WHEAT

"Wheat Agronomy Trials"

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Key Outcomes:

- In 2010 we saw little effect of varying nitrogen rates on grain yield at Conmurra or Frances
- Barley Yellow Dwarf Virus decreased grain yield by about 1 t/ha at both sites in 2010
- Highest grain yield was achieved by the earlier sowing dates but very good disease control was required to achieve this

Trial Objectives: To assess the yield of a range of agronomic treatments on wheat varieties at several sites

Trial Duration: 2009-10
Location: Various
Farmer Co-operators: Lachie Seears, Martin & Kirsty Flower
Soil Type: Various
Paddock History: 2009 Canola (both sites)
Monthly Rainfall:

Rain	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec	April-Oct	Total
Frances, 2010	14.4	40.8	26.8	60.6	31.6	57.6	43.8	119.2	55.4	29.8	29.2	92.2	398	601.4
Conmurra, 2010	18	35.2	24.8	65.2	42	77.4	48.8	146.8	74.8	29.4	27.4	130.2	484.4	720

Yield Limiting Factors: BYDV (Barley Yellow Dwarf Virus) at both Conmurra and Frances
Type of Trial: Replicated Plot Trial
Trial Design: 8m Long Plots x 8 Rows at 15cm Spacings (1.2m);
1.5 Replicates

Treatments:

Wheat agronomy trials were sown in a one and a half replicate design at both Conmurra and Frances. Treatments included;

- Time of sowing (x2)
- Variety Treatments (x4)
- +/- Spray to control Aphids (and therefore BYDV)
- Varying Nitrogen rates (x4)
- Time of Nitrogen applications (early development to GS31)

Trials were sprayed with fungicide to control stripe rust. All trials were sown with small plot equipment and managed as per usual agronomic treatment. Grain yield was determined by machine harvest. Statistically significant results are presented in tables below.

Results:

Table 1: Effect of variety and sowing date on yield and quality of wheat at Conmurra, 2010

Variety	Yield kg/ha		1000 grain wt		Test wt (kg/hl)		Protein		Screenings	
Column1	TOS 1	TOS 2	TOS 1	TOS 2	TOS 1	TOS 2	TOS 1	TOS 2	TOS 1	TOS 29
Brennan	7044	6396	42.24	40.62	75.64	75.41	14.26	14.47	1.06	1.22
Espada	7620	7571	42.44	39.24	73.64	72.89	15.15	14.78	1.04	1.11
Mackellar	7940	6874	34.3	30.31	72.33	69.61	12.89	13.76	4.01	6.35
Preston	9468	7779	40.26	35.42	73.31	70.62	13.47	13.49	1.22	2.71

Conmurra: **Time of Sowing 1: 19th May 2010**
Time of Sowing 2: 15th June 2010

Table 2: Effect of control of BYDV and sowing time on yield and quality of wheat at Conmurra, 2010

	Yield kg/ha		1000 grain wt		Test wt (kg/hl)		Protein	
BYDV control	Nil	Sprayed	Nil	Sprayed	Nil	Sprayed	Nil	Sprayed
TOS 1	7580	8456	38.75	40.87	73.42	74.04	14.17	13.72
TOS 2	6966	7344	36.17	36.62	72.07	72.19	14.09	14.16

Table 3: Effect of variety and control of BYDV on yield and quality of wheat at Conmurra, 2010

Variety ↓	Yield kg/ha		1000 grain wt		Test wt (kg/hl)		Protein	
BYDV control→	Nil	Sprayed	Nil	Sprayed	Nil	Sprayed	Nil	Sprayed
Brennan	6288	7152	40.5	42.36	75.15	75.89	14.59	14.15
Espada	7138	8054	39.66	42.01	72.89	73.64	14.98	14.95
Mackellar	7264	7550	32.35	32.26	71	70.93	13.34	13.31
Preston	8402	8844	37.33	38.35	71.93	71.99	13.62	13.34

Table 4: Effect of variety and sowing date on yield and quality of wheat at Frances, 2010

Variety	Yield kg/ha		1000 grain wt		Test wt (kg/hl)		Protein	
	TOS 1	TOS 2	TOS 1	TOS 2	TOS 1	TOS 2	TOS 1	TOS 2
Espada	3755	3108	39.54	37.95	73.28	74.46	12.52	12.29
Gladius	2796	2435	41.94	39.23	72.85	74.17	13.7	12.72
Preston	4044	3532	38.97	38.77	73.07	73.64	11.59	11.64
Pugsley	4014	2954	38.42	36.51	74.57	75.01	11.32	11.95

