

Chemical Composition and *in vitro* Degradability of *Gleditsia triacanthos* L. pods.

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Abstract: *Gleditsia* pods were given to 4 varieties of sheep and its consumption was analyzed as a possible dietary complement in forage. Ingestion and rejection of seeds and pods was measured. Dry matter, organic matter, Nitrogen and fiber content was determined. Good palatability and ingestion, a high metabolic energy of rations, high nutritional parameters and nitrogen content make *Gleditsia* seeds and pods a valuable supplement in grazing animals forage.

Key words: *Gleditsia triacanthos*, seed digestibility, feed complementation, merino sheep

INTRODUCTION

Most of the studies on animal feeding in rural areas during drought periods deal with the chemical composition of the feed products given to ruminants and have been mainly focused on the relationship between feed composition and its degradation in the digestive tract (Jarrige, 1980; Genin, 1990).

In forage from herbaceous species it has been possible to establish adequate correlations between their chemical composition and their nutritional values (Baertsche *et al.*, 1986). On the contrary, for woody forage the available information on this relationship is still insufficient. At present only a few Nitrogen (N) fixing woody forage species have been studied from the agronomic and nutritional point of view. Thus, there is a lack of knowledge on the main nutritional parameters of native and exotic trees and shrubs of forage importance (Lachaux *et al.*, 1987).

Because of ecological and socioeconomic considerations research has also been focused on new forage sources. Trees and shrubs have been introduced more and more in the nutritional experimental protocols with the hope of diminishing the costs of traditional forage importation (Le Houerou, 1980; Cooper *et al.*, 1988). In this sense, dry pods have been added to concentrated feed to considerably increase the quality and quantity of the rations administered. We have studied here the potential use of some *Gleditsia triacanthos* L. clones in forage by determining the degradability and the

in vitro digestibility of the pods on sheep. This research allowed a more efficient rationing and the introduction of *Gleditsia* into animal feeding.

MATERIALS AND METHODS

A feeding trial was conducted on 6 wethers (castrated sheep) in handling cages. Daily rations distributed at 9 a.m. included 1,350 g of dry pods, 380 of dehydrated alfalfa and 50 g of mineral supplement. After a 17-day familiarization phase the trial was divided into 4 weekly measurement periods. Each week a different variety of pods was fed to the animals. The selected varieties were named according to the region from Montpellier, France: MIL (South); TOT (North); VFM (South-east), SUM (West); VPO (North-west) and ADV (East).

During the final week and *ad libitum* feeding trial was conducted.

Altogether, it was a seven and a half week long experiment, from January 6th through March 1st. During the weekly periods, measurements were taken from the 3rd to the 7th day. The first two days were a transition period to allow the animals to be fully accustomed to the new variety of pods. The measures included: Daily distributed and rejected feed for each animal and weekly weighing of each animal.

Samples were subjected to the following assays after drying and grinding them: Determination of Organic Matter (OM) and crude protein (N) according to the

AOAC (1990) methods; determination of acid fiber detergent (AFD), neutral fiber detergent (NDF) and lignin based on Van Soest and Wine method (1968) and assessment of digestibility *in vitro* of organic and dry matter by the Tilley and Terry technique (1963).

Data were analyzed using a completely randomized design and the Tukey test at 95% probability level was computed (Zar, 1996).

RESULTS AND DISCUSSION

Six *Gleditsia* varieties were fed to the sheep during the *in vivo* digestibility experiment. Pod samples from these four varieties and samples from dehydrated alfalfa used as supplement were analyzed.

Feed units were calculated according to Jarrige (1980). Digestible Organic Matter (DOM) and Digestible Protein (DP) were calculated to further determinate the metabolic energy (ME), the metabolizable Energy Yield (ENL) and then converted to Milk Feed Units (MFU) with the following equations (Jarrige, 1980):

$$ME \text{ (Cal)} = 3.4 \text{ DOM (g kg}^{-1} \text{ DM)} + 1.7 \text{ DP (g kg}^{-1} \text{ DM)}$$

$$ENL \text{ (Cal)} = ME \times 0.6$$

$$MFU = ENL / 1730$$

A forage ration of about 1.2 MFU energetic value was found and its high total N suffice for the daily maintenance requirements of sheep and their production needs (meat, milk, etc.).

Dry matter digestibility resulted very high for the seeds. Whole pods surpassed alfalfa values for digestibility (70% versus 62%). Differences between

the six varieties were not very important suggesting that clonal selection might have little impact on the feeding value of the pods. The crude protein content of the seeds varied from 19.8 g kg⁻¹ DM for ADV to 29.7 g kg⁻¹ DM for MIL. The crude protein content of pods (10.1-13.0) showed quite lower than that of dehydrated alfalfa (Table 1).

The lignin content in pods from the varieties TOT (7.1) and SUM (7.0) was lower than the content reported for *Medicago sativa* (9.0).

The ADF and NDF values obtained from pods of *Gleditsia* show good expectancy as a suitable feed for sheep compared to values obtained from alfalfa.

