Evaluation of short-term fodder options between cropping phases in Tasmania

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Abstract

Irrigated forage crops sown in autumn increase land utilisation compared to the common practice in Northern Tasmania of grazing crop stubbles over winter. However, there is little information on which crops best suit this short cropping phase prior to sowing an irrigated winter/spring crop such as poppies or green peas. The aim of this study was to evaluate a diverse range of forage species and varieties that provide the most valuable grazing over autumn and winter. Thirty four varieties of cereals, grasses, legumes and other broadleaf species were selected and dry matter production and nutritive value evaluated.

There was significant variation in DM yields both between and within species. The highest cumulative total DM production for the season (5 - 5.5 t ha^{-1}) was from annual ryegrass and cereals with winter habit. The main production difference between varieties was the timing of maximum growth. Spring varieties of cereals, canola and grain legumes showed rapid early growth but damage to growing points with removal of dry matter reduced subsequent regrowth. In contrast, there was minimal damage to slower growing winter cereals with more prostrate early growth. This work highlights the importance of species and variety selection when determining optimal feed production.

Key words

Forage, intensive grazing, integrated cropping

Introduction

An increase in water availability in Tasmania has stimulated an increase in prime lamb production in mixed grazing/cropping systems. Consequently the popularity of dual-purpose crops has increased. To date cereals and canola have been grown to provide quality winter feed and a harvestable grain crop at maturity. As an extension to this system an increasing number of farmers are seeking other short-term winter feed options to provide quality winter feed. These fodder crops are sown in late summer/autumn, established under irrigation and grazed during winter, before being planted with a spring crop such as poppies or green peas.

Recently, studies have focussed on the impacts of grazing on grain yield of dual purpose crops. For example, Kirkegaard et al. (2012) conducted studies on the management of dual purpose canola, investigating grain yield penalties with time of grazing. However, further work is required on single purpose alternative crop species for grazing. Deciding on the best short-term fodder option is complicated by the range of species and varieties that could fit this role.

This study was a preliminary evaluation of winter dry matter (DM) production and nutritive value (NV) of 34 varieties of cereals, grasses, legumes and other broadleaf species. The specific aims of this study were to (i) determine the species and varieties most suitable for both DM production and NV during the autumn / winter period, (ii) compare multiple forage cuts (simulating grazing) and single forage cut (simulating silage production) in terms of DM production.

Methods

The trial site was located near Bishopsbourne, in northern Tasmania (49°62'S, 146°99'E) in 2010. The soil is a brown dermosol with clay content increasing with depth to a clay subsoil. The previous crop was poppies. The experiment was a randomised complete block design with two replicates with varieties nested within a species block for ease of management. The species and varieties used in the trial are outlined in Table 1. Growing season rainfall (February to August) was 429 mm plus 50 mm of irrigation at establishment.

Management and measurements

The trial was sown on 25th February 2010 with an Ojyard precision drill with 10 rows at 150 mm row spacing. Sowing rates were based on current best practice and final plot size was 8 m x 1.5 m. A basal

fertiliser (9-13-14-4) was applied at 150 kg ha^{-1} and weeds and pests were controlled as required. Half of each plot was cut up to three times (19th April, 10th June and 3rd September), depending on growth stage and maturity of individual varieties. To avoid preferential and overgrazing by livestock, DM cuts were taken with a mower at a height of 50 - 60 mm. These accumulated cuts are herein referred to as '*grazing cuts*' as they simulate grazing events. The other half of the plot was left to grow through the duration of the trial and then harvested, known herein as '*silage cuts*'. This provided an indication of the DM available if the crop was turned into either silage or green manure. Harvest dates were 22ndJuly for early maturing material or 3rd September, prior to the paddock being sown with green peas. Samples were dried at 56°C for 48 hours. For the silage cuts feed value measurements were undertaken. Crude protein (CP), digestibility (DMD) and an estimate of metabolisable energy (ME) were determined by Near Infrared Reflectance at FeedTest Laboratories, Werribee. All data are reported as a percentage of DM.

Table 1. List of the 34 varieties of crop and fodder species evaluated and their growth habit.

