

THE VOLUNTARY INTAKE AND DIGESTIBILITY OF DIETS CONTAINING
DIFFERENT PROPORTIONS OF TEF (*ERAGROSTIS TEF*) STRAW AND
TRIFOLIUM TEMBENSE HAY WHEN FED TO SHEEP

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Increasing levels of legume hay (*Trifolium tembense*) were fed with tef straw (*Eragrostis tef*) to sheep. Total DM intake was stimulated by the legume until it represented 27% of the feed DM eaten. Digestibility was not affected by the proportion of legume in the diet, but N retention increased linearly and was doubled when the legume increased from 27 to 35% of the feed DM eaten. It is suggested that the beneficial effects of the legume at the lower levels of feeding were due to its role as a source of fermentable N for the rumen microorganisms while at the highest level it probably contributed bypass protein for gastric digestion in the intestines.

Key Words: Sheep, tef straw, legume, trifolium, intake, digestibility, N retention

The provision of year-round feed is a major constraint to livestock production in many densely populated parts of Africa. Family croplands rarely exceed three hectares and communal grazing lands are subjected to intensive exploitation. However, stock are required for cultivation and to provide milk, and a few small ruminants are kept for meat and to provide cash inputs for arable farming operations.

Farm-produced, cereal crop residues are an important feed resource in these mixed farming systems. However, these residues are high in ligno-cellulosic compounds and characterised by low protein digestibility and voluntary intake.

Procedures for improving nutritive value by chemical methods have not been adopted by farmers because of lack of information and the cost of inputs. However, there is a wide variety of indigenous legumes, which could improve the nutritional status of livestock in the farming system if fed as supplements to crop residues.

There are some 30 native clover species in the Ethiopian highlands. One of these, *Trifolium tembense*, produces about one tonne dry matter (DM)/ha under unimproved conditions but can yield up to five tonnes/ha if fertilised (ILCA 1984). In addition to being an important forage, clover would increase the nitrogen status of the soil for subsequent cropping.

The objective of the present experiment was to assess the difference in nutritive value when trifolium hay was fed to sheep at increasing levels with tef straw (*Eragrostis tef*) which is an important cereal staple in the Ethiopian highlands.

Materials and Methods

Trifolium hay was chopped and mixed with chopped tef straw so as to constitute 0, 35, 45 and 65% of the final mixture (as fed basis). Twenty Ethiopian highland rams (25 ± 3 kg) were housed in individual metabolism cages and five animals were offered each of the tef straw/trifolium hay mixtures at 125% voluntary intake. Water and cobalt-iodised salt were freely available. Adjustment and voluntary intake periods of ten and seven days respectively were followed by seven days of total faecal collection. Feed offered and refusals were weighed daily throughout all three periods. During the collection period, daily aliquots of feed offered, feed refused and faeces were dried at 105° . Separate aliquots were kept in a cold room at 4° , mixed, dried at $55-60^\circ$ and analysed according to AOAC (1980) and Goering and Van Soest (1970) procedures. Although both forages were chopped and mixed thoroughly before feeding, there was a large degree of selective consumption. This resulted in legume consumptions of 19.3 ± 0.44 , 26.5 ± 0.50 and $35.5 \pm 0.70\%$ based on composition of feeds and refusals of individual animals in the various groups. Data for intake of dry matter and the digestibility of the various chemical components were subjected to one way analysis of variance.

Then content of N and ash were much higher and hemicellulose and NDF much lower in the legume than in the straw. Other constituents did not differ (Table 1). Intake of the legume was little more than half the planned quantity (Table 2) the maximum being 35% of the total DM. Straw intake was only reduced when the legume exceeded 27% of the diet DM. Total intake was the same with 27% legume as with 35% legume; however, N retention was almost double (1.03 g/d) with 35% legume compared with 27% (0.55 g/d). Digestibility was similar on all straw:legume combinations.

Table 1:

Composition of the trifolium hay and the tef straw (DM basis)

	Tef straw	Legume hay
Ash	6.6	12.1
ADF-Ash ¹	.45	.89
Nitrogen	.68	3.0
NDF	74.4	47.9
ADF	41.0	40.2
Lignin	5.58	5.67
Hemicellulose	34.4	7.66
Cellulose	35.4	34.5
Phosphorus	0.20	0.26

¹ Mostly silica

Table 2:

Intake and digestibility of diets containing different proportions of trifolium hay and tef straw fed to sheep

	Trifolium offered (% of diet)			
	0	35	45	65
DM intake (g/kg W ^{.75} /d)				
Tef straw	45 ^a	44 ^a	43 ^a	38 ^b
Legume hay	0	11 ^a	15 ^b	21 ^c
Total	45 ^a	54 ^b	58 ^c	59 ^c
Trifolium as % of diet DM	0	19±.44	27±.50	35±.70
OM digestibility (%)	50	52	49	50
N in diet (% of DOM) ¹	1.46	2.63	3.96	4.8
N retention (g/d)	.15 ^a	.18 ^b	.55 ^c	1.0 ^d

¹Digestible organic matter

abc Means in the same row with different superscripts are significantly different (P < .05)

Discussion

The feeding value of tef straw is almost certainly constrained by its low N content (0.7%). The continuous improvement in animal performance (measured by N retention) with increasing intake of legume ($r^2=.91$) is probably due to several factors. The first is likely to be the improvement in rumen function due to the increase in N (and possibly other micro-nutrients) for the rumen microorganisms. Although the rumen degradability of the N in the legume is not known, it is likely that the N requirements of the rumen microorganisms were satisfied with 27% legume since this represented a concentration of almost 4 g N per 100 g digestible organic matter. The doubling in animal performance when the legume content increased from 27 to 35% presumably can be explained by the escape of some of the legume protein DM from the rumen to the intestine (Kempton et al 1977).

Conclusions

Tef straw fed alone to sheep did not support maintenance due to a combination of low intake and low digestibility. Substitution of one third of the straw with legume hay increased total dry matter intake by 31% and put the sheep into positive N balance. It is noteworthy that these beneficial effects were achieved with no improvement in digestibility which was the same on straw alone as when it was supplemented with the legume.

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