

## Maximising productivity from Brassica crops

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**Abstract:** *Regrowth forage rape (Brassica napus) crops can be an important forage source for lambs, particularly in environments which are periodically dry. Lambs were grazed on regrowth from a rape crop over summer at four different allowances to determine grazing parameters for maximising lamb production. Maximum live weight gain per hectare was achieved at a daily allowance of 2.5 kg DM/head/day where lambs ate 60% of the crop and left a grazing residual of 1350 kg DM/ha. There was some evidence that grazing intensity affected regrowth ability.*

### Introduction

Forage rapes (eg. *cv* Winfred) with the ability to re-grow following grazing have been widely adopted as a feed source for finishing lambs and feeding other livestock classes. Over a 2–3 month period, such forage rapes can produce high quality dry matter (2–6 t DM/ha). Traditionally they fit into summer dry environments utilising late spring moisture. In these environments the quality, and usually the quantity, of dry matter from rapes is superior to grass at this time. In NSW they are increasingly being sown in the autumn to provide large quantities of high quality winter feed. These forage systems are characterised by either a mid to late September sowing or an April sowing, with grazing commencing 80–100 days after sowing. Multiple grazing (2–3 events) are possible when moisture is available.

A large number of studies in New Zealand and overseas have indicated that the performance of lambs can vary with degree of utilisation of the crop and method of grazing (Armstrong *et al.* 1984). New Zealand data show that maximising animal production from summer leaf turnips requires a rotational system which optimises stocking rate and utilisation (Judson & Parris 2007).

The aim of this experiment was to investigate the effect of grazing intensity on liveweight gain of lambs eating a mid-height forage rape (*cv.* Winfred) to determine optimum grazing parameters.

### Methods

Forage rape (*cv* Winfred) treated with 12 ml/kg Gaucho (Bayer Crop Sciences) was sown into a pre-irrigated, 1.5 ha trial area in spring (24th October) at a seeding rate of 4 kg/ha. Diammonium phosphate (DAP; 350 kg/ha) was broadcast prior to drilling. The area was fenced into 4 small paddocks (approx 0.3 ha) each representing a different grazing treatment. In each paddock, temporary fences were erected dividing the paddock into 5 weekly grazing breaks. In mid-January, mixed sex, cross-bred lambs (approximately 28 kg) were placed in each paddock after being weighed. Animals were randomly allocated to treatment groups and stocked at a rate that achieved a daily allowance of 1.0, 1.5, 2.0, or 3.5 kg DM/head/day (Table 1). Lambs were re-randomised before grazing the second rotation. Grazing ceased in late March, 148 days after sowing. The number of lambs in each break at the beginning of the experiment and at the beginning of each subsequent week was determined by;

No. of lambs =

$$\frac{\text{Pre-grazing crop mass (kg DM/ha)} \times \text{break area (ha)}}{\text{Allowance (kg DM/head/day)} \times 7 \text{ days}}$$

Pre-grazing crop mass was determined by cutting 6 quadrats (each 0.25 m<sup>2</sup>) to ground level and drying a sub-sample to constant weight in an oven at 80°C. Post-grazing residuals were determined in the

**Table 1. The stocking rates employed to create a range of daily allowances, utilisation and grazing residuals.**

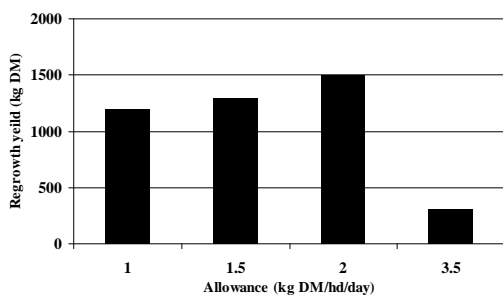
Allowance (kg DM/lamb/day)	Utilisation (%)	Residual (kg DM/ha)	Stocking rate (lambs/ha)
1.0	100	0	93
1.5	80	467	55
2.0	66	1003	51
3.5	40	2205	38

same way. The proportion of leaf, petiole and stem on plants was estimated by dissecting 10 plants in each plot prior to grazing and a further 10 plants in each plot after grazing in all treatments. Freshly harvested plants were weighed and subsequently dissected into leaf, petiole and stem. Sub-samples were dried to constant weight at 80°C to determine dry matter percentage.

