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Stubble efficiency – Stubble Grazing Condobolin 2015

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Key Points

- Treatment 1, Nil grazed, moderate stubble yielded the highest, (2.18 t/ha)
- No significant difference in Total Plant Available Water, majority of stored water was below the 50 cm depth.
- There was a significant difference between the eight treatments when comparing available soil nitrogen.
- There was a significant difference in grain quality attributes between the eight stubble treatments.

Trial aim

This trial is part of a series of trials aimed to investigate how differing summer farming practices influence stored water and how plant available water may influence grain yield potential and grain quality attributes in the low rainfall area in central NSW. The summer farming practices that were investigated included stubble and weed management.

Stubble was managed either through full or partial removal with sheep, other stubble treatments involved the stubble left standing or stubble being burnt prior to sowing. In addition when stubble was retained the effect of weed control through sprays treatments.

As studied in previous year, the effect of stubble, grazing and spray management over the summer period was measured through its effect on plant available water at sowing and flow on effect in grain yield and quality parameters.

Trial details

| | |
|--------------|--|
| Soil type: | Red Sandy Loam |
| Crop 2014: | Twilight field peas and Mannus oats, brown manured |
| Crop 2015: | Livingston wheat |
| Sowing rate: | 30 kg/ha |
| Sowing Date: | 20 th May 2015 |
| Fertiliser: | 50 kg MAP |

Seeder type: DBS Parallelogram Hydraulic tyne seeder, with disc culters
 Row spacing (cm): 25.4 cm
 Harvest date: 9th November 2015

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

Grazing treatments were imposed on the 20th January 2015, when 330 merino ewes were placed on plots. Moderately grazed trial plots had a stocking rate of 727 sheep/ha for one day and were excluded on the 21st January 2015. The heavily grazed trial plots had a stocking rate of 727 sheep/ha for one day and 1455 sheep/ha for an additional day, the sheep were excluded on 22nd January 2015.

Seasonal review

The seasonal condition experienced at Condobolin Research and Advisory Station, Condobolin during 2015 year had profound influence on the trial results. 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.

The rainfall for the growing season (May to October) was just below average, with Condobolin Research and Advisory Station recording 198.7 mm during the growing season (Table 1), with the Long Term Average (LTA) during the growing season rainfall of 209 mm. Good rainfall fell in June, July, August and October. Rainfall during both May (11.6 mm) and September (6.2 mm) were well below the long term average of 34.4 mm and 29.1 mm, respectively. In addition to lower than expected rainfall in September, high daytime temperatures in the mid to high thirties were experienced, in conjunction with hot strong winds occurred during the first week in October. Combination of high daytime temperatures, hot winds and low rainfall produced a hard finish for the crop.

Table 1. Monthly rainfall (mm) at Condobolin Research and Advisory Station, Condobolin during 2015.

| Dec 14 | Jan 15 | Feb 15 | Mar 15 | Apr 15 | May 15 | Jun 15 | Jul 15 | Aug 15 | Sept 15 | Oct 15 | Nov 15 | Dec 15 | Total | In-crop |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--------|--------|--------|-------|---------|
| 88.8 | 59.2 | 35.2 | 0.2 | 64.7 | 11.6 | 31.8 | 41.6 | 42.3 | 6.2 | 65.2 | 67.3 | 28.5 | 454.4 | 198.7 |

Trial results

Soil plant available water and nutrient tests

Soil tests were taken just prior to sowing at the soil depths of;

- 0-10cm
- 10-30cm
- 30-50cm
- 50-70cm
- 70-90cm

Plant available water

The application of the eight stubble treatments over the summer season did not result in any difference to total plant available water for the eight stubble treatments when soil was taken to a depth of 90 cm. The amount of plant available water to a depth of 90 cm was low and ranged from 43mm to 82 mm over the

eight treatments. When plant available water was divided into depths there were increasing amounts of stored moisture at lower depths. The majority (69 %) of the little plant available water stored in the profile was below 50 cm in depth. This moisture was beyond the capacity of seedlings or moderately sized plants to exploit.