Pod intake by sheep: Pods were readily eaten by the sheep. The habituation phase was reduced to 17 days given the high palatability of the pods. It took 2 days for the animals to entirely eat their daily pod allowance. This ration was only 1,000 g per day at the beginning of the experiment but it was raised to 1,350 g on the 14th day when we realized that they could eat much more.

A mean pod ingestion of 68 g Kg⁻¹ was achieved during the experiment. Alfalfa was preferably eaten at the beginning of the experiment, but after some weeks, some animals clearly preferred honeylocust pods to alfalfa.

During the *ad libitum* phase daily intake of 2.3 kg of pods were recorded. It should be noted that ewes who had never seen pods before were fed with some scraps at the end of the experiment and ate them readily. Therefore, the palatability of the tested varieties is satisfactory.

Changes in animal weight: Two fistulated animals were very disturbed by their fistulae. Pod fermentation induced

Table 1: Chemical composition and *in vitro* digestibility of the honeylocust pods and alfalfa supplement used during the *in vivo* digestibility experiment

Variety	Chemical composition %						<i>In vitro</i> digestibility %DM	Feed units MFU
	DM	OM	CP	ADF	NDF	LIG		
MIL:								
Pod	90.7	95.1	12.3	25.6	44	10	67.7	1.02
Seeds	90.2	94.3	29.7	13.4	29.2	1.5	94.7	1.48
TOT:								
Pod	90.7	94.7	11.6	22	37.6	7.1	72.1	1.07
Seeds	90.4	94.8	28.4	13.8	36.3	1.5	94.7	1.49
VFM:								
Pod	90.9	95.4	10.5	24.5	39.9	9.3	68.4	0.96
Seeds	90.2	95.2	27.7	14.8	40.6	2	90.8	1.42
SUM:								
Pod	90.9	95.3	13	22.2	47.3	7	71.9	0.85
Seeds	90.6	95.6	23.3	12.6	46.9	1.2	94.9	1.45
VPO:								
Pod	88.6	93.4	10.1	22.3	37	11.1	66.7	0.81
Seeds	89.1	94.2	21.2	12.6	32.4	2.3	88.9	1.25
ADV:								
Pod	87.5	91.8	11.2	20.8	35.6	9.7	62.1	0.79
Seeds	89.3	90.7	19.8	12.1	28.8	1.6	81.5	1.16
Alfalfa	93.4	88.8	18.4	33.2	51.1	9.1	62.3	----

DM = Dry matter; OM = Organic matter; CP = Crude protein; ADF = Acid detergent fiber, NDF = Neuter detergent fiber; LIG = Lignin

Table 2: Daily weight gain of sheep during the honeylocust pod feeding trial

Measurement phase	Animal number				Mean weight gain
	J551	K532	G100	L463	
Rehab	123	59	300	85	141±29.2 d
MIL	143	242	186	71	160±18.6 c
TOT	371	-28	100	271	178±48.6 c
VFM	171	271	414	257	278±15.6 b
SUM	129	186	57	14	96±40.3 f
VPO	115	122	86	59	95±48.5 f
ADV	95	134	110	68	102±16.2 e
<i>Ad libitum</i>	260	460	820	480	585±89.7 a
Mean weight gain	176±23.5bc	181±108.9b	259±64.3a	163±81.2c	

Values followed by the different letters are significantly different at the 5% level (standard deviation). All values in g. day⁻¹ animal⁻¹. The average weight gain per animal was calculated on the 4 weeks period with the six pod varieties. During these 4 weeks, the daily allowance of pods was constant

high pressures in the rumen so expelling the fistula up to 8 times in one of the animals. Rumen fluid was then practically lost resulting in a poor animal status. These two animals were not included in the following results (Table 2).

Weekly weight measurements are usually difficult to analyze since many misleading factors usually interfere even when animal growth is “normal”. Our measurements indicate that the 4 animals gained weight continuously throughout the experiment. During the 4 weeks, with a daily allowance of 1,350 g of pods, average daily weight gains ranged from 153-203 g day⁻¹. During the 5 day *ad libitum* phase, values ranging from 260-820 g day⁻¹ were recorded. Although such results lack accuracy, the trend is obvious: sheep thrive on selected honeylocust pods. The new weight gain ranged from 8-14 kg animal⁻¹ in 7 weeks.

The body status obtained by palpation confirmed the efficiency of the pod ration. On a five degree scale (from starvation = 0 to obesity = 5), a significant increase of 0.5 point was recorded (from 2.5-3.0).

Within the 6 pod varieties the best results seem to have been achieved by VFM, (278 g day⁻¹) and the worse by SUM (96 g day⁻¹), VPO (95 g day⁻¹) and ADV (102 g day⁻¹). But once a week measurements are not accurate enough to elaborate on these differences. SUM and ADV pods are very low in sugar and very high in seeds.

From these results, we can state that honeylocust pods from selected varieties are a valuable feed that might provide animals with both their maintenance and their production requirements.

CONCLUSION

In view of its chemical composition and digestibility it can be confirmed that the honeylocust pods may be considered as an appropriate potential forage feed and a protein supplement of good nutritional properties worth of interest for the improvement of grazing livestock. The

pods and seeds would considerably reduce the feed cost during winter period improving the animal yield.

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