The Glen Innes feeds laboratory – supporting pasture research with nutritive value analysis

A.D. Turner and J.F. Ayres
Agricultural Research & Advisory Station, NSW Agriculture, Glen Innes, NSW 2370

Nutritive value of pasture refers to the capacity of pasture in the diet to meet the nutritional requirements of grazing animals. Implicit in the concept of nutritive value is a set of plant attributes termed *nutritive quality* and animal/plant attributes termed *feeding value*. Nutritive quality by definition refers to the composition and concentration of nutrient constituents (eg. protein, carbohydrate, fat, minerals) while feeding value refers to the animal's dietary response (dietary preferences, voluntary intake, digestibility, utilisation of digested nutrients). The Glen Innes feeds laboratory was set up in 1990 to consolidate NSW Agriculture's pasture quality research for northern New South Wales and has contributed to a wide range of research projects measuring nutritive quality and feeding value including nutritive value screening in conjunction with plant improvement, nutritive value assessment in species and variety testing, and determination of nutritional feedgaps.

Analytical procedures

The feeds laboratory comprises facilities to measure nutritive quality and feeding value as well as field facilities to grow and harvest pastures under test. It also has a batch drier to dehydrate tonne lots of forage, laboratory for chemical analysis and bio-assay, a 32-metabolism unit animal house for sheep feeding trials, and computer workstation and data base for downloading and retrieving nutritive value records.

Nutritive quality constituents routinely determined in the laboratory include dry matter and organic matter (AOAC 1998), together with nitrogen and phosphorus (Williams and Twine 1967), and ADF/NDF /lignin (Van Soest and Wine 1967). Bioassays include *in vitro* digestibility (OM) using the rumen fluid/pepsin assay (Ayres 1990) and cyanoglycosides (HCN) by imagery procedure based on the picrate reaction (A.D. Turner pers. comm.). The feeding value factors measured in the animal house include voluntary intake, *in vivo* digestibility (DM, OM), nutrient balance and liveweight gain. Standard operating procedures are being documented for NATA accreditation, and animal house protocols comply with ARIP animal care and ethics requirements.

Nutritive value database

Nutritive value data from the feeds laboratory have been compiled into a data base to provide comprehensive and accessible information on the nutritive value of northern NSW pasture species. The data base has the capacity to generate comprehensive nutritive value information on pasture species representing a wide range of conditions such as feed type (eg. pasture, hay, silage), plant fraction (eg. whole tops, leaf, stem), and stages of maturity (eg. vegetative, bloom, ripe seed).

The data base also forms the hub of the Laboratory Information Management System and was developed using 'Microsoft Access' which has the capacity to handle large data sets and can be fully integrated with other 'Microsoft' software for developing auxiliary data base programs. An input application program enters sample ID and

descriptor information using built-in keyword 'libraries' during sample log-in. Data base query programs facilitate retrieval of summarised information in feed composition tables and generate client reports. The data base comprises 50 fields per record which includes 31 descriptor fields and 19 fields for analytical values. The data base currently contains over 12,000 records on 87 species/cultivars including some 6,200 records for temperate species and 5,800 records for subtropical species. An outline of the number and composition of nutritive value records held in the data base is presented in Table 1, together with a summary of digestibility data. This illustrates the differences in nutritive value between temperate species compared with tropical species, grasses compared with legumes, and effects of onset of maturity on pasture quality.

Table 1. Nutritive value records in the Glen Innes data base. (Number of records according to species type and analytical determination, and digestibility at different stages of maturity.)

	Number of	Number of analytical determinations *					OM digestibility (%)		
	Records	OM	N	P	NDF	ADF	D	Veg.	Bloom	Mature
Temperate										
pasture grass	1923	1149	1760	643	93	93	1445	68.5	63.2	49.6
pasture legume	2805	1911	1445	1331	121	115	1835	67.6	65.3	62.5
forage grass	452	112	410	97	9	-	78	82.5	-	78.5
forage legume	812	468	490	304	113	104	454	68.8	63.0	56.7
Subtropical										
pasture grass	2841	1069	2227	671	136	121	783	60.3	55.9	52.7
pasture legume	2029	1335	842	505	350	338	1309	60.4	59.0	55.7
forage grass	58	15	50	27	1	1	12	66.4	-	53.1
forage legume	628	76	583	575	74	75	85	-	-	-

* OM: organic matter, N: nitrogen, P: phosphorus, ADF: acid detergent fibre, NDF: neutral detergent fibre, D: Digestibility

Future applications of the data base are: i) to continue to strengthen the data base from ongoing nutritive value analyses, ii) to provide data for detailed study of the nutritive value characteristics of pasture grown under different conditions, and iii) to provide a knowledge base for industry use through documentation of feed composition tables and on-line services.

References

Association of Official Agricultural Chemists (1998). Official Methods of Analysis, 16th Edition, Washington AOAC.

Ayres, J.F. (1991). Sources of error with *in vitro* assay of pasture feeds. *Grass and Forage Science* **46**, 89 – 97.

Van Soest, P.J. and Wine, R.H. (1967). Use of detergents in the analysis of fibrous feeds. IV. Determination of plant cell wall constituents. *Journal of Official Analytical Chemists* **50**, 50 – 55.

Williams, C.H. and Twine, J.R. (1967). Determination of nitrogen, sulfur, phosphorus and potassium in plant material by automatic analysis. CSIRO Division of Plant Industry Technical Paper 24.