Short Communication

Relationships between the water solubility of roughage dry matter and certain chemical characteristics

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The relationships (during summer) between the water solubility of *Cymbopogon-Themeda* veld grass, *Digitaria eriantha* (finger grass) and *Medicago sativa* (lucerne) and their respective contents of crude protein (CP), acid-detergent fibre (ADF) and neutral-detergent fibre (NDF) were determined in samples which were collected from oesophageally fistulated steers. Highly significant ($P < 0.001$) linear relationships were described in all cases. Separate relationships were described for the three different herbages.

Die verwantskappe (gedurende die somer) tussen die wateroplosbaarheid van *Cymbopogon-Themeda* veldgras, *Digitaria eriantha* (vingergras), *Medicago sativa* (lusern) en hulle onderskeie konsentrasies van ruproteïen, suuronoplosbare vesel (ADF) en neutraal onoplosbare vesel (NDF) is bepaal in monsters wat van slukdermgefistuleerde osse versamel is. Hoogs betekenisvolle ($P < 0.001$) lineêre verwantskappe is in al die gevalle beskryf. Afsonderlike verwantskappe is vir die drie verskillende tipes weiding beskryf.

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Although Van Soest (1964) warned against the dangers of producing easily performed practical tests (for predicting nutritive value of forage) that are based on inadequate theories and methods, there is evidence that, in the absence of specific mineral deficiencies, the nutritive value of forage for ruminant production can be characterized by the CP, ADF and NDF contents. For example, Cilliers & Van der Merwe (1993) and Cilliers *et al.* (1995) described, for the situation near Potchefstroom, reliable relationships between the CP and the ADF content of veld herbage respectively and the *in vitro* dry matter digestibility of the herbage, its intake by grazing ruminants, and the actual animal performance in terms of daily gain. However, the measurement of CP, ADF and NDF requires expensive infrastructures like analytical laboratories together with trained personnel to carry out analyses. There is a need for relatively rapid, inexpensive and reliable methods of predicting the nutritive value of pastures for grazing ruminants, especially in those situations where facilities for carrying out chemical analyses are unavailable. Seoane (1982) demonstrated that the nutritive value (dry matter intake per kg $W^{0.75}$ and certain chemical characteristics) of a variety of grass hays can be accurately predicted from, *inter alia,* a simple analysis like their solubility in water.

Against this background, the relationships between certain chemical characteristics of veld (*Cymbopogon-Themeda* type, No. 48, as described by Acocks, 1988) and two dry land cultivated herbages and their solubility in water were determined. Such relationships may be of value in screening pastures for nutritive value under conditions where analytical laboratories lack equipment.

Herbage samples were collected at six weekly intervals during the summers of different years on two camps each from

Table 1 Linear relations between water solubility of DM of herbage (%) and CP, ADF and NDF content (% of DM)

	r^2	*n*	Intercept[1]	Slope[1]	Data range	Mean ± SD	Sy.x
Veld grass							
CP	0.78***	40	−1.1 (± 1.35)	1.07 (± 0.12)	6.5 – 20.1	10.5 ± 3.5	1.69
ADF	0.69***	40	62.9 (± 1.79)	−1.20 (± 0.16)	36.5 – 55.1	49.6 ± 3.9	2.13
NDF	0.78***	40	89.3 (± 2.67)	−1.57 (± 0.23)	64.0 – 81.5	71.4 ± 7.0	3.01
Finger grass							
CP	0.85***	24	3.7 (± 1.16)	0.72 (± 0.09)	9.7 – 18.5	13.0 ± 2.9	1.14
ADF	0.69***	24	51.3 (± 1.71)	−0.58 (± 0.12)	38.3 – 47.6	43.6 ± 3.1	1.77
NDF	0.75***	24	92.2 (± 3.21)	−1.50 (± 0.23)	62.7 – 82.5	72.0 ± 6.8	3.50
Lucerne							
CP	0.90***	16	10.5 (± 1.34)	0.38 (± 0.05)	16.1 – 24.9	20.4 ± 3.6	1.23
ADF	0.90***	16	68.2 (± 3.69)	−1.20 (± 0.14)	23.2 – 51.2	37.3 ± 10.7	3.49
NDF	0.83***	16	83.3 (± 5.07)	−1.30 (± 0.19)	34.6 – 67.8	51.0 ± 12.3	5.29

*** = $P < 0.001$
[1] = Standard errors of intercepts and slopes in brackets
SD = Standard deviation from the mean
Sy.x = Error of estimate

veld, *Digitaria eriantha* (finger grass) on a Bainsvlei 3100 soil, and *Medicago sativa* (lucerne) on a Valsrivier 1122 soil. Samples were taken over periods of two years, three years and five years from lucerne, finger grass and veld, respectively. Each sample was represented by the pooled samples from three oesophageally fistulated steers.

The DM content of samples was obtained by drying in a draught oven at 105 °C, until the weight was constant. Samples were ground through a Wiley mill (1 mm screen) and analysed for nitrogen (Clare & Stevenson, 1964), ADF (Van Soest, 1963) and NDF (Van Soest & Wine, 1967). Forage solubility in water was obtained by soaking 2 g of the dried material for 1 h in 60 ml of distilled water. The sample was then filtered (Duran filter crucibles, porosity no. 3) and dried at 100 °C overnight. The weight loss was expressed as the percentage of dry matter (DM) dissolved (Seoane, 1982). Correlation coefficients and regressions were calculated by simple linear regression which described the data best (Statgraphics, 1993). Significance of the correlations was determined by analysis of variance. Comparisons of slopes and intercepts of regression lines were used in combination with Bartlett's test for homogeneity of variance to determine whether or not single regression models could be used for data groups from veld, finger grass and alfalfa (Snedecor & Cochran, 1980).

Linear relationships between the percentage solubility of the herbage and its CP, ADF and NDF content are presented in Table 1. Bartlett's test for homogeneity of variance and comparisons of slopes and intercepts of regression lines showed that separate regression equations should be used for veld grass herbage, finger grass and lucerne. The relationships were calculated for solubilities within the ranges 7.7%–20.0% for veld grass; 9.5%–21.2% for finger grass; and 15.0%–39.7% for lucerne.

It is concluded that the CP, ADF and NDF content of veld grass, finger grass and lucerne can be predicted with a reasonable degree of accuracy from the solubility in water of the herbage. Separate relationships must be used for the three different herbages.

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