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THE EFFECT OF PERENNIAL RYEGRASS CULTIVAR LOCK UP LENGTH AND NITROGEN ON FORAGE QUALITY FOR SILAGE

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Abstract

A study was undertaken to determine the effects of three perennial ryegrass (*Lolium perenne* L.) cultivars (Vedette, Impact and Nevis) with differing maturities, lock up length and nitrogen (N) application upon the dry matter (DM) yield and nutritive characteristics of pasture for silage. The addition of N at 50 kgN/ha significantly ($P<0.05$) increased DM yield for all cultivars. Metabolisable energy (ME) (MJ/kgDM) of the ryegrass declined with time for all treatments, although by week 8 of lock up the ME content of Vedette was significantly ($P<0.05$) lower than for other cultivars. When the DM yield and ME content of ryegrass at early ear emergence for each cultivar was compared, the harvestable metabolisable energy (MJ/ha) was highest for Nevis followed by Impact and Vedette. In conclusion, there is potential to use later maturing cultivars of ryegrass in south east Australia to allow for later harvesting of forage for silage, whilst maintaining ME and maximising DM yields. Furthermore the use of N fertiliser can also increase DM yields without impinging on pasture quality.

Keywords: Perennial ryegrass, diploid, tetraploid, nitrogen, metabolisable energy, dry matter yield

Introduction

Pasture and home grown conserved forages are the main source of nutrients for dairy cows in Victoria, even when the price of purchased feeds is relatively low. Within the temperate winter rainfall climate of south eastern Australia over 60% of pasture dry matter (DM) production occurs between early September and late November. With this growth pattern, producing conserved forages is an integral component of pasture management. Traditionally farmers have focussed upon quantity rather than quality of conserved forage and made hay as opposed to silage. More recently there has been a trend toward producing high quality silage, with studies identifying appropriate lock up lengths and cutting dates for ryegrass dominant swards (Jacobs *et al*, 1998b). Although ideal cutting dates have been defined, the introduction of later maturing diploid and tetraploid ryegrasses may alter such dates allowing further flexibility in making quality silage. This study aimed to determine appropriate cutting dates to optimise DM yield and pasture nutritive characteristics for three cultivars of perennial ryegrass with and without applied nitrogen (N).

Material and Methods

This study was conducted on a commercial dairy farm near Terang ($38^{o}14$'S, $142^{o}55$'E) in western Victoria on a sandy clay loam soil. Three perennial ryegrass (*Lolium perenne* L.) cultivars, two of which were diploid cultivars (Vedette, Impact) and one tetraploid (cv. Nevis) were compared in a completely randomised design in 3m x 4m plots replicated three times. Treatments were cultivar (3), N (0 kg N/ha and 50 kg N/ha) and lock up length (5-10 weeks). All plots were mown to a uniform height (5cm) on September 14 1998 (first day of lock up). On September 21, N was applied as urea (46% N) at either 0 or 50 kg N/ha to the respective plots. Sampling commenced on October 19 (week 5 of lock up), and thereafter samples were taken weekly until November 23. At each harvest, a 1.1m strip

of herbage was cut from respective plots using a sickle bar mower and weighed. Representative samples were taken and used to determine DM yield and nutritive characteristics of the ryegrass. Nutritive characteristics were analysed using near infrared spectroscopy (NIR). NIR spectra were collected on all samples using a NIRSystems 6500 scanning monochromator in conjunction with Infrasoft International software. NIR calibrations for dry matter digestibility (DMD), CP, neutral detergent fibre (NDF) and water soluble carbohydrates (WSC) had been previously derived on large sample populations using the procedures of Shenk and Westerhaus (1991). Metabolisable energy (ME) values were calculated from predicted DMD values using SCA (1990). Statistical analysis was undertaken using residual maximum likelihood (Genstat 5.3, 1995).

Results

Nitrogen significantly ($P<0.05$) increased DM yields for each cultivar throughout the measurement period (Fig.1a). After week 8 of lock up the DM yield of Vedette with N was significantly ($P<0.05$) higher than for other cultivars. The, DM yield of Vedette was significantly ($P<0.05$) higher than other cultivars after week 7 of lock up. The ME of all forages declined with length of lock, although changes with Vedette were greater than for other cultivars (Fig.1b). By week 8 the ME of Vedette was significantly ($P<0.05$) lower than either Impact or Nevis. Nitrogen tended to reduce ME of all cultivars, however differences were not significant. Crude protein content declined with length of lock up for all treatments, with rate of decline being greater for treatments with applied N. The NDF content of both Impact and Nevis without N was significantly ($P<0.05$) lower than all other treatments throughout the study. There were no significant differences in the WSC content of all treatments with concentrations above 15% DM through the study.

Discussion

In recent years there has been a shift from the conservation of bulk, low quality hay towards high quality silage in south east Australia. Production of such silage can only be achieved if the initial pasture for conserved forage is of high quality, a goal unattainable if high DM yields are sought. The use of N to increase DM yields may be one option to allow for a reasonable compromise between quality and quantity of conserved forage. Previous studies (Jacobs *et al*, 1998a,b) indicate that the ideal stage of harvest to achieve the balance between DM yield and quality is at early ear emergence of the ryegrass component of the sward (generally the end of October with current cultivars). However, climatic conditions may be such that cool damp conditions prevail and wilting is often prolonged leading to substantial reductions in forage quality prior to ensiling. The introduction of newer later maturing ryegrasses provides an opportunity to avoid these unfavourable drying conditions. Two of the ryegrass cultivars used in this study (Impact and Nevis) are reported to be later maturing than current cultivars such as Vedette. Evidence from this study would concur, with Impact and Nevis reaching early ear emergence approximately two and three weeks later than Vedette. When these differences in maturity date are taken into account and ME values are compared, all three cultivars have similar ME values (10.9 MJ kg/DM) at early ear emergence. However, DM yields are higher with the later cut material and therefore potential gains in harvestable ME can be made with the later maturing cultivars. The use of N can further increase DM yields without having a detrimental effect upon ME values. Table 1 highlights the increases in ME (MJ/ha) harvested at early ear emergence for the different cultivars with and without N and shows the increases achievable with the later maturing cultivars. Allowing for likely losses of approximately 5% during the silage making process, the resultant silage would have an ME of approximately 10.4 MJ kg/DM which is close to the

