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Regrowth of two ligneous species as affected by clipping intensity and frequency

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RESUME – *"Reprise de croissance de deux espèces ligneuses soumises à différentes intensités et fréquences de coupe". Les effets d'intensité et de fréquence des coupes sur la reprise de la croissance des deux espèces ligneuses* (Amorpha fruticosa *et* Colutea arborescens*) ont été étudiés. Deux traitements d'intensité des coupes étaient appliqués : la faible intensité (30%) et l'intensité modérée (60%) qui avaient eu lieu toutes les six semaines au cours des stades de développement des espèces. Les mesures du nombre des rameaux et des feuilles ainsi que leur rapport (feuilles/rameaux) sont considérés comme la réponse des plantes au pâturage. La coupe modérée résulte en une augmentation de feuilles chez deux espèces et leur rapport, bien signifiée, par rapport à la coupe faible. La fréquence de coupe a aussi significativement augmenté le nombre de feuilles et de rameaux chez* Amorpha fruticosa *mais non chez* Colutea arborescens.

Mots-clés : *Intensité et fréquence des coupes, espèces ligneuses.*

Introduction

Introduction of woody species especially leguminous (shrubs or trees) in the rangelands could be an effective solution to reduce the imbalance between supply and demand of feed during the summer, when herbaceous species are dormant (Cook, 1972; Papanastasis and Papachristou, 1994). The removal of shoot growth from a woody species (Kirmse *et al*., 87) either by grazing or by clipping stimulates plant to produce new twigs. The response of shrubs to clipping depends on the intensity, frequency, and season of clipping (McKell, 1980; Buwai and Trlica, 1977).

Clipping of current growth (Tsiouvaras, 1984; Parissi and Nastis, 2000) could increase the overall quantity of the forage during the critical summer-early autumn period. However, this increase of the total production after clipping, maybe due to the increase of the woody part of the plant, while in the same time the ratio leaves/stems decreases (Pasquale and Gerard, 1993), lowering the foliage quality (Corleto *et al*., 1994). The present study was undertaken to investigate the effect of clipping intensity and frequency on the regrowth of two ligneous leguminous species during the summer period.

Materials and methods

The experiment was carried out at the Aristotle University's farm (40°34´ E, 23°43´ N, at sea level) in northern Greece. The climate is semi-arid, with mean annual temperature 16.4ºC, and mean total precipitation 374 mm. Two shrubby broadleaved leguminous fodder species *Amorpha fruticosa* L. (A.fr.) and *Colutea arborescens* L. (C.ar.) were investigated. The species were planted in a 1x1m spacing in three blocks with 25 plants per block for each species. Every year during January all plants were topped to 80 cm height, in order to maintain a shrubby form. In each block, clipping of the current growth at light (30%) and moderate (60%) intensities repeated in spring during the season of rapid growth (immature), in middle summer, when growth had just terminated (mature), and at the end of summer when growth had long completely ceased and the woody parts were hardend (very mature). On each harvesting period the regrowth of the tested species was determined by measuring the number of the new twigs and leaves. Thereafter, the ratio of number of leaves to number of twigs was calculated. Data were evaluated by analysis of variance using GLM procedures of SPSS 10.0 for Windows. Steel and Torrie's (1980) least significant difference test (LSD) was used to detect differences between means.

Results and discussion

Number of new leaves was significantly higher under moderate clipping to both of species compared to light clipping (Table 1). Similar results obtained for *Anthyllis cytosoides* (Alados *et al*., 1997) when a 10% and 50% clipping intensity was applied. However, there was no significant difference on the number of twigs between the two treatments (Table 1). Tsiouvaras (1984) found similar results for *Quercus coccifera* clipped at 20%, 40%, and 60% of the currently growth.

Table 1. Number of leaves and twigs (per plant) for the two treatments

	Light clipping	Moderate clipping
Leaves	270b	398a
Twigs	50a	51a

* Means in the same row with different letters (a,b) were significantly different (P≤0.05).

These results indicated that the leaves density per twig was greater at the moderate clipping (Alados *et al*., 1997). Moderate clipping stimulated production of new leaves more than plants clipped lightly. This is very important because the higher proportion of leaves/twigs pointed at foliage which produced was of higher nutritive value since leaves are more nutritious and digestible than twigs (Mero and Uden, 1997; Assefa, 1998). The ratio number of leaves/twigs was significantly higher (Table 2) in moderate clipping in both of species than the light clipping.

Table 2. Ratio of leaves/twigs number (per plant) for the two species in the two treatments

Species / Treatments	Light	Moderate
Amorpha fruticosa	5.4b	8.5a
Colutea arborescens	5.5b	7.7a

* Means in the same row or column with different letters (a,b) were significantly different (P≤0.05).

There was significant interaction between species and harvesting season which indicated that the production of new leaves and twigs after clipping had been affected by the harvesting season (Table 3). *Amorpha* was resistant to intense clipping and had the ability to maintain its vigor and to produce green foliage during the critical period of summer when the feed is scarce (Parissi, 2001). In addition A.fr. produced significantly higher number of leaves and twigs in both middle summer and late summer- autumn season compared to C.ar. but not in the spring season.

Table 3. Regrowth of new leaves and new twigs number (per plant) for the two species at three harvesting seasons

	Periods	Spring		Middle Summer		Late Summer	
Species		Leaves	Twigs	Leaves	Twigs	Leaves	Twigs
Amorpha fruticosa		338CD	41bc	422B	61b	381BC	82a
Colutea arborescens		591A	83a	291D	40bc	144E	25cd

* Means for the same component in the same row or column with different letters (a,b) were significantly different (P≤0.05).

Growth of C.ar. initiated earlier and it fruited earlier (Papanastasis *et al*., 1998) than A.fr. This lower regrowth of C.ar. may be due to the reduced carbohydrate reserves since C.ar. was on the seed formation stage (Willims, 1991; Papanastasis and Noitsakis, 1992). The leave to stem ratio was decreased significantly (Table 4) from spring compared to middle summer and late summer season. It is obvious that the production rate of new leaves was lower (Valladares and Pugnaire, 1999) because of some leaves had fallen due to senescence, a fact that could be attributed to the change of photosynthetic product partitioning (Schulze, 1986).

Table 4. Ratio of leaves/twigs number (per plant) at the three harvesting season

Spring	Middle summer	Late summer
8.1a	6.8b	5.2c

* Means in the same row with different letters (a,b) were significantly different (P≤0.05).

Conclusions

Clipping every six weeks at different growing stages resulted the regrowth of two ligneous species. Moderate clipping was more efficient than light one to stimulate the regrowth of the plants and to produce more green foliage during summer period. A.fr. seems to be more productive under clipping during the summer period.

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