The impact of grazing on grain yield of canola

By Simon Falkiner - Falkiner Ag, Cam Nicholson - Nicon Rural Supplies & Gina Kreeck - SFS

Take home messages:

- Sowing time is essential for dry matter production and yield preservation
- Poor growing conditions, the winter doldrums, during recovery from grazing seem to reduce final grain yield.
- Canola appears to be more sensitive to grazing than cereals, especially, but not solely, under adverse weather and grazing conditions.
- With a traditional a sowing time, mid May, dry matter production levels didn't reach a level that warrant taking the risk of impacting on grain yield when compared to grazing cereals.
- Even following established grazing protocols, that work north of the divide, grazing reduced grain yield for most varieties.
- This trend has been the case over the 3 years we have conducted grazing canola trials in SW Victoria.
- This trial suggests that yield loses associated with grazing are less with the newly released winter habit hybrids Hyola 930 and Hyola 971 when compared with most spring and winter types of canola.
- Initial work is suggesting that spring sown winter habit canola varieties may reverse the decline in yield associated with grazing and generate a large amount of feed out of season.

Location: Lake Bolac
Researcher(s): Simon Falkiner (FalkinerAg), Gina Kreeck (SFS) and Cam Nicholson (Nicon Rural Services), SFS
Acknowledgements: Neil Vallance.
Funding: GRDC, DAFF (through the Caring for our Country program)

Background/Aim:

Grazing cereals has proved to be a major opportunity for mixed livestock and cropping farmers in Southern Victoria. If certain grazing principles are met, dry-matter can be harvested in early winter without reducing grain yield.

While work being conducted in Southern NSW, Western and South Australia, by the CSIRO, (Kirkegaard, 2006) is suggesting the same applies for canola; however, in our high rainfall zone of Southern Victoria we are not finding this is the case.

The aim of our work over the last three seasons was to:

- Evaluate the fit of commonly used and non commercial (dual purpose) canola varieties in Southern Victoria under a range of sowing dates.
- Quantify the yield response of canola to a range of grazing regimes.
- Develop grazing principles, if possible, for canola in our unique region.

This experiment reports on the results of our "best bet" approach to making grazing canola work in our unique region. The longer term impacts of grazing on soil structure and weeds are also being investigated but this information is not covered in this report.

Experimental design

Number of trials: 1
Plot size: 12 m x 1.45 m
Replicates: 4
Grazing: Exclusion areas were erected on half of each plot to prevent grazing (ie an area of 6 m x 1.45 m). Merino wethers were used to graze the plots.

Varieties

A range of Conventional, Triazine tolerant (TT), Clearfield (CF) and Roundup Ready (RR) canola varieties that have either showed potential in previous years or have recently been purpose released were evaluated. Table 2. The trial was conducted with good agronomy and seasonal conditions.

Table 2 This table summarises the growing attributes and performance of the tested varieties.

Variety	Herbicide Tolerance	Growing Habit	Breeding	Performance
Hyola 930	Conventional	Winter	Hybrid	Good DM & Yield
Taurus	Conventional	Winter	Hybrid	Poor DM & Yield
Garnet	Conventional	Spring	Open Pollinated	Good DM ⬇ Yield
Hyola 971	Clearfield	Winter	Hybrid	Good DM & Yield
46Y83	Clearfield	Spring	Hybrid	Poor DM & Yield
Jardee	Triazine	Spring	Hybrid	Poor DM ⬆ Yield
Crusher	Triazine	Spring	Open Pollinated	Poor DM & Yield
Hyola 502	Roundup Ready	Spring	Hybrid	Good DM ⬇ Yield

Sowing time

The sowing date of mid May was chosen because it was seen as the most reliable starting date to a cropping program that ensured vigorous and even crop establishment. This together with good growing conditions are essential if an adequate amount of dry matter is to be produced for grazing before plant growth enters the doldrums during winter.

Herbicide Interaction

Due to a need to research the different growing and recovery patterns of canola we chose to use all of the different types of canola that were available to us, even though we knew in some cases this would compromise our goal of producing good amounts of dry matter for grazing whilst maintaining grain yield. We also accepted that with conventional chemical technology linked to them, three varieties had limited potential for broad uptake due to their unsuitability in paddocks containing Wild Radish.

