

VALUE OF MATURE GRAIN LEGUME CROPS FOR OUT OF SEASON PRIME LAMB PRODUCTION

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SUMMARY

The growth and carcase characteristics of South Suffolk x Merino ewe lambs, grazed on mature crops of either faba beans, field peas, or lupins were evaluated. Lambs grazing faba beans grew significantly ($P < 0.05$) faster (220 g/head/day) than lambs grazing field peas (186 g/day), which in turn grew faster than lambs grazing lupins (166 g/day). These differences in growth rate were also reflected in significant ($P < 0.05$) differences in carcase weight. Carcases from lambs grazing lupins had whiter fat than those from lambs grazing faba beans or field peas ($P < 0.05$) but there were no differences in either meat colour or GR tissue depth. The gross margin from grazing lambs on lupins was greater than grazing lambs on either field peas or faba beans. Grazing mature crops of lupins and field peas to produce prime lambs out of season generated greater gross margins per hectare than would have been achieved had these crops been harvested for sale of grain.

Keywords: lamb performance, grain legumes, profitability

INTRODUCTION

The WA prime lamb industry is characterised by a marked seasonal supply of lambs with up to 60% of lambs marketed from August to November and the remainder sold over the other eight months of the year. Cost-effective feeding systems are required to encourage out of season prime lamb production, to improve the efficiency in all sectors of the WA industry and to better service and develop domestic and export markets.

Hynd and Allden (1986) found that the liveweight gain of young sheep supplemented with legume grain was better than of those receiving supplements of cereal grain. Allden and Geytenbeek (1984) grazed crossbred lambs on mature crops of lupins, faba beans or field peas, and found that lambs grew faster on lupins compared with either faba beans or field peas.

Carcase weight and fatness (measured at the GR site) are the most important determinants of the price for prime lamb carcases in WA. These measurements provide useful estimates of the proportion of lean meat in commercial cuts from carcases (Hopkins *et al.* 1995b). Consumers prefer lamb meat that has a bright cherry-red colour (Channon 1990), and with fat that is white rather than yellow in colour (Kruggel *et al.* 1982). This paper reports the growth and carcase characteristics of South Suffolk x Merino ewe lambs grazed on mature crops of either faba beans, field peas or lupins. The gross margin from grazing each crop is also compared with that for harvesting the crops for sale of grain.

MATERIALS AND METHODS

The study was conducted at 'SpringHill', near Northam in the WA wheatbelt, from December 1995 to January 1996. The three treatment groups consisted of standing mature crops of either faba beans (*Vicia faba*), field peas (*Pisum sativum*), or lupins (*Lupinus angustifolius*). The crops were grown using the recommended rates of seed and fertiliser for the district, and according to other standard agronomic practices.

Samples of the seeds with pods, for each of the crops were collected one week prior to the commencement of grazing, from eight randomly sited 0.25m² quadrats. Estimates of seed yields were determined. Composite samples were analysed for dry matter (DM), crude protein (CP) and *in vitro* DM digestibility for estimation of metabolisable energy (ME) using standard procedures.

Two hundred and seventy South Suffolk x Merino ewe lambs approximately 6 months of age, were stratified on liveweight for allocation to the treatment groups, so that there were 90 lambs grazed on each crop. The lambs in each treatment group had an initial mean liveweight of 32.0 ± 2.0 kg and mean fat score of 1.1 ± 0.2 . Before being allocated to the treatment groups, all lambs had run together on the same pasture paddock for a period of 6 weeks. The lambs were shorn, vaccinated with Glanvac 3S (for prevention of Enterotoxaemia, Tetanus and Black Disease), and drenched with Ivomec® (to control internal parasites) four weeks, two weeks and three days respectively before the study.

