Effects of olive mill waste compost and arbuscular mycorrhizal fungi application on soil fertility

J. Carneiro[1,2], C. Horta[1,2], A. Veloso1[1], M. Batista[1], M. Antunes[1], C. Almeida[1,2]

Resumo

The decline of soil organic carbon (SOC) is one of the most serious processes of soil degradation. Furthermore, agricultural management practices that increase SOC stocks will have effects on climate change mitigation. Olive mill waste (OMW) is a common by-product of olive oil production, which has a high plant and microbial toxicity. However, composted OMW can be safely used as a soil fertilizer. Arbuscular mycorrhizal fungi (AMF) are commonly known as bio-fertilizers that enhances the access of roots to a large soil surface area, improving in plant growth. The impact of AMF symbioses varies in different environmental conditions and depends on the specific combination of plant and fungus involved. In INNOACE project, the effectiveness of a fertilization system with soil application of OMW compost and/or mineral fertilizers, with the use of AMF, was evaluated. The soil taken from the layer 0-0.20 m of a dystric Regosol derived from granitic rock was acidic (pHH2O = 5.2), with sandy loam texture, medium level of OM (27 g kg-1), low level of Olsen P (8 mg kg^{-1}) and high level of available K (127 mg kg^{-1}). The OMW compost dry matter content was above 75%, with more than 50% of OM, a pH value of 8.0, a C/N ratio of 22 and low content of heavy metals. A pot experiment with a randomized block design and four replications was carried out with fourteen treatments, including: the application of two levels of nitrogen (1–85 kg ha-1 and 2–170 kg ha-1) applied through OMW compost (1Norg and 2Norg) and/or mineral forms (1N and 2N), three levels of mineral phosphorus (0P–0 kg ha-1, 1P–40 kg ha-1 and 2P–80 kg ha-1) and application, or not, of AMF. It was also considered the non-application of any fertilizer or AMF (Control) and the practice of a conventional mineral fertilization (2N+2P). A tetraploid annual ryegrass

[1] Instituto Politécnico de Castelo Branco - Escola Superior Agrária –, Qtª. Sra de Mércules, Ap. 119, 6001-909 Castelo Branco, Portugal
[2] CERNAS - Research Centre for Natural Resources, Environment and Society, Instituto Politécnico de Castelo Branco, Qtª. Sra de Mércules, Ap. 119, 6001-909 Castelo Branco, Portugal
* Autor para correspondência: jpc@ipcb.pt

(*Lolium multiflorum* L.) was used. The mycorrhizal fungi (*Glomus intraradices and Glomus mosseae*) were applied to the soil (1 kg ha^{-1}; 500 spores g-1 of each species) at the first watering, after sowing. In the ryegrass, three cuts were made and at the end of the experiment the soil of each pot was analysed. No significant differences were observed between the soil pH measured in the Control (5.4) and that observed when only organic material was applied (5.4 and 5.5, with or without AMF addition, respectively). The incorporation of the compost, in the amounts applied (7 and 14 t ha^{-1}), did not promote significant changes ($p>0.05$) in the total soil organic matter quantified by incineration of the sample, nor on the organic matter easily oxidizable. This ranged between 2.96% in 1N 1Norg 1P (with addition of AMF) and 3.20% in 1N 1Norg 0P (with addition of AMF). Only with P fertilization and simultaneous incorporation of compost in the highest amount, it was possible to increase the P content of the soil to more suitable values (P2O5 from 51 to 100 mg kg-1). Even in the presence of a soil with a high assimilable K level (153.0 mg kg^{-1}), the application of compost led to a significant increase in the K content in the soil. The highest CEC (until 22.0 cmolc kg^{-1}) was obtained with the absence of AMF and with the application of the highest dose of organic waste.

Palavras-chave: circular economy, organic matter, sustainable fertilization