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The XXII International Grassland Congress (Revitalising Grasslands to Sustain Our Communities) took place in Sydney, Australia from September 15 through September 19, 2013.

Proceedings Editors: David L. Michalk, Geoffrey D. Millar, Warwick B. Badgery, and Kim M.

Broadfoot

Publisher: New South Wales Department of Primary Industry, Kite St., Orange New South Wales, Australia

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# Effect of time of access to pasture and the provision of a total mixed ration on the performance and methane production of high yielding dairy cows

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**Keywords:** Methane production, dairy cows.

## Introduction

Allowing cows to spend time on pasture may improve their welfare, although high yielding cows are unable to consume sufficient amounts of grass to maintain milk yield and require supplementation (Charlton *et al.* 2011). The inclusion of grass in the diet of high yielding cows may have benefits as grass contains polyunsaturated fatty acids which can reduce methane production (Martin *et al.* 2008). Additionally, the soluble carbohydrate content in grass is higher in the afternoon which may increase intake (Trevaskis *et al.* 2004). The aim of the experiment was to determine the effects of timing of pasture access and the provision of access to total mixed ration (TMR) when at grass on the performance and methane production of high yielding dairy cows.

## Materials and methods

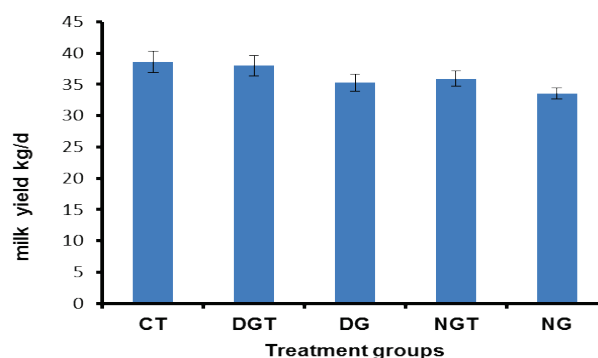
### Cows and treatments

Sixty high yielding early lactation dairy cows yielding  $39.3 \pm 0.72$  kg/d of milk were used in the study. The experiment had 2 periods each of 35 d duration, with 30 cows used in each period. Individual cows were allocated to one of 5 treatment groups (Table 1).

The TMR was composed of (g/kg DM) 409 maize silage, 112 grass silage, 226 protein blend, 103 wheat, 67 soya hulls, 35 molasses, 21 straw, 13 protected fat, 14 minerals and vitamins. Milk yields were recorded and samples for composition analysis taken during the final 7 days of each period. Live weights were recorded at the beginning and at the end of each period. Methane production was measured during the final 5 days of each period using the SF<sub>6</sub> tracer technique as described by Johnson and Johnson (1995). Data was analysed in Genstat (v 14.1) as a 2 x 2 factorial design with a Control, using general analysis of variance.

**Table 1. Description of the treatments undertaken**

| Treatment | Description                                 |
|-----------|---|
| CT        | Indoor housed and fed TMR                   |
| DG        | Day time grazing only                       |
| DGT       | Day time grazing + access to TMR at grass   |
| NG        | Night time grazing only                     |
| NGT       | Night time grazing + access to TMR at grass |



**Figure 1. Milk yield (kg/d) of the five treatment groups used in the study.**

## Results

Cows in DGT had a similar milk yield to those in CT (38.0 vs 38.6 kg/d respectively), while yields were lower ( $P < 0.05$ ) in all the other groups (Fig. 1). Within the grazing groups, cows that had access to TMR on pasture (DGT and NGT) had a higher yield (av. 37 kg/d) compared to those that had no access to TMR (DG and NG, av. 34.5 kg/d;  $P < 0.05$ ). Providing access to grazing during the day time also resulted in a higher yield than grazing at night (av. of 36.7 and 34.8 for day and night grazing respectively,  $P < 0.05$ ).

Daily protein yield was higher in cows that were continuously housed than in those that had access to grazing (Table 2;  $P < 0.001$ ). Grazing with access to a TMR increased ( $P < 0.01$ ) milk protein yield and live weight gain. Methane output was affected ( $P = 0.003$ ) by whether cows were indoors or outdoors. When expressed as g/day or g/kg milk yield (Fig. 2) methane output was higher in cows receiving CT and lower in all the grazed groups.