Frances: **Time of Sowing 1: 12th May 2010**
Time of Sowing 2: 2nd June 2010

Table 5: Effect of variety and control of BYDV on yield and quality of wheat at Frances 2010

Variety ↓	Yield kg/ha		Test wt (kg/hl)		Protein	
BYDV control→	Nil	Sprayed	Nil	Sprayed	Nil	Sprayed
Espada	2897	3966	73.27	74.47	12.88	11.93
Gladius	2175	3056	72.81	74.22	13.86	12.56
Preston	3374	4202	73.18	73.52	11.86	11.37
Pugsley	3045	3922	74.46	75.11	11.97	11.31

Table 6: Effect of N rate on yield and protein of wheat at Conmurra and Frances, 2010

Nitrogen rate	Yield (kg/ha)		Protein	
(kgN/ha)	**Conmurra**	**Frances**	**Conmurra**	**Frances**
0	7755	3229	13.72	11.45
25	7535	3334	13.9	12
50	7570	3389	14.15	12.3
100	7487	3365	14.36	13.12

Table 7: Effect of timing of N application on protein of wheat at Frances, 2010

N Timing	Protein	
	TOS 1	**TOS 2**
Sowing	12.34	12.08
GS31	12.23	12.22

Comments

Time of Sowing;

Preston produced the highest grain yields at both sowing dates at Conmurra (Table 1) (although there was a decrease in yield by delaying the time of sowing), while Espada produced similar yields at both times of sowing. Mackellar produced up to 7.9 t/ha at the first sowing date, but both Mackellar and Brennan yielded only 6.9 and 6.4 t/ha respectively at the later sowing as would be expected with winter wheat varieties. Grain size of Mackellar was low at both sowing dates. At Frances, Preston and Pugsley produced 4 t/ha at the first sowing but Preston still produced 3.5 t/ha in the later sowing (Table 4). Gladius produced the lowest yield at both sowing dates with Espada being intermediate between Gladius and Preston and Pugsley.

At both sites, grain size was reduced by later sowing, however test weight tended to decrease at Conmurra (Table 1), but increase at Frances as sowing was delayed (Table 4). There was little effect of sowing date on grain protein at Frances, but at Conmurra with delayed sowing, Brennan and Mackellar increased slightly in protein content. Other varieties weren't really affected. At Frances, the protein of Espada and Gladius tended to decrease with delayed sowing while Preston and Pugsley increased slightly. The tendency at both sites was for the later maturing varieties to produce higher protein as sowing was delayed.

Timing of Nitrogen Application;

There was a slight decrease in grain yield with an increased application rate of nitrogen at Conmurra, but a slight increase in grain yield at Frances (Table 6). This result was very different from the large effects of applied nitrogen in 2009. At both sites grain protein content increased with increased rates of nitrogen. There was a significant interaction between time of sowing and nitrogen application timing at Frances (Table 7). Protein content was higher when nitrogen was applied at sowing in the first sowing date but lower in the second sowing. This was very different from what had been seen in previous years when later sowings gave higher protein as did the GS31 application.

BYDV Control;

At both sites the level of Barley Yellow Dwarf Virus (BYDV) was high with yield responses of 0.9-1 t/ha resulting for the susceptible varieties (Tables 3 and 5). The tolerant variety Mackellar once again showed little response to aphid control treatments at Conmurra as has been shown in previous years. At both sites, control of aphids and hence control of BYDV increased grain size and test weight but had variable results on grain protein content. We have also seen little effect of BYDV on protein in previous years, even when grain yield increases have been as high as 2.5 t/ha.

BYDV is transmitted by aphids and is persistent which means that it infects the aphid and the aphid will then continue to transmit the virus for the rest of its life. Low numbers of aphids can still cause significant spread of BYDV. The aphid takes about one day to intake the virus so that it can then pass it on to plants. There are different biotypes of BYDV and these are transmitted by different species of aphids. Both the oat aphid (Rhopalosiphum padi) and the maize aphid (Rhopalosiphum maidis) can transmit the disease. Symptoms of BYDV vary with crop from severe reddening of leaves with oats to golden leaves in barley. Wheat leaves show a red to purple colouration of the tip in particular. Infected plants have reduced above ground biomass and also a reduced root system. This results in reduced grain size and therefore lower grain yield.

