoil 1330 Seed box
3. Conventional - 50' HB Scaribar (Work up and Sow) 8¾ " spacing, finger harrows.

Sowing date: 28th May 2009 with 50 kg/ha Yitpi.

The paddock was harvested and yield mapped on December 22th, 2009.

Quadrats for grain analysis were hand harvested on 23rd November from each paddock zone in every seeder and fertiliser treatment. Samples were hand threshed and cleaned for quality analysis.

Results:

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Yields were determined for zones in each sowing and fertiliser treatment from the yield and zone map. Results are tablulated with the grain quality results in Table 1 shown below. Average yield over the whole paddock was 0.869 t/ha of wheat with a range of from 0.252 to 1.173 t/ha in the various treatments.

Trial yields were analysed with a split split plot model. Significant differences were only found between yields from the paddock zones. There were no differences between fertiliser, tillage machines or any interaction. Table 2. below shows the yield and grain results for each of the treatments and interactions.

Meribah received 174 mm growing season rainfall (decile 6). Overall water use efficiency was 7.6 kg of grain per mm of effective rainfall, which is low compared to other years. The severe sub soil moisture deficit at the beginning of the year and the winter/spring drought, along with high evaporation and temperature events in spring significantly affected grain set.

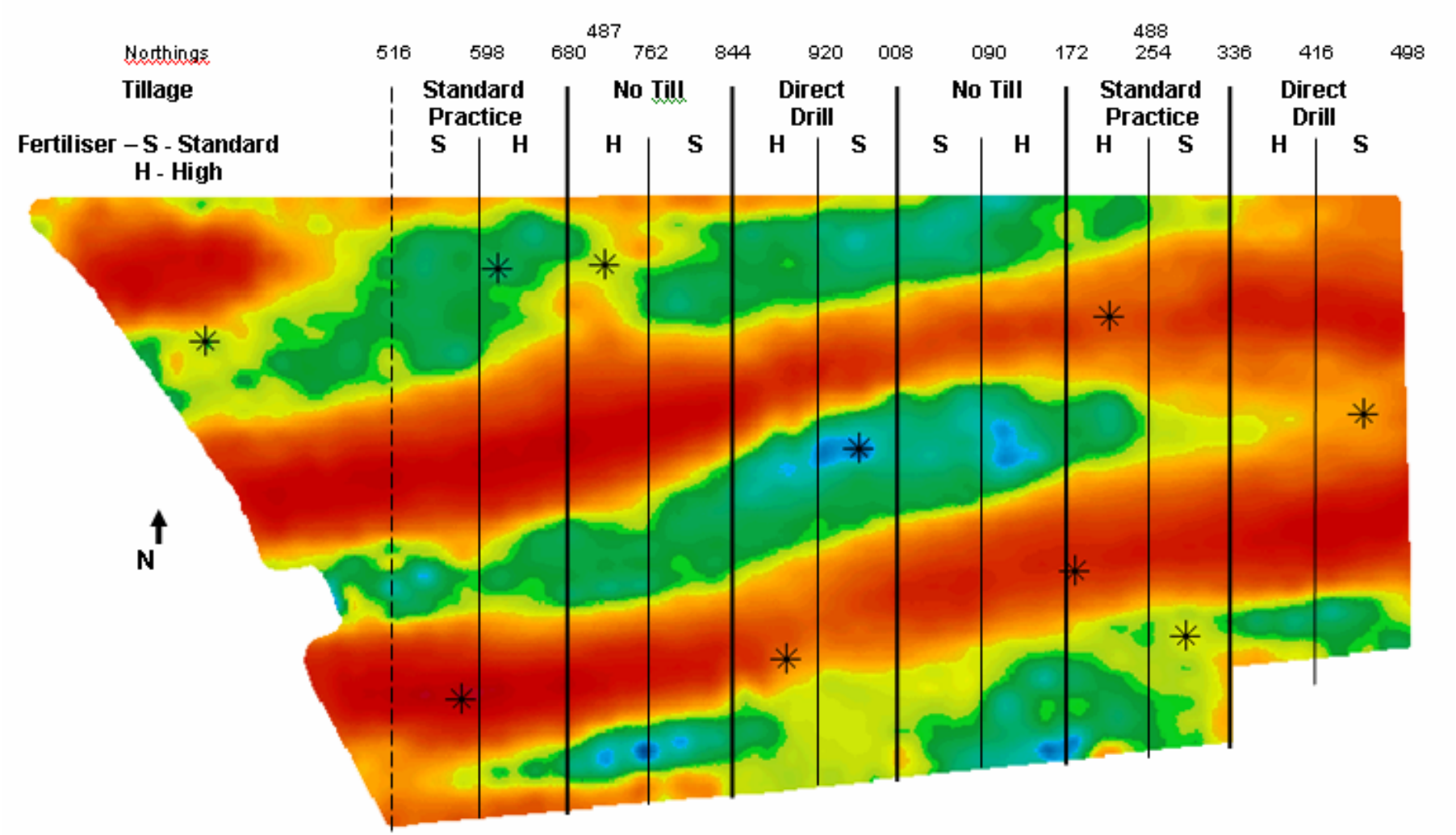

Figure 1. Trial treatment layout overlayed over EM38 map.

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Table 1. Effect of machine type and fertiliser input in five paddock zones on yield (t/ha), test weight (kg/hL), screenings (%<2mm), protein (%) and 1000 grain weight (g) at Meribah in 2009.