The varieties linked with Triazine tolerance proved the most difficult to manage as their slow growth rates and long withholding period restrictions (made easier by spraying Atrazine post emergent, withholding period 6 weeks not 15 as with pre-emergent application) made the grazing window a very short one when sowing occurred in mid May. Although Jardee, as was the case in 2010, although not producing a great deal of DM, tolerated grazing well and maintained its grain yield. Figure 3.

The newly released hybrids Hyola 930 and Hyola 971 CL both have straightforward chemical and grazing management as do the other Conventional, Clearfield and Roundup Ready varieties. Taurus (as has been the case in other years) although not suffering a significant grain yield reduction due to grazing didn't provide either a large amount of DM or a high yield. Its winter habit suggests it is suited to an earlier sowing. In other trials (see results from the Dunkeld Taurus trial) it has shown great promise when sown in spring and carried all the way through to harvest the following spring.

Discussion

Dry matter for grazing

The dry matter production available for grazing varies significantly between varieties. This is not surprising given the breeding nature, either hybrid and conventional and the different growth rates associated with the differing chemical tolerances and growing habits (winter or spring). Generally hybrids with a spring growing habit are the most productive in terms of producing early dry matter. Varieties that use Triazine chemistry generally struggle to produce enough dry matter. The dual purpose released Clearfield Hybrid Hyola 971 performed well producing one of the highest amounts of dry matter in this trial (Table 3).

Table 3 Dry matter available at grazing (kg/ha) on the 7th August 2012. Figures in blue show levels considered enough for grazing.

Variety	Breeding	Herbicide Tolerance	Growing Habit	DM @ Grazing
Hyola 930	Hybrid	Conventional	Winter	815
Taurus	Hybrid	Conventional	Winter	584
Garnet	Open Pollinated	Conventional	Spring	1275
Hyola 971	Hybrid	Clearfield	Winter	1241
46Y83	Hybrid	Clearfield	Spring	768
Jardee	Hybrid	Triazine	Spring	681
Crusher	Open Pollinated	Triazine	Spring	877
Hyola 502	Hybrid	Roundup Ready	Spring	1041

However canola when compared to grazing cereals sown at a similar time, the best canola produced less dry matter than the worst cereal at the same site (McMasters Road Lake Bolac). In this case the best canola could only match the performance of the two winter wheats being trialled which we know (Free Food for Thought Booklet, 2008) have the slowest growth rate of the cereals we use for grazing. Figure 1.

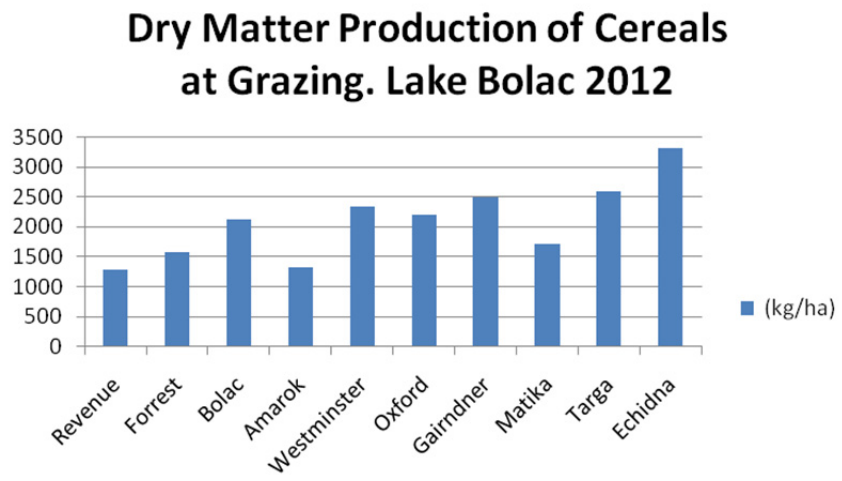

Figure 1 Cereal Production levels compared to the best canola DM yield at grazing. McMasters Road, Lake Bolac 2012

Another question often asked is "how well do animals respond to grazing canola?" When we look at recent work carried out in a Western Australian Grain and Graze 2 Project (Seymour & Ryan,2012) suggests that there is a lag period before any live weight increase is seen when canola is grazed by cattle. Anecdotally you often hear people say "the animals ate everything bar the canola before cleaning it up." Figure 2 below shows the slowing of weight gain followed by a subsequent increase. In the light of this evidence to make proper use of canola as a feed, a period of not less than two weeks should be contemplated. As with all grazing crops proper feed budgeting needs to be conducted to maximize performance.

