CROP SEQUENCING and GRAIN&GRAZE 2 TRIALS, 2012 LOCHABER

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Key Outcomes:

- Wheat sown after break crops produced up to 1 t/ha more than wheat after wheat
- The greatest benefit of the break crop was produced at the earliest sowing
- Safflower produced the break crop effect but produced low wheat yields, small grain but high protein due to drying out the soil profile.

Trial Objectives: To explore rotational options for the South East region with the aim of improving yield and water use efficiency of these and subsequent wheat crops.

Trial Duration: 2011-2014
Location: Naracoorte (north) **Farmer Co-operators**: Ranch Miles
Soil Type: Loam over clay
Paddock History: Barley in 2010, beans in 2011

Monthly Rainfall:

Yield Limiting Factors: Late sown due to late start, dry finish
Type of Trial: Replicated plot trial
Trial Design: Split split plot

Treatments:

Rotational crops:

A range of rotational crops was sown in plots 18 m long by 9 m wide. Antas sub clover, canola and beans were sown on 31 May, wheat on 7 June and winter peas on 26 June. Antas sub clover and canola were also sown to measure dry matter of a hay crop (Antas) and a crop cut to simulate a frost (canola). Later in spring, barley, safflower and pea plots were sown on 10 September. All trials were sown with small plot equipment and managed as per usual agronomic treatment. All wheat plots were sprayed with fungicides to control

any stripe rust. Grain yield was determined by machine harvest.

Soil water was measured on several bulked samples taken before sowing, with another measurement taken after harvest of all plots. Crop dry matter was measured at flowering.

Wheat sown after rotational crops:

A range of rotational crops had been sown in 2011. After harvest of these crops, all plots were sampled at 0-10 cm to get the Predicta B test of fungal pathogens present after each rotational crop. Significant differences were noted for different pathogens under different rotational treatments. Medium to high levels of several pathogens were noted after wheat. These pathogens included Take-all, Rhizoctonia solani, Fusarium colmorum and Mycosphaerella piondes/ Phoma medicoginis var pinodella. Little or none of these pathogens were recorded after the break crops. Little or no Pratylenchus neglectus, Pratylenchus, stem nematode and crown rot were found in any rotational crops.

In April, all plots were sampled at 0-10 cm and 10-60 cm to measure the amount of ammonium and nitrate nitrogen present before sowing.

Following the series of rotational crops sown in 2011, Scout wheat was sown at 100 kg/ha on two sowing times (7 June and 26 June 2012). Nitrogen (25, 50, 75, 100 kgN/ha) was applied at GS31 to all plots. All trials were sown with small plot equipment and managed as per usual agronomic treatment. All plots were sprayed with fungicides to control any stripe rust. Grain yield was determined by machine harvest.

Soil water was measured before sowing and after harvest to determine water use and water use efficiency of wheat following the range of rotational crops.

Results:

Table 1: Dry matter production (t/ha) at Lochaber 2012

Treatment	t/ha DM
Canola grazed (22/8)	1.53
Canola hay (11/10)	9.07
Antas (7/11)	6.04

Table 2: Grain yield of rotational crops (kg/ha) at Lochaber 2012

Crop	Yield kg/ha
Barley (Spring)	775
Beans	2090
Canola	1721
Canola G&G	1234
Peas (Spring)	495
Peas (Winter)	2832
Safflower	*
Wheat	4065
Lsd (0.05)	597

* safflower plots were damaged by birds, grain yield was estimated in quadrats but probably over estimated yield.

Table 3: Grain yield of wheat following a range of rotational crops (kg/ha) at two sowing dates at Lochaber 2012

Previous crop	TOS1 kg/ha	TOS2 kg/ha
Antas	6130	5723
Barley(spring)	5338	4921
Beans	5394	4466
Canola	5880	5134
Canola(Hay)	5828	5130
Canola G&G	5466	4775
Peas(spring)	6191	5353
Peas(winter)	6005	5296
Safflower	4695	4328
Wheat	4925	4617
Wheat(30cm rows)	4850	4596
Wheat G&G	4875	4784

Table 4: Grain yield of wheat following a range of rotational crops (kg/ha) at four rates of nitrogen applied at GS31 at Lochaber 2012

Previous crop	25N kg/ha	50N kg/ha	75N kg/ha	100N kg/ha	Mean kg/ha
Antas	5848	6098	5923	5838	5927
Peas(spring)	5941	5691	5745	5714	5773
Peas(winter)	5856	5641	5559	5546	5650
Canola	5468	5388	5648	5522	5506
Canola(Hay)	5467	5555	5415	5480	5479
Barley(spring)	5021	5441	5109	4947	5130
Canola G&G	5309	5146	4998	5030	5120
Beans	5037	4967	4973	4743	4930
Wheat G&G	4614	4795	4936	4972	4829
Wheat	4753	4534	5016	4782	4771
Wheat(30cm rows)	4596	4605	4863	4829	4723
Safflower	4593	4439	4548	4468	4512

