

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.

The aim of this study was to determine the nutritive value of sainfoin (Onobrychis viciifolia) and sheeps' burnet (Sanguisorba minor). Lucerne (Medicago sativa) was used as a control. The nutritive value indices employed were as follows: DM yield, leaf to stem ratios and selection of plant parts by sheep, chemical composition of pasture material, digestibility and voluntary intake of OM of the forages, post-ruminal disappearance of NAN and degradation of the forage proteins in the rumen of sheep.

The study was conducted in two phases with Phase I covering mid-summer to mid-autumn and with only sainfoin and sheeps' burnet as treatments. Phase II covered late autumn to early summer with lucerne included as a treatment.

Each phase comprised four periods with the pastures cut in a way as to yield portions with different chronological ages.

Dry matter yields were obtained by clipping samples of pasture during each period of the study using quadrats and wool shears. Leaf:stem ratios were measured by separating a weighed sample of clipped material into leaf and stem and expressing their masses as a ratio. An indication of the selection of plant parts by sheep was obtained by measuring leaf:stem ratios inside and outside exclusion cages.

Extrusa from oesophageal fistulae of sheep were collected during the different periods and used for the determination of OM, CP, ADF, NDF, Cellulose, Hemicellulose, Lignin, ADIN and Ash. Clipped samples were used for the determination of Ca, P and Mg because of salivary contamination of material from oesophageal fistulae.

The following conclusions and recommendations were reached:

The dried extrusa from the oesophageal fistulae were also used for the determination of IVDOM of the pastures during the different periods of the study. The IVDOM values were corrected to in vivo DOM values using the relationships obtained in an in vitro vs. in vivo study. Organic matter intake by sheep on the pastures was calculated using the calculated in vivo values and faecal output of intact rams.

Multiple cannulated sheep were used to measure the flow and disappearance of NAN in the small intestine. Chromium-EDTA and Yb-acetate were infused as liquid phase and particulate phase marker respectively to determine the flow of digesta in the digestive tract. Rumen NH_3 and VFA production were also measured.

An explanation for the relative flows and disappearance of NAN was then sought in terms of the degradation of forage proteins in the rumen (nylon bag technique employed) and the occurrence of tannins.

Lucerne had higher proportions of leaf material compared to sheep's burnet which had about equal proportions of leaf and stem. The proportion of leaf

Sheep used in the study were randomly allocated to treatments. Data were analysed using the analysis of variance procedure in the General Linear Models programme, using the least square means and a probability level of 5%.

From the results of the study the following conclusions and recommendations were reached:

- 1) Dry matter yields were generally higher on sheep's burnet than on sainfoin whilst both sainfoin and sheep's burnet produced higher yields than lucerne. Although there is evidence in the literature (Hanna & Smoliak, 1968; Carleton *et al.*, 1968) to support the higher yields of sainfoin compared to lucerne, the results in this study must be treated with circumspection since the lucerne pasture had been more intensively utilized prior to the study. Lucerne was also evaluated during the period where it was probably more sensitive to cold. Furthermore, the problem of the persistence of sainfoin mentioned in the literature (Sheehy & Popple, 1981; Wilman & Asiedu, 1983) needs to be investigated under local conditions and if confirmed, a selection and breeding program to obtain cultivars with more vigorous regrowth (Varga, 1968) initiated.

Both sainfoin and lucerne had higher proportions of leaf material compared to sheep's burnet which had about equal proportions of leaf and stem. The proportion of leaf

in sainfoin increased with frequent cutting. The proportion of leaf in lucerne declined with maturity.

Sheep consumed considerably more leaf than stem material in sainfoin and lucerne and about equal proportions of leaf and stem in sheeps' burnet. The selection of more leaf material by sheep on sainfoin also diminishes the notion of unpalatability (at least at the levels present in sainfoin in this study) attributed to condensed tannins which has been shown to be higher in leaf material.

2) Chemical composition.

All three forages contained adequate amounts of CP even at mature stages of growth or in winter. Crude protein content was highest in lucerne, followed by sainfoin and sheeps' burnet in that order and declined with maturity.

