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INNOVATIONS FOR SUSTAINABLE USE OF NITROGEN RESOURCES

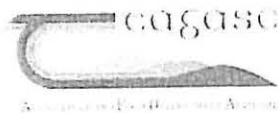
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Self-reseeding annual legume species as cover crops for rainfed olive orchards

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1. Background & Objectives

The ground of perennial crops must be permanently covered by herbaceous vegetation for soil protection (Lipecki and Berbeć, 1997). However, in rainfed orchards the growth of the vegetation should be kept controlled due to low water availability (Rodrigues et al., 2011). The cultivation of self-reseeding annual legumes may have advantages over natural vegetation. These species can fix atmospheric N and might be less competitive for water. In this work, results of ground-cover %, dry matter yield and N recovery are presented for several legume species sown in a rainfed olive orchard. The suitability of these plants to be grown as cover crops is tested, taking into account that these agrosystems are not grazed by animals. The self-seeding of the legumes over the years must be achieved by cutting the vegetation as a simulation of grazing.

2. Materials & Methods

Eleven species/varieties were sown in separated plots in a rainfed olive orchard in the region of Mirandela, NE Portugal, according to the following list: *Ornithopus compressus* L. cv. Charano, *Ornithopus sativus* Brot. cvs. Erica and Margurita, *Trifolium subterraneum* L. ssp. *subterraneum* Katzn. and Morley cvs. Dalkeith, Seaton Park, Denmark and Nungarin, *Trifolium resupinatum* L. ssp. *resupinatum* Gib and Belli cv. Prolific, *Trifolium incarnatum* L. cv. Contea, *Trifolium michelianum* Savi cv. Frontier and *Biserrula pelecinus* L. cv. Mauro. The ground-cover percentage was monitored for two consecutive years after sowing using the point sampling method to evaluate the proportion of legumes species in relation to natural vegetation. Dry matter (DM) yield and N recovery was determined from field samples of the above-ground biomass. Nitrogen concentration in plant tissues was determined by a Kjeldahl procedure. Data analysis consisted of the estimation of means and confidence limits ($\alpha < 0.05$) for comparison among species/varieties.

3. Results & Discussion

Late in spring, the vegetation was generally dominated by the sown legumes from the first year of installation (Figure 1). The tallest and late-maturing cultivars (Contea, Prolific, Denmark) benefited from the wet spring of 2010, with ground-cover close to 100% and substantially higher than that of the early-maturing cultivars (Nungarin, Dalkeith and Charano). In the spring of 2011 the ground-cover percentages were similar to that of the previous year, except for Prolific, which was severely damaged by winter frost. In 2010, DM yield and N recovery were higher for the late-maturing cultivars, benefiting from the long and wet spring of that year. Contea reached the highest DM yield and N recovery. Mauro produced the opposite result due to the problems of emergence (Figure 2). In 2011, during a dry spring, the late-maturing cultivars did not show great differences in DM yield and N recovery to the early-maturing cultivars (Figure 3). In the Prolific plot, only 35 kg N ha⁻¹ were recovered due to the negative impact of the winter frost on this particular species.

4. Conclusion

In spite of the higher dry matter yields and N recoveries of the late-maturing cultivars, the early maturing ones seem very promising as cover crops for the olive groves of the Mediterranean region. They can protect the soil and fix satisfactory amounts of N using less water than the late-maturing ones, since the biomass yielded is lower and their growth cycles finish earlier in spring.

