Grazing Crops at Dudinin - 2013

Company/Organisation: Department of Agriculture and Food WA
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AIM
To investigate the impacts of degree and timing of grazing on crop yield.

TRIAL DETAILS

Property:	Kolindale (average 325mm rainfall)
Plot size & replication:	Each treatment plot is 6 rows wide at 25cm row spacing and 2m long. There were 4 times of cutting and 4 replicates. Layout attached.
Soil type:	Sandy loam
Crop Variety:	Buloke barley
2013 Application Dates:	Treatment dates T1 – 6/6, T2 – 27/6, T3 – 18/7, T4 – 8/8
Cutting heights:	Handcuts included Ground Level (GL), Cut once and leave 5 cm (5 once), Cut multiple times to 5cm (5 multi), Leave 15 cm (15cm) and Take 10 cm (T10).
Seeding Rate:	70kg/ha on 25/4
Fertiliser	70kg Thumper Extra Lite incorporated with seed at seeding
Paddock rotation:	Wheat in ’12, Pasture in ’11, Sub Clover in ‘10
Sprays (rate/ha):	25/4 : 1L/ha Roundup + 2L/ha Trifluralin + 0.35kg/ha Diuron+ 0.08L/ha Goal 20/6 : 0.36L/ha MCPA 570 + 0.05L/ha Brodal + 3.5L/ha Wetter + 0.5% Oil
Insecticides:	25/4: Chlorpyrifos 0.07L/ha
Post Grazing Fertilize:	4/7: 40kg/ha Urea

BACKGROUND
Previous grazing crop work showed that if crops are grazed after they cannot be easily pulled-out (pinch and twist test) and before stem elongation (Z30) that:

1. there will be little or no yield difference at harvest.
2. there is the opportunity to provide valuable feed for stock at a time when pasture is limited.

Work has also shown that maintaining early leaf area is important to capture light to support early plant growth. If defoliation occurs around the commencement of elongation (Z30), rapid growth for recovery depends on leaf area, water and nutrient availability. Grain yield then requires sufficient time for recovery and grain fill.

However, work from the eastern states has considered only grazings before Z30, and grazing usually is to the white line or no more than 5cm remaining. It is recognised that grain yield is associated with residual biomass and time to senescence. Therefore, we should be able to, at and past Z30, clip graze up to 10cm from the top of 30cm high plants and have limited effects on yield - unless we damage the developing ear.

METHODOLOGY
Plant material was removed by cutting at 20 day intervals from treatment plots. The cuts were performed depending on crop height at time of cutting. Cuts were not taken unless at least 5cm would be removed and there was no “5 once” cut taken at T4. The multi cuts were introduced to simulate rotational grazing. T2 5 multi was cut to 5cm high on 6/6 and 27/6, T3

5 multi was cut to 5cm high on 6/6, 27/6 and 18/7, and T4 was cut to 5cm on 6/6, 27/6, 18/7 and 8/8. The residual biomass was measured for each treatment, with biomass removed calculated. The exception to this was the 5 multi cut, which was taken a number of times to simulate rotational grazing, where the all tops and the final residual were taken. The simulation cuts were 6 rows wide, allowing for the outside row on each side to be used to measure biomass, with the centre four rows cut to the treatment height. After the treatments were cut, the plots were allowed to recover and mature. These were then hand harvested at maturity to measure yield. At harvest, 2 one metre rows from the centre of each plot were harvested and yield calculated. Delay in maturity was also assessed.

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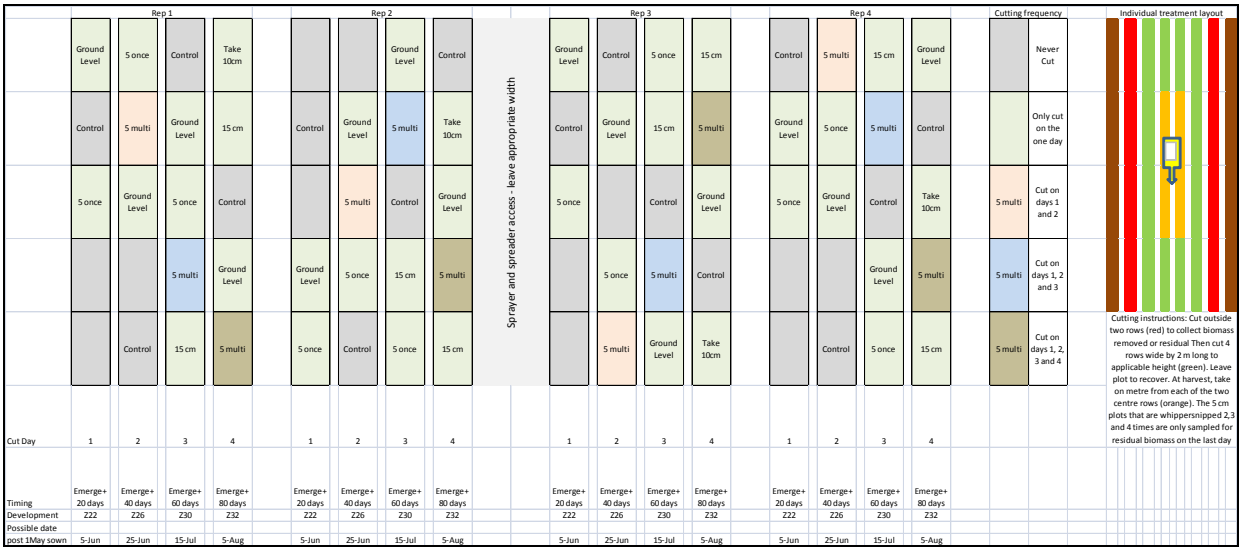