Tillage	Fert	EM38 Zone	Yield t/ha	% mean	Rank	TW kg/hL	Scrn %<2mm	Protein %	tkw g/1000
Conventional	Std	1	1.002	115	10	84.0	0.7	11.8	44.3
Conventional	Std	2	1.070	123	5	86.9	0.2	11.9	49.5
Conventional	Std	3	0.717	83	18	86.5	0.4	10.8	49.1
Conventional	Std	4	0.658	76	21	80.9	3.0	14.8	39.6
Conventional	Std	5	0.252	29	30	82.3	0.4	14.1	41.6
Conventional	High	1	0.840	97	13	81.9	0.3	12.9	45.5
Conventional	High	2	1.009	116	9	86.1	0.2	11.5	51.0
Conventional	High	3	0.561	65	24	81.8	0.2	14.1	45.9
Conventional	High	4	0.425	49	29	84.6	2.3	13.9	44.4
Conventional	High	5	0.553	64	25				
No Till	Std	1	0.987	114	11	84.8	0.2	11.5	47.6
No Till	Std	2	1.137	131	3	86.4	0.3	9.3	48.4
No Till	Std	3	0.805	93	14	85.8	0.2	12.7	46.3
No Till	Std	4	0.772	89	16	83.5	0.4	13.1	44.8
No Till	Std	5	0.652	75	22	86.6	0.2	12.6	47.4
No Till	High	1	1.030	119	8	81.3	0.5	14.3	46.3
No Till	High	2	1.138	131	2	86.3	0.2	10.8	50.3
No Till	High	3	0.792	91	15	86.2	0.1	8.2	50.7
No Till	High	4	0.704	81	19	81.7	0.2	14.5	44.8
No Till	High	5	0.888	102	12	82.9	1.0	14.0	44.3
Direct Drill	Std	1	1.047	120	7	87.0	0.1	9.3	50.8
Direct Drill	Std	2	1.062	122	6	84.8	0.2	10.5	49.2
Direct Drill	Std	3	0.687	79	20	83.9	0.8	13.8	42.0
Direct Drill	Std	4	0.514	59	27	83.8	1.3	13.4	43.4
Direct Drill	Std	5	0.610	70	23	85.6	0.3	13.6	48.3
Direct Drill	High	1	1.173	135	1	82.4	0.1	13.4	47.0
Direct Drill	High	2	1.098	126	4	85.9	0.3	11.9	48.1
Direct Drill	High	3	0.738	85	17	86.0	0.1	12.5	47.0
Direct Drill	High	4	0.534	61	26	81.1	0.2	14.3	40.8
Direct Drill	High	5	0.497	57	28	85.4	0.9	14.3	44.9
mean			0.869			84.4	0.5	12.5	46.3
lsd			ns (P<0.05)						

The lightest soil zones, 1 and 2, produced yields over 1 t/ha whereas on average zones 3-5 produced less than 75% of this yield. This yield pattern is consistent with results from 2008. Although there was no difference between the fertiliser or tillage treatments the standard fertiliser treatments produced better yield than high fertiliser and the Seed Hawk and direct drill machines bettered the conventional sowing. There were no significant interactions between any of the treatments and zones.

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Table 2. Yield and quality for trial treatments.

Fertiliser	Yield t/ha		% mean	TW kg/hL	Scrn %<2mm	Protein %	tkw g/1000
Standard	0.892	a	103	84.9	0.6	12.2	46.2
High	0.846	a	97	83.8	0.5	12.9	46.5
mean	0.869						
lsd	ns (P<0.05)						

Tillage	Yield t/ha		% mean	TW kg/hL	Scrn %<2mm	Protein %	tkw g/1000
Conventiona	0.809	a	93	83.9	0.9	13.0	45.8
No Till	0.912	a	105	84.5	0.3	12.1	47.1
Direct Drill	0.888	a	102	84.6	0.4	12.7	46.2
mean	0.869						
lsd	ns (P<0.05)						

Zone	Yield t/ha		% mean	TW kg/hL	Scrn %<2mm	Protein %	tkw g/1000
1	1.010	a	116	83.3	0.3	12.3	46.8
2	1.090	a	125	86.0	0.2	11.3	49.6
3	0.712	b	82	84.9	0.3	11.9	46.9
4	0.625	b	72	82.4	1.4	14.2	42.6
5	0.711	b	82	84.0	0.7	14.0	44.8
mean	0.869						
lsd	sig. (P<0.05)						

Overall grain quality was excellent – high test weights, very low screenings, proteins acceptable in H2 grade in most cases and very large grain size. There appears to be some small trends in the grain quality and the treatments – increasing protein from zones 1 to 5 and increased protein standard to high fertiliser.

Conclusion:

The dominant driver of yield, as in past years, has been the soil types as delineated by the paddock zones. The fact that there are no interactions between treatments and zones is another sign that zones over-ride all other treatments imposed on the paddock. The ability to map and zone the paddock in this way is a powerful tool along with the technology to draw out yields for zones and treatments from the yield map.

In this trial, grain quality is apparently largely unaffected by zone or treatment, whereas in the Paringa trial there were strong protein trends.

Who's Involved:
The trial is supported by

- Growers: Jody and Adam Flavel (Meribah),
- Consultants: Peter Treloar, Precision Ag Services, Vision Ag

Figure. 2. Sowing trial treatments at Meribah, 28th May 2009.

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- Darren and Danielle Nitschke for use of the Seed Hawk drill.
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Figure. 3. (L-R) Jody Flavel, Darren Nitschke and Adam Flavel discussing merits of seed equipment, 28th May 2009.