**Results and discussion**

**Dry matter production**

Pre-grazing mass for the first grazing averaged 5100 kg DM/ha, which represented a crop at mid-thigh height. The mean regrowth across all treatments was 2000 kg DM/ha. There were large differences (1600 kg/ha) between treatments in total yield. Some of this difference may have been due to differences in fertility resulting from previous cropping rotations. Brassica yields are well known to respond to soil availability of both phosphate and nitrogen (de Ruiter *et al.* 2009). However, regrowth potential of the crop also appeared to be significantly affected by previous grazing intensity (Figure 1.).

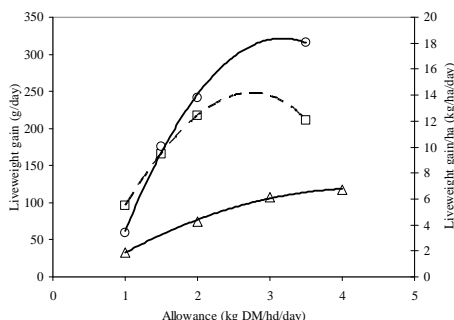


**Figure 1. Effect of different daily allowances of brassica (kg DM/lamb/day) on dry matter (kg DM/ha) produced in the regrowth period.**

At generous allowances where grazing residuals were high (2200 kg DM/ha), regrowth was poor (300 kg DM/ha), compared to the regrowth from lower allowances where residuals were lower (1200–1500 kg DM/ha). As the effect of grazing intensity and pre-grazing mass were somewhat confounded, it is unclear whether poor regrowth is a symptom of high residuals and/or large first yield brassica crops. The effect of grazing intensity on regrowth requires further investigation, because it has serious implications for both optimal grazing management and cultivar selection.

**Lamb liveweight gain**

Daily allowance of forage rape had an effect on the average liveweight gain of lambs in this study (Figure 2). Lamb growth rate increased as daily allowances increased, from 59 g/day at a daily allowance of 1.0 kg DM/head/day, up to 316 g/day at a daily allowance of 3.5 kg DM/head/day. In this study, the maximum liveweight gain was achieved at an allowance equivalent to 10% of liveweight. This is in general agreement with



**Figure 2. Effect of daily allowance of brassica (kg DM/lamb/day) on lamb liveweight gain per head (g/day) (O; solid line) and per hectare (kg/ha/day) (□; broken line) compared with liveweight gain data from pastures (Thompson *et al.* 1979) (Δ; solid line)**

Armstrong *et al.*, (1984) and Fitzgerald (1983) who suggested that allowance in excess of 7% of liveweight were necessary to maximise growth rate in lambs. It is possible that maximum liveweight gain could have been reached at allowances less than 3.5 kg DM/head/day but not detected in this study because there was not a treatment to generate a data point between 2 and 3.5 kg DM/head/day.

In all but the lowest allowance, lambs grew faster on the brassica crop than ryegrass when compared with previous data (Thompson *et al.* 1979). Brassicas generally contain a greater concentration of metabolisable energy than pasture, especially during summer. They also may contain higher concentrations of crude protein and may have a faster fractional degradation rate in the rumen, which generally leads to increases in intake.

In the present experiment, as allowance increased, lamb liveweight increased, most likely due to increases in intake. Allowances in excess of 2.5 kg DM/head/day had little effect on lamb liveweight gain because it is likely they had reached maximum intake. Allowances below 2.5 kg DM/head/day reduced liveweight gain, which maybe attributed to individual intake being limited as a result of increased inter-animal competition at higher stocking rates.

