Ripping by timing of nitrogen demonstration

Bill Bowden and Chris Wilkins, WMG

Purpose: To demonstrate that, in the right season, ripping affects nitrogen uptake efficiency and availability to crops

Location: Charles Roberts, "Kayanaba", Dandaragan

Soil Type: Wakea, red loamy sand

Soil Test Results:

Soil analyses for adjacent Summit K trial site

Depth	NH4 +	NO3-	P	K	S	Cu	Zn	Org C	pH[Ca]	Al	EC	PBI
0-10	14	2	29	38	6	0.64	0.3	0.69	5.1	0.6	0.04	35
10-20	8	2	19	32	5	0.63	0.15	0.59	4.6	0.3	0.02	44
20-30	3	1	8	32	6	0.31	0.02	0.31	4.5	1.2	0.02	45

Rotation: Canola stubble and burnt windrows. 2014: canola, 2013: wheat, 2012: oats

Growing Season Rainfall (April- October 2015): as for 2015 the WMG field day site

BACKGROUND SUMMARY

Removing chemical (acidity) or mechanical (plough or traffic) pans allows crop roots to penetrate soils more rapidly and so keep up with leaching nitrate nitrogen and improve nitrogen uptake efficiency. Ripping or deep cultivation can also stimulate nitrogen mineralization. Deeper roots also allow crops to access deeper water and so perform better in seasons with a dry finish or terminal drought. Given the right shaped season this work will demonstrate some of those effects.

We also tested direct diagnostics at this site using a long ripped strip in the paddock and canola windrow effects.

TRIAL DESIGN

This is a split, split plot latin square, design. Ripped and non-ripped plots are crossed with 4 time of nitrogen treatments (nil, 50 kg N/ha at 4 weeks after seeding, 8 weeks after seeding and at 4 and 8 weeks after seeding.

Plot size: 10 metres by 3 metres

Machinery use: Ripped with the DAFWA Merredin ripper to 35 cm with modified box boots. The trial was sown by the farmer as a bulk wheat crop across the ripped treatments

Repetitions: 4

Crop type and varieties used: Mace wheat

Seeding rates and dates: Sown on 25 May with Mace wheat at 100kg/ha. 80 kg/ha of MAXamRITE and 50 litres/ha of MAXamFLO applied at seeding. 100kg NKS applied in late June.

Rates of basal nutrients- 50kg N/ha, 15 kg P/ha, 22 kg K/ha and 9 kg S/ha

Treatment rates and dates: The 4/5 WAS N treatments were applied at 110 kg urea/ha on 1 July and the 8/9 WAS N treatments were applied at 110 kg urea/ha on 29 July.

Herbicide rates and dates:

First knock (pre seeding)	Seeding 25th May	Post seeding	Post seeding
80L Water Rate	80L Water rate	100L Water rate	300mL Tebuconazole
0.4L 2,4-D ester 680	2L trifluralin 480	0.8L 2,4-D ester 680	Alpha Cyper 125mL
1.8L Roundup 570	1L Sprayseed	10g Logran	Wetter 1000 0.2%
	300ml chlorpyrifos	50g Lontrel	

Other applications/ treatment rates and dates:

TRIAL LAYOUT

▲				<----------40 metres---------->					
	north		north						
		fence							
		bend	1	4was	4+8 was	nil	8 was	rip 2.4 metres wide, 3 metre centres	
		to NE- right	2	4was	4+8 was	nil	8 was		
	cattle yards		3	nil	4was	8 was	4+8 was		
			4	nil	4was	8 was	4+8 was	rip 2.4 metres wide, 3 metre centres	
			5	8 was	nil	4+8 was	4was	rip 2.4 metres wide, 3 metre centres	
			6	8 was	nil	4+8 was	4was		
			7	4+8 was	8 was	4was	nil		
			8	4+8 was	8 was	4was	nil	rip 2.4 metres wide, 3 metre centres	
		south							

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RESULTS

The results from measurements during the season and at maturity are shown below.

		plt/M^2	Biomass in t/ha				Yield components				
		10 July	29 July	11 Aug	8 Sept	9 Nov	Yield	HI	head #	tgw	screen%
Mean	Rip	150	0.7	1.2	3.3	4.9	2.0	0.41	248	31.0	17
Mean	No rip	85	0.4	0.8	2.4	3.3	1.3	0.39	194	31.0	23
C of V	Rip	NA	0.25	0.2	0.10	0.11	0.09	0.05	0.11	0.05	0.25
C of V	No rip	NA	0.36	0.4	0.28	0.35	0.39	0.17	0.22	0.05	0.43

Results were averaged across N treatments for all in-season measurements. The final biomass and yield component measurements were made on the control (no N except for farmer basal applications) and the 100 kg N/ha split application treatments only.