Figure 1. *Layout of time x height cutting plots*

RESULTS & DISCUSSION

Growth stage

Impacts: On 20th August, growth stages across the treatment plots were assessed. Ungrazed plants had reached Z55. In Table 2, below, is a summary of the effects of grazing severity and timing on plant maturity. It can be seen that both early and late light grazing had a small effect on maturity, and that moderate to heavy grazing at T2 and T3 had a moderate effect. Heavy late grazing severely delayed maturity, and is likely to impact grain maturation.

Message: Moderate changes to the maturity of grazed plants is likely to change frost risk, however with no frost events, there were no advantages in shifting plant maturity.

Table 2*: Impact timing and intensity of defoliation on plant maturity at 20/8*

	T1	T2	T3	T4
Control	Z55	Z55	Z55	Z55
Ground Level	Z41	Z41	Z40	Z25
5cm Once	Z45	Z49	Z42	
5cm Multi		Z45	Z42	Z33
15cm high			Z53	Z43
Take 10cm off				Z42-Z57

Biomass removed

Impacts: Grazing crops can allow biomass to be used by animals to meet their nutritional needs. More biomass is available later in the season, and more severe or later grazing will affect maturity to a greater extent as shown above. In Figure 4, the chart of Grain Yield vs

Timing of Defoliation, shows the Feed On Offer (FOO) “consumed” in green text next to the % yield of each treatment. It can be seen that the heavier the “grazing” at any time of defoliation results in the removal of more biomass. The later the defoliation, the higher the biomass removed as well.

Messages: The benefits to livestock grazing crops include provision of an accessible feed source, at a time where pasture availability may be limited. Early in the season, there is a small amount of grazing available in grazing crops, which is also highly accessible due to a cereal crop’s upright nature. Later in the season there may be more feed available in pasture paddocks, making feed availability in crops less important. On stocking rate, a low stocking rate of 5 dse/ha may be appropriate for up to a week when grazing early, whereas later in the season, stocking rates of 30 or more for up to a week or more may be possible, while still meeting height targets for stock removal to minimise yield impacts.

Residual biomass after defoliation

Impacts: In Figure 3 below, there is a high correlation (R2 = 0.98) between yield and total crop biomass at harvest. Thus in absence of other yield limiting factors such as frost, any treatment that affects harvest biomass significantly is then likely to also impact yield. In Figure 4, the chart of Grain Yield vs Timing of Defoliation, the residual FOO or biomass is shown in blue text next to the % yield of each treatment. It can be seen for each time of treatment, that the least affected yield has the highest residual biomass post defoliation. It can also be seen that to maintain yield at the same level across times of defoliation that more residual must remain as the time for recovery and regrowth decreases. For example in this case to maintain about 100% of control yield, the residuals (and defoliation type) at each treatment time were:

T1 = 78kg residual (GL); T2 = 176kg residual (5 multi);
T3 = 540kg residual (15cm); T4 = 1510kg residual (T10)

