Dual purpose canola – possibility or pipedream?

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ABSTRACT

A field experiment at Wagga Wagga NSW comprising three spring canola (*Brassica napus*) cultivars sown at three sowing rates was grazed by sheep for a period of 7 days in mid-winter. Increased sowing rate produced greater early biomass for grazing, while the TT cultivar produced less biomass than Conventional or Hybrid cultivars. Grazing (196 dse d.ha) reduced dry matter by an average 50% and leaf area index by 63%. At flowering, grazed plots had accumulated 12% less dry matter than the un-grazed plots. Grazing delayed flowering by 4 days on average but there was no difference in final grain yield between grazed and un-grazed plots, while increased sowing density reduced grain yield. The results suggest grazing canola is possible in drier inland environments without yield penalty provided the timing and intensity of grazing are matched to available biomass and the anticipated seasonal water supply to support grain production.

Key words: graze – defoliation – development – regrowth – grain yield

INTRODUCTION

Dual purpose canola is the practice of grazing canola during the vegetative stage while producing an economic grain yield. A small number of farmers have previously grazed canola crops without a noticeable effect on yield. Kirkegaard *et al* (2008a) demonstrated that with favourable spring conditions and timely grazing there was little effect of winter grazing on canola grain yield in studies near Canberra. Both spring and winter varieties, generally crash grazed were used in the study. Grazing reduces biomass and delays development (Kirkegaard, et al., 2008a,b), both of which are important in determining grain yield. Grazing a canola crop in a less favourable environment heightens the risk of delayed flowering and reduced biomass. Grain yield of canola is closely associated with the date of flowering and biomass accumulation (Hocking & Stapper, 2001a; Thurling, 1974a; Thurling & Vijendra Das, 1979b). The timing of flowering is critical as early flowers will be lost to frosts while later flowering will lead to the plant maturing under hot, dry conditions. Any changes in flowering date can have large consequences in yield especially in drier environments. The aim of these studies was to quantify the impact of grazing on crop biomass accumulation and developmental delay (in flowering time) and to relate both to final grain yield in a drier inland environment than the studies reported by Kirkegaard et al (2008a). The aim was to consider how feasible grazing may be as an option in these drier areas. Commercially available cultivars differing in vigour and sown at different seeding rates were used to investigate effects on feed supply and crop recovery.

MATERIALS AND METHODS

A grazing canola experiment was conducted at Wagga Wagga, NSW (35°03'S, 147°18'E) in 2008. The paddock history was an annual ryegrass pasture 2007, wheat in 2006 and a lucerne pasture phase that finished in 2005. The site was situated on alluvial flats with heavy clay subsoil and was pre-irrigated with 50 mm of water (9th April). The experiment was sown on the 29th April on 18 cm row spacings into 20 x 1.4 m plots. This split-split plot design consisted of grazing as a main plot, cultivar as a subplot and sowing rate as a sub-sub plot. Three different cultivar types (hybrid, conventional, triazine tolerant) varying in vigour, but matched for maturity times (mid-maturity) were selected. Each cultivar was sown at three sowing rates with plant emergence densities averaging 27, 48 and 67 plants/m^2. The grazing treatment consisted of grazed and un-grazed plots. Sheep grazed plots at 28 DSE/ha at the 6-8 leaf stage in a single mob from the 4th-11th July providing 196 dse.d.ha of grazing. Weeds and insects were controlled throughout the experiment. Plots were fertilised to achieve maximum yield potential. Further irrigations of 50 mm each were applied on the 3rd June and 18th September and together with growing season rainfall of 195 mm provided a total seasonal water supply of 345 mm (average for Wagga April – October is 350 mm). However spring temperatures were very hot (Sept-Oct mean maximum 3°C greater than LTM) and the crop experienced considerable stress during the grain-filling period.

RESULTS

Pre-grazing dry matter on 4th July ranged from 365-1820 kg/ha (Table 1). The level of available feed was dependent on cultivar ($p<0.001$) and sowing rate ($p<0.001$). The hybrid cultivar out yielded other cultivars at all sowing rates while dry matter yield of the TT cultivar was lowest.

Table 1. Dry matter pre-grazing (kg/ha)

	Sowing Rate		
Cultivar	Low	Mid	High
Hybrid	1061	1688	1820
Conventional	1034	1452	1793
TT	365	810	1073

Hybrid, conventional and TT grazed plots contained 46, 45 and 62% dry matter compared to un-grazed plots immediately after grazing while leaf area index was reduced to 33, 28 and 49% of un-grazed plots. The conventional cultivar had 51% of stems removed during grazing while the hybrid and TT lost 33% and 17% of stems respectively.

