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## Nutritional potential of woody vegetation for local goats in Israel

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**SUMMARY** - Direct observations (n=390) were carried out on local Mamber goats, in a commercial flock located in Northern Galilee on a Mediterranean woodland in Israel. Diets eaten by goats were simulated by hand plucking of vegetation. On a yearly basis, goats spent less time at handling and ingesting herbaceous, as compared with ligneous (tree and shrub leaves) vegetation (40% and 60%, respectively;  $P < 0.05$ ). This was found at all seasons with the exception of the spring (April-May). Some environmental factors affected the grazing behaviour: (i) on rainy days there was a significant trend toward selection of more ligneous vegetation and (ii) during morning hours goats spent more time ingesting ligneous vegetation than later on during the day. Herbaceous vegetation and *Quercus calliprinos* were the main components of diet throughout the year, and approximately 50% of the annual eating time was devoted to their consumption. Crude Protein (CP) concentration in the diet ranged between 3.5 to 15.3% of DM, but levels of CP in the selected diet varied between 9.1 to 14.7% of DM. 9 to 18% of the CP was linked to the ADF fraction. Condensed Tannin (CT) concentration on the range varied between 0.13% to 12.21% of DM, as compared with 3.52 to 4.74% of DM in the selected diet. Although the variation in CP and CT levels in the different species was large, their concentration in the selected diet remained quite constant throughout the year. Selectivity skills of the goats seem to be aimed at keeping the nutrient concentration in the diet constant.

**Key words:** Goats, Mediterranean woodland, grazing behaviour, selectivity.

**RESUME** - "Potentiel nutritionnel de la végétation boisée pour des caprins locaux en Israël". Des observations directes (n=390) ont été menées sur des caprins locaux de race Mamber, dans un troupeau commercial qui se trouvait dans le Nord de la Galilée dans une forêt méditerranéenne en Israël. Les régimes distribués aux caprins étaient simulés par un ramassage à la main de la végétation. Sur une base annuelle, les chèvres ont passé moins de temps pour manipuler et ingérer la végétation herbacée, par rapport à la végétation ligneuse (arbres et feuilles d'arbustes) (40% et 60%, respectivement ;  $P < 0,05$ ). On a trouvé ce résultat pendant toutes les saisons excepté au printemps (avril-mai). Certains facteurs environnementaux ont affecté le comportement de pâturage : (i) pendant les jours pluvieux il y avait une tendance significative vers une sélection de végétation plus ligneuse et (ii) pendant les heures de la matinée les caprins passaient plus de temps à ingérer de la végétation ligneuse que plus tard dans la journée. La végétation herbacée et *Quercus calliprinos* étaient les composantes principales du régime pendant toute l'année, et environ 50% du temps annuel d'alimentation y était consacré. La concentration en protéine brute dans le régime a varié de 3,5 à 15,3% de la matière sèche, mais les niveaux de protéine brute dans le régime sélectionné ont varié entre 9,1 à 14,7% de la matière sèche. De 9 à 18% de la protéine brute était liée à la fraction ADF. La concentration en tannins condensés sur parcours a varié de 0,13% à 12,21% de la matière sèche, comparée à 3,52 jusqu'à 4,74% de la matière sèche pour le régime sélectionné. Bien que la variation des niveaux de protéine brute et de tannins condensés chez les différentes espèces était élevée, leur concentration dans le régime sélectionné est restée tout à fait constante tout au long de l'année. Les aptitudes à la sélectivité des caprins semblent viser à maintenir constante la concentration du régime en nutriments.

**Mots-clés :** Caprins, forêt méditerranéenne, comportement de pâturage, sélectivité.

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## Introduction

Mamber goats are native of the upper Galilee mountain range of Israel. They yield approximately 130 liters of milk after weaning of their kids (Landau *et al.*, 1995). The gross margin in goat operations is border-line, and higher milk production is desired, on the condition that it is consistent with the ecological role of goats in this region, i.e., the control of fire-prone brush vegetation. The aim of this study was to define the seasonal composition of diets and to quantify the nutrient composition of the diet throughout a year in order to identify dietary limits to production in ranging dual-purpose Mamber goats.

