2014 Seasonal effects of strategic stubble treatments on *wheat* and *barley* in CWFS districts; Year 2 of a 5 year investigation

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This trial report is an interim harvest report for 2014 only. This is a preliminary analysis – there has been no checking of data values, outliers etc. or of other measurements taken, so these should be treated with caution.

During 2015 further reports will be released that include results relating to grain quality and crown rot.

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

Key Points

- Stubble treatments involving late burning or cultivation resulted in significantly different yields in wheat and barley in 4 of 6 trials conducted at Nyngan, Ungarie, Tullamore, Gunning Gap, Alectown and Lake Cargelligo during 2014. The yield effects were not consistent and these trials could not be used to predict response pre-sowing.
- The effects of stubble treatments observed during 2014 were similar to the effects observed during similar trials in 2013.
- Variety rankings were not significantly affected by stubble treatments.
- The best option in terms of yield was to simply grow the variety with the highest yield potential for the sowing window.

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 varietal responses within crop species to the impact of the different stubble treatments.

During 2013 CWFS conducted trials at 6 locations Tottenham, Euabalong, Weethalle, Rankins Springs, Wirrinya, and Tullamore which have been reported previously. Small statistically significant differences in yield due to stubble treatments were observed at 4 of the 6 sites. 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. During 2014 these

sites were monitored for any second year effects of the stubble treatments imposed in 2013 on the 2014 farmer established commercial crop.

During 2014 CWFS again conducted similar trials to the 2013 trials at 6 locations Nyngan, Alectown, Gunning Gap, Lake Cargelligo, Ungarie and Tullamore. In 2014 trials changes to the 2013 designs were incorporated to reflect farmer questions. The oats component of the 2013 trial were replaced with a nitrogen trial that investigated the impact of different stubble treatments imposed towards the end of the fallow on nitrogen response in wheat. The nitrogen trial will be reported separately but should be considered a sister trial to this report. Collectively these 2 trials investigate the agronomic influences impacting production in stubble retained systems in the Central West.

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 207000 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 9 ranges and 12 rows, and consisted of 3 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 6 varieties tested. They were selected on the basis “farmer interest” and type (early, late, disease response etc).

	3	4	5	2	6	1			2	4	1	3	5	6	
	3	5	4	2	6	1			4	6	2	3	1	5	
	2	5	1	4	3	6			2	1	5	3	4	6	
	4	1	5	6	2	3			5	4	1	2	3	6	
	4	5	3	6	2	1			3	2	5	4	6	1	