Stocking rate was initially the same for each treatment, at 23 lambs per tonne of dry seed on offer. When the level of dry seed declined to approximately ten seeds per square metre the size of the plot available for grazing was increased, therefore the lambs grazed the crops *ad lib*. The lambs were weighed and fat scored (1-5) each week. The lambs were slaughtered in a commercial abattoir 45 days after starting the study when at least 50% of all lambs had reached a liveweight of 42 kg or more and/or a fat score of at least two. The hot carcass weight (HCW) for each lamb was recorded immediately after slaughter and was used to calculate dressing percentage. Measurements of tissue depth at the GR site (degree of fatness over the 12th rib, 110 mm from the midline), colour of the *M. longissimus dorsi* between the 12/13th rib, and fat colour over the 12/13th rib and tail were taken after the carcasses had been chilled for 20 hours. Meat and fat colour were measured using a Minolta Chroma Meter (CR-200) set on the L*, a* and b* system (where L* measures relative lightness, a* relative redness and b* relative yellowness), as described by Hopkins *et al.* (1996).

Analysis of variance was used to determine the effect of the treatments on liveweight, growth rate, dressing percentage and carcass measurements. Covariance analysis was applied to measures of carcass fatness and meat colour, using HCW and GR as covariants, respectively. The computer software package SuperANOVA, was used for the statistical analyses.

In calculating the gross margins it was assumed that all available grain from each crop could be sold as Grade 1 grain, at prices current for January 1996. The additional costs to harvest and transport the grain were taken into account in calculating the gross margins from the sale of the grain.

RESULTS

The CP (% in DM) and ME (MJ/kg DM) of the seeds with pods were as follows: faba beans, 22.4 & 11.1; field peas, 20.7 & 10.9; and lupins 24.3 & 11.4. The dry seed yield (t/ha) estimate for the faba bean, field pea and lupin crop was 2.3, 2.0 and 2.9, respectively. The calculated amount of seed consumed (kg/lamb) to reach final liveweight for lambs grazing faba beans, field peas and lupins was 83, 67 and 59, at an overall stocking rate (lambs/ha) of 28, 30 and 49.

The mean liveweight of the lambs in each treatment group was not different at the start of the study. At the final weighing, prior to slaughter, lambs that grazed faba beans were significantly ($P<0.05$) heavier than lambs that grazed field peas, and these were heavier than lambs that grazed lupins (Table 1). These differences in liveweight were also reflected in the mean growth rate and HCW. The dressing percentage of the lambs grazed on field peas was higher ($P<0.05$) than the lambs grazed on faba beans, and these lambs had a higher dressing percentage than the lambs that grazed lupins (Table 1).

The fat score of the lambs on the three treatments was not different at the start of the study. The mean GR for the lambs grazed on lupins was less than that of the lambs grazed on the other two crops, but these differences did not remain when GR measurements were adjusted for differences in HCW (Table 2).

There were no differences between the treatments in the colour of the meat of the *M. longissimus dorsi*, and the mean values for lightness were all above 32, considered acceptable by Hopkins *et al.* (1996).

Lambs that grazed on lupins had significantly ($P<0.05$) whiter fat (lower values) at the 12/13th rib and at the tail, than the lambs that grazed faba beans or field peas (Table 3). These differences remained when the values were adjusted for GR as a covariate.

Under the prevailing economic conditions, it was considerably more profitable to graze out of season prime lambs on unharvested crops of lupins, than it was to graze them on faba beans or field peas (Table 4).

Table 1. Initial and final liveweight, growth rate, hot carcass weight (HCW) and dressing % of South Suffolk x Merino lambs grazed on standing mature grain legume crops

Treatment	Initial liveweight (kg)	Final liveweight (kg)	Growth rate (g/h/day)	HCW (kg)	Dressing %
Faba beans	32.0 (1.97)	42.3 ^a (2.94)	220.5 ^a (55.63)	19.6 ^a (1.59)	46.3 ^a (2.48)
Field peas	31.9 (2.00)	40.5 ^b (2.75)	186.1 ^b (57.45)	19.1 ^b (1.40)	47.2 ^b (1.97)
Lupins	32.1 (2.11)	39.6 ^c (2.19)	166.5 ^c (51.96)	17.9 ^c (1.21)	45.2 ^c (2.15)