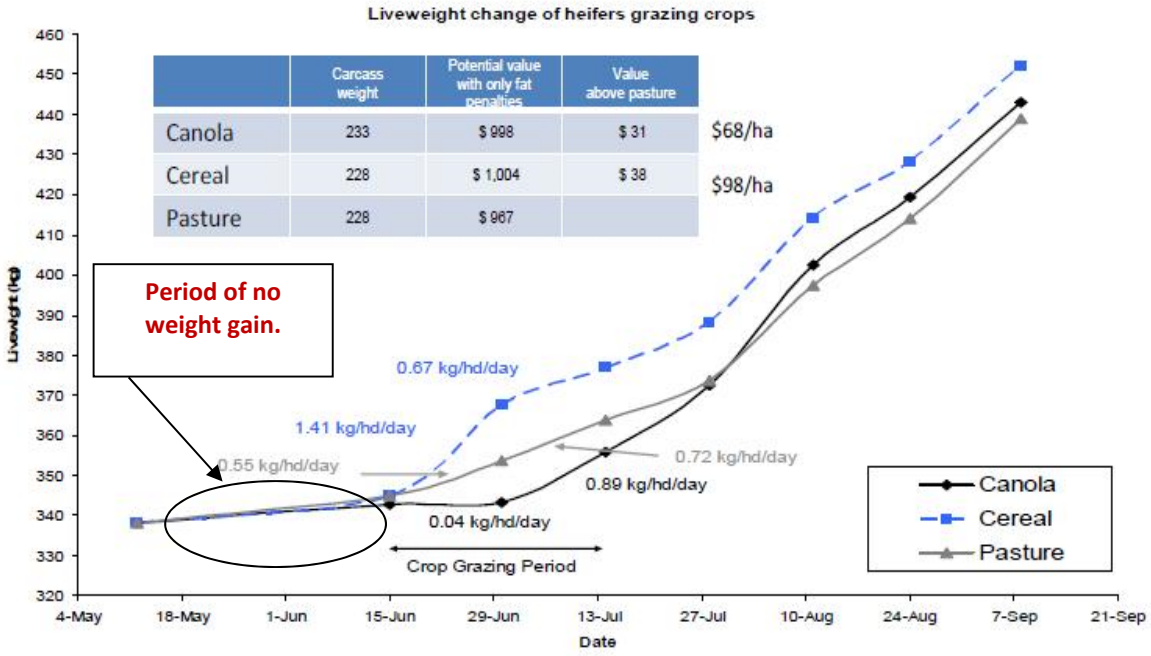

Figure 2 Comparison of liveweight gain in heifers grazing different feed supplies. (GRDC Perth 2012 Crop Updates)

Impact of grazing on grain yield

Statistically, across the trial, grazing had a detrimental effect on grain yield (when p=0.05, LSD=0.9536). Grazing reduced the grain yield in all varieties however in some cases the difference was not significant. Figure 3. The impact was more pronounced and significant on the traditional spring type varieties, grown predominately for grain, by not solely. Jardee again bucked the trend showing little grain yield penalty but being a triazine tolerant variety DM production was only 681Kg/ha Dm.