Burnt

Cultivated

Standing

standing

cultivated

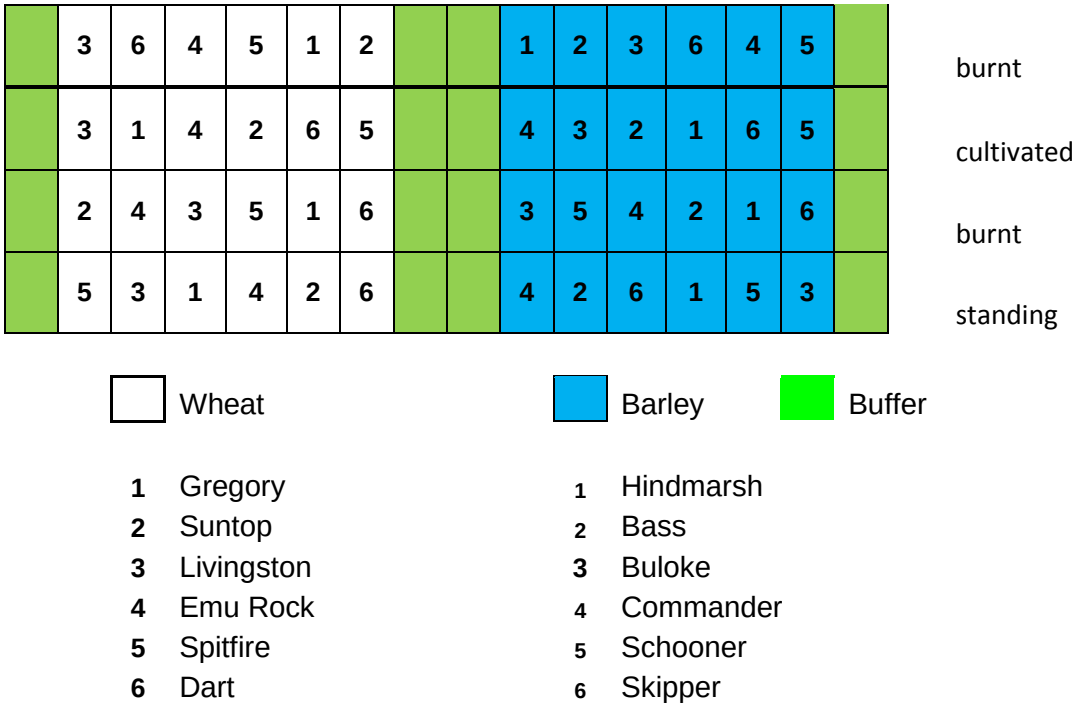

Figure 1: 2014 trial plan.

2014 trial sites:

Alectown
Co-operator; Ian Westcott
Paddock History; Full stubble retention system with sheep grazing fallows. Management target is to maintain ground cover at all times. 2011 oats for grazing and grain, 2012 fallow, 2013 Wedgetail wheat for grazing and grain,
Soil Type; Sandy loam
Stubble treatments imposed; 9 April 2014
Sowing Date; 20 May 2014 Seeding rate 35 kg/ha, 63 kg/ha MAP fertiliser into moist seedbed
Harvest date; 24 November 2013
Special notes; Cultivation treatment imposed with off set discs. Stubble conditions at 9 April was 100% cover generally about 300mm high with an average load of 4.5 t/ha, ranging from 3.3 to 6.2 t/ha. The amount of standing stubble varied from 15 to 31% of total load. Available N to 120cm across the replicates varied from 168 to 193 kg/ha. 0-10 cm Cowell P values varied from 33 to 53 across the replicates with the 10-30cm varying from 9 to 16. PredictaB tests rated 1 replicate at high risk of crown rot infection with others below detectable levels.

Results
There was no yield response to stubble treatment in wheat although a response was observed in barley. There may have been some frost damage at the site. Analysis of biomass samples, NDVI and grain protein will assist in understanding this finding.

There was little difference between the performance of wheat varieties with Suntop, Gregory and Dart being among the highest yields. At this site Dart performed similar to Suntop perhaps due to the later sowing date, possible frost effects or the more gentle finish experienced at the site. There was no difference between the barley varieties.

Wheat trial Stubble	Yield (t/ha)
Burnt	2.63
Cultivated	2.85
Standing	2.49
Lsd	*n.s.*

Barley trial Stubble	Yield (t/ha)
Burnt	3.04
Cultivated	3.58
Standing	3.37
Lsd	*0.13*

Wheat	Yield (t/ha)
Suntop	2.93
Gregory	2.79
Dart	2.74
Livingston	2.57
Spitfire	2.55
Emu Rock	2.35
Lsd	*0.29*

Barley	Yield (t/ha)
Commander	3.56
Skipper	3.49
Schooner	3.37
Bass	3.26
Hindmarsh	3.15
Buloke	3.15
Lsd	*n.s.*

Gunning Gap

Co-operator; Pat O'Connell

Paddock History; 2011 wheat, 2012 Monola, 2013 wheat yielded 4.1 t/ha with the stubble baled and removed

Soil Type; clay loam

Stubble treatments imposed; 9 April 2014, Burning treatments were difficult to impose due to lack of ground cover due to baling. In a commercial situation the paddock would not have been able to carry a fire at this time.