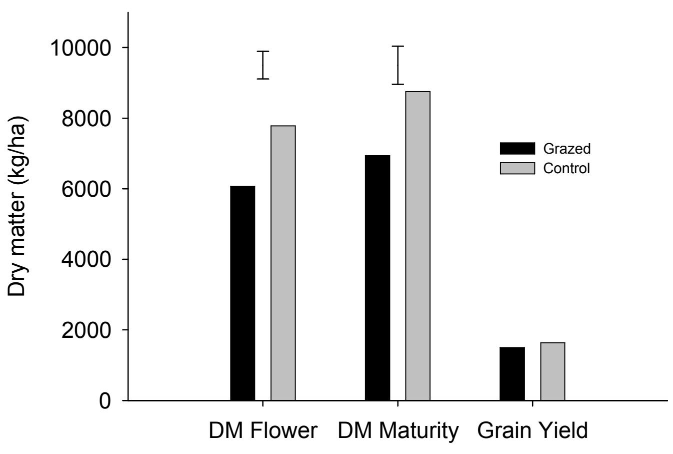

Figure 1. Dry matter at flowering (LSD 779.9, p = 0.006) and maturity (LSD 1081.0, p = 0.013), final grain yield (not significant)

Differences in dry matter due to cultivar and sowing rate persisted at flowering (data not shown). Grazing reduced dry matter at flowering by 12% (Figure 1). At flowering, no interaction was observed between sowing rate or cultivar to improve recovery rate. Flowering was delayed by 4 days overall but there was significant variability within the data ($p = 0.076$).

Final dry matter was reduced by grazing but final yield was not affected (Figure 1). Low sowing rates out-yielded higher sowing rates (Table 2) but there was no interaction with grazing. Grain yield response in relation to dry matter accumulation at flowering was different between grazed and un-grazed treatments (Figure 2). Higher biomass at flowering in un-grazed treatments reduced grain yield significantly ($p = 0.008$), while this was not the case for grazed treatments. Grazing treatments improved harvest index from 13.9% to 15.8% ($p=0.086$) when dead leaves were included.

Table 2. Grain yield for grazed and ungrazed crops (kg/ha). Average grain yield for sowing rate (kg/ha), LSD 229.9, $p < 0.001$

	Low		Mid		High	
	Control	Graze	Control	Graze	Control	Graze
Hybrid	2045	1663	1541	1569	1037	906
Conventional	1619	1682	1990	1388	1375	1481
TT	2086	1742	1396	1744	1635	1268
Sowing Rate Mean	1806		1605		1284	

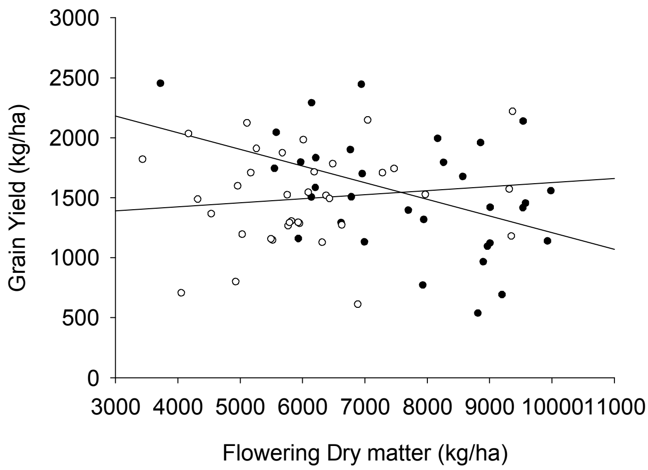

Figure 2. Dry matter at flowering and final yield. Closed circles control ($y = -0.1391x + 2598.7$, $R^2 = 0.2063$), open circles grazed ($y = 0.0338x + 1288.5$, $R^2 = 0.0148$)

DISCUSSION

Cultivar choice and sowing rate determined the level of feed available at time of grazing. The hybrid cultivar produced the greatest level of early dry matter followed by conventional and TT cultivars. This relationship between early dry matter and type of cultivar has been previously demonstrated for a large number of cultivars (Kirkegaard, et al., 2008b). Sheep apparently preferred the hybrid and conventional cultivars over the TT cultivar leading to different grazing pressures being applied across the experiment (as seen by different proportions of biomass removal). Primarily this resulted from the smaller TT plants rather than any intrinsic difference in acceptability. This cultivar selection is unimportant commercially as sheep only have access to one cultivar in a field situation. The cultivar and sowing rate combinations that lead to low available feed would not support long grazing periods. The number of stems grazed generally related to the level of grazing on a particular plot although sheep often randomly selected particular main stems to graze while leaving lower leaves.

Grazed plants recovered quickly from low dry matter levels to 88% of the control plots at flowering. Using different sowing rates and cultivar types did not influence recovery. Low density stands produced larger individual plants that enabled recovery to occur more quickly on an individual plant basis. High density plots had smaller plants that recovered slowly at a single plant level but recovery on a canopy basis was the same due to higher plant numbers.

Previously it has been reported that removing the main stem leads to significant flowering delays (McCormick et al, 2008) but this was not apparent in this experiment. Individual plants function within a community where there is a variety of flowering times and defoliation levels between individual plants. Although some plants maybe severely defoliated, the delay in development at a canopy level is moderated as other plants are less affected.

The effect of grazing on dry matter was still evident at maturity in reduced plant height. However, grazing did not reduce final grain yield, while increased sowing rate strongly reduced yield. It appears that the increased canopy size generated by higher sowing rates used more water during the season, increasing water stress during the hot and dry finish, while grazing may have had the reverse effect.

These results suggest that canola can be grazed in winter with little impact on yield even in drier inland environments under average seasonal conditions. However there will need to be a balance between increasing the size of the canopy for increased winter feed production with the need to conserve water for grain-filling.

ACKNOWLEDGEMENTS

This work would not have been possible without the assistance of Shane Hildebrand and Kerry Schirmer.

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