VARYING INPUTS TO IMPROVE PROFITABILITY OF CROPPING ON SHALLOW GRAVEL SOILS

Stephen Davies, Research Officer, Department of Agriculture and Food, WA
Lara Swift, Project Coordinator, Liebe Group & Roger Lawes, Research Scientist, CSIRO

AIM

To assess and demonstrate the benefits of varying fertiliser inputs across a range of productivity zones from a poor performing shallow gravel to a good performing loamy earth.

BACKGROUND

This trial is an on-farm demonstration for the Liebe Group's GRDC funded adoption project **'Growers critically analysing new technologies for improved farming systems'** and is also part of the GRDC funded project **'Putting precision agriculture on the ground in Western Australia'**.

With high input costs the opportunities to improve gross margin by using variable and lower inputs across paddocks with variable soil types and yield potential are of considerable importance. Poor performing soils often contain specific constraints such as water repellence, subsoil acidity or compaction or may have inherently poor water and nutrient holding capacity.

On the Kennedy family farm at Miling soil types include productive deep sands and sandy loams to poor performing loamy and sandy gravels with very high gravel contents (40-70% gravel) which results in low water holding capacity. High gravel content is an intractable problem and opportunities for spatial agronomic management primarily through reduced inputs are being considered as a tool to minimise costs associated with cropping these areas and improve gross margin.

TRIAL DETAILS

Property	Lance and Robyn Kennedy, Miling
Plot size & replication	12m x 1040m (1.25ha) x 2 replicates
Soil type	Loamy gravel and yellow loamy earth
Sowing date	27/5/08
Seeding rate	70 kg/ha
Fertiliser	K-Plant: Low rate = 40kg/ha; High rate = 80 kg/ha Urea Ammonium Nitrate (UAN): Low = 25 L/ha upfront + 50 L/ha on 23/7/08 Medium = 50 L/ha upfront + 50 L/ha on 23/7/08 High = 65 L/ha upfront + 100 L/ha on 23/7/08 (An additional 25 L/ha UAN was mistakenly applied to second replicate)
Paddock rotation	2005 = Wheat, 2006 = Wheat, 2007 = Wheat
Herbicides, Fungicides & Insecticides	Knockdown: 1.1 L/ha Raze (510 g/L glyphosate) 400 mL/ha Ester 600 350 mL/ha Metalachlor 1.5 L/ha Triflur Postemergent: 750 mL/ha Jaguar 50 mL/ha Brodal 65 mL/ha Topic 7 g/ha Rovral 800 mL/ha Ester 600 Fungicide: 145 mL/ha Stingray Insecticide: 500 mL/ha Dimethoate
Growing Season Rainfall	216mm

RESULTS

The trial is situated so that it runs down a hill slope through several distinct soil types with varying productivity. At the crest of the hill is a poor performing loamy gravel with up to 40% gravel in the top 10cm and up to 70% gravel in 10-30cm. The 10-30cm layer is very hard when dry due to reasonable clay content in the loamy soil matrix and root abundance in this layer was poor. The swale represents a zone of moderate productivity with increasing amount of loam over gravel while the valley floor is a productive yellow deep loamy earth with good root growth to 60cm.

Only preliminary results for the whole plots, which were given a specific fertiliser treatment, are presented here (Table 1) as spatial yield map analysis has not yet been completed. The second replicate of the trial accidently received an additional 25 kg/ha of UAN on 23/7/08 so the results of each replicate are presented separately as this additional UAN did appear to remove a small yield trend with increasing fertiliser application rate seen for rep 1 (Table 1).

Application of higher amount of K-Plant at seeding had no effect on yield or protein. Higher UAN application did increase grain protein by 0.3-0.7%. Wheat grade was downgraded from APW to general purpose (AGP) at the higher UAN treatments due to higher contamination by small foreign seeds, high frost or low hectolitre weight in these treatments.

Table 1: Yield, quality and grade of wheat for both replicates of a variable rate trial at Miling.