10.5MJ kg/DM considered as acceptable by Chamberlain and Wilkinson (1996) for dairy cows in early and mid lactation.

In summary this study indicates that there is potential to use later maturing cultivars of ryegrass in south east Australia to allow for later harvesting of forage for silage, whilst still maintaining the quality of the parent material and maximising DM yields. Furthermore the use of N can also increase DM yields without impinging on pasture quality.

References

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Table 1 - The effect of perennial ryegrass cultivars and applied nitrogen on harvested metabolisable energy (MJ/ha) of ryegrass at early emergence

	Vedette	Impact	Nevis
0 N	32,700	38,150	41,800
50 kg N/ha	48,600	54,000	58,320

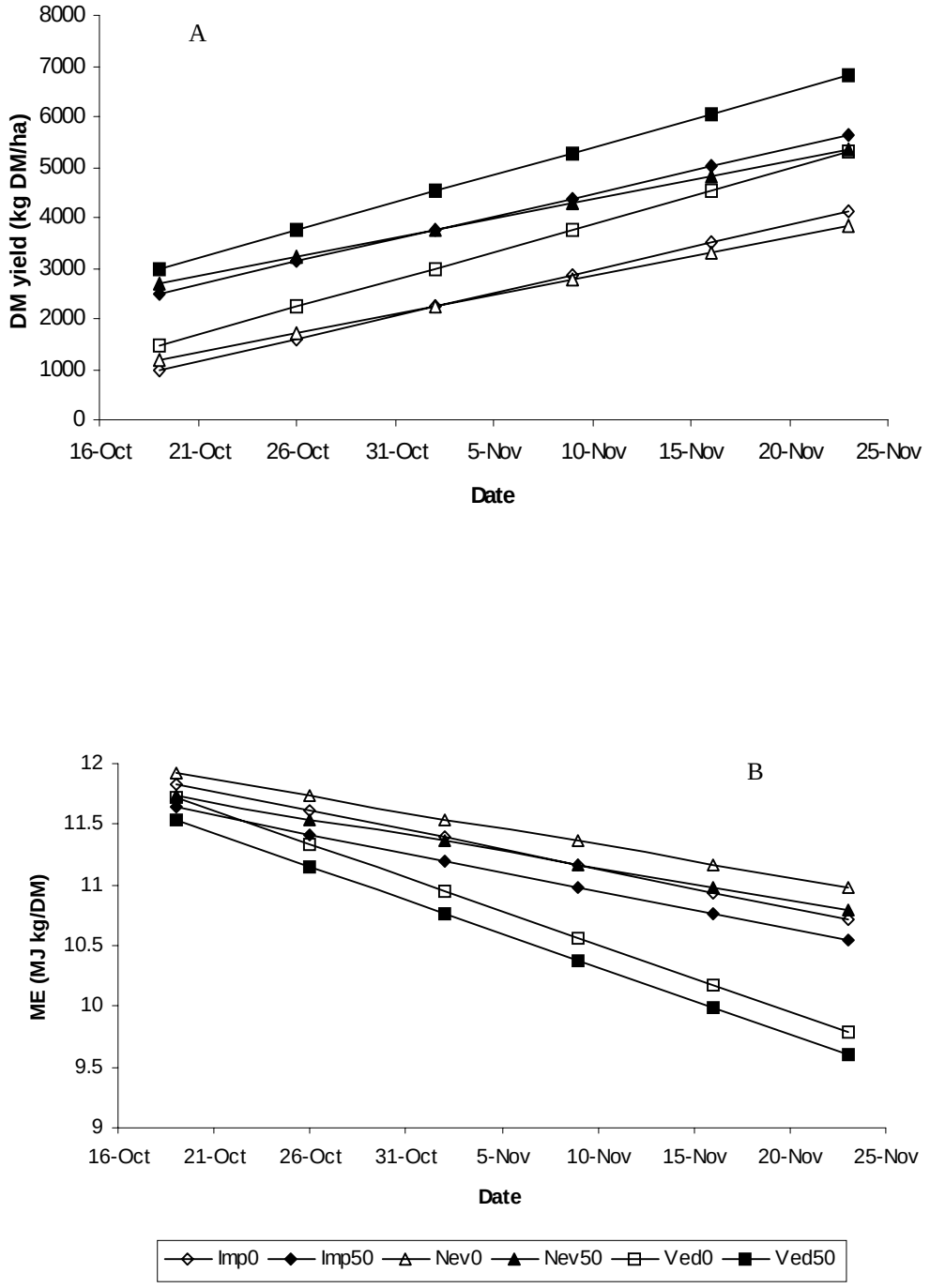

Figure 1 - The effect of perennial ryegrass cultivar, lock up length and applied nitrogen on dry matter yield (kg DM/ha) (A) and metabolisable energy (MJ kg/DM) (B) of ryegrass for silage