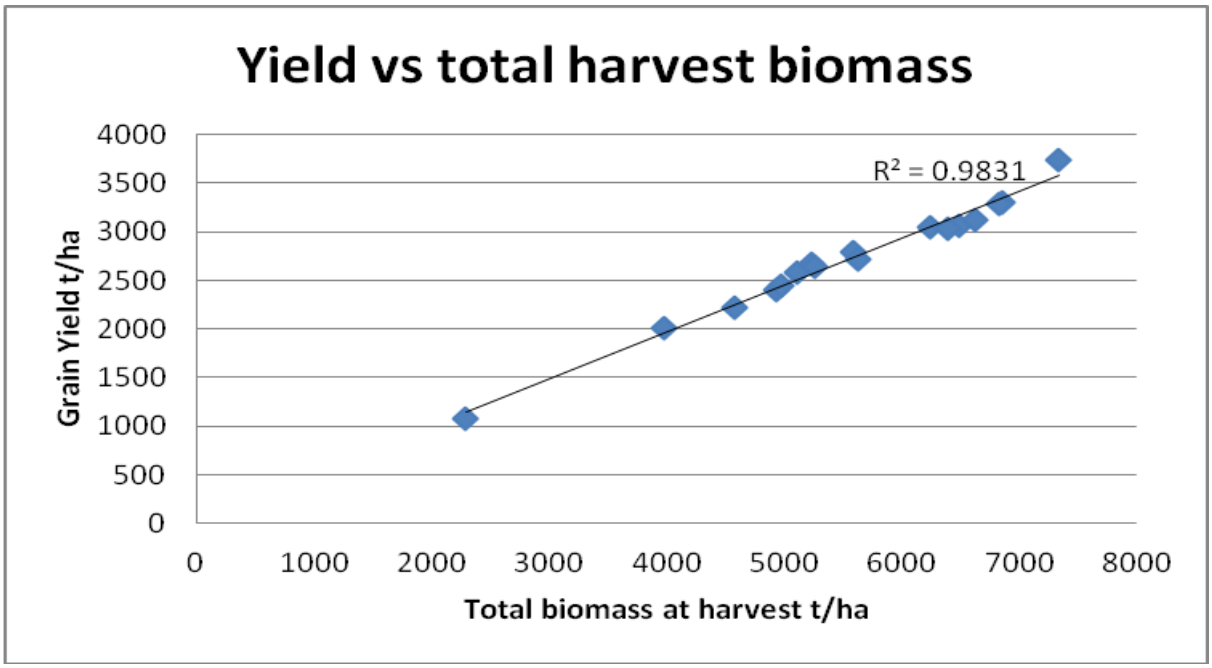

***Figure 3**: Relationship between yield and total crop biomass at harvest*

Messages: To minimise the effect of grazing on total crop biomass at harvest, there is a trade off between residual biomass after grazing and the recovery time for the crop. A low residual early and a high residual late, are the key to good crop biomass while still achieving livestock production from grazing..