## Material and methods

### Site

Matat is located in Northern Galilee (33.1°N, 35.2°E). Elevation is 840 m. Rainfall during the study was 1300 mm, from October to May. Six snow days were recorded in February. The growing season of vegetation was from mid-March to mid-June.

### Habitats

The eco-system may be described as Mediterranean woodland (garrigue), characterized by steep aspects and slopes and scarce patches of shallow soil throughout the rocky cover. The vegetation was dominated by low trees (mainly *Quercus calliprinos*, *Rhamnus libanoticus*, *Styrax officinalis* and *Pistacia palestina*) and shrubs (mainly *Calicotome villosa* and *Sarcopoterium spinosum*).

### Animals and management

Goats of the local Mamber breed in a commercial flock were managed as follows: they were grazing freely daily between 6:00 to 18:00 on an undivided fenced area of 200 hectares (0.55 hectares/head). Goats were not shepherded but guard (Maremma) dogs were present in the herd at all times. The kidding period started on January 5<sup>th</sup>.

### Observations

Feeding behaviour was monitored using 390 observations of individual goats, for 10-30 minutes each. About 5 observations were carried out daily, from November 1991 to October 1992. Observations were distributed equally throughout grazing hours. Goats were identified by using numbers printed by liquid nitrogen hair discoloration. Observations were made from a distance of 0.50 to 1.50 m. Activities, i.e., standing, walking, eating, resting in shadowed, were monitored using a tape-recorder. Date, hour, weather, habitat, species consumed, avoided and duration of eating were recorded in each observation. Eaten parts from the major species that were consumed by the goats were sampled throughout the year and Dry Matter (DM) was established after drying in an oven at 60°C for 3 days. Samples were then ground in a Wiley grinder, using a 1 mm sieve, until analysed for Crude Protein (CP) (N\*6.25, AOAC, 1984). Acid detergent fiber (ADF) linked Protein analysis was according to Hogan and Lindsay (1980). Condensed tannins (CT) analysis was according to Hagerman and Butler (1978).

Statistics: The comparison of means was according to the Duncan's multiple range test (SAS, 1985).

## Results

The distribution of grazing time between plant species is shown in Table 1. On a yearly basis, the goats spent approximately 20% of grazing time at consuming *Quercus calliprinos* leaves. This proportion more than 20% at all seasons but not in spring (approx. 12%). Time spent on grazing *Sarcopoterium spinosum* and *Calycotome villosa* was 12.7% and 7% on yearly basis respectively.

Table 1. Distribution of ingestion time between plant species (least square means): only species grazed during more than 2% are represented

Annual		Autumn		Winter	
Herbaceous	29.32	Acorns	28.12	Acorns	1.92
<i>Quercus calliprinos</i>	20.88	<i>Quercus calliprinos</i>	24.83	Herbaceous	33.35
<i>Sarcopoterium spinosum</i>	12.67	Herbaceous	18.25	<i>Quercus calliprinos</i>	23.63
<i>Calycotome villosa</i>	6.92	<i>Sarcopoterium spinosum</i>	17.76	<i>Sarcopoterium spinosum</i>	21.48
Thorns	5.79	Cistus	3.45	<i>Calycotome villosa</i>	6.78
Forbs	5.13	<i>Calycotome villosa</i>	3.33	Forbs	5.1
<i>Ramnus palaestinus</i>	4.95	Forbs	2.05	Fungi	3.39
Acorns <sup>†</sup>	2.36			Thorns	2
Cistus	2.08				
Spring		Summer			
Herbaceous	42.72	<i>Quercus calliprinos</i>	25.97		
<i>Quercus calliprinos</i>	11.94	<i>Ramnus palaestinus</i>	14.01		
Forbs	9.38	Herbaceous	11.07		
<i>Calycotome villosa</i>	8.37	Thorns	9.99		
Thorns	8.08	<i>Calycotome villosa</i>	6.29		
<i>Sarcopoterium spinosum</i>	6.36	<i>Styrax officinalis</i>	6.14		
<i>Ramnus palaestinus</i>	2.85	<i>Sarcopoterium spinosum</i>	5.91		
Crataegus	2.46	<i>Pistacia palaestina</i>	4.70		
		Vines	4.19		
		Cistus	3.65		
		Crataegus	2.50		

<sup>†</sup>*Quercus calliprinos*

Concentrations (% of DM) of CP (a) and CT (b) in the main species on range, compared with the concentration in the selected diet are figured in Fig. 1. Although the range of CP content in the different plants at pasture was generally wide (Fig. 1a), concentration of CP in the selected diets did not vary very much throughout the year (maximum 14.6% and minimum 10%). This range is even narrower if ADF-linked CP is subtracted (maximum 12.5% and minimum 9%). The content of CT was quite steady and ranged between 3.5% and 4.7% (Fig. 1b).

