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Measuring the variance in digestion rate of forages fed to ruminants

Digestion rate of feed ingredients in ruminant diets highly influences nutrient utilization by affecting intake, digestibility, microbial efficiency, and other parameters key to animal performance. It is critical to have estimates for digestion rates of feed ingredients for use in diet formulation. Estimates currently available are simple averages of digestion rates. It has been suggested, though seldom tested, that digestion rates within feed types have great variability, which questions the precision in using simple averages as estimates. This study was conducted to determine digestion rates of a wide population of grass, legume, and grass/legume forages to quantify the variance in digestion rate among these feed types. Forty-six alfalfa, 16 grass, and 19 mixed grass/legume forage samples were collected from across Missouri. Digestion rates of DM, NDF, hemicellulose (HEM), and CP were determined using in situ technique with lactating cattle. Digestion and chemical composition data were sorted according to forage (alfalfa, grass, grass/legume). Statistical analysis indicates digestion rate of DM, NDF, HEM, ADF, and CP fractions had a high standard deviation and coefficient of variance (CV); average CV was 23%, 25%, 23%, 31%, and 42%, respectively. To attempt to account for this variance, correlations between digestion rate and potential extent of digestion, solubility, and chemical composition of all chemical fractions, where applicable, were calculated. Five of 75 comparisons between digestion rate and potential extent of digestion, 3 of 30 comparisons between digestion rate and solubility, and 5 of 75 comparisons between digestion rate and chemical composition were significant ($P < 0.05$). This illustrates that variability in digestion rates cannot be accounted by available chemical, solubility, or digestibility assays. This study confirms and quantifies the large variance associated with digestion rates of grass and legume forages. It illustrates the danger in using simple average digestion rates as estimates of true digestion rate.