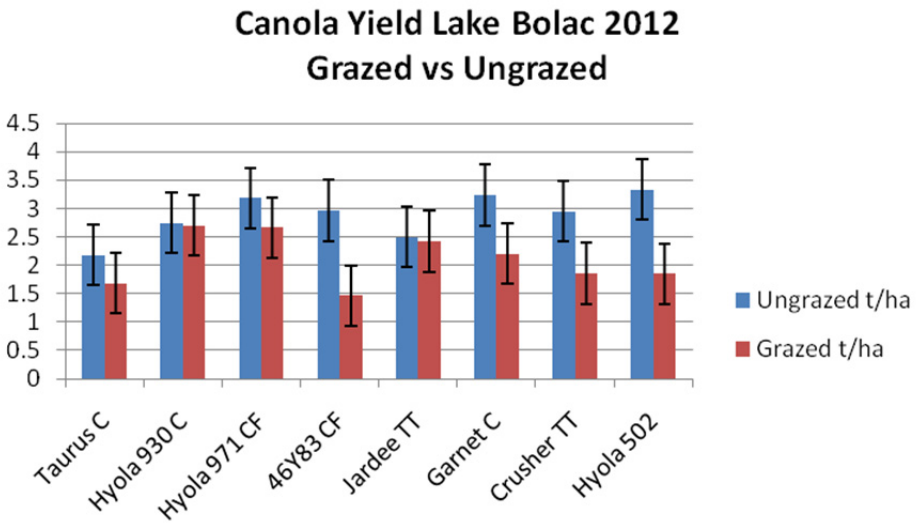

Figure 3 Grain yield with and without grazing (Lake Bolac)

Discussion

2012 provided an opportunity to test the tolerance of canola to grazing under good growing conditions, 2012 being a season when district yields were generally above average. Under our "Best Bet" regime crop agronomy was good with both weed control and nutrient applications being undertaken in a timely effective manner. Also, to minimise the potential for yield reduction, the grazing guidelines that were developed and set down by the CSIRO over recent years were observed. These are as follows: Commence grazing at the six to eight-leaf stage when plants are well anchored (biomass .75t- 1.5 t/ha) but before the buds elongate more than 10 cm. (J Kirkegaard, 2010)

Even after following the above protocols and having the season "go with us" grazing canola did still have a significantly negative effect on grain yield. Importantly, if producing dry matter without compromising yield was the driver to making the decision to graze canola then our grazing cereal trial at the same site suggested that grazing cereals was a far better option. See Figure 1. When we look at the two trials side by side, at best, the best canola variety produces only the same amount of dry matter as the worst performing cereals whilst also incurring a yield penalty.

The limiting factors to being able to graze canola without impacting on grain yield seem to be time of sowing and slow recovery from grazing. Our inability to sow prior to May due to unsuitable sowing conditions and/or a desire to still be grazing paddocks must be overcome if we are to make grazing canola work.

From work conducted in other regions protocols suggest that sowing needs to occur in April with early May being the latest possible option if yield is to be maintained. Although we haven't managed to regularly sow in April to test the benefits of this theory we, have certainly experienced the down side; yield reductions and poor levels of dry matter production.

APSIM modelling has shown that sowing, at Wagga Wagga, later than the 15th of May completely removes the opportunity to graze canola successfully if we want to maintain yield. The modelling suggests that as a consequence of a late sowing (May onwards) grazing is delayed due to a need to produce enough dry matter which in turn restricts crop recovery. The winter doldrums in our environment exacerbate the problem not allowing the crop to reach 5000kg/Dm at flowering which is the first trigger point for yield reduction (Jeffrey I. McCormick, Jim Virgona and John A. Kirkegaard, 2011). The second trigger point which compounds the problem is the season finishing prematurely. Again, if plant maturity is delayed by grazing, which is likely, the problem is only exacerbated.

Image 1 Canola showing reduction in biomass at flowering. Grazed foreground ungrazed background.

In this 2012 trial, both the above described events occurred with a subsequent significant (when p=0.05, LSD=0.9536) impact on grain yield being witnessed across the trial. As with other years only a couple of varieties came close to providing an adequate quantity of dry matter for grazing (1.0 to 1.5 t/ha) without compromising yield (figure 4). These were Hyola 930, Hylola 971 Cl and Jardee.

