



2015 Seasonal effects of strategic stubble treatments on *wheat* and *barley* in CWFS districts; Year 3 of a 5 year investigation

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GRDC project CWF00018 – Maintaining profitable farming systems with retained stubble in Central West, NSW

Key Points

- During 2015 stubble treatments involving late burning or cultivation resulted in significantly different yields in wheat and barley in 2 of 3 trials conducted at Tottenham, Weethalle, and Mumbil Creek.
- The stubble treatments had no effect on cultivar rankings or grain quality at any site.
- The effects of stubble treatments observed during 2015 were similar to the effects observed during similar trials in 2013 and 2014. The trend emerging is best summarised:
“Cultivation late in fallow to reduce stubble loads for sowing is the most likely option to reduce yield unless it resolves a physical soil constraint such as compaction or established hard to kill weeds. Burning late in fallow to reduce stubble loads for sowing is unlikely to significantly improve yields compared to sowing into district typical standing stubbles. Burning may be a good last minute option where despite good planning, stubble is still interfering with sowing.”

Background

CWFS are conducting trials at its regional sites that:

- investigate the impact of different stubble treatments (burning, cultivation or standing stubble) imposed towards the end of the fallow have on the yield of wheat and barley
- evaluate any cultivar responses within crop species to the impact of the different stubble treatments.

During 2013 and 2014 CWFS has conducted similar trials at 12 locations Tottenham, Euabalong, Weethalle, Rankins Springs, Wirrinya, Nyngan, Alectown, Gunning Gap, Lake Cargelligo, Ungarie and Tullamore (2 trials) which have been reported previously. Small statistically significant differences in yield due to stubble treatments were observed at 8 of the 12 trials. No cultivar responses to stubble treatments have been observed.

Ongoing trials during the CWFS “Rain n Grain n Stubble” project will hopefully allow responses to be predicted pre-sowing rather than just measured at harvest.

Agronomic issues

Stubble retention during fallows within cropping systems in CWFS districts is a common practice. The 2013 CWFS farmer survey (representing 47 producers managing 207,000 ha) highlighted that 70% of producers regularly maintained stubble cover over summer, whilst 20% regularly maintained fallows by cultivation alone. No simple relationship between farm size and stubble management practice could be determined. Anecdotally, the reliance on herbicide for weed control in stubble retained systems, and the increasing threat to system profitability posed by herbicide resistant and hard to kill summer weeds, have seen the adoption of more integrated weed management programs; including a reversion to stubble burning and cultivation. CWFS members are asking about short and longer term impacts of using chemical fallows, cultivation and burning in more seasonally specific dynamic combinations to resolve agronomic problems such as weeds, pests, disease or crop nutrition issues, with the aim of increasing profitability.

Trial design

The trial was 12 ranges and 10 rows, and consisted of 4 replicates. Each replicate was 3 ranges. The trial was a split plot with varieties nested in (stubble x crop) nested in replicates. There were 3 stubble treatments: standing, burnt and cultivated. There were 2 crop species, wheat and barley. For each crop species there were 5 varieties tested. They were selected on the basis “farmer interest” and type (early, late, disease response etc).

burnt	8	9	6	7	10	5	1	3	4	2
cult	6	7	10	8	9	2	4	3	1	5
standing	9	8	6	7	10	3	5	4	1	2
burnt	5	3	1	2	4	10	6	8	7	9
cult	1	2	4	3	5	7	8	10	6	9
standing	5	2	1	3	4	10	7	8	9	6
standing	2	3	1	4	5	8	10	7	9	6
cult	5	2	1	4	3	8	7	6	9	10
burnt	4	1	5	2	3	9	7	10	6	8
cult	7	8	9	6	10	3	1	4	5	2
standing	10	6	7	8	9	4	3	2	1	5
burnt	8	7	9	10	6	3	4	2	1	5

wheat (green)	barley (yellow)
1 gregory	6 Latrobe
2 Suntop	7 Compass
3 Livingston	8 Commander
4 Spitfire	9 Buloke
5 Condo	10 Oxford

Figure 1: 2015 trial plan.

2015 trial sites:

Wirrinya

The trial at the Wirrinya regional site suffered significant herbicide damage and will not be reported.

Mumbil Creek

Co-operator; Jeff and Tim Bennett

Paddock History; 2012 to 2014 wheat no till

Soil Type; Sandy loam

Stubble treatments imposed; March 2015

Sowing Date; 7 May Seeding rate 40 kg/ha, 63 kg/ha MAP fertiliser into moist seedbed

Harvest date; 16 November

Special notes; Cultivation treatment imposed with offset discs. Stubble conditions at sowing was 80% cover generally about 300mm high with an average load of 2 t/ha, ranging from 1.5 to 3 t/ha. The amount of standing stubble varied from 85 to 70% of total load. Available N to 120cm across the replicates varied from 57 to 84 kg/ha. 0-10 cm Cowell P values varied from 11 to 13 across the replicates with the 10-30cm varying from 3 to 4. PredictaB tests rated crown rot infection below detectable levels.