Predicting the likelihood of BYDV in cereals seems to rely on predicting what conditions allow aphids to survive over summer, ie. The greater the rainfall over summer and just before sowing, the greater the chance of aphid survival and therefore early infection of plants that leads to greater plant damage (Figure 1). Many perennial grasses in pastures and roadsides are infected with BYDV and so if aphids occur early they can pick up the disease from these grasses and then transmit it to cereals. Early infection results in the greatest yield loss.

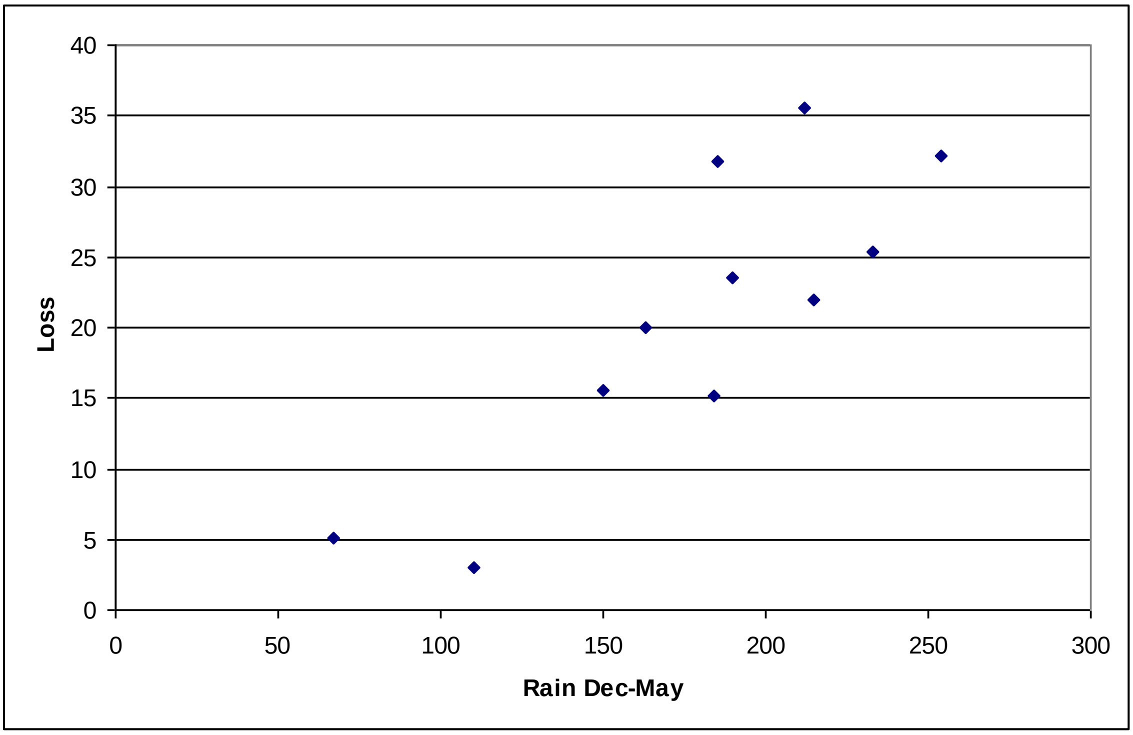

Figure 1: The level of yield loss from BYDV as affected by summer and autumn rainfall over a number of years

If you decide to do something about aphids it is critical that you plan your control strategy. Do not wait until you have found some aphids as they will have infected your crop already.

Seed dressings with imidacloprid have been shown to reduce aphids in cereal crops at the early stage of growth when cereals are most susceptible to BYDV. Do not graze treated cereal crops within 9 weeks of sowing. In high risk areas, a top up spray as below is recommended at 6-8 weeks after sowing.

In addition, in trials and in crops in WA, synthetic pyrethroids have been shown to repel aphids and therefore result in increased yield in years when aphids are present in high numbers, particularly when plants are young and small. Trial work in WA has shown that foliar sprays of synthetic pyrethroids at 3 and 7 weeks after crop emergence decreased BYDV spread by up to 87% and increased grain yields by up to 41%. These insecticides kill aphids but also have an anti-feeding effect that deters new aphids from feeding for a further 3-4 weeks. We have found similar results in the South East. These insecticides can be tank mixed with many herbicides and so will reduce spraying costs.

Conclusion and into the paddock

- Little effect of applied nitrogen on grain yield was seen in 2010 except for increasing grain protein content.
- Earlier sowing gave the highest grain yields at both sites but also resulted in the greatest response to controlling BYDV.
- Control of BYDV increased grain yield by about 1 t/ha in all varieties except Mackellar which has tolerance to this disease.

Figure 2: BYDV Syptoms

Acknowledgements

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