Crop/fodder	Species	Variety/cultivar (and growth habit)
Ryegrass	*Lolium multiflorum* Lam	Feast II (Italian), T-Rex (annual)
Oats	*Avena sativa* L.	Graza 50, Quamby, Targa (spring); Bass (winter)
Black oats	*Avena strigosa* L.	Negrita, Saia (spring)
Wheat	*Triticum aestivum* L.	Bolac, Preston, Sentinel (spring); Brennan, Naparoo, Revenue, Tennant (winter)
Triticale	*Triticosecale rimpaui* Wittm	Hawkeye, Tahara (spring); Endeavour (winter)
Cereal rye	*Secale cereal* L.	Oonose (spring)
Barley	*Hordeum vulgare* L.	Dictator, Gairdner, Yerong (spring); Barley E (winter)
Forage rape	*Brassica napus* L. var. *napus*	Ace (mid season); Greenland, Leafmore (long season)
Hybrid rape	*B. campestris* x *B. napus*	Pasja (mid season)
Canola	*Brassica napus* L.	Summit (spring); CBI206 (winter)
Field peas	*Pisum sativum* L.	Morgan, AP2 (spring)
Faba bean	*Vicia faba* L. var. *minor*	Tick bean (spring)
Vetch	*Vicia sativa* L.	Rasina (spring)
Persian clover	*Trifolium resupinatum* L. var. *majus*	Shaftal (annual)
serradella	*Ornithopus sativus* Brot.	Serratas (annual)

Statistical analysis

Separate analyses of variance (ANOVA) were conducted for the silage and grazing yields. Yields of totalled harvests were analysed by ANOVA (Genstat 17, VSN International Ltd). When F tests were significant at $P < 0.05$, the least significant difference (LSD) was calculated at $P = 0.05$ for testing differences between mean DM yields. Forage quality data were not subjected to statistical analysis as samples were pooled over replicates.

Results and Discussion

Accumulated grazing cuts

There were significant differences between the accumulated grazing DM yields of different varieties (Figure 1). In general, there was higher early DM production from barley, triticale, oats and cereal rye varieties compared with the other species, including wheat and ryegrass. Within this grouping the cereals with winter habit i.e. requiring vernalisation (Barley E, Bass oats and Endeavour triticale) tended to be at the lower end of the range of DM yields for each species. However, the subsequent recovery and growth of the more prostrate winter types was superior resulting in higher total DM accumulated across the three cuts. The winter cereals, also including Naparoo, Brennan and Revenue wheat produced over 5 t DM ha^{-1}. In addition, Feast II and T-Rex ryegrass responded well after the first cut and were not significantly different to the winter cereals in accumulated DM yield. Regrowth of the spring types of barley, triticale, oats and rye was generally poor suggesting that the first cut was too severe and damaged the growing points. One exception was the relatively good regrowth of Gairdner barley where many secondary tillers grew after the first cut.

Initial growth of brassica fodder crops was slower than most cereals. Pasja hybrid rape with better regrowth was the best performing brassica in accumulated cuts. Tick beans and field peas grew well initially but percentage DM was low due to high moisture content. The field peas and vetch, with lodging, became difficult to mow and there was no subsequent regrowth in the grain legume species following the first cut. The pasture legume species were slower to establish resulting in increased competition from weeds.

