

IMPROVEMENT OF MEDITERRANEAN ANNUAL TYPE PASTURES, UNDER COVERING OF OLIVE GROVE, IN CASTELO BRANCO (PORTUGAL)

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SUMMARY

Trial comparing improvement techniques of unirrigated Mediterranean pastures, on acid soil, under covering of an old olive grove has been installed on N. S. Mercurus Farm (High School of Agriculture - Castelo Branco). There were high significant differences ($P < 0.01$) between treatments for total dry matter production with emphasis on the response of natural pasture to fertilization. Yield was correlated with seed reserve of annual legumes in soil. Some pasture improvement techniques decreased consistently olive production

Additional key-words: Natural pastures, sown pastures, selfseeding legume species, *Dactylis glomerata*, *Lolium rigidum*.

RIASSUNTO

Miglioramento dei pascoli mediterranei a ciclo annuale in terreni coltivati ad olivo a Castelo Branco (Portogallo)

Una prova comparativa di tecniche di miglioramento di pascoli mediterranei non irrigati, su terreno acido, occupato da un vecchio oliveto, è stata realizzata nell'azienda Mercurus (Escola Superior Agraria - Castelo Branco). Differenze significative ($P < 0,01$) sono state evidenziate tra i diversi trattamenti in termini di produzione totale di sostanza secca, con particolare riferimento alla risposta del pascolo naturale alla concimazione. La resa si è dimostrata correlata alla dotazione in semi di leguminose annuali nel terreno. Alcune tecniche hanno determinato una sostanziale riduzione della produzione olivicola.

Parole chiave aggiuntive: Pascoli naturali, pascoli artificiali, leguminose autoriseminanti, *Dactylis glomerata*, *Lolium rigidum*.

INTRODUCTION

The region of Castelo Branco has a thermomediterranean climate, 800 mm of rain, and 111,4 biologically dry days (Horta and Gomes, 1983); the soils are shallow, acid, with low levels of organic matter and nutrients (Antunes, 1981).

The olive production is an important activity, covering about 35,000 hectares (I.N.E., 1985), but the yield per hectare is quite low. The conversion of those old olive groves is difficult, and limited because of soil characteristics.

The main activity of agricultural systems is sheep production (cheese) with low stocking rates (1-2 sheep per hectare); more than 30% of farms are "familiar type" (Almeida *et al.*, 1989).

The expected price evolution for cheese and meat, led farmers to improve the production per unit area. The olive production is expected to remain for self-consumption, due to traditional consumption habits and due to the limited alternatives for other crop on those areas. Therefore pasture production under olive groves can have a good potential, allowing an increase in animal production.

The purpose of this trial was to study the effect techniques on D.M. yield of Mediterranean pastures under an olive grove and on the olive production itself.

MATERIAL AND METHODS

The trial has been installed, in September 1985 on a soil of "corneanas-xistos", poor in organic matter (1.12%), acid (pH KCl 3.9), with 146 ppm of phosphorus and 140 ppm of potassium.

Treatments: A - Sown pasture (subterranean clover) with "deep" soil tillage (deep ploughing); B - Sown pasture with minimum tillage (scarifying/disk drills) on dry soil and reduced sowing density (aiming at exploiting spontaneous existing legumes); C - Natural fertilized pasture; D - Natural pasture; E - Treatment to evaluate olive production, when natural pasture was destroyed.

Mixture and sowing rate per ha in treatment A were as follow: *Trifolium subterraneum* cv Nungarin (2 Kg), cv Seaton Park (5 Kg), cv Woogenelup (6 Kg), *Trifolium brachycalycinum* cv Clare (2 Kg), *Dactylis glomerata* cv Currie (6 kg), *Lolium rigidum* cv Wimmera (4 Kg).

In treatment B the same legume cultivars were used, but in 50% lower than A sowing rate, according to Carter's technique (Carter, 1984).

In treatment E, natural pasture was destroyed every year, by scarifying the soil at the beginning of spring.

The first year's fertilization, applied per hectare in treatments A, B and C was 1500 kg lime, 72 kg P₂O₅, 60 kg K₂O and 26 kg N. The next years was applied 35 kg P₂O₅ per hectare, was applied in the same treatments.