K-Plant (kg/ha)	UAN (L/ha)	Yield (t/ha)	Protein (%)	Screenings (%)	Grade	Gross Return ($/ha)[1]	Fertiliser Costs ($/ha)[2]	Gross return less fert. ($/ha)
				Replicate 1				
40	**25/50**	1.9	10.5	2.1	APW	570	73	498
40	**50/50**	1.8	10.9	1.3	APW	539	86	453
40	**65/100**	2.0	11.2	1.6	AGP	551	122	429
80	**25/50**	1.8	11.0	1.9	APW	539	103	436
80	**50/50**	2.0	10.6	1.8	AGP	551	117	434
80	**65/100**	2.1	11.3	3.3	AGP	582	153	430
				Replicate 2				
40	**25/75**	2.1	10.7	1.7	APW	638	86	552
40	**50/75**	2.1	10.7	1.6	APW	638	100	538
40	**65/125**	2.0	11.1	2.6	AGP	551	133	418
80	**25/75**	2.1	10.5	1.2	APW	638	117	521
80	**50/75**	2.2	10.7	2.2	APW	672	131	541
80	**65/125**	2.1	11.4	2.4	AGP	582	164	419

[1]Based on EPR on 31/12/08 for APW $338/tonne and AGP $313/tonne (AWB Western Pool No. 1) less estimated grain selling costs; [2]Costs based on prices in Farm Budget Guide 2008; [3]All other variable costs (eg. pesticides) not included but are the same regardless of treatment.

Overall best returns were achieved with low rates of upfront K-Plant fertiliser and low to moderate rates of UAN (table 1). The addition of an extra 25 kg/ha of UAN in July to the second rep for a total of 75kg UAN/ha at the low and moderate fertiliser application rates was sufficient to negate any yield differences and gave better returns than the 50 kg/ha UAN applied in the first rep (table 1).

COMMENTS

- Further analysis using yield monitor data will allow for a comparison of fertiliser rates on the different productivity zones in the paddock which should enable us to determine the benefit from applying lower fertiliser rates to the poorer productivity areas. In seasons with lower rainfall the differences in return between the low and high fertiliser treatments may be more pronounced.

- Overall the lower, more conservative, upfront fertiliser applications were the best strategy and there is still an opportunity to add more nitrogen later, depending on the season. Increased grain protein was the biggest impact of higher nitrogen inputs later in the season.

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CONTACTS:

Stephen Davies
Email: sdavies@agric.wa.gov.au
Ph: (08) 9956 8515

Lara Swift
Email: lara@liebegroup.asn.au
Ph: (08) 9664 2030

CROP SAFETY OF BOXER® GOLD AND CRUSADER

David Scholz, Merchandise Manager Dalwallinu, Elders Ltd

Aim

To investigate the crop safety of new products Boxer® Gold (Syngenta) and Crusader (Dow).

Background

Selectivity of Boxer® Gold in cereals is obtained by positioning herbicide away from the seed and by the ability of cereals to metabolise the herbicide to inactive compounds more rapidly than susceptible weed species.

Movement into the seed zone may induce crop damage from Boxer® Gold where heavy rainfall follows sowing, in the event of crop stresses including frost or in sandy soils with high leaching potential. Crusader, a group B post emergent grass herbicide, can cause transient stem shortening and crop yellowing but yield is normally unaffected.

Crusader was released in 2008 as a new post-emergent herbicide for the control of grass weeds and some broadleaf weeds in wheat. It has good activity on Brome grass, as well as wild oats and some activity on susceptible ryegrass. It also has good activity on many broadleaf weeds currently found in the WA cropping system. Use of Crusader can cause transient stem shortening and crop yellowing (when adverse growing conditions are experienced) but yield is normally unaffected.

Trial Details

Property	Clint, Ian and Helen Hunt, Marchagee
Plot size & replication	4m x 5m x 3 replicates
Soil type	Sandy loam
Sowing date	10/5/08
Seeding rate	100 kg/ha
Fertiliser	10/5/08: 50 kg/ha Urea (IBS), 50 kg/ha Muriate of Potash (IBS), 100 kg/ha Agstar extra (DB) 7/6/08: 50 kg/ha Urea (TD)
Paddock rotation	2006 = Wheat; 2007 = Wheat
Herbicides, Insecticides & Fungicides	10/5/08: 2 L/ha Spray.Seed®, IBS & PSPE treatments 18/5/08: Post-emergent treatments 7/6/08: Post-emergent treatments 1/7/08: Post-emergent Group B treatments 12/7/08: 500 mL/ha Tilt®
Growing Season Rainfall	234mm

The trial was sown at 5.5kph, using a knife point + presswheel configuration on 9 inch row spacing with seed at 3cm and into moisture. Treatment #3 (Boxer Gold 2.5 L/ha pspe) was applied when the crop was at 5% germination (½ leaf). The group B treatments were crossplotted across the IBS treatments and were not applied until 1/7/08 (52 days after sowing).

Results

Wheat in Boxer® Gold and Duet treatments were similar to the untreated control at 18 days after sowing, however there was a visual effect in the Trifluralin plots that was evident in each replicate. Plant numbers were significantly reduced in the Trifluralin treatment (table 1). Plot biomass was also significantly reduced in the Trifluralin treatment *cf.* Boxer® Gold and Duet (table 1).

