Letter to the Editor

Some thoughts on comparing the quality of different pasture species

Dear Sir,

Recently I have been involved with editing a series of contributions to a book on tropical forages. The book was one of a series with a standard format, and one of the sections specified was 'properties', which in the case of forages covered aspects like N concentrations and digestibility. Having completed this exercise I have been questioning the value of much of the data that compare the quality of different species or even accessions within a species. In this letter I have only dealt with measurements of N and P but the questions raised may apply to other supporting measurements taken in forage studies.

Let us consider the N concentration in legumes. This should be easier than with grasses because soil N status is less of a complicating factor as legumes primarily derive N from fixation of atmospheric N by *Rhizobium* bacteria. The result we get from a N analysis will depend on a number of factors. These factors include the leaf/stem ratio of the sample, the range of physiological ages of the leaves and stems, and whether they are alive or dead. In cutting experiments these factors are largely controlled by cutting frequency. When taking plucked samples from grazed pastures, there are the additional problems of deciding what to sample and then standardizing procedures between different operators and different species. Then there are the factors associated with soil fertility and soil physical conditions and the legume/*Rhizobium* symbiosis. After all these factors are taken into account, is it possible to draw conclusions on differences between legume accessions *per se*? That is, if management and environmental factors dominate over genetic differences, we may well question the value of studies or data which seek to compare accessions. Although comparing nutrient concentrations of accessions within an experiment is valid, such a ranking is likely to change between the same accessions given differing environments and/or management. Thus the ranking may not be a reflection of inherent differences in quality. The same argument applies to yield, but I believe that, while it is universally accepted that species cannot be ranked for ability to yield irrespective of environment, the same qualification is not recognized for measurements of nutrient concentration.

Any comparison of nutrient concentrations in accessions is even more suspect when based on data collected from different experiments. This is illustrated by the lists of crude protein percentages reported for a range of legumes by different workers in the book 'Tropical Pasture Legumes' (Skerman *et al.* 1988). Taking the 10 species where 6 or more measurements are listed, I have calculated the mean N% and the range of N%, as follows:

Species	No. of Measurements	Mean N %	Range of N %
Stylo	11	2.2	1.4–2.9
Townsville stylo	10	2.3	0.9–3.4
Glycine	8	2.8	2.0–3.6
Peuro	10	2.8	2.5–3.3
Silverleaf	6	2.8	1.9–3.7
Centro	18	2.8	2.1–4.0
Lotononis	8	2.8	2.3–3.8
Greenleaf	9	2.9	2.0–4.2
Siratro	10	2.9	2.3–3.9
Leucaena	9	3.3	2.0–4.6

From these results it can be seen that the N% of the two *Stylosanthes* species tends to be lower than the other legumes and that of leucaena could be higher. However, there is still overlap between the N% measured for *Stylosanthes* and leucaena, the species which had the lowest and highest mean values. Differences between the remaining species are of little consequence. Overall, the differences between species are minor when compared with the variation within species. This reflects the impact of management and environment. Even if some species, such as leucaena, may have somewhat higher N levels, this does not need repeated verification.

The main problem with our tropical legumes is not whether they inherently have a high or low N%, but rather how to select and manage them so as to maintain a reasonable proportion of legume in the pasture without creating unstable

conditions that could lead to weed invasion and erosion. If we can achieve this, even the legumes with lower concentrations of N, such as *Stylosanthes*, will make a major contribution towards increasing animal production.

The same problems of interpretation that occur when N concentrations are compared between species also occur with concentrations of P and other nutrients, except that in this case differences in soil P exert an even greater influence than does soil N on N concentration.

This problem of interpreting analyses of nutrients is even greater with grasses than it is with legumes, due to the greater effect that soil nutrient status has on nutrient concentration in grasses. Also grazing pressure appears to have more effect on the nutrient concentration in grasses than it does with legumes. The N concentration in most recognized pasture grasses can range from *c.* 3% in young leafy tissue to *c.* 0.5% in mature standing feed. The higher the soil N status and the higher the frequency of defoliation, the slower the rate of decline as the forage matures and the higher the minimum value. Most of the differences between accessions are small in relation to the differences due to time of sampling, type of sample and soil fertility. The differences remaining are largely related to variation in leaf:stem ratios rather than to intrinsic differences between the nitrogen concentrations in leaves of different accessions. If several grass accessions are being compared in a cutting trial, it is likely that they will come into flowering at different times and so the differing presence of seed heads will have a marked effect on N concentration at a particular time.

Please note that I am not questioning the measurement of chemical composition in all experiments. In many cases such measurements are important or essential in understanding particular problems, pursuing specific objectives, or investigating principles. Some comparisons of the nutrient composition of different species are also useful. For example, measurements of sodium concentrations have shown how some species have characteristically 'high' or 'low' sodium levels, a finding with practical implications for animal production. The difficulty that I have is when and where such measurements are used in a context where they are not particularly useful.

Perhaps we had to go through a phase of taking too many of these measurements of nutrient concentration to give us the background data of tropical forages that we now have. However, there are two issues worth considering: firstly, that where evaluation of forages is being actively pursued, careful thought is needed about the value of using plant samples for comparing nutrient concentrations; secondly, can we make more critical use out of published and unpublished data?

I do not want to give the impression that I have not done my share of unnecessary analyses. In my 26 years with CSIRO the records show that I have submitted 3844 plant samples for analysis! While I can justify some of these, there is no doubt that many were of minimal value.

R.M. Jones
CSIRO Division of Tropical Crops and Pastures,
306 Carmody Road,
St. Lucia, Queensland 4067