## Discussion

Grazing with access to TMR at pasture increased milk yield, milk protein yield and live weight gain. Day compared to night time grazing also improved performance. These results contrast with the findings of Trevaskis *et al.* (2004) who reported a 2.1 kg/cow/d higher milk yield when cows grazed at night compared with day time grazing, even though the soluble sugar content was higher in the grass samples in the current

**Table 2. The effect of time of grazing with or without access to a TMR compared to continuous housing on milk composition and live weight change**

|                 | CT   | DGT  | DG    | NGT  | NG    | s.e.d. | In vs. Out <sup>1</sup> | Graz time <sup>2</sup> | TMR <sup>3</sup> |
|-----------------|------|------|-------|------|-------|--------|-------------------------|------------------------|------------------|
| Fat, g/kg       | 37.0 | 37.9 | 35.4  | 35.8 | 37.6  | 2.68   | 0.876                   | 0.973                  | 0.866            |
| Fat, kg/day     | 1.42 | 1.45 | 1.23  | 1.27 | 1.27  | 0.097  | 0.126                   | 0.337                  | 0.119            |
| Protein, g/kg   | 34.1 | 32.8 | 31.5  | 33.2 | 33.4  | 0.95   | 0.063                   | 0.085                  | 0.426            |
| Protein, kg/day | 1.30 | 1.25 | 1.10  | 1.18 | 1.12  | 0.046  | <0.001                  | 0.572                  | 0.002            |
| Lwt change, kg  | 1.1  | 0.45 | -0.11 | 1.1  | -0.10 | 0.437  | 0.041                   | 0.311                  | 0.006            |

<sup>1</sup>Continuously housed vs. grazed; <sup>2</sup>Days vs. night grazing; <sup>3</sup>Access or no access to TMR when grazing.

study when sampled in the afternoon (265g/kg DM) compared to the morning (155g/kg DM). Providing access to grazing reduced methane production when expressed as g/d or g/kg milk, and may therefore reduce the carbon emissions of dairy cattle.

### Conclusion

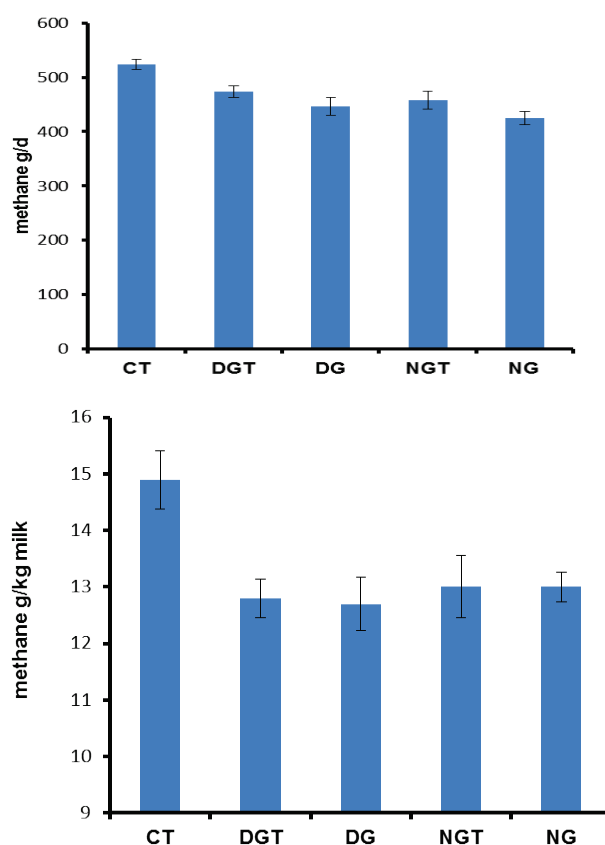
Grazing during the day time with access to a TMR results in a similar level of performance to continuously housed cattle, but with reduced methane production. Grazing high yielding cows during the day or night without access to a TMR at grass reduces performance.

### Acknowledgement

This work was supported by DairyCo, UK

### References

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**Figure 2. Methane output expressed as (top) g/day and (bottom) g/kg milk.**