Key benefits from deep ripping in the trial were:

- Plant establishment improved by 76%, an increase of 65 plants/m^2;
- Biomass improvements, these were evident from the first sampling and by maturity (9 November) biomass of the ripped plots was 48% higher, 1.6 t/ha more shoot biomass;

- The ripped crop was far less variable than the non-ripped crop as seen in the lower coefficient of variation (C of V) numbers for almost all measurements;
- Grain yield was increased by 700 kg/ha, a 53% increase over the unripped control, this was partly a result of higher head numbers (28% more) in the ripped treatment and lower screenings.

The diagnostic ripped strip was sampled in two places in the paddock– (1) in a severely non-wetting area south of the trial where there was a marked response in both establishment and growth and (2) north of the trial where there were no establishment differences but a small growth response. The diagnostic windrows were sampled north of trial (2) on 10 July and also south of trial (3) on better crop performing country in the valley on heavier soil on 18th August (3). These were paired on/off samples with no replicates – see the table below.

Rip strip yield components - Kanyana 2015

sandy soil		plants #/M^2	spring tops kg/ha	mature tops kg/ha	head # / M^2	grain yield kg/ha	HI total	screen <2mm %	tgw grams total	grains #/hd total
2 wettable	rip	166	3600	6700	305	2775	0.41	9.9	29.9	30
2 wettable	norip	120	3100	5700	285	2250	0.39	12.2	26.6	30
1 non wet	rip	105	2700	4700	210	2000	0.43	11.3	35.1	27
1 non wet	norip	66	1600	2200	168	775	0.35	61.3	23.6	20

Windrow yield components - Kanyana 2015

soil		K % early	tops dwt kg/ha early	tops dwt kg/ha mature	head # / M^2	yield kg/ha	HI total	<2mm %	tgm gms	#/hd total
2 sandy	on	4.0	519	2088	205	1950	0.47	7.7	30.3	31
2 sandy	off	2.2	139	2150	250	1625	0.38	26.2	28.9	23
3 loamy	on	2.8	1744	10930	393	4600	0.42	1.6	31.8	37
3 loamy	off	1.4	1500	9700	470	4255	0.44	3.6	25.6	35

Key points in the above tables are:

- The strip on non-wetting soil showed much better establishment and a large % biomass (114%) and yield (158%) increases over the non-ripped area. These effects were also seen on the more wettable site but were not as large;
- Ripping not only increased yield, grain size (tgw) and harvest index (HI) but decreased screenings;
- The crops on the windrows had higher K% at the sampling times and also had higher biomass than those off the windrows, indicating much greater K uptake;
- The higher K status plants gave greater grain yields due largely to higher grains/head and grain size (tgw) and lower screenings than those off the windrows.

DISCUSSION

There has been a major response to ripping but little response to nitrogen above and beyond the farmer dressings. The ripping treatment markedly improved crop emergence numbers and timing. The very dry nature of the season after seeding has meant no leaching of nitrogen and therefore no improvement in nitrogen uptake efficiency due to faster root

penetration on the ripped plots. Plant counts, estimated biomass levels and yield components are shown in the table of results, above.

There was a marked establishment and growth response to ripping and variability was much more marked on the non-ripped plots than on those which were ripped. Measures of surface soil wettability showed no difference between ripping so the better establishment was probably due to better and more uniform wetting on the rougher, more disturbed, ripped soil. Ripping gave better early growth but also better finishing conditions as reflected in higher harvest indices and lower screenings. The ripped strip samplings emphasized this point so it seems that the ripping allowed better access to stored sub-soil moisture over the harsh finish to the season. Plant samples from on and off the ripped strips showed no difference in K status.

We sampled on and off visually obvious windrows north of trial (2) on 10 July and south of trial (3) on heavier country on 18th August. Both sites showed unambiguous K deficiency which again was reflected in better grain size and lower screening measures on the K adequate windrow. The sandy site had more severe K deficiency and bigger responses than the loamy site which had a higher soil K status. Both areas would respond to K fertilizer applications.

PEER REVIEW

Stephen Davies (DAFWA)

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