Sowing Date; 14 May 2014 Seeding rate 35 kg/ha, 63 kg/ha MAP fertiliser into moist seedbed

Harvest date; 20 November 2014

Special notes; Cultivation treatment imposed with off set discs. Stubble conditions at 9 April was 100mm high standing stubble in the 2013 crop rows, ground between the rows was generally bare. Available N to 120cm across the replicates varied from 33 to 53 kg/ha. 0-10 cm Cowell P values varied from 31 to 44 across the replicates with the 10-30cm varying from 6 to 8. PredictaB tests for crown rot rated the 3 replicates differently 1 replicate at high risk, 1 at low risk and 1 below detectable levels.

Trial management for this site was a co-operation between CWFS and Matt McRae, Ag n Vet, Forbes.

Results

There was no response to stubble or tillage at Gunning Gap nor did the wheat varieties differ significantly for yield. In barley, Commander and Skipper out-

yielded Schooner and Hindmarsh by 0.3 t/ha. There was no interaction between stubble treatment and variety performance for either wheat or barley, perhaps because of the low levels of foliar disease in 2014.

Stubble	Yield (t/ha)
Burnt	2.66
Cultivated	2.76
Standing	2.58
Lsd	*n.s.*

Wheat	Yield (t/ha)
Suntop	2.83
Gregory	2.77
Dart	2.70
Livingston	2.66
Emu Rock	2.59
Spitfire	2.46
Lsd	*n.s.*

Barley	Yield (t/ha)
Commander	3.18
Skipper	3.16
Buloke	3.01
Bass	2.98
Schooner	2.87
Hindmarsh	2.82
Lsd	*0.25*

Lake Cargelligo

Co-operator; The Davis family

Paddock History; No till no sheep for last ten years.

2011 wheat; 2012 canola; 2013 wheat. The longer term rotation is generally wheat.

Soil Type; Red sandy loam

Stubble treatments imposed; 14 March 2014. Burning treatments were difficult to impose due to lack of ground cover. In a commercial situation the paddock would not have been able to carry a fire at this time.

Sowing Date; 21 May 2014 Seeding rate 35 kg/ha, 63 kg/ha MAP fertiliser into moist seedbed with good soil moisture

Harvest date; 12 November 2014

Special notes; Cultivation treatment imposed with offset discs. Stubble conditions at 9 April was 200mm high standing stubble in the 2013 crop rows, ground between the rows was generally bare. There was no evidence of older crop residue from the canola or prior wheat crops. Available N to 120cm across the replicates varied from 88 to 192 kg/ha. 0-10 cm Cowell P values varied from 25 to 50 across the replicates with the 10-30cm varying from 6 to 10. PredictaB tests for crown rot rated the 3 replicates all at no detectable risk.

Results

There was a large response to cultivation at Lake Cargelligo, the cultivated treatment (1.76 t/ha) out yielding the uncultivated treatments by 0.45 t/ha. Further analysis should shed some light on this result. There were no

significant differences among either the wheat or the barley varieties, partly because the yields were quite variable across the site.

Stubble	Yield (t/ha)
Burnt	1.36
Cultivated	1.76
Standing	1.26
Lsd	*0.34*

Wheat	Yield (t/ha)
Spitfire	1.54
Suntop	1.53
Emu Rock	1.50
Livingston	1.48
Gregory	1.39
Dart	1.32
Lsd	*n.s.*

Barley	Yield (t/ha)
Commander	1.82
Buloke	1.79
Schooner	1.73
Hindmarsh	1.56
Bass	1.56
Skipper	1.56
Lsd	*n.s.*

Nyngan

Co-operator; David Carter

Paddock History; 20 year no till continuous cropping paddock, with rotation dependant on soil moisture at sowing and market outlook. Legumes have not been part of the crop mix. Cattle are sometimes grazed over summer if feed is required but stocking rate is too low to be considered significant. 2010 barley, 2011 canola, 2012 wheat, 2013 long fallow.