Table 5: Grain size (g) and protein content (%) of wheat following a range of rotational crops at Lochaber 2012

Previous crop	1000 grain wt (g)	Protein (%)
Antas	41.0	11.4
Barley(spring)	42.0	11.3
Beans	42.0	11.2
Canola	43.4	11.1
Canola(Hay)	40.8	11.6
Canola G&G	44.1	11.0
Peas(spring)	40.4	11.6
Peas(winter)	42.1	10.9
Safflower	33.4	13.0
Wheat	39.7	11.2
Wheat(30cm rows)	42.4	10.2
Wheat G&G	43.2	10.2

Table 6: Grain size (g) and protein content (%) of wheat at four rates of nitrogen at Lochaber 2012

Nitrogen rate	1000 grain wt (g)	Protein (%)
25N	42.1	10.9
50N	41.2	11.2
75N	40.9	11.4
100N	40.7	11.5

Table 7: Grain size (g) and protein content (%) of wheat at two sowing dates at Lochaber 2012

Time of sowing	1000 grain wt (g)	Protein (%)
TOS1	42.2	11.1
TOS2	40.2	11.3

Comments:

Rotational crops:

Sowing of the range of rotational crops was delayed due to very dry conditions. Antas sub clover, canola and beans were sown on 31 May, wheat on 7 June and winter peas on 26 June. As well, conditions remained dry after early September and the spring crops were sown on 10 September.

Delayed sowing had the effect of reducing the dry matter production when canola was cut on 22 August to simulate grazing

(Table 1). Canola was cut on 11 October to simulate what a farmer could do if his crop was frosted. About 9 t/ha of dry matter was produced which is similar to that produced in 2011. Antas sub clover was cut on 7 November at peak biomass and about 6 t/ha was produced (Table 1). The Antas produced less biomass than in 2011, probably due to the dry spring.

At harvest, wheat still produced about 4 t/ha (Table 2). Winter sown peas and beans produced 2.8 and 2.1 t/ha respectively. The canola that had been mown to simulate grazing did not recover as well as it did in 2011 and produced 1.2 t/ha compared to 1.7 t/ha for the canola that was not grazed. Spring crops were severely affected by the dry conditions and produced much lower yields than in 2011 (Table 2).

Wheat sown after rotational crops:

The wheat was sown on 7 June and 26 June to determine if the "break crop effect" was different as sowing was delayed. There was a significant interaction between previous crop and sowing date (Table 3) and wheat sown after the break crops did produce higher grain yields relative to wheat sown after a cereal sown in winter in 2011, or safflower, especially at the earlier sowing date. Overall, the break crops produced wheat yields of about 1 t/ha higher than wheat after wheat at the first sowing date and about 0.4 t/ha at the second sowing. The mean decrease in yield from the first sowing to the second sowing date was about 0.7 t/ha for wheat after pulses and canola but 0.2 t/ha for wheat after wheat.

There was a weak interaction (p=0.02) between previous crop and applied nitrogen with wheat after wheat and wheat after spring barley producing slightly increased grain yield with increased nitrogen application rate (Table 4). It is likely that with a wetter finish to the season we would have seen more of a response to nitrogen.

There were few significant effects of previous crop, sowing date or nitrogen rate on grain quality (Tables 5, 6 and 7). Wheat grown after safflower produced the smallest grain size but highest protein content (Table 5). This is presumably due to reduced soil water caused by the safflower crop growing over the previous spring and summer. As ould be expected, delaying sowing decreased grain size and increased protein content while increasing nitrogen rate decreased grain size and increased protein content (Tables 6 and 7).

Conclusion and into the paddock

Grain production from the rotational crops sown in 2012 was less than in 2011 due to the dry finish to the season. In particular, spring sown crops were much more affected.

The break crops produced increased grain yields of wheat in the following year with the greatest yield increase being produced at the earlier sowing date. There was some difference in yield between wheat following pulses compared to wheat following canola,

mean difference of 0.2 t/ha. While safflower also acted as a cereal disease break crop, the wheat following was severely impacted by dry conditions and produced lower grain yields, lower grain weight but higher grain protein.

If you are trying to benefit from growing a break crop in the rotation you should aim to maximise the growing season for the following wheat crop.

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