Distribution of grazing time between trees, shrubs and herbaceous plant species is shown in Fig. 2. On a yearly basis, goats spent less time at handling and ingesting herbaceous, as compared to ligneous (tree and shrub leaves) vegetation (40% and 60% respectively,  $P < 0.05$ ). This was found at all seasons with the exception of spring (April-May).

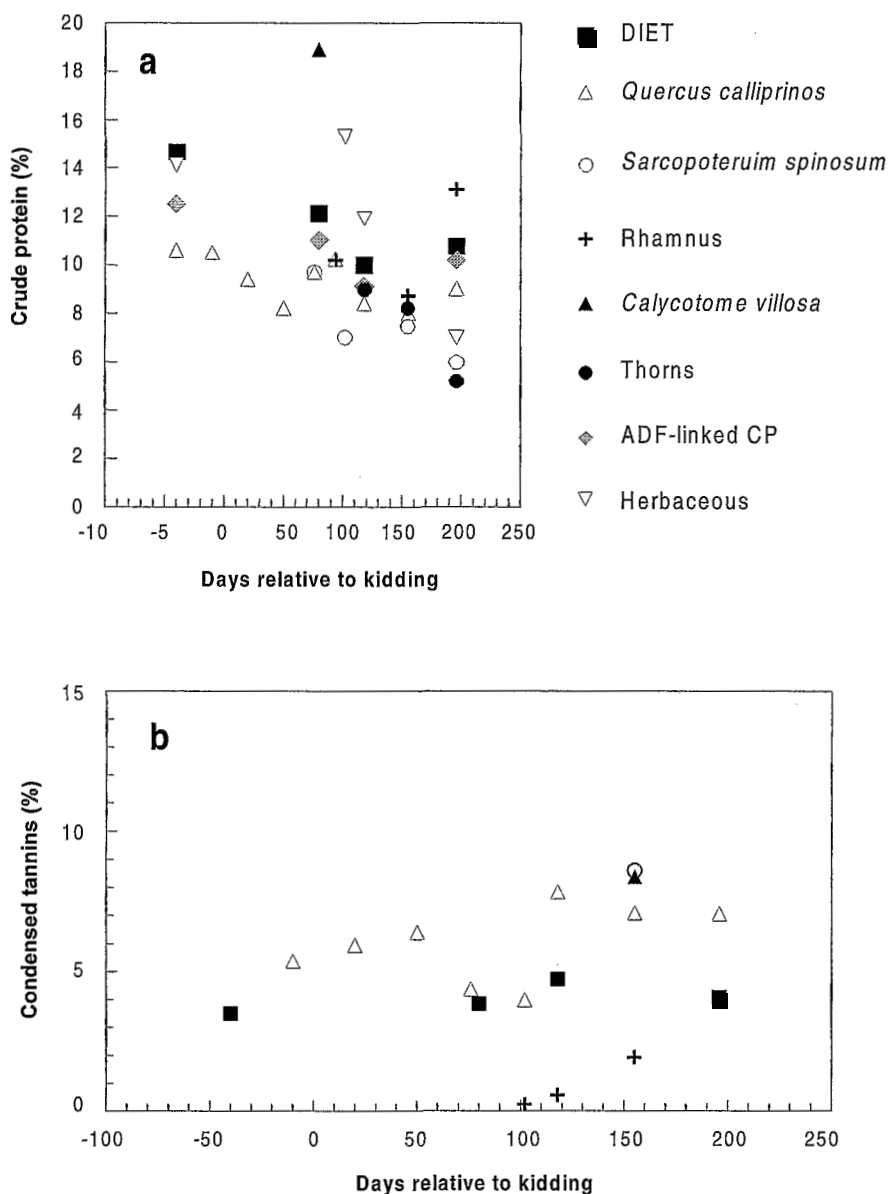


Fig. 1. Concentrations (% of DM) of crude protein (a) and condensed tannins (b) in the main species on range, compared with the concentration in the selected diet.