Soil Type; Clay loam

Stubble treatments imposed; 2 April 2014

Sowing Date; 7 May 2014 Seeding rate 35 kg/ha, 63 kg/ha MAP fertiliser into moist seedbed with good subsoil moisture

Harvest date; 3 November 2014

Special notes; Cultivation treatment imposed with offset discs. Uneven stubble conditions across the paddock existed on 9 April. Generally it ranged in height from 200 to 300mm high with an average load of 3.5 t/ha, ranging from 1.6 to 6.0 t/ha, ground cover varied from 0 to 100%. It is reasonable to suggest that this variation was due to the way water had drained and settled on the surface during the fallow. The amount of standing stubble averaged 14% of the total load but varied from 4 to 22%. Available N to 120cm across the replicates varied from 168 to 193 kg/ha. 0-10 cm Cowell P values varied from 33 to 53 across the replicates with the 10-30cm varying from 9 to 16. PredictaB tests rated 1 replicate at high risk of crown rot infection with others below detectable levels.

Trial management for this site was a co-operation between CWFS and Greg Brooke NSW DPI.

Results

The cultivated treatment was higher yielding than the standing stubble at this site, but not significantly higher than the burnt treatment. Grain quality and

other measurements might help explain this response. Gregory and Suntop, the two slower varieties, performed the best of the wheats, with no significant difference among the other varieties. Barley yields were excellent, averaging 4.38 t/ha, and the yield of all varieties was similar. There was no interaction between stubble treatment and variety performance for either wheat or barley, perhaps because of the low levels of foliar disease in 2014.

Stubble	Yield (t/ha)
Burnt	3.36
Cultivated	3.59
Standing	3.10
Lsd	*0.36*

Wheat	Yield (t/ha)
Gregory	3.72
Suntop	3.68
Spitfire	3.32
Livingston	3.26
Emu Rock	3.07
Dart	3.06
Lsd	*0.27*

Barley	Yield (t/ha)
Bass	4.29
Buloke	4.37
Commander	4.56
Hindmarsh	4.39
Schooner	4.27
Skipper	4.41
Lsd	*n.s.*

Tullamore

Co-operator; Neville Jones

Paddock History; No till cropping for over 5 years. In 2011 controlled traffic and interow sowing were introduced. Rotation is generally wheat, barley then canola. 2013 crop was 3.2 t/ha wheat crop

Soil Type; Clay loam

Stubble treatments imposed; 3 April 2014

Sowing Date; 2 May 2014 Seeding rate 35 kg/ha, 63 kg/ha MAP fertiliser into moist hard seedbed

Harvest date; 4 November 2014

Special notes; Cultivation treatment imposed with off-set discs. Stubble conditions at 3 April was 100% cover generally about 400mm high with an average load of 3.7 t/ha, ranging from 2.9 to 4.8 t/ha. The amount of standing stubble varied from 18 to 60% of total load with and average load of 40%. Available N to 120cm across the replicates varied from 102 to 201 kg/ha. 0-10 cm Cowell P values varied from 29 to 44 across the replicates with the 10-30cm varying from 11 to 14. PredictaB tests rated 1 replicate at high risk of crown rot infection with others below detectable levels.

Trial management for this site and a nearby canola trial was a co-operation between CWFS and Grains Orana Alliance.

Results

There was a 0.35 t/ha response to cultivation at Tullamore (P=0.06), and based on the results from the adjacent nitrogen trial this may have come from

greater soil nitrogen availability. Analysis of biomass samples, NDVI and grain protein will assist in understanding this finding. There were few differences in wheat grain yield among varieties except that Dart yielded significantly less than Suntop and Spitfire. In barley, variety yields were similar except that the out-dated Schooner was lower yielding than Bass, Commander and Skipper. There was no interaction between stubble treatment and variety performance for either wheat or barley, perhaps because of the low levels of foliar disease in 2014.

