Forage value of Mediterranean deciduous woody fodder species and its implication to management of silvo-pastoral systems for goats

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Abstract. Forage value of 10 deciduous woody fodder species during six stages of maturity as well as their acceptance by goats in July and August were studied in Macedonia, northern Greece. The fodder species studies were Amorpha fruticosa L., Carpinus orientalis Mill., Colutea arborescens L., Corylus avellana L., Fraxinus ornus L., Ostrya carpinifolia Scop., Pyrus amygdaliformis Vill., Quercus pubescens Willd., Quercus sessiliflora Salich, and Robinia pseudoacacia L. with two accessions, common and spineless. All these species are integral components of the mediterranean silvo-pastoral systems. Monthly forage samples were collected throughout their growing period (May to November), which coincides with the long dry summer when herbaceous plants are dormant, and analyzed for crude protein content, neutral detergent fiber (NDF), lignin and in vitro organic matter digestibility (IVOMD). Comparing the leguminous species (Robinia pseudoacacia, Amorpha fruticosa, Colutea arborescens) with the remaining species, the leguminous one had on average a higher (P ≤ 0.05) content of crude protein (21.1%, 21.0% and 17.1% vs. 10.5–13.3%, respectively) and higher (P ≤ 0.05) IVOMD values (58.4%, 56.0% and 60.0% vs. 47.3–52.8, respectively). Moreover, the leguminous species were among species with lower NDF (42.3%, 45.0% and 35.2% vs. 36.0–48.9%, respectively) and lignin content (7.1%, 8.3% and 9.1% vs. 7.6–10.9%). All species showed a significant increase in crude protein when new leaves appeared (May). Most of the fodder species had digestibilities in the higher range (> 55% IVOMD) and low NDF content (< 53.5%) during the growing season (first five stages). Lignin contents ranged from 5.9% (A. fruticosa, May) to 16.0% (O. carpinifolia, Nov.). Robinia pseudoacacia had the highest relative acceptance index while Amorpha fruticosa, Colutea arborescens and Corylus avellana the lowest. It is concluded that deciduous woody fodder species may play a significant role as sources of nutrients in the mediterranean silvo-pastoral systems during the summer period of seasonal nutritional shortage.

Introduction

In areas of low or intermittent rainfall the dry season of the year is prolonged. Woody species are considered to be well adapted to these environmental conditions providing multiple benefits such as decrease of the risk of soil erosion, production of fuel and timber, improvement of wildlife habitat, aesthetically more pleasing landscapes and food resources [Le Houerou, 1993; Papanastasis, 1993]. In the Mediterranean region with a pronounced dry season (June–Oct.), trees and shrubs are an integral component of the silvo-pastoral systems and their grazeable material (browse) is considered important for the
nutrition of range animals [Le Houerou, 1993; Nastis, 1981; Tsiouvaras, 1993]. During this critical period (summer) when grasses and forbs are dormant browse species supply green material for grazing animals, thus being the only source of nutrients. Additionally, they are abundant and of a consistently higher quality than herbaceous plants during drought [Cook, 1972; Holechek et al., 1989; McKell, 1980; Nastis, 1981; Wilson, 1969].

Browse species, however, have several disadvantages as animal feed. They are often inaccessible to grazing animals, slow to establish, their foliage has a higher fiber and lignin content than grasses and higher levels of soluble phenolics/tannins compounds than herbaceous species [Lefroy et al., 1992; Nunez-Hernandez et al., 1989; Wilson, 1969]. Elevated levels of these compounds may depress digestibility and reduce nitrogen availability and retention [Mould and Robbins, 1981; Nastis and Malechek, 1981; Nastis, 1982]. In the last years, considerable research has been carried out on the role of native and introduced browse species, in mediterranean grazing systems [Papanastasis, 1993]. Studies in Greece have shown that the most common native woody plants (evergreen or deciduous) have higher crude protein than grasses and forbs during summer [Nastis, 1982; Papanastasis, 1982; Papachristou and Nastis, 1990; Papachristou et al., 1993; Yiakoulaki, 1987]. However, deciduous broad-leaved species seem to have better quality protein than the kermes oak (*Quercus coccifera* L.), the dominant evergreen species of Greece's grazing lands [Nastis, 1982; Papachristou et al., 1993; Yiakoulaki, 1987]. Therefore the introduction of deciduous woody fodder species into kermes oak shrublands was suggested as an economical way of meeting the demands of goats for a nutritionally balanced diet during summer [Papachristou and Nastis, 1993]. Other workers [Liacos et al., 1983; Papanastasis, 1985; Platis and Papanastasis, 1993; Tsiouvaras and Nastis, 1990] have studied the performance of some introduced fodder shrubs and trees. Based on these data, such plants are promising for the future mediterranean silvo-pastoral systems.

A critical point in the assessment of the contribution of browse species to grazing systems seems to be their nutritive value and acceptance by grazing animals. Moreover, their establishment and management costs, their productivity, the time of first use and their ecological value in the landscape are factors which must be also taken into account. It has been found [Platis and Papanastasis, 1993] that deciduous fodder trees and shrubs, introduced into open areas in a sub-humid mediterranean environment, produced high amounts of grazeable material from the second year after planting. Information on the nutritional properties of such fodder trees and shrubs and their acceptance by grazing animals is limited. This, however, needs to be studied before making any recommendations for their introduction in the mediterranean silvo-pastoral production systems.

The purpose of the present study was to determine (a) the forage quality of 10 woody fodder species (trees and shrubs) in different stages of maturity; (b)