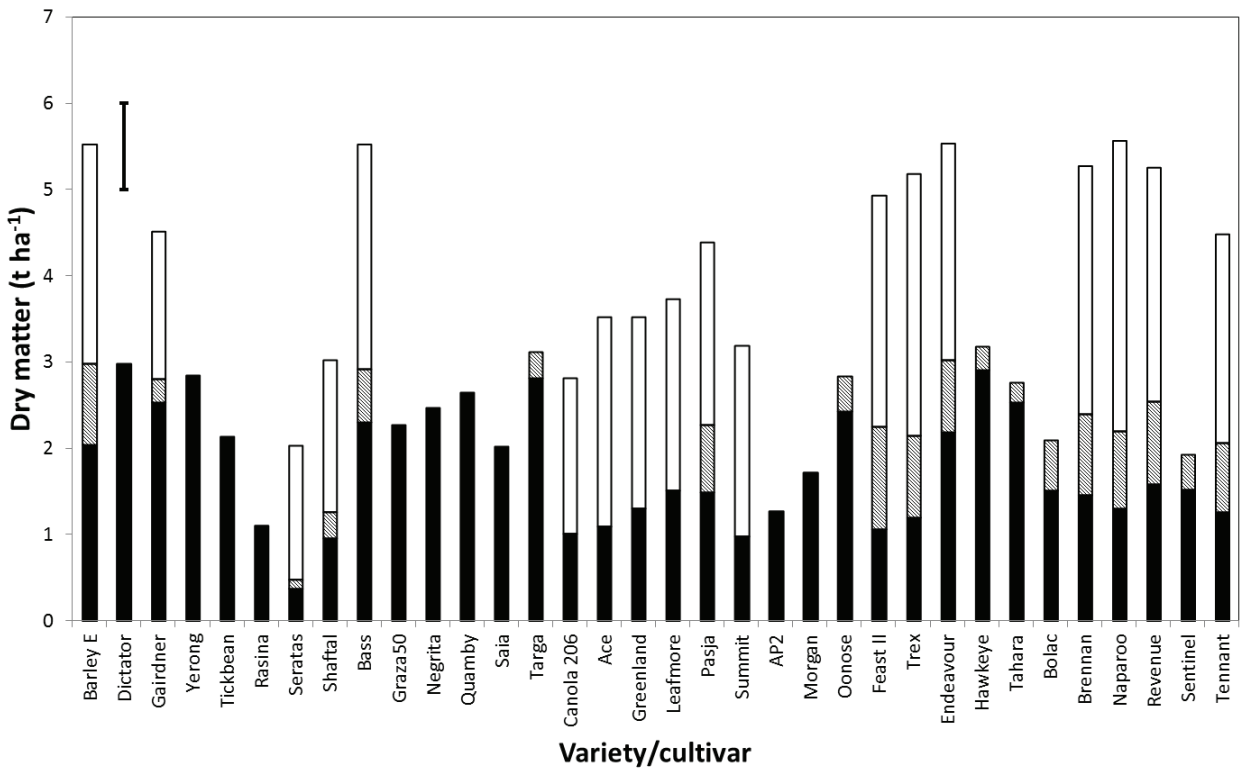

Figure 1. Mean total dry matter yields (t ha^{-1}) of three 'grazing' cuts of 34 forage crops from February to September 2010. The vertical bar indicates $LSD_{0.05}$ of 1.04 t ha^{-1} for comparison of accumulated yields of forages. There were 3 harvests dates but not all forages recovered from early cuts; cut 1 = 53 days after sowing (DAS; solid fill), cut 2 = 105 DAS (diagonal lines), cut 3 = 189 DAS (open fill).

Silage cuts

In general, higher DM was produced in the silage cuts than accumulated in the grazing cuts but the response differed between species and variety growth habit (Figure 2). Spring lines of barley, oats and triticale tended to produce significantly higher DM than winter equivalents, demonstrating the impact of mowing on subsequent regrowth. Regrowth of cereals may be affected by available soil moisture. Kelman and Dove (2009) suggested that regrowth of wheat and oats post grazing was lower than in ungrazed plots in dry springs, but higher in wet springs. However, given the wet conditions during the current study, moisture should not have limited DM production in 'grazing' plots.

The higher yields from grazing cuts compared with silage cuts in Bass oats and barley E is explained by the prostrate growth habit of these two varieties with cuts having less effect on the growing points. Problems with disease were more prevalent in the plots left for silage cuts. In particular field pea and vetch varieties were badly affected by ascochyta and began to rot at the lower stem resulting in low DM yields. Weed competition was also greater in silage cuts of the vetch and pasture legumes, compared with repeated cutting.

The higher DM yields of earlier maturing material are also a function of more advanced growth stage. For example some of the spring cereals were flowering by July. The consequence of this was lower quality NV. For example while the mean CP, DMD and ME values for cereals were 9.7%, 60.4% and 8.8 MJ/kg DM respectively, these values on average were 25 to 30 % higher for winter cereals compared with spring types (data not presented). Neal *et al*. 2010, also reported that repeated cutting or grazing in general results in lower total DM compared with silage cuts due to limiting the time the forage spends in the maximum growth stage. As a consequence the nutritive feed value of repeat cut material is likely to be higher (Neal *et al*. 2010).

The legumes were highest for CP with a mean around 17% (data not presented). While DMD and ME for the pasture legumes were comparable to that for cereals, the grain legumes as a group were much lower due to disease-affected foliage. The brassicas showed considerably higher feed values than the cereals; 14.8%, 78.6% and 11.9 MJ/kg DM for CP, DMD and ME respectively. Overall the fodder brassicas were of higher NV than canola (data not presented).

