Stubble efficiency – Stubble Grazing Condobolin 2014

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

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Key Points

- Grazing of the stubble does have an influence on dry matter production.
- Available N was only significantly affected within the 0-10 cm and 10-30 cm layers of profile

Trial aim

To investigate the effect of stubble and grazing management on dry matter production within the cropping phase in low rainfall climate.

In previous year, the effect of stubble and grazing management had been investigated to measure their influence on crop yield and soil moisture.

Trial details

Soil type:	Red Sandy Loam
Crop 2013:	Barley
Crop 2014:	Twlight field peas and Mannus oats
Sowing rate:	PBA Twilight field peas @100kg/ha + Mannus oats @ 35 kg/ha
Sowing Date:	May 29 2014
Fertiliser:	50 kg MAP
Seeder type:	DBS Parallelogram Hydraulic tine seeder, with disc culters
Row spacing (cm):	25.4 cm
Harvest date:	Brown manured October 3 2014

Treatments

1: Nil graze, as is moderate stubble retain

2: Nil graze, as is moderate stubble retain, burnt late

3: Nil graze, high stubble retain

4: Nil graze, mown stubble removed

5: Stubble moderate graze, stubble retention, sprayed for weeds

6: Stubble moderate graze, sprayed for weeds, burnt late

7: Stubble heavy graze stubble retention, sprayed for weeds

8: Stubble heavy graze, stubble retention, one missed spray

Seasonal review

Temperature data for this site showed that during July there were 9 frost events with the coolest being on July 14 at -3.8 ºC. A total of 13 frosts occurred in early August with the lowest record temperature being -5.4 ºC on August 3. Between August 2 and August 15, there were 10 days below – 2.0 ºC.

The rainfall for the growing season was below average, with Condobolin Research and Advisory Station recording 155 mm during the

growing season (April to September). The bulk of this rain fell between April and June (113 mm). Long Term Average (LTA) growing season rainfall for this period of time is 209 mm.

Rainfall for the 2013/2014 fallow period (December to March) was 204.6 mm with 104.5 mm falling in March. Rainfall over this fallow period was higher than the LTA which is 153 mm.

The trial was sown into good moisture and established very quickly and evenly. Weed control was exceptional, and the trial was very even throughout the season.

Low in-crop rainfall meant that the majority of crop growth was attributed to stored soil moisture. In-crop rainfall was 155.1 mm with LTA being 209 mm

Table 1: Monthly rainfall at Condobolin 2014

	Rainfall (mm)
December 2013	18.2
January	35.2
February	46.7
March	104.5
April	28.0
May	27.6
June	57.4
July	9.2
August	21.9
September	11.0
October	11.5
November	17.7
December	88.6
Total	477.5
In-crop	155.1

Trial results

Soil nutrient tests

Soil tests were taken just prior to sowing (before any fertiliser was applied) at soil depths of;

0-10cm

10-30cm

30-50cm

50-70cm

70-90cm

Nitrogen

Total soil nitrogen levels varied significantly dependant on the stubble management treatment in the previous year. Highest residual soil nitrogen levels, prior to sowing, were recorded for stubble treatment 7 (146.5 kgN/ha), whilst treatment 5 (126.9 kgN/ha) and 2 (121.7 kg/ha) were similar (Table 2.). The lowest available soil nitrogen at the beginning of the season of all the stubble treatments was treatment 8 with only 84.4 kgN/ha (Table 2.).

Soil nitrogen levels prior to sowing, significantly varied for samples taken at the 0 to 10 cm and 10 to 30 cm depths. Soil samples taken from deeper in the profile had no difference in soil nitrogen levels due to previous stubble and grazing treatments.

Soil nitrogen was highest in the 0 to 10 cm depth and ranged from 24.5 to 58.7 kgN/ha (Table 2.). Treatments that had the highest residual nitrogen level were 7, 5 and 2, with 58.7, 52.7 and 45.93 kgN/ha, respectively (Table 2.). Treatments that had the highest level of soil nitrogen included both nil and moderate stubble grazing. Increased nitrogen has resulted from better weed control, stopping the removal of nitrogen from the system.

Stubble treatment in the previous year, affected soil nitrogen at a depth of 10 to 30 cm. Stubble treatments 5 (29.3 kgN/ha), 7 (28.9 kgN/ha), 2 (27.0 kgN/ha), and 6 (25.4 kgN/ha) all has similar levels of nitrogen (Table 2.). These results above do not indicate a direct collation with the type of stubble manipulation imposed on the plots. Treatments 5, 6 and 7 have had a grazing period imposed, but treatment 2 has had no grazing. The continuation of this trial in 2015 may provide some explanation for this trend.

