# Relationships Between the Nutrient Content of Irrigated Pasture on Offer and that Selected by Grazing Dairy Cows

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# RELATIONSHIPS BETWEEN THE NUTRIENT CONTENT OF IRRIGATED PASTURE ON OFFER AND THAT SELECTED BY GRAZING DAIRY COWS

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**ABSTRACT**
An experiment was conducted to determine the dry matter, energy, crude protein and fibre intake by dairy cows in late lactation when grazing perennial pasture offered at allocations of 15, 20, 30 and 40 kg DM/cow.day. The cows consistently selected a diet 10% higher in digestibility than that on offer. In contrast, cows selected diets with crude protein levels increasing from 22% to 40%, above that in pasture on offer, as pasture allocation increased. A similar pattern was observed for the intake of white clover (*Trifolium repens* L). The increase in the concentration of crude protein in the diet (as allocation increased) was due to the consumption of white clover and a decrease in the consumption of the dead components of the sward. On the other hand, the neutral detergent fibre content of the diet selected was lower than that on offer, and declined as pasture allocation increased.

**KEYWORDS**
Dairy cows, grazing, irrigated perennial pastures, nutrient selection

**INTRODUCTION**
Milk production in south-eastern Australia is predominantly from pasture. Production per cow has increased in recent years primarily through greater inputs of concentrate supplements currently approaching 1 tonne/cow.yr (Doyle et al., 1996). The extent to which nutrients in the diet of grazing cows fed high levels of supplements can be balanced to improve milk production and milk quality needs to be assessed. Selection of pasture nutrients by the grazing cow is not constant because pastures vary in composition, and can be affected by grazing management. Little data exist on the selection of nutrients by grazing dairy cows. Stockdale (1992) showed that cows selected metabolisable energy from a subterranean clover (*Trifolium subterraneum* L) pasture that was from 6 to 17% higher than that on offer, while Kellaway et al. (1993) found cows selected a diet that was 16% higher in metabolisable energy.

An experiment was conducted at the Kyabram Dairy Centre (36° 18' S., 145° 03' E.) in April 1995 to determine the dry matter, energy, crude protein and fibre intake by dairy cows in late lactation when grazing perennial pasture offered at allocations of 15, 20, 30 and 40 kg DM/cow.day.

**METHODS**
The pasture was comprised of perennial ryegrass (*Lolium perenne* L) and white clover, with weeds (mainly *Rumex* species) and dead material contributing the balance (54, 22, 7 and 18% of DM, respectively).

Twenty four, multiparous, Friesian cows (540 s.d.± 23.9 kg liveweight) grazed as a single herd for 10 days. During this time, average milk production (± s.d.) was 16.3 (± 1.88) kg/day. Four grazing treatments (15, 20,30,40 kg DM/cow.day), replicated 3 times (2 cows per replicate), were run as separate groups for 21 days.

Cows received a new strip of pasture twice a day. The intake of pasture by each group of cows was estimated using a rising plate to measure pre- and post-grazing pasture height, with herbage mass calculated from the following regressions which relate pasture mass (PM, kg DM/ha) and pasture height meter reading (MR, 0.5 cm):

Pre-grazing PM = 1643 + 148 (± 17.4) MR
($100r^2$ = 71.9; r.s.d. = 435 ; c.v. = 11.7%; $n$ =30)

Post-grazing PM = -183 + 310 (± 51.3) MR
($100r^2$ = 68.3 ; r.s.d. = 552; c.v. = 24.8%; $n$ = 19)

Daily samples of herbage (0.08 $m^2$) offered and remaining after grazing were handsorted into botanical components and freeze dried. Herbage samples were analysed for *in vitro* dry matter digestibility (Clarke et al., 1982), neutral detergent fibre (Van Soest et al., 1991) and total nitrogen (LECO Model FP-428, Leco Corporation, USA).

**RESULTS AND DISCUSSION**
Pre grazing pasture characteristics were not different between treatments. Pasture on offer had an in vitro DM digestibility of 74%, a crude protein content of 170 g/kg DM and contained 450g neutral detergent fibre/kg DM. As pasture allocation increased from 15 to 40kg DM/cow.day, intake increased from 8.0 to 14.6kg DM/cow.day (Table 1), and the utilisation of the pasture, measured to ground level, ranged from 54% to 37%. Milk production ranged from 8.9 to 15.5 kg/day as pasture allocation increased from 15 to 40kg DM/cow.day, respectively (Table 1).