Results

There was a yield response and no grain quality response to stubble treatment in wheat. The yield response showed burnt stubble was better than cultivation but not standing stubble, and standing stubble was no better than cultivation. No grain yield response to stubble treatment was observed in barley. No differences in crop performance were observed between treatments when considering plant emergence or biomass.

The dry spring and heatwave conditions the trial experienced during early October more than likely limited any potential yield advantages from either stubble treatments or variety selection. It is suggested that the yields obtained despite these difficult spring conditions are a reflection of the timely fallow management undertaken by the cooperating farmer prior to sowing.

<i>Wheat trial</i>		<i>Barley trial</i>	
Stubble	Yield (t/ha)	Stubble	Yield (t/ha)
Burnt	1.76	Burnt	2.12
Cultivated	1.53	Cultivated	2.19
Standing	1.60	Standing	2.28
<i>Lsd</i>	<i>0.20</i>	<i>Lsd</i>	<i>ns</i>

Wheat	Yield (t/ha)	Protein (%)	Screenings (%)	Barley	Yield (t/ha)
Condo	1.65	10.1	8.3	Buloke	2.17
Gregory	1.58	9.9	8.4	Commander	2.03
Livingston	1.69	10.2	9.4	Compass	2.21
Spitfire	1.53	10.6	9.1	Latrobe	2.46
Suntop	1.69	10.2	11.8	Oxford	2.11
<i>Lsd</i>	<i>0.1</i>	<i>ns</i>	<i>2.3</i>	<i>Lsd</i>	<i>0.16</i>

Weethallee

Co-operator; Leuff family "Malonga Park"

Paddock History; rotation is fallow with one cultivation, followed by wheat, followed by barley no till, then back to fallow. 2014 crop wheat

Soil Type; red sandy loam

GSR; 243mm

Stubble treatments imposed; March 2015

Sowing Date; 11 May. Seeding rate 40 kg/ha, 63 kg/ha MAP fertiliser into moist seedbed

Harvest date; 24 November

Special notes; Cultivation treatment imposed with offset discs. Stubble at sowing about 300mm high with an average load of 2 t/ha, ranging from 1.5 to 3 t/ha. The area between last years' rows was generally bare. Available N to 120cm across the replicates varied from 113 to 145 kg/ha. 0-10 cm Cowell P values varied from 26 to 31 across the replicates with the 10-30cm varying from 6 to 7. PredictaB tests rated crown rot infection below detectable levels.

Results

There was no yield or grain quality response to stubble treatment in wheat. No grain yield response to stubble treatment was observed in barley. No differences in crop performance were observed between treatments when considering plant emergence or biomass.

The dry spring and heatwave conditions the trial experienced during early October more than likely limited any potential for impact of stubble treatments. The very small difference observed in wheat yields and no difference in barley yields is most likely related to seasonal influence.

<i>Wheat trial</i>		<i>Barley trial</i>	
Stubble	Yield (t/ha)	Stubble	Yield (t/ha)
Burnt	2.21	Burnt	2.76
Cultivated	2.30	Cultivated	2.60
Standing	2.35	Standing	2.59
<i>Lsd</i>	<i>ns</i>	<i>Lsd</i>	<i>ns</i>

Wheat	Yield (t/ha)	Protein (%)	Screenings (%)	Barley	Yield (t/ha)
Condo	2.20	9.4	5.8	Buloke	2.69
Gregory	2.16	9.5	5.1	Commander	2.76
Livingston	2.40	9.4	7.1	Compass	2.64
Spitfire	2.20	9.7	6.9	Latrobe	2.60
Suntop	2.49	9.4	5.6	Oxford	2.58
<i>Lsd</i>	<i>0.21</i>	<i>ns</i>	<i>0.9</i>	<i>Lsd</i>	<i>n.s.</i>

Tottenham

Co-operator; Paul Adam

Paddock History; 2012 lupins, 2013 wheat, 2014 wheat

Soil Type; red sandy loam

GSR; 148 mm

Stubble treatments imposed; March 2015

Sowing Date; 27 May. Seeding rate 40 kg/ha, 63 kg/ha MAP fertiliser into moist seedbed

Harvest date; 26 November

Special notes; Cultivation treatment imposed with offset discs. Stubble at sowing about 300mm high with an average load of 3 t/ha, ranging from 1.5 to 4 t/ha. Stubble cover over the ground was generally 100% and the standing stubble represented about half the total load. Available N to 120cm across the replicates varied from 50 to 75 kg/ha. 0-10 cm Cowell P values varied from 15 to 16 across the replicates with the 10-30cm varying from 4 to 5. PredictaB tests rated crown rot infection below detectable levels.