Soil Nitrogen

There was a significant difference, at the 5 % level, between the eight treatments when comparing the total available soil nitrogen (kgN/ha) as well as available soil N for soil depths of 0-10 cm, 10-30 cm prior to sowing the trial in 2015. There was no difference in soil N between the eight treatments at depths lower than 30 cm.

Total soil nitrogen levels varied significantly dependant on the stubble management treatment in the previous year. Highest total residual soil nitrogen level, prior to sowing, were recorded for stubble treatment 7 (146.5 kgN/ha), whilst treatment 5 (126.9 kgN/ha) and treatment 2 (121.7 kgN/ha) were similar. These three treatments had stubble retention with weed control through spraying or burning (Table 2.). The lowest total available soil nitrogen prior to sowing was treatment 8 with only 84.4 kgN/ha (Table 2.).

Soil nitrogen levels at the 0 to 10 cm depth ranged from 24.5 kgN/ha to 58.7 kgN/ha (Table 2.). The highest level of available N in the 0 to 10 cm depth was 58.7 kgN/ha for treatment 7, with 52.7 kgN/ha for treatment 5 and with 45.9 kgN/ha for treatment 2 similar in value (Table 2.).

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 2015.

| Stubble treatment | 0 to 10 (cm) | 10 to 30 (cm) | Total N (cm) |
|--|--------------|---------------|--------------|
| 1. Nil graze, moderate stubble retain | 44.7 | 16.0 | 101.0 |
| 2. Nil graze, moderate stubble retain, burnt late | 45.9 | 27.0 | 121.7 |
| 3. Nil graze, high stubble retain | 30.1 | 18.8 | 91.8 |
| 4. Nil graze, mown stubble removed | 37.6 | 19.0 | 114.9 |
| 5. Stubble moderate graze, stubble retained, sprayed | 52.7 | 29.3 | 126.9 |
| 6. Stubble moderate graze, sprayed for weeds, burnt late | 36.6 | 25.3 | 100.9 |
| 7. Stubble heavy graze, stubble retained, sprayed | 58.7 | 29.0 | 146.5 |
| 8. Stubble heavy graze, stubble retained, one miss spray | 24.5 | 19.8 | 84.4 |
| l.s.d. (p=0.05) | 13.7 | 6.0 | 26.2 |

Soil nitrogen levels at the 10 to 30 cm depth ranged from 16.0 kgN/ha to 29.3 kgN/ha (Table 2.). The highest level of available N in the 10 to 30 cm depth was 29.3 kgN/ha for treatment 5, with 29.0 kgN/ha for treatment 7, with 27.0 kgN/ha for treatment 2 and with 25.3 kgN/ha for treatment 6 being similar (Table 2.).

Grain Yield and Quality

There was significant difference between the eight treatment grain yields of Livingston (Figure 1.). Treatment 1 (Nil grazed, as is moderate stubble retain) achieved the highest grain yield with 2.18 t/ha. Other treatments that also achieved similar yields were treatment 3 (2.13 t/ha), treatment 4 (2.11 t/ha), treatment 5 (2.07 t/ha) and treatment 6 (2.06 t/ha) (Figure 1. and Table 3.).