The cows consistently selected a diet 10% higher in digestibility than that on offer (Figure 1). In contrast, cows selected diets with crude protein levels ranging from 22% to 40% above that in pasture on offer, as pasture allocation increased (Figure 1). A similar pattern was observed for the intake of white clover (Figure 1). The increase in the concentration of crude protein in the diet (as allocation increased) was due to the consumption of white clover and a decrease in the consumption of the dead components of the sward. On the other hand, the neutral detergent fibre content of the diet selected was lower than that on offer, and declined as pasture allocation increased. The results can be explained in terms of the higher levels of crude protein in the white clover leaf compared with stem (and lower fibre), with little difference in the energy concentration content between leaf and stem.

The results from this experiment describe how selection differentials vary across different pasture allowances and adds to our base data on nutrient selection by grazing dairy cows. This information can be used to determine the type and amount of supplements required to address nutrient deficiencies for increased production.

**REFERENCES**
**Clark, T., Flinn, P.C.** and **McGowan, A.A.** 1982. Low cost pepsin-cellulase assays for prediction of digestibility of herbage. Grass For. Sc. **37**: 147-150.

**Doyle, P.T., Stockdale, C.R.** and **Lawson, A.R.** 1996. Pastures for Dairy Production in Victoria. ISIA, Tatura, Australia.

**Kellaway, R.C., Tassell, R.J., Havilah, E., Sriskandarajah, N**. and **Andrews, A.** 1993. Nutrient balancing in the diet of grazing dairy cows. Aust. J. Agric. Res. **44**: 423-430.

**Stockdale, C.R.** 1992. The nutritive value of subterranean clover herbage grown under irrigation in northern Victoria. Aust. J. Agric.

Res. **43**: 1281-1295.

**Van Soest, P.J., Robertson, J.B.** and **Lewis, B.A.** 1991. Methods for dietary fiber, neutral detergent fiber, and nonstarch polysaccharides in relation to animal nutrition. J. Dairy Sc. **74**: 3583-3597.

**Table 1**
Effect of pasture allocation (kg DM/cow.day) on intake of dry matter (kg DM/cow.day), percentage of pasture consumed (%), characteristics of pasture selected measured as composition (%), in vitro dry matter digestibility (%), nitrogen (g/kg DM) and neutral detergent fibre (g/kg DM), and milk yield (kg/cow.day)

| Pasture allocation | 15 | 20 | 30 | 40 | SED |
|---|---|---|---|---|---|
| Dry matter intake | 8.0$^{d}$ | 9.9$^{c}$ | 12.4$^{b}$ | 14.6$^{a}$ | 0.14 |
| Pasture utilisation | 54$^{a}$ | 50$^{b}$ | 42$^{c}$ | 37$^{d}$ | 1.2 |
| Characteristics of pasture selected | | | | | |
| White clover | 31 | 28 | 32 | 36 | 6.3 |
| Perennial ryegrass | 57 | 58 | 60 | 57 | 5.6 |
| Weeds | 8 | 7 | 5 | 5 | 2.7 |
| Dead material | 4 | 7 | 3 | 2 | 3.6 |
| Digestibility | 79.4 | 80.4 | 80.6 | 80.1 | 2.01 |
| Nitrogen | 33.6$^{b}$ | 32.9$^{b}$ | 36.2$^{ab}$ | 39.9$^{a}$ | 1.72 |
| Neutral detergent fibre | 353 | 368 | 322 | 337 | 17.5 |
| Milk yield | 8.9$^{d}$ | 9.5$^{c}$ | 12.7$^{b}$ | 15.5$^{a}$ | 0.62 |

Values on the same line with different superscripts are different at $P < 0.05$.

**Figure 1**
The relationship between pasture allocation and selection differential (selected as a proportion of that on offer) of in vitro DM digestibility, nitrogen, neutral detergent fibre and white clover