Characterisation of the fibre composition of fresh and ensiled herbage species under varying management conditions

C. King[1, 2], J. McEniry[1], M. Richardson[2] and P. O'Kiely[1]

[1]Teagasc, Grange, Dunsany, Co. Meath, Ireland
[2]School of Architecture, Landscape & Civil Engineering, University College Dublin, Belfield, Dublin 4, Ireland

Introduction

- There is much interest in alternative uses for grassland (e.g. renewable energy, Green Biorefinery).
- For some industrial uses it would be logistically impractical to continuously process fresh herbage throughout the year. Preservation as silage would ensure year-round availability of consistent quality feedstock.
- In a 'Green Biorefinery' processing grass silage, the fibre fraction would be one of the largest material streams produced, and its composition would need to be characterised.
- The objective was to quantify the changes in the fibre composition of silages produced from of a range of common grasses, grown under different nitrogen fertiliser regimes and harvested at different stages of maturity.

Methods

- Five common grasses, perennial ryegrass (PRG), Italian ryegrass (IRG), timothy, cocksfoot and tall fescue were grown in field plots (20 m^2; with triplicate replication; n =150) under two inorganic nitrogen fertiliser inputs (a) low = 0 kg/ha and (b) high = 125 kg/ha (Fig. 1).
- Plots were harvested at five dates in the primary growth (fortnightly from 12 May – 7 July; harvests 1-5) using a forage plot harvester and passed through a precision-chop harvester.
- A 6 kg representative sample of each herbage was then ensiled in laboratory pipe silos for a period of 100 days (Fig. 2).
- Representative samples of both the fresh grass and silage were taken for chemical analysis.
- Samples were oven dried at 40°C for 48 hours, milled (1 mm screen), and analysed for neutral and acid detergent fibre concentrations (NDF and ADF respectively; Van Soest, 1963).
- Data were analysed as a split-split plot design using Proc MIXED procedure of SAS.

Figure 1. Field plots

Figure 2. Laboratory silos

Results

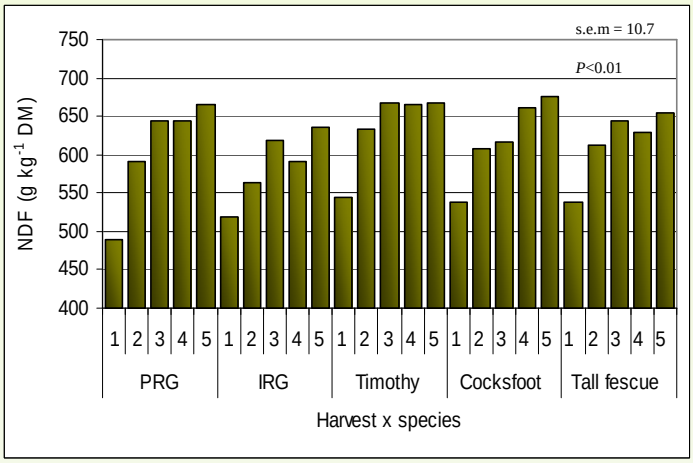

Figure 3. NDF concentration of five grass silages across five harvest dates (1-5)

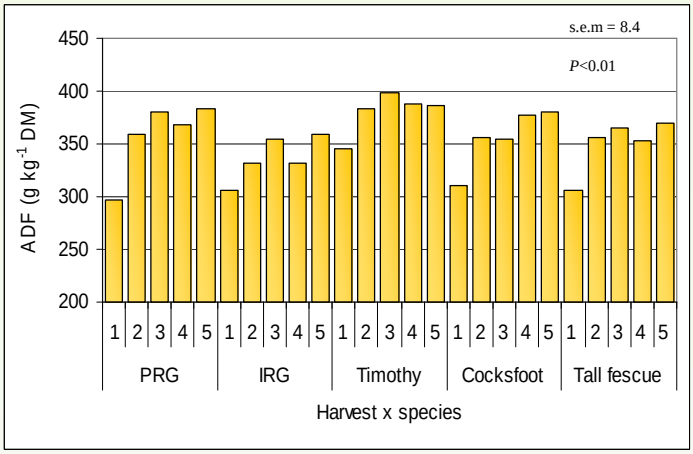

Figure 4. ADF concentration of five grass silages across five harvest dates (1-5)

Conclusions

- Of the five grass species investigated, timothy and cocksfoot had the highest NDF and ADF concentrations.
- In general, silage NDF and ADF concentrations increased with advancing plant maturity (Fig. 3 & 4).
- Although statistically significant the effects of rate of inorganic N application were biologically small.
- As a result of ensiling there were slight increases in NDF and ADF concentrations for all species, with this being more evident for the early harvest material where the fermentation of soluble compounds may have been most extensive.

References

Van Soest P. J. (1963) The use of detergents in the analysis of fibrous feeds. II. A rapid method for the determination of fiber and lignin. *J AOAC Int* 46, 829-835.