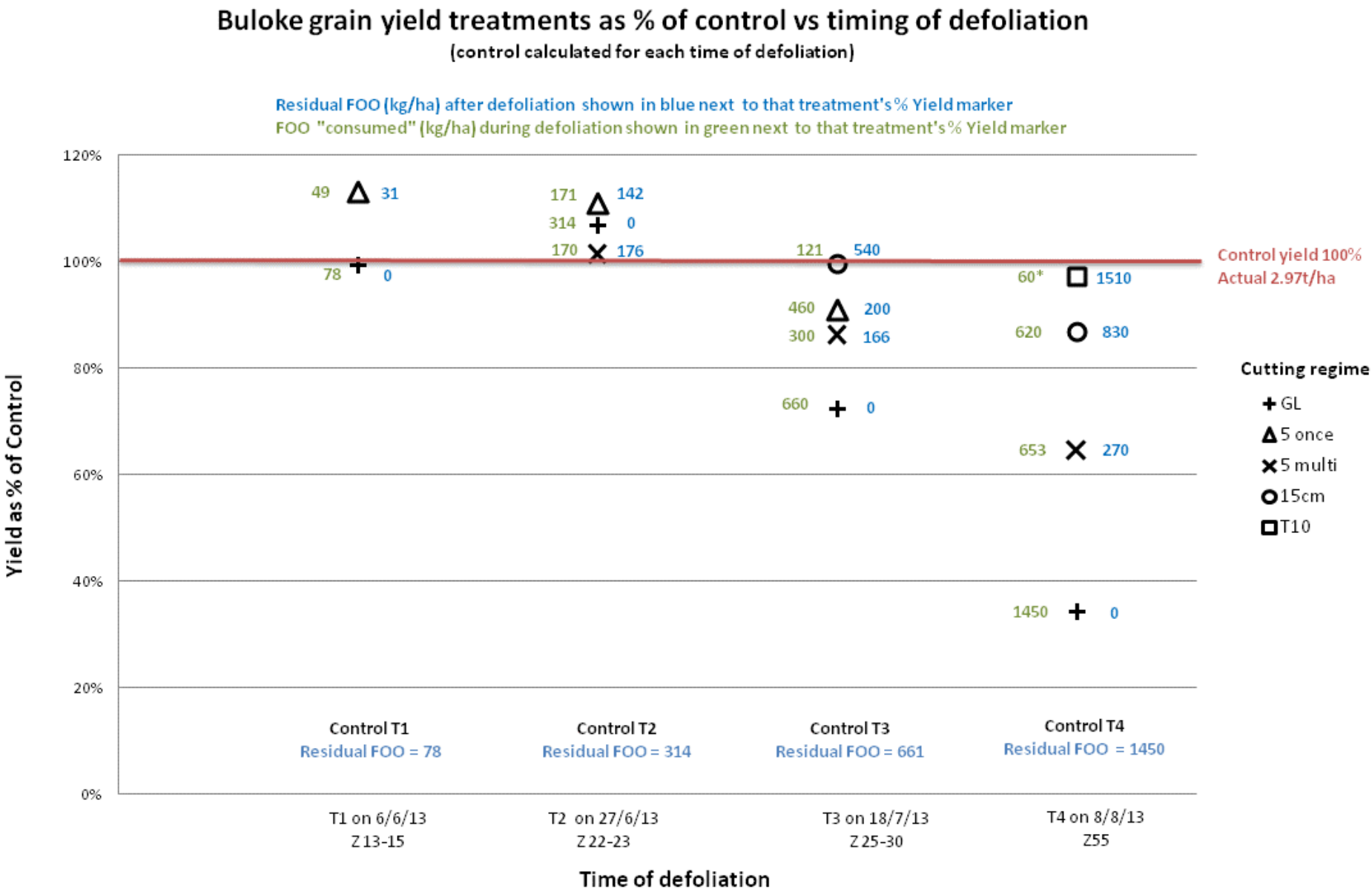

Figure 4: *Grain Yield vs Timing of Defoliation*

Grain yield

Impacts: Figure 4, the chart of Grain Yield vs Timing of Defoliation shows that grain yield as a % of the controls is not adversely affected by defoliation at times T1 or T2. In fact there is an indication that there may be a yield improvement. This may be as a result of improved water use efficiency of plants supporting less biomass transpiring less moisture. However it can be seen in T3 and T4, that yield is affected by grazing, with the greatest effects of those treatments that leave the least residual biomass. In addition, treatments GL at T3 and GL, and 5 multi at T4 removed the developing head, requiring new tillers to form. The high correlation between total biomass at harvest and yield and the effects of timing and intensity of defoliation have an impact on harvest biomass as discussed previously.

Messages: To minimise the effect of grazing on total crop yield, there is a trade off between residual biomass after grazing and the recovery time for the crop. A low residual early and a high residual late are the key to yield. However, it is essential to ensure that when grazing past Z30, that the developing head is not removed through grazing.

Summary of grazing treatments

GL. The results indicate that removing all biomass above the ground has a significant impact on yield once past T2. Early cuts may have an impact on the crop's ability to capture light for photosynthesis. Cuts taken later to ground level, removed the developing heads, requiring new tillers to be grown, severely impacting yield. While the GL biomass removed for grazing is greatest, the advantage may be outweighed by yield loss.

5 once. It appears that leaving some green leaf area allows the plant to recover more quickly after defoliation. Yield was not significantly impacted until Z30 was reached.

5 multi. Cutting down to 5 cm multiple times appears to reduce total biomass grown by the plant, compared to taking a single biomass cut. At T3, there was only a total of 300kg removed from the T1, T2 and T3 grazings (multi cuts on same plot) vs 460kg/ha when the crop was only cut down to 5cm once at T3. This suggests that rotational grazing is not advised, however, more data in subsequent years should provide a clearer message.

15 cm. Grazing to 15cm delays time to grazing. Figure 4 indicates that there are no significant yield losses until after Z30. However even at T4, the yield reduction in this case was only around 10% and allowed 640kg FOO to be removed or "grazed".

T10. Taking off 10cm or 'clip grazing'. These results indicate that grazing the top off the plant around Z55 does not have an impact on yield. The practicalities of grazing evenly to remove just 10cm are likely to be difficult. Grazing lightly across a whole paddock may result in uneven grazing, which is unlikely to affect whole paddock yields.

Heavier grazing later will see greater returns from the biomass removed through grazing, but will also have a more significant impact on yield. Grazing to ground level or 5cm early allows feed to be provided when pastures are limiting, while providing only a small amount of feed per ha. But the value to the system from early grazing may be higher for lambing twin bearing ewes or finishing early lambs. A combination of grazings across crop paddocks are likely to be necessary to minimise risk and maximise opportunity in the farming system.

CONCLUSION

Overall, moderate grazing up to Z25 - Z30 and clip grazing at and after Z25 - Z30 had little to no significant impacts on yield. However,assessing the value of grazing to the farm system is complicated as grazing can affect time of flowering and frost impacts. It can also increase water use efficiency, allow pasture paddocks to be deferred, reduce the need for supplementation and allow increased stock numbers and/or crop area.

ACKNOWLEDGEMENTS

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