At low allowances (1.0 kg DM/lamb/day) liveweight gain per-hectare was low (5.5 kg/ha/day) because, despite high stocking rates (93

lambs/ha), mean liveweight gain per-lamb was low (59 g/day). At the highest allowance (3.5 kg DM/lamb/day) liveweight gain per-hectare was not maximised because, despite rapidly growing lambs (316 g/day), stocking rates were low (38 lambs/ha). Maximum liveweight gain per-hectare (approximately 14 kg/ha/day) would probably have been achieved at an allowance of around 2.5 kg DM/lamb/day, where lambs would have grown at close to maximum (300 g/day) with stocking rates of 47 lambs/ha. The tentative nature of this conclusion reflects the absence of data points between allowances of 2 and 3.5 kg DM/lamb/day. However, in earlier work on leaf turnip (Judson and Parris 2007) maximum liveweight gain per-hectare (12 kg/ha/day) was achieved at an allowance of 2–2.5 kg DM/lamb/day, which is comparable to the current data.

#### Utilisation

The effect of daily allowance on utilisation and post-grazing crop mass is shown in Figure 3. Increasing allowance reduced utilisation from 100% at an allowance of 1.0 kg DM/lamb/day to 40% at 3.5 kg DM/lamb/day. Post-grazing crop mass increased as allowance increased (from 0 kg DM/ha at an allowance of 1.0 kg DM/lamb/day to 2200 kg DM/ha at an allowance of 3.5 kg DM/lamb/day). According to the data in Figure 3, at an allowance of 2.5 kg DM/lamb/day, which probably maximised liveweight gain per-hectare, lambs would utilise 60% of the pre-grazing crop mass on a DM basis and leave on

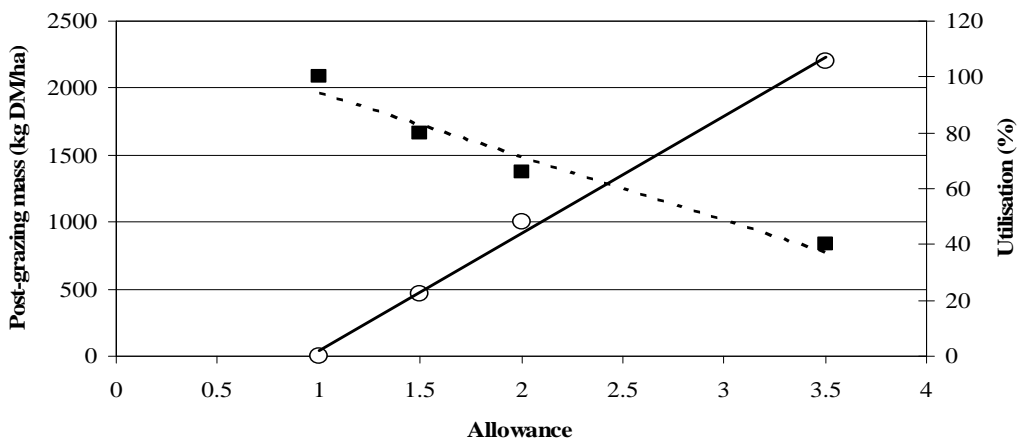


Figure 3. Effect of daily allowance on post-grazing crop residuals and percent utilization.

average 1350 kg DM/ha after grazing. As the lower stem has a significantly higher dry matter content compared with other parts of the plant a 60% utilisation of dry matter represents, from a practical point of view, lambs consuming all the leaf and petiole and eating a little more than half the height of the stem.

This data suggests that grazing management aimed at increasing utilisation of summer crop beyond 60% of dry matter would not optimise production of liveweight. Systems which currently utilise more than 60% of the crop by dry matter could increase productivity per-hectare by leaving a higher residual and increasing lamb liveweight gain.

## Conclusions

This data has shown that using regrowth forage rape brassica crops (eg. cv. Winfred) is likely to have a beneficial effect on lamb growth rates over and above pastures. However, maximising animal production from these crops requires careful management of daily allowance through stocking rate. An allowance of 2.5 kg DM/lamb/day, where only 60% of the crop (on a dry matter basis) is removed at grazing, appears to maximise liveweight gain per-hectare on mid-height (75cm) crops. Lower allowances (through higher


stocking rates) will limit lamb growth rate, while higher allowances (through lower stocking rates) will limit crop utilisation. There is some need to investigate further the relationship between crop yield, grazing intensity and potential for regrowth. This study suggests that rape crops may suffer from reduced regrowth where high residuals are left.

## References

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