Results

There was no yield or grain quality response to stubble treatment in wheat at the accepted 95% confidence level. At 92.5% a response between grain yield and stubble treatment became evident. A grain yield response to stubble treatment was observed in barley. No differences in crop performance were

observed between treatments when considering plant emergence or biomass and winter crop growth considered good. The dry spring and heatwave conditions the trial experienced during early October more than likely limited any potential impact of stubble treatments and most likely contributed to the high screenings observed. The final yields were also heavily influenced by the Spring conditions. Low protein levels reflect low soil nitrogen levels at sowing and the very limited N applied as starter fertiliser.

<i>Wheat trial</i>		<i>Barley trial</i>	
Stubble	Yield (t/ha)	Stubble	Yield (t/ha)
Burnt	1.62	Burnt	2.11
Cultivated	1.51	Cultivated	1.79
Standing	1.68	Standing	1.98
<i>Lsd</i>	<i>ns</i>	<i>Lsd</i>	<i>0.27</i>

Wheat	Yield (t/ha)	Protein (%)	Screenings (%)	Barley	Yield (t/ha)
Condo	1.59	9.5	9.7	Buloke	2.11
Gregory	1.56	10	12.5	Commander	1.90
Livingston	1.65	9.9	14.6	Compass	2.14
Spitfire	1.63	10.2	12.6	Latrobe	1.99
Suntop	1.59	10.1	14.6	Oxford	1.69
<i>Lsd</i>	<i>ns</i>	<i>0.32</i>	<i>1.78</i>	<i>Lsd</i>	<i>0.23</i>

2nd year effects of 2014 trials

This series of trials has been run over 2013, 2014 and now 2015. During 2014 the 2013 wheat replicates at trial sites were monitored for any second year effects by collecting biomass samples during the spring. At most sites there was a visual difference in the crop performance across the stubble treatments. Statistically at all sites and all stubble treatments there was no significant difference between the biomass production achieved during the Spring 2014.

During the 2015 spring, 2014 sites were visited and little visual difference between the wheat replicates could be observed. Based on the previous years' results little benefit could be identified by collecting further samples and no further data was collected.

Discussion

There is no evidence from the 2015 trials that variety yield ranking changes with stubble or tillage treatment for either wheat or barley. Overall, 2015 produced similar results to 2013 and 2014 findings. All years have experienced in producer terms a "good start", "good winter rain" then a "disappointing dry Spring" (heavily edited). The 2015 Spring was perhaps the most "disappointing" and limiting for crop performance since it was a combination of high temperatures and dry conditions. Based on observations made during 2013, 2014 and 2015, it maybe concluded that yield from any of the cultivars tested cannot be improved by pre sowing stubble management

when a dry Spring is encountered. This may not be the case in a wet spring when foliar disease may impact crop performance.

Again as in 2013 and 2014, the seasonal conditions this year did not bring short term agronomic benefits or risks associated with stubble conservation, burning or cultivation into play. The autumn break was timely and all trial sites were sown with good seedbed moisture. Therefore, the potential benefit of retained stubble providing a more favourable seedbed for an extended sowing time was again not observed. Given the sowing speeds and efficiencies that modern sowing equipment can achieve, this perceived benefit of stubble retention may not be as important as when stubble retained systems were initially being developed.

During 2015, at Mumbil Creek wheat and Tottenham barley sites a significant relationship existed between yields and pre sowing stubble treatments. The burnt treatment yielded statistically higher than cultivation but not the standing stubble; although statistically the standing stubble was not better than the cultivation. This statement has been generally supported by 2013 and 2014 trials where yield responses have been observed except at sites where physical soil constraints to sowing, such as soil compaction and established weeds, were reduced due to the cultivation treatment.

Considering the implications to crop management in CWFS districts of this trial during the years 2013, 2014 and 2015, the following key points emerge:

- At sowing, the best option in terms of yield is to sow the cultivar with the highest yield potential for the sowing window
- Cultivation late in fallow to reduce stubble loads for sowing is the most likely option to reduce yield unless it resolves a physical soil constraint, such as compaction or established hard to kill weeds
- Burning late in fallow to reduce stubble loads for sowing is unlikely to significantly improve yields compared to sowing into district typical standing stubbles. Burning may be a good last minute option where despite good planning, stubble is still interfering with sowing.
- Burning may not be a cheap option. The cost of burning stubble needs to be considered both in terms of dollar labour cost and lost nutrients. Costs of compliance with burning regulations, WHS and insurance should not be underestimated.

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