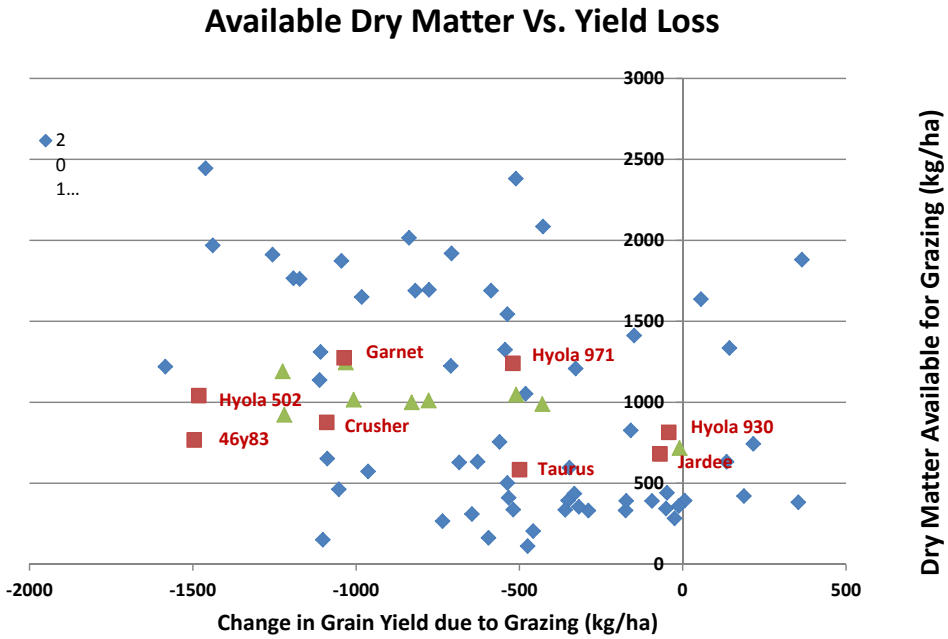

Figure 4 Available DM vs Yield 2102 trial varieties show in red. Lake Bolac

A critical aspect of grazing canola is the interaction between herbicide tolerance, withholding periods and dry matter production. The lengthy withholding period associated with some herbicides excludes potential grazing as late grazing leads to grain yield reduction in most cases. Late grazing also removes canopy at a time when chemical efficiency is waning and good canopy closure is essential for prolonged weed suppression.

Luckily the chemical group with the longest withholding period, the Triazine's, tend to have poor seedling vigour and early growth making them less suitable to a grazing scenario. Varieties associated with Clearfield technology are better suited as their withholding period is shorter and shouldn't interfere with grazing. Roundup Ready and Conventional varieties are largely unaffected as they have very short or no withholding periods. It must be noted that varieties with conventional chemical tolerance unsuitable in paddocks where radish occurs because of our inability to control this weed.

Conclusion

This trial suggests that grazing canola with the view of not impacting on grain yield is difficult to achieve in south western Victoria. The winter doldrums impact too severely on plant recovery to allow yield to be maintained. Our 2010 trials showed that grazing can have a drastic affect on grain yield especially when severe grazing conditions and levels of defoliation were encountered.

Early sowing (pre May) or even possibly the previous spring, with a variety that shows a strong winter habit looks to be the most likely protocol to adopt if grain yield preservation is critical. Early sowing also allows for adequate amounts of dry matter to be produced. The value of a large amount of dry matter (2.5-3 t/ha), in a mixed farming situation, may help compensate for any loss in grain value.

As a comparison, no significant yield losses have been measured in numerous trials on adjacent cereal crops grazed at a similar time to the canola. This would suggest the canola may be more sensitive to our grazing conditions than cereals. Factors which we see as unfavourable at this stage would include:

- Late sown canola - post May
- Water logged conditions at grazing
- Post grazing recovery period occurring during the winter doldrums
- Complete defoliation of the plants
- Incorrect paddock selection - Low nutrient availability or poor seed bed preparation.
- Incorrect variety selection. E.g. Varieties that have poor vigour like non hybrid TT's.
- High weed populations and slow canopy closure.

Acknowledgements

This project was funded by the GRDC.

References

1. Dual-purpose canola – a new opportunity in mixed-farming systems?
2. John Kirkegaard, Susan Sprague, Hugh Dove, Walter Kelman and Steve Marcroft
3. CSIRO Plant Industry, GPO Box 1600, Canberra ACT 2601 Marcroft Grains Pathology, Grain Innovation Park, 110 Natimuk Rd, Horsham, Vic. 3400
4. 2010 - Best Bet Management for Dual Purpose Canola - Kirkegaard, J; Sprague,S; Dove, H; Kelman, W; Hamblin, P
5. 2008 Free Food For Thought. Workshop Notes Grain and Graze 1
6. Perth 2012 Crop Updates Grazing Crops with Cattle- Mark Seymour, Matt Ryan, DAFWA Esperance
7. Exploring opportunities for dual-purpose canola in south– eastern Australia using crop simulation models. Jeffrey I. McCormick, Jim Virgona and John A. Kirkegaard