Crop phyto-toxicity response from the application of group B herbicides were obvious at seven days after application, in the order Crusader > Atlantis > Monza. Plot biomass was not reduced by Monza® or Atlantis but use of Crusader resulted in a significant reduction of about 5% biomass (table 1). Crop damage from group B application appeared greater in Trifluralin treated plots compared with other IBS treatments, with Crusader showing the most damage of the group B's. Trifluralin + Crusader treated plots had reduced biomass, plant number and in general had shorter stems, but there was no interaction with main plot treatments (F(prob)=0.32ns), suggesting the crop damage from group B's did not increase when Trifluralin was used upfront compared to the use of Boxer Gold® or Duet, and in particular the damage caused by use of Crusader was not exacerbated by previous IBS herbicides.

Table 1: Visual ratings for plant number and plot biomass.

IBS Treatment	Plant	Visual rating of plot biomass for post-emergent group B treatments

	Number (% of control)	(% of control)				
		Untreated	**Crusader 500 mL/ha**	**Monza 25 g/ha**	**Atlantis 330 mL/ha**	**Mean**
Trifluralin 2.3 L/ha	81.7	91	82	86	91	87.4
Boxer Gold 2.5 L/ha (IBS)	97.3	97	95	98	97	96.6
Boxer Gold 2.5 L/ha (PSPE)	98.3	99	97	100	98	98.6
Boxer Gold 2.5 L/ha (Post-em)	96.0	98	92	99	97	96.3
Duet 2 L/ha	95.3	98	86	99	97	95.0
Mean	-	96.5	90.5	96.2	95.9	-
ANOVA for plant number	F(prob) < 0.001, LSD= 2.3, CV=5.8%					
ANOVA for plot biomass	Effect of main trt (IBS)- F(prob) = 0.010, LSD = 5.3					
Effect of sub plot	(Gp B)- F(prob) = 0.005, LSD = 2.7					
Interaction	F(prob) = 0.32, LSD = ns, CV = 4%					

Site mean yield was 2.88 t/ha. There was no significant difference in grain yield between main plots (Trifluralin v's BoxerGold v's Duet) or between the group B treatments (Table 2).

Table 2: Grain yield for each IBS and post-emergent treatment (t/ha).

IBS Treatment	**Post-emergent group B treatments**				**Means**
	Untreated	**Crusader 500 mL/ha**	**Monza 25 g/ha**	**Atlantis 330 mL/ha**	
Trifluralin 2.3 L/ha	2.68	2.54	2.60	2.84	2.67
Boxer Gold 2.5 L/ha (IBS)	2.85	2.84	2.98	3.06	2.93
Boxer Gold 2.5 L/ha (PSPE)	2.89	3.01	2.95	2.99	2.97
Boxer Gold 2.5 L/ha (Post-em)	3.01	3.08	3.11	3.00	3.05
Duet 2 L/ha	2.85	2.73	2.81	2.73	2.80
Means	2.86	2.84	2.89	2.93	2.88
Effect of main trt (IBS)-	F(prob) = 0.167, LSD = ns				
Effect of sub plot (Gp B)-	F(prob) = 0.823, LSD = ns,				
Interaction	F(prob) = 0.840, LSD = ns, CV=5.8%				

COMMENTS

- Trifluralin use resulted in significant crop damage at this site. This was surprising as crop safety has been shown at up to 3 L/ha for Trifluralin 480 g/L active rate in a minimum tillage situation. Plant number (visual rating) was significantly reduced and about 30% of emerged plants suffered a retardation of growth. This also highlighted the relative crop safety of Boxer® Gold, although the superior plant establishment from Boxer® Gold in this trial did not significantly improve yield.

- Crusader can cause early crop damage, and the label does warn about crop yellowing, but in general the crop will “grow out” of this damage in a matter of weeks. Although at this site Crusader reduced plot biomass significantly by about 5% compared with Monza or Atlantis and biomass reduction was present beyond tillering and stem elongation.

- Crop phyto-toxicity responses to the application of the group B's coincided with infection from Yellow Leaf Spot (*Pyrenophora tritici repentis*). It is possible that disease may have disguised the extent of crop damage resulting from herbicide use.

- To give the grower peace of mind, although Trifluralin and Crusader caused significant crop damage, there was no effect on crop grain yield, and the crop safety of Boxer Gold was a feature at this site.

- Please note: The product label for Boxer Gold specifies IBS use only, always follow the label.

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CONTACT:
David Scholz
Email: david.scholz@elders.com.au
Ph: (08) 9661 2000