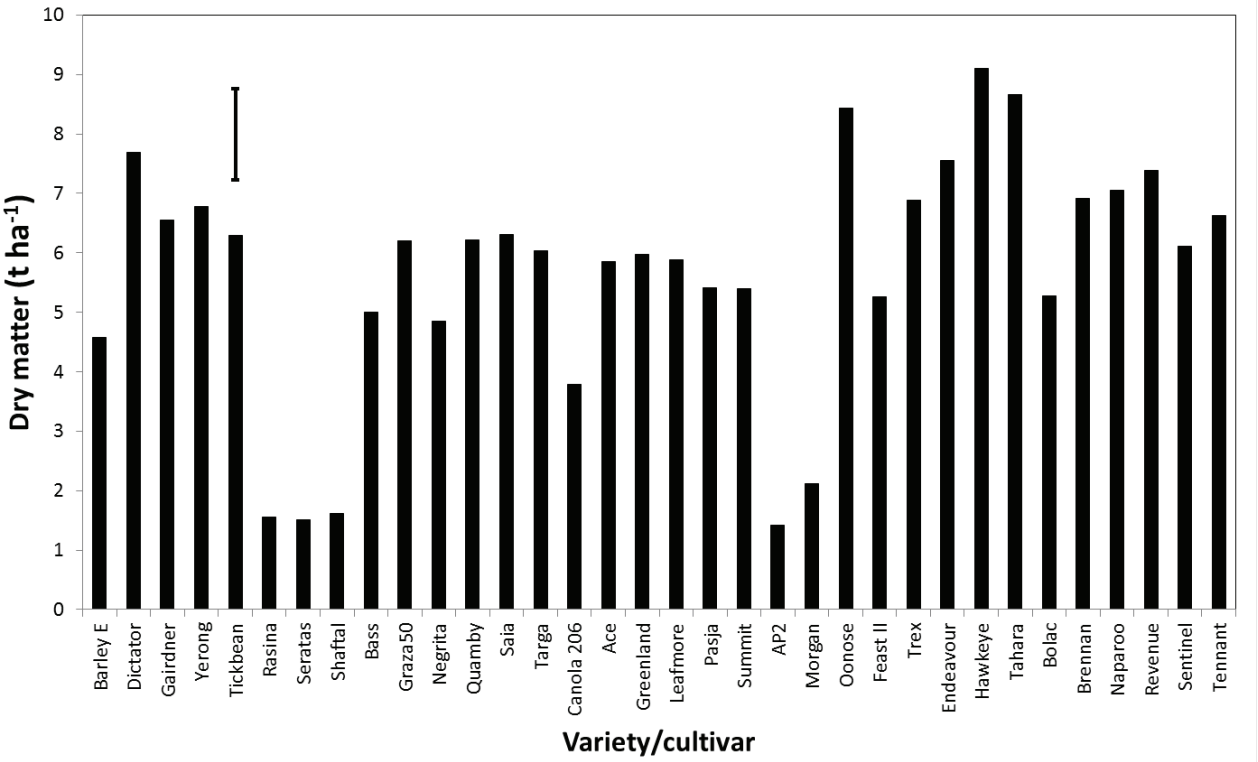

Figure 2. Mean dry matter yields (t ha^{-1}) of the final 'silage' cuts from 34 forage crops. Harvest date depended on crop maturity; early maturing material was cut 22 July and later maturing, 3 Sep 2010.
The vertical bar indicates $LSD_{0.05}$ of 1.55 t ha^{-1} for comparisons between forages.

Conclusions

The work in this study highlights the importance of species and variety selection when filling winter feed gaps. Spring varieties of barley, oats, triticale and rye showed rapid early growth and can be planted for feed supply early in winter. However damage and/or removal of plant growing points reduced subsequent regrowth and therefore caution in grazing these types is required. In contrast, damage to slower growing winter cereals (barley, oats, triticale and wheat) and ryegrass (T Rex and Feast II) with more prostrate early growth habit was minimal and this material can be utilised for extended grazing over winter. With a higher feed value some of the fodder brassicas, in particular Pasja rape, also show potential. From this preliminary screening more detailed evaluation of the varieties with greater potential was conducted.

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