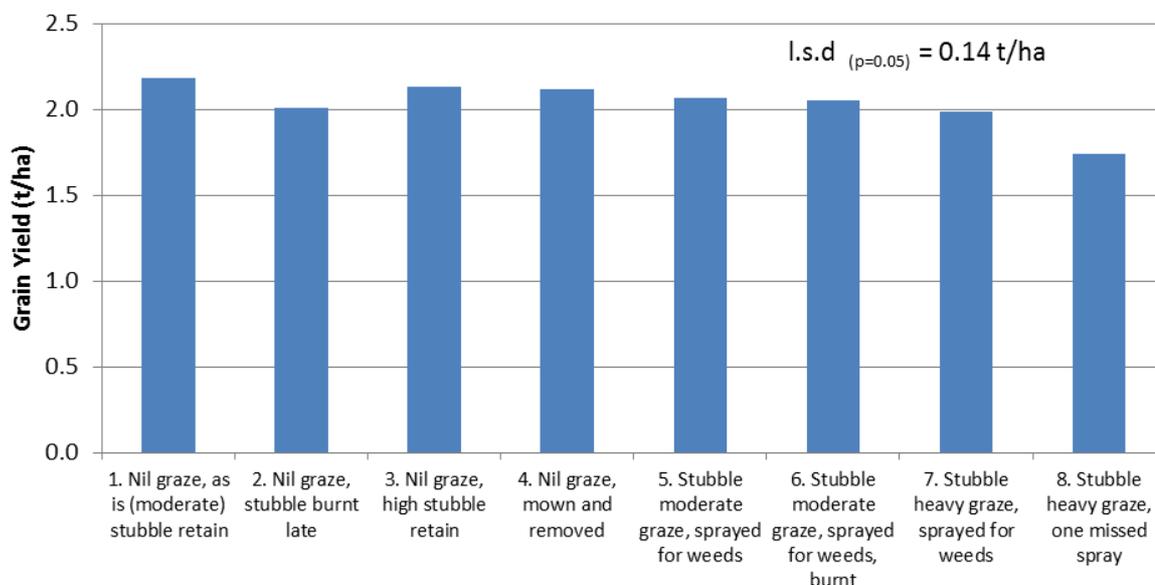


Figure 1: Grain yield (t/ha) for the eight stubble management treatments conducted on the stubble grazing trial at Condobolin in 2015.

The lowest achieved grain yield was achieved for treatment 8 (stubble heavy graze, one missed spray) at 1.74 t/ha (Figure 1. and Table 3.). This is a reduction in grain yield of approximately 20 % when compare to the highest achieved grain in treatment 1.

There were differences, at a 5% significance level, in grain quality attributes between the eight stubble treatments when comparing grain protein, test weight and screenings (Table 3).

The highest grain protein, was achieved in treatment 7, heavy grazed; stubble retained and weeds sprayed (11.7 %), this treatment had the highest total available soil nitrogen (146.5 kgN/ha) (Table 3.). Grain protein levels for treatment 4 (11.1 %), treatment 5 (10.9 %), treatment 8 (10.5 %) and treatment 6 (10.4 %) were similar to that achieved for treatment 7 (Table 3.). There was a significant difference between treatment 7 and treatment 1, treatment 2 and treatment 3, with 9.4 %, 10.3 % and 9.5% respectively (Table 3.).

The grain nitrogen removal ranged from 40.9 kgN/ha for treatment 4 to 31.6 kgN/ha for treatment 8 over the eight stubble treatments (Table 3.). There was no significant difference between the highest five grain nitrogen removal values. The top five rates of grain nitrogen removal were 40.9 kgN/ha, 40.3 kgN/ha, 38.9 kgN/ha, 37.7 kgN/ha, and 36.9 kgN/ha for treatment 4, treatment 7, treatment 5, treatment 6 and treatment 2, respectively (Table 3.).

Table 3: Grain yield (t/ha), grain nitrogen removal (kgN/ha), grain protein (%), test weight (kg/hl), screening (%), tiller number and total available soil nitrogen (kgN/ha) for the eight stubble management treatments conducted on the stubble grazing trial at Condobolin in 2015

| Treatment | Grain Yield (t/ha) | Grain Nitrogen Removal (kgN/ha) | Protein (%) | Test Weight (kg/hl) | Screening (%) | Tiller number (m ²) | Available soil nitrogen (kgN/ha) |
|-----------|--------------------|---------------------------------|-------------|---------------------|---------------|---------------------------------|----------------------------------|
| 1 | 2.18 | 35.6 | 9.4 | 75.3 | 23.1 | 181.9 | 101.0 |
| 2 | 2.01 | 36.9 | 10.3 | 73.9 | 28.2 | 229.4 | 121.7 |
| 3 | 2.13 | 35.4 | 9.5 | 75.7 | 28.5 | 201.9 | 91.8 |
| 4 | 2.11 | 40.9 | 11.1 | 72.8 | 42.8 | 234.4 | 114.9 |
| 5 | 2.07 | 38.9 | 10.9 | 73.1 | 36.9 | 265.6 | 126.9 |
| 6 | 2.06 | 37.7 | 10.4 | 73.6 | 36.6 | 221.6 | 100.9 |
| 7 | 1.98 | 40.3 | 11.7 | 72.4 | 52.6 | 234.9 | 146.5 |