Dry matter Yield

This trial was brown manured in 2014; there was no grain yield or grain quality data available.

Overall biomass, of both Twilight peas and Mannus oats, varied greatly between the treatments. There was up to a 1.0 t/ha reduction in biomass between the highest stubble treatment 5 with 4.2 t/ha biomass to treatment 8 with 3.2 t/ha (Table 3.). Stubble treatments 1 to 6 had similar levels of biomass production (Table 3.) indicating that the level of stubble retention (nil or moderate) in the previous year gave a higher biomass production and potential grain yield.

Oats and field pea components of the dry matter were separated and individually weighted. There was a significant difference between the treatment for the Mannus oat dry matter, yet not for Twilight field pea.

Oat dry matter was similar between treatment that included nil or moderate grazing. The highest amount of oat biomass was for treatment 2 (3.34 t/ha) whilst the lowest was for treatment 8 (2.39 t/ha) (Table 3.). There was a range of ratios between oats and barley biomass, they ranges from 0.19 to 0.34 for treatment 4 and treatment 8 respectively.

Discussion

Stubble treatments, in this trial, have been imposed on the same plot area for the last 6 years. In previous years the trial area had been sown to a number of different cereal crops; both wheat and barley.

In 2014, the trial area was sown to a mix of PBA Twilight field peas and Mannus oats with the intention of the crop being brown manured. This crop was brown manured in early October 2014.

In January 2014, the plots were mown and stubble removed for treatment 4 and this stubble was relocated to treatment 3. Sheep were allowed to graze the moderately and heavy grazed plots.

It appears that the stubble and grazing treatment are only having effect on the available N in the upper layers of the profile. There was no difference between treatments in the level of available nitrogen below 30cm. The barley crop in 2013 may not have removed any nitrogen from below 30cm.

The highest available soil nitrogen at the beginning of the growing season was seen in three stubble and graze treatments (2, 5 and 7). Rotations that include a no graze fallow period over summer have the highest available soil nitrogen if the level of stubble is moderate and stubble as well as weeds reduced with a burn prior to sowing. When grazing of stubble occurs over the summer fallow period, either moderately or heavily, the highest available soil nitrogen was observed when weeds were controlled. Farm rotation and stock management practices over the fallow period can increase soil available nitrogen prior to cropping.

Biomass differences between treatments were observed. Stubble and grazing treatments that included nil or moderate grazing had the highest oat and hence total biomass. Level of stubble retained from the previous crop and the use of that stubble could have the potential to increase biomass which may lead to an increase in plant biomass or grain yield (Table 3.)

Heavily grazed treatments, within this trial, irrespective of stubble retention or weed control had lower biomass production less than 3.62 t/ha of biomass (Table 3.).

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Table 2: Available soil nitrogen (kgN/ha) for soil depths of, 0 to 10 cm, 10 to 30 cm and total profile prior to sowing for eight stubble treatments at Condobolin in 2014.

Stubble treatment	0 to 10 (cm)	10 to 30 (cm)	Total N (cm)
1. Nil graze, moderate stubble retain	44.74	16.02	101.00
2. Nil graze, moderate stubble retain, burnt late	45.93	27.00	121.70
3. Nil graze, high stubble retain	30.14	18.85	91.80
4. Nil graze, mown stubble removed	37.63	18.99	114.90
5. Stubble moderate graze, stubble retained, sprayed	52.66	29.32	126.90
6. Stubble moderate graze, sprayed for weeds, burnt late	36.64	25.35	100.90
7. Stubble heavy graze, stubble retained, sprayed	58.70	28.96	146.50
8. Stubble heavy graze, stubble retained, one miss spray	24.54	19.81	84.40
Average 5% LSD	13.75	6.00	26.17

Table 3: Total pea and oat dry matter (t/ha) accumulation for eight stubble treatments at Condobolin in 2014.

Stubble treatment	Pea DM (t/ha)	Oats DM (t/ha)	Total DM (t/ha)
1. Nil graze, moderate stubble retain	0.90	3.20	4.09
2. Nil graze, moderate stubble retain, burnt late	0.81	3.34	4.20
3. Nil graze, high stubble retain	0.92	3.20	4.13
4. Nil graze, mown stubble removed	0.62	3.23	3.87
5. Stubble moderate graze, stubble retained, sprayed	0.91	3.33	4.21
6. Stubble moderate graze, sprayed for weeds, burnt late	0.65	3.14	3.77
7. Stubble heavy graze, stubble retained, sprayed	0.71	2.89	3.62
8. Stubble heavy graze, stubble retained, one miss spray	0.83	2.39	3.21
Average 5% LSD	ns	0.40	0.50