

Effects of concentrate type on dry matter intake and milk solids production of mid-lactation dairy cows grazing perennial ryegrass with elevated neutral detergent fibre, indigestible NDF and reduced crude protein

Michael Dineen^{1,2}, Brian McCarthy², Fergal Coughlan², Pat Dillon² and Michael E. Van Amburgh¹

¹Cornell University, Ithaca, New York, U.S.A.; ²Teagasc, Animal & Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork

Summary

- Grazed pasture is a high quality forage, however due to seasonal and climatic factors, the chemical composition is variable.
- Providing a source of metabolisable protein when pasture offered was elevated in neutral detergent fibre, indigestible NDF and reduced crude protein enhanced animal performance.
- Increased performance from pasture can be achieved if a greater understanding of the specific nutrient first limiting milk solids production is identified.

Introduction

Pasture-based systems have the ability to utilise large quantities of human inedible forages and convert them to edible human food of high biological value contributing positively to net food production. These systems also support environmental sustainability and an animal welfare friendly image. It is important to investigate if the efficiency of milk production from pasture-based systems can be enhanced in a sustainable manner. The objective of this experiment was to evaluate factors limiting dry matter intake (DMI) and milk solids production in dairy cattle grazing mid-season swards.

Experimental design

An experiment was conducted at Teagasc Clonakilty Agricultural College from June to August 2018. Eighty dairy cows were randomly assigned to one of four treatments: 1. perennial ryegrass (PRG), 2. PRG plus 4.8 kg DM citrus pulp and 0.075 kg DM urea (Citrus); 3. PRG plus 0.8 kg DM heat treated soybean meal (TSBM); and 4. PRG plus 3.1 kg DM of a mix of citrus and heat treated soybean meal (Mix). Briefly, the increased sugar and reduced fibre content of citrus was postulated to allow greater DMI compared to PRG only by reducing physical fill limitations and providing more feed for digestion in the rumen. By heat treating soybean meal, the degradability of the protein in the soybean is reduced, thereby allowing more of the protein to escape digestion in the rumen and pass into the small intestine to supplement the amino acids needed for enhanced milk solids production.

Results

Grass growth during week one to seven of the experiment was severely restricted due to increased soil moisture deficit. This resulted in increased neutral detergent fibre (NDF), indigestible NDF (uNDF) and reduced crude protein in the pasture offered compared to typical mid-season pasture composition (Figure 1). During week eight, drought conditions

were alleviated. Total DMI of cows on the Citrus treatment was greatest, as they had 2 kg/day greater DMI compared to PRG only (Table 1) cows. Although greater DMI was achieved on the Citrus treatment, milk solids production was greater for the treatments that included heat treated soybean meal compared to PRG suggesting that, under the conditions experienced during this experiment, i.e. severe drought, metabolisable protein might have limited milk solids production rather than metabolisable energy. A greater response to supplement was achieved for the TSBM than the Citrus treatment (2.25 and 0.44 kg milk/kg concentrate, respectively) as the citrus was offered at a higher rate.

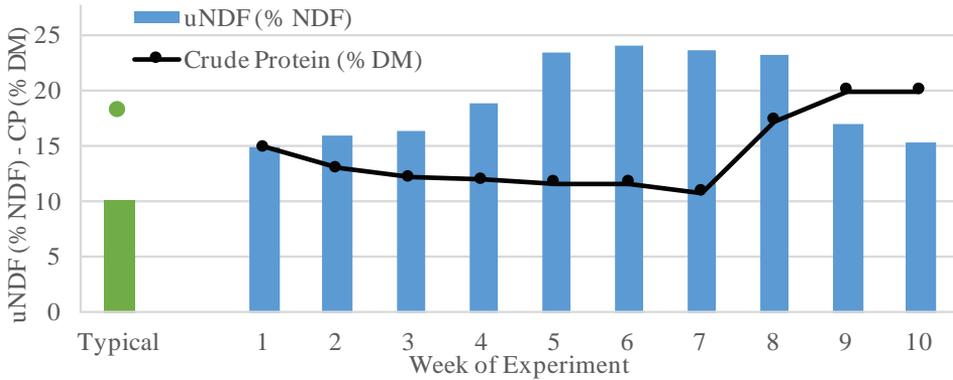


Figure 1. Weekly indigestible neutral detergent fibre (uNDF) and crude protein content of mid-season perennial ryegrass offered over 10-weeks

Table 1. Effects of concentrate type on dry matter intake and milk production of mid-lactation dairy cows grazing PRG

Item	PRG ¹	Citrus	TSBM	Mix
Pasture intake (kg DM/day)	15.6	12.8	15.3	13.8
Supplement intake (kg DM/day)	0	4.8	0.8	3.1
Total intake (kg DM/day)	15.6	17.6	16.1	16.9
Milk production (kg day)	18.5	20.6	20.3	21.3
Crude protein (g/kg)	33.9	33.0	34.7	33.7
Milk solids production (kg/day)	1.41	1.49	1.55	1.59

¹PRG = perennial ryegrass, Citrus = perennial ryegrass + citrus pulp + urea, TSBM = perennial ryegrass + heat treated soybean meal, Mix = perennial ryegrass + citrus pulp + heat treated soybean meal

Conclusions

The severe soil moisture deficit in 2018 significantly altered the chemical composition of the pasture offered. Encouragingly, in weeks eight to ten, when sward chemical composition returned to typical values, heated treated soybean still outperformed PRG. The data generated is a future resource for when the industry is faced with similar drought conditions. These findings indicate that it is critical to understand the chemical composition of the pasture available in order to supplement effectively and meet animal requirements.