Values in parentheses are standard deviations

Values in columns with different superscripts are different ($P<0.05$)

Table 2. Mean initial fat score, GR tissue depth, and GR adjusted for HCW for South Suffolk x Merino lambs grazed on mature grain legume crops

Treatment	Fat score	GR (mm)	GR (adjusted)
	Day 1	Day 45	
Faba beans	1.1 (0.25)	14.2 ^b (2.66)	13.5 (2.62)
Field peas	1.1 (0.23)	13.6 ^b (2.59)	13.4 (2.52)
Lupins	1.1 (0.22)	12.5 ^a (3.01)	13.3 (2.70)

Values in parentheses are standard deviations

Means in columns with different superscripts are different ($P < 0.05$)

GR (adjusted) = GR adjusted for hot carcass weight.

Table 3. Least square means for measures of fat colour adjusted for GR, at the 12/13th rib and at the tail of South Suffolk x Merino lambs grazed on mature grain legume crops

Treatment	12/13th rib	tail
Faba beans	5.8 ^a (1.54)	5.6 ^a (1.46)
Field peas	6.1 ^a (1.52)	5.8 ^a (1.45)
Lupins	5.2 ^b (1.55)	4.8 ^b (1.48)

Values in parentheses are standard deviations

Means in columns with different superscripts are different ($P < 0.05$).

Table 4. Gross margins for prime lambs grazed on mature crops of faba beans, field peas and lupins for out of season production of prime lambs, versus harvesting the crop to sell the grain

Crop	Gross margin (\$/ha)	Gross margin (\$/ha)
	Graze lambs	Sell grain
Faba beans	381	496
Field peas	392	287
Lupins	641	368

DISCUSSION

This study demonstrates the value of grazing mature grain legume crops *in situ* to sustain good growth rates of crossbred lambs over summer in WA. The magnitude of the growth rates in our study are comparable to those reported by Allden and Geytenbeek (1984). However, the relative growth rates of lambs grazing the crops in our study differ from those recorded by Allden and Geytenbeek (1984). These workers showed that Suffolk x Merino lambs, grazing with cattle, grew faster on mature crops of lupins (251 g/h/day) than lambs grazing mature crops of faba beans (225 g/head/day) or field peas (208 g/day). It is possible in their study that the competition between the cattle and the lambs for the grain available contributed to the relative differences in lamb growth rates. Nevertheless, in an earlier study with young Merino sheep grazing a number of grain legume crops *in situ*, Allden and Geytenbeek (1980) found that, over a 12 week period, faba beans supported the best liveweight gain (11.3 kg), followed by lupins (10.1 kg). In this earlier study there was heavy rain halfway through the experiment and this adversely affected the subsequent liveweight gains of the lambs on the other crops, especially those on field peas. There was no rain during our 45 day study.

The high correlation between liveweight and the proportion of fat in a carcass (Kempster *et al.* 1982) helps explain why there were no significant differences between the treatments for GR after adjustment for HCW. Hopkins *et al.* (1995a) reported an effect of diet on meat colour. They considered the heavier and fatter carcasses from one dietary treatment may have allowed the carcasses to cool more slowly, resulting in lighter meat colour. In our study, there were significant differences between treatments for HCW and GR (unadjusted for HCW), yet there were no differences in meat colour between the treatments.

The difference between lupins and the other treatments for the colour of carcase fat may be due to the level of lutein in the crops grazed. Legumes contain lutein which is the main carotenoid in lamb fat, and carotenoid concentration is strongly correlated with fat colour values (Tume 1994).

It was more profitable to produce out of season lambs by grazing them on standing mature crops of lupins or field peas than it was to harvest these crops for grain. The considerably higher gross margin from grazing the lambs on the crop of lupins was largely due to the stocking rate of the lambs on lupins being much higher than the lambs grazing either faba beans or field peas. The economics of finishing lambs on mature grain legume crops *in situ* will depend on yield of grain; market price for the grain; stocking rate, lamb growth and carcase characteristics and the price difference between store and finished lambs.

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