## Discussion

Mamber goats in this study spent 60% of time at pasture browsing ligneous vegetation (Table 1). This fits well previous results established in Mamber goats bred in similar environment and reviewed by Landau *et al.* (1995), and is also consistent with results obtained in Alpine x local Tunisian goats in similar conditions (Nefzaoui *et al.*, 1993).

The finding that simulated diets were of relatively constant chemical composition (Fig. 1) is consistent with our previous study in Anglo-Nubian goats, where CP ranged between 10.3% and 12.6% of DM, and digestibility ranged between 45% and 52% (Kababya *et al.*, 1992). This comforts the hypothesis, that even though goats are able to thrive on an all-herbaceous diet, as reviewed by Masson *et al.* (1991), they will not do so at any time when they are allowed to feed freely on a range where tree and shrub foliage is available. Ruminants tend to ingest diets of constant chemical content hence providing ruminal bacteria with constant environment in order to insure stability. Data in the present study show that free-ranging goats tend to limit the tannin content of their diet, to such a level

that may be stabilized all-year long. Recent data in Israel show that the neutralization of tannins in the diets of goats fed foliage of *Quercus calliprinos*, *Pistacia lentiscus* or *Ceratonia siliqua* (carob) by using Poly ethylene glycol (PEG) results in increased feed intake, increased digestibility of DM, CP and cell-walls, and improved energy balance (Gilboa *et al.*, 1996). The data presented here suggest that neutralization of tannins in the diet of free-ranging goats in Galilee could be easily carried out, since tannin content do not vary greatly, and neutralization could be achieved through provision of PEG proportionally to DM intake.

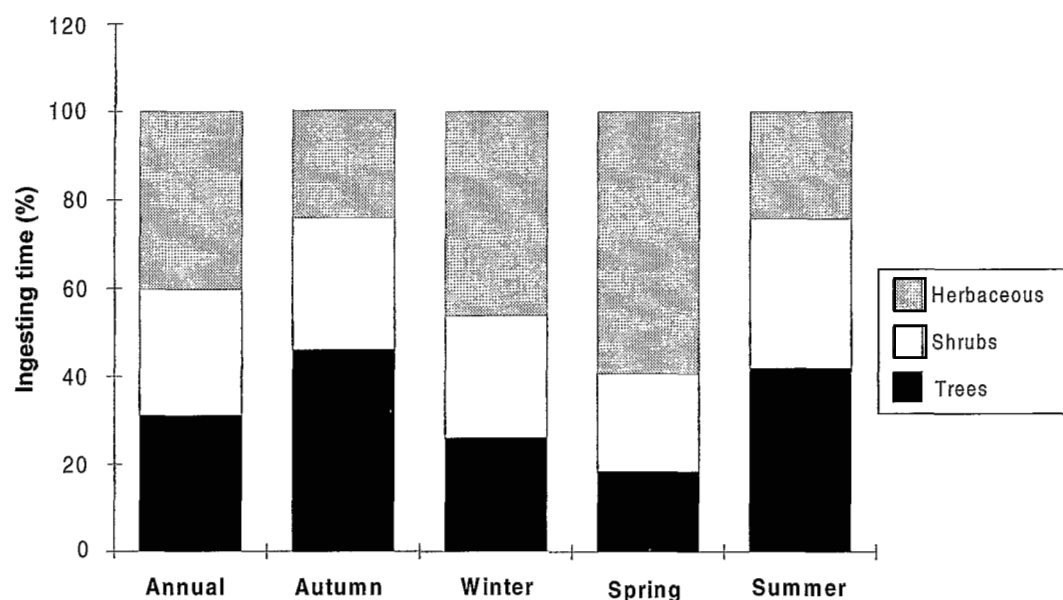


Fig. 2. Seasonal distribution of ingestion time (%) between trees, shrubs and herbaceous vegetation.

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