Stubble	Yield (t/ha)
Burnt	2.03
Cultivated	2.40
Standing	2.08
Lsd	*0.32*

Wheat	Yield (t/ha)
Suntop	2.36
Spitfire	2.22
Emu Rock	2.20
Gregory	2.16
Livingston	2.12
Dart	1.95
Lsd	*0.26*

Barley	Yield (t/ha)
Bass	2.44
Commander	2.41
Skipper	2.34
Hindmarsh	2.21
Buloke	2.18
Schooner	1.95
Lsd	*0.31*

Ungarie

Co-operator; Graeme Mason

Paddock History; No till, no stock, continuous cropping paddock since 1998 it target rotation of wheat/canola/wheat/lupins. 2012 canola, 2013 wheat.

Soil Type; Sandy loam

Stubble treatments imposed; 13 March 2014

Sowing Date;14 May 2014 Seeding rate 35 kg/ha, 65 kg/ha MAP fertiliser into moist seedbed with good subsoil moisture.

Harvest date; 27 November 2014

Special notes; Cultivation treatment imposed with off set discs. Stubble conditions at 13 March was a thick 100% cover between 400 and 500mm high with an average load of 7.3 t/ha, ranging from 5.6 to 8.9 t/ha. The amount of standing stubble varied from 29 to 48% of total load with and average load of 36%. Available N to 120cm across the replicates varied from 59 to 81 kg/ha. 0-10 cm Cowell P values varied from 36 to 55 across the replicates with the 10-30cm varying from 11 to 13. PredictaB tests for crown rot rated 1 replicate at high risk of crown rot infection and 2 at low risk.

Results

The three stubble treatments gave similar yields at Ungarie, averaging 1.73 t/ha. Gregory and Suntop, the two slowest varieties, performed the best of the wheats, while Dart, the quickest variety was lower yielding. There may have

been some frost damage at the site. Hindmarsh, Skipper and Commander were the best of the barleys. There was no interaction between stubble treatment and variety performance for either wheat or barley, perhaps because of the low levels of foliar disease in 2014.

Stubble	Yield (t/ha)
Burnt	1.63
Cultivated	1.76
Standing	1.80
Lsd	*n.s.*

Wheat	Yield (t/ha)
Gregory	1.93
Suntop	1.93
Spitfire	1.75
Livingston	1.67
Emu Rock	1.60
Dart	1.51
Lsd	*0.16*

Barley	Yield (t/ha)
Hindmarsh	2.03
Skipper	2.00
Commander	1.93
Buloke	1.79
Bass	1.73
Schooner	1.72
Lsd	*0.23*

2nd year effects of 2013 trials

During 2013 CWFS conducted similar trials at 6 locations Tottenham, Euabalong, Weethalle, Rankins Springs, Wirrinya, and Tullamore which have been reported previously. In 2014 the trial sites became part of the cooperating farmers commercial cropping program. During 2014 the 2013 wheat replicates at these sites were monitored for any second year effects by collecting biomass samples during the spring. Commercial crops established were lupins, field peas, self sown pasture, long fallow, canola and wheat.

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.

Discussion

There is no evidence from the 2014 trials that variety yield ranking changed with stubble or tillage treatment for either wheat or barley. Overall 2014 produced similar results to 2013 findings.

Again as in 2013 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 seed bed moisture. Therefore, the potential benefit of retained stubble providing a more favourable seedbed for sowing was not observed. Similarly the dry spring conditions did not promote foliar disease pressures that may have resulted in advantages for burnt treatments.

For this season the best option in terms of yield was to simply grow the variety with the highest yield potential for the sowing window.

Overall site performance appears to be inline with nearby National Variety Trials. It is critical to remember that this report only represents yield data from the 2014 season and growers should rely on a range of data sources and experience in assessing varieties for their farming system.

Acknowlegdments
CWFS would like to acknowledge the support provided by the co-operating farmers, without their in-kind support the trials would not have been possible. The help from Matt McRae, Walkers Ag N Vet, Forbes at the Gunning Gap site, Greg Brooke, NSW DPI at The Nyngan site and Scott Boyd, GOA, Dubbo at the Tullamore site is also acknowledged. The authors also thanks Neil Fettell for his support in compiling this report.