Mineral (Ca, P, Mg) contents in all three forages exceeded normal requirements by grazing animals. The differences in the Ca:P ratio may not be an important factor influencing the nutritive value since there is evidence that strongly suggests that wide Ca:P ratios are tolerated by the ruminant animal.

Higher fibre contents occurred in sainfoin compared to the others and was typified by high ADF and NDF contents.

This was due largely to the high lignin contents and did not vary much with season as reported by Meissner et al. (1989) or maturity. However this apparently did not hamper intake. Evidence from the literature (Wilman & Asiedu, 1983) suggests the availability of cultivars/ecotypes with lower fibre and lignin contents; a fact that must be borne in mind in any improvement program.

- 3) The digestibility of OM was highest in lucerne, followed by sheeps' burnet and sainfoin, in that order. The digestibility of sainfoin did not vary much as the season progressed as previously reported (Meissner et al., 1989). Sheeps' burnet behaved similarly to a fair degree. The digestibility of lucerne, however, declined markedly at very mature stages of growth. The results of the in vitro vs. in vivo study revealed that in future studies with sainfoin or other condensed tannin containing legumes, a relationship should be established between in vitro and in vivo digestibilities in order to accurately determine intake. This should be related to tannin content and if possible tannin threshold levels established. Organic matter intake by sheep on sainfoin was markedly higher than on lucerne and could be similar to or higher than on sheeps' burnet. Organic matter intake in sheeps' burnet was generally higher than on lucerne. Like

digestibility, OM intake on sainfoin and sheeps' burnet did not vary much as the season progressed. Organic matter intake was considerably lower in young lucerne and increased with maturity.

It is recommended that in future studies with very slowly

The results of this study make it pertinent to graze the animals for 24 hours/day (instead of the 12 hours/day used in part of this study and previous studies at the same research facility) due to the highly significant changes in intake for all three forages noted after changing the grazing time. Furthermore, the extended grazing time is what one would expect under practical livestock management regimes.

incubation periods.

- 4) The different rates and extent of degradation of proteins in the rumen and the consequent differences in NAN availability, clearly portrayed the inadequacy of the use of CP content as the sole index of N availability and pasture quality. Non-ammonia nitrogen availability was markedly different with sainfoin having the highest availability followed by sheeps' burnet and lucerne, in that order. The availability of amino acids postruminally could also account partially for the intake differences on these pastures (Egan, 1965). Though degradation was lowest in sheeps' burnet (lucerne had the highest), there was a lower availability of its NAN compared to sainfoin due to a lower digestibility of NAN. The results also confirmed the presence of condensed tannins and revealed

into such mixtures.

the occurrence of maybe hydrolysable tannins in sheeps' burnet which accounted for the relatively lower degradation in the rumen.

It is recommended that in future studies with very slowly degradable feedstuffs or forages like sheeps' burnet the period of incubation in the nylon bag studies must be extended to at least 48 hours. Although crude protein degradation in this study appeared to have peaked after 24 hours incubation and no problems were therefore encountered in the derivation of the asymptotes for the calculation of proportion of N disappearing (Ørskov, 1982), a better picture might be obtained using longer incubation periods.

- 5) The common practice of growing sainfoin in conjunction with sheeps' burnet (Fair, 1989) might be justifiable when dry matter yields are used as a criterion as noticed in this study. However, the results of this study also questions the rationale behind the mixing since the two forages are similar in the manner in which they are utilized by the grazing animal, especially with respect to N intake and utilization.

It is recommended therefore that either sainfoin or sheeps' burnet be mixed with other forages with highly soluble protein fractions. Palatability evaluations, however, must form an important part of investigations into such mixtures.

6) The generally low intake, very high degradation of protein in the rumen and consequent low proportion of absorbed N absorbed postruminally found in sheep fed lucerne, are serious problems that need to be addressed. Research efforts should be geared towards:

- (i) Grazing different cultivars at different maturity stages to find out the effect on these indices of nutritive value.
- (ii) The possibility of incorporating into lucerne the gene responsible for condensed tannin production in sainfoin by genetic engineering. This would increase amino acid supply to the lower digestive tract without adversely affecting carbohydrate digestion in the rumen (Barry, 1984).

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