| | | | | | | | |
|-----------------|------|------|------|------|------|-------|------|
| 8 | 1.74 | 31.6 | 10.5 | 73.7 | 43.4 | 227.1 | 84.5 |
| l.s.d. (p=0.05) | 0.14 | 4.7 | 1.3 | 1.2 | 12.2 | 31.1 | 26.2 |

Variation between stubble treatments was evident when examining test weight, yet even with this difference none of the samples were in excess of the acceptable GTA standard of 76 kg/hl. The highest test weight was obtain from treatment 3, nil grazed high stubble retained (75.7 kg/hl), treatment 3 was similar to treatment 1, nil graze, moderate stubble retain (75.3 kg/hl) but greater than all other stubble treatments (Table 3.).

Differences in screening was observed between the eight stubble treatments, yet as with test weight all values were well over the acceptable GTA standard of 5 %. Screenings ranged from 23.1 % for treatment 1 to 52.6 % for treatment 7. Treatment 1 achieved the lowest screening with 23.1 %, with not statistically difference at the 5 % level between treatment 1 and treatment 2 (28.2 %) and treatment 3 (28.5 %). The nil grazed, retained stubble treatments (treatments 1, 2 and 3) achieved the lowest screenings (23.1 %, 28.2 % and 28.5 %, respectively), in conjunction these treatments also had the highest test weights (75.3 kg/hl, 73.9 kg/hl and 75.7 kg/hl, respectively) (Table 3.).

Stubble treatment 5 had the largest number of tillers with 265.6 tiller/m², whilst treatment 1 had the lowest with 181.9 tiller /m². Plant tillers for stubble treatment 7 were similar to that of treatment 5 (Table 3.).

Discussion

Seasonal conditions resulted in a short dry spring resulting in a fast, hot grain fill in and around the Condobolin region in 2015. These seasonal conditions resulted in high screenings and low test weights that fell below the GTA standard of 76 kg/hl and 5 % screenings for any grade ASW1 and above.

Nil grazing stubble treatments, did not affect overall plant available water but did on average improve grain yield to over 2 t/ha, screenings and test weight when compared broadly to stubble treatments that grazed the stubble treatments. The nil grazing treatment with exception of treatment 2, (nil graze, moderate stubble retain and burnt late), achieved the highest grain yields (Table 3. and Figure 1.). It appears that the effect of burning stubble on treatment 2 may have had an influence on the grain yield as this was the difference between treatment 1 and treatment 2.

Sheep grazing on stubble over the summer period in moderate intensity lead to similar grain yield than the nil graze stubble treatments yet the grain quality parameters of test weight were lower and screenings were higher (Table 3.). If grazing intensity was increased from moderately too heavy a reduction in grain yields were observed. In conjunction, increased grazing intensity reduced test weight and increased screening.

Removal of stubble, either by grazing, mowing or burning increased the number of tillers counted in a unit area. Under more normal conditions higher tiller numbers would in increase grain yield potential. The hot dry spring may have reduced productivity from each tiller causing many small pinched grains, resulting in low test weight and high screenings. Higher screenings and test weights in both moderately and heavily grazed may have resulted from increased tillers during the growing season.

In contrast, treatment 1, nil grazed, moderate stubble retained, had the highest ground cover over summer, the lowest number of tillers during the growing season. This caused the highest grain yield, high test weight and low screenings.

Under hot and dry spring conditions, highest grain yields and test weights in conjunction with the lowest protein and screenings were observed when paddocks were not grazed and at least a moderate level of stubble cover was maintained over summer.

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