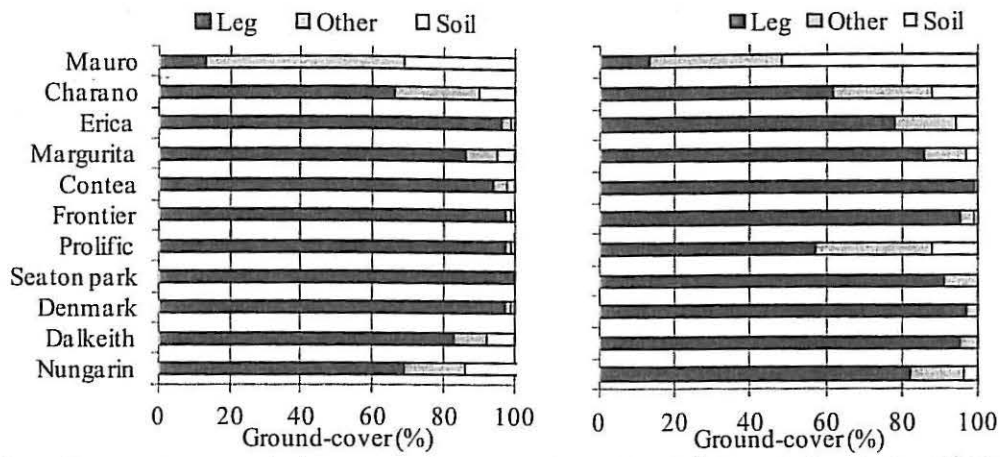


Figure 1. Ground-cover percentage by legumes and other species at May 13th 2010 (left) and May 3rd 2011 (right).

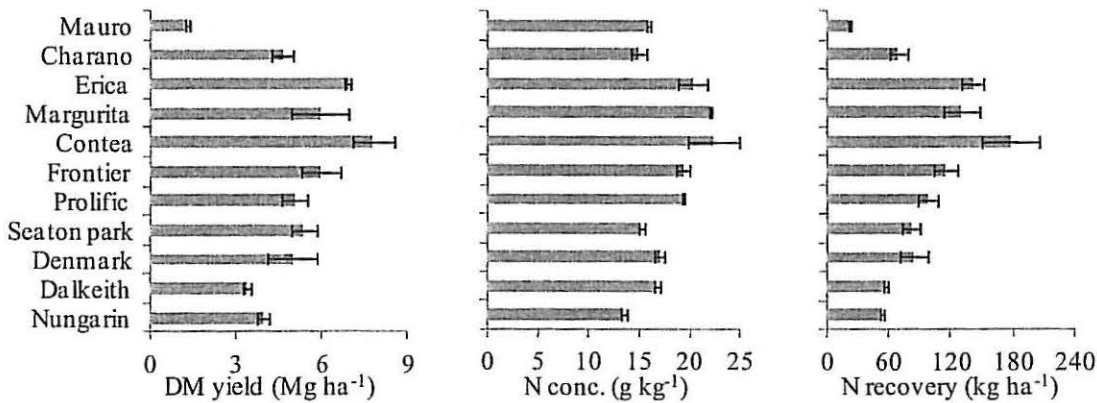


Figure 2. Dry matter yield, N concentration and N recovery in the different plots in the growing season of 2010.

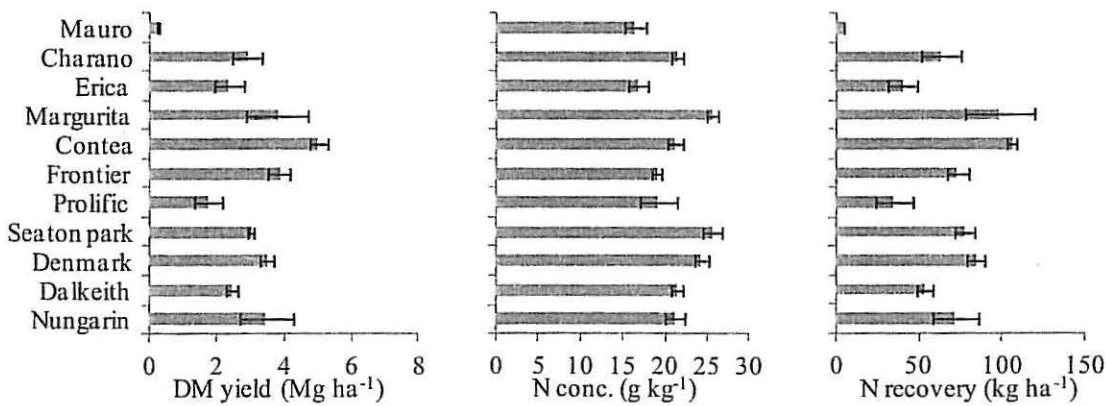


Figure 3. Dry matter yield, N concentration and N recovery in the different plots in the growing season of 2011.

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Lipecki, J., and S. Berbeć. 1997. Soil management in perennial crops: orchards and hop gardens. *Soil and Tillage Research* 43, 169-184.
 Rodrigues, M.A., Lopes, J.I., Pavão, F.M., Cabanas, J.E. and Arrobas, M. 2011. The effect of soil management on olive yield and nutritional status of trees in rainfed orchards. *Commun. Soil Sci. Plant Anal.* 42, 993-2011.

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