A complete randomized block design was used, with three replications. Plot area was 30 x 22 meters, with 2 olive trees in the middle (separated by 10 meters).

The trial was grazed by sheep, with a high grazing pressure for a short time (2-5 hours), five times per year.

Pasture production was measured by cutting before and immediately after each grazing cycle. The results of the 5th year (1989/90) are presented in this work.

Total seed reserve was measured by soil core samples (until 5 cm deep), in September 1989, using the technique heavy solvents (Carter *et al.*, 1977). Seeds were separated into two fractions, according to their diameter: more than 1 mm (BF) corresponding to subterranean clovers and *Ornithopus* sp. and 1-0.5 mm (SF) corresponding to other annual legumes (e.g. *Trifolium glomeratum*, *Trifolium resupinatum*, *Trifolium angustifolium*).

Olive grove was from "galega" strain. Yield was measured weighing the production of 2 trees per plot. The results of three years are analysed (1987, 1988 and 1989).

The dry matter was determined after drying samples for 24 hours at 65°C.

Statistical analyses were performed by one-way and multifactor analysis of variance and Least Significant Differences test (LSD) for average comparison.

RESULTS AND DISCUSSIONS

Analysis of variance revealed significant differences between treatments for number of seeds per m² (P<0.05), weight of seeds per m² (P<0.05) and total DM production (P<0.01). The results are represented on table 1.

Fertilization and sowing increased the number of seeds in the soil; the weight was influenced too, but the spontaneous legume seeds (BF, treatment C) have less weight than the commercial cultivars (3.3 g/1000 seeds, 5.1 g/1000 seeds on A).

Mineral fertilization (C) increased DM production (comparing with natural pasture D) by about 1500 kg ha⁻¹; sowing (A and B) increased DM yield by about 1200 kg ha⁻¹, when compared with C. DM production presented a correlation coefficient of 0.527 (P<0.05) with "BF" seed weight.

Table 1-Total seed reserve and pasture DM production

Treatment	Number seeds/m ²		Weight seeds (g)/m ²		Dry matter (kg ha ⁻¹)
	(BF)	(SF)	(BF)	(SF)	
A	3318 A	29581 A	16.45 AB	5.97 A	6283.3 A
B	4447 A	34445 A	21.99 A	7.57 A	6199.2 A
C	3284 A	47041 A	9.90 BC	9.59 AB	4986.3 B
D	1365 B	106544 B	4.74 C	16.77 B	3455.1 C

NOTE: Averages referenced with the same letter are not significantly different among them (LSD<0.05).

The effect of mineral fertilization on natural pasture was higher than the values observed by Olea (1986), Olea *et al.* (1986) and Olea *et al.* (1987) under similar conditions; weight of seed reserve, beside the climate (mainly total rainfall) and soil characteristics, is important for DM production and pasture regeneration, as other authors remarked (Carter, 1982).

The analysis of variance for olive production has shown significant differences between "years" ($P < 0.01$) and treatments ($P < 0.05$). The averages (Table 2) remark that destroying the pasture (E) allowed to produce about 800 kg ha⁻¹ more than olive yield with pasture treatments B, C and D, and 400 kg more than A. This fact may be explained by water competition (trees pasture) and higher efficiency of symbiosis *Rhizobium*-legume, on treatment A, due to commercial strains of *Rhizobia* used to inoculate seeds.

Table 2 - Averages of olive production (1987/88/89).

	A	B	C	D	E
kg/2 trees	32.6 A	20.5 B	27.6 B	24.4 B	40.1 C

NOTE: Averages referenced with same letter have no significant differences among them (LSD < 0.05).

CONCLUSION

Comparing pasture improvement techniques among them, fertilization by itself can increase the stocking rate by about 3 sheep per hectare, with low costs and risks; sowing can increase about 2 sheep more, but cost and risk increase too. Between the two sowing techniques, we conclude that using a minimum tillage (scarifying/disk drills) on dry soil and low seeding density, has the same effect on DM production as "deep" ploughing of soil, but with lower cost and risk.

The production system integrating pasture sheep and olive, at current market prices, has a higher gross income per unit area, considering that no modernization of olive grove is made.

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