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Kommission IV: Bodenfruchtbarkeit und Pflanzenernährung

Landnutzung und Kohlenstoffhaushalt

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Titel
Processes governing development of ecotoxicity in clayey and silty soils incubated with olive mill wast water under different temperature and humidity conditions

Abstract
Olive oil production generates olive mill wastewater (OMW) with a high content in nutrients and phenolic substances. Its application to soil could be a cost-effective solution for recycling. However, the degree of toxic effects of OMW on soil biota is widely unknown and has to be considered when searching for adisposal strategy.
The objective of this study was to understand the degradation process of OMW organic matter and its influence on toxic effects as well as soil properties. We hypothesized that OMW toxicity decreases with degradation of its phenolic components. A higher soil biological activity was expected to increase degradation.
We incubated a clayey soil and a silty soil with OMW for 60 days under conditions typical for this region in order to simulate the application during various seasons (winter, spring, summer dry, summer wet). Soil respiration, pH, electrical conductivity, total phenolic content as well as anion and cation content, specific ultraviolet absorbance at 254 nm and dissolved organic carbon were measured at ten points of time during incubation. Soils and methanolic soil extracts were tested for ecotoxicity using Lepidium sativum germination and Folsomia candida egg hatching rate.
The degradation and transformation of OMW-organic matter was stronger under warm and humid conditions than under cold and dry conditions. It was furthermore enhanced in the clayey soil compared to the silty soil. Most severe ecotoxicological effects were found under summer dry conditions while spring as well as summer wet conditions led to a fast recovery of both germination and hatching. However, the silty soil did not recover to preapplication levels. In the clayey soil, germination parameter were higher than in control after around 30 days suggesting a fertilizing effect. Effects in methanol extracts were higher in all soils and climatic scenarios. Therefore, remobilization of OMW derived toxic compounds has to be considered on a long-term scale. Egg hatching as most sensitive life-cycle parameter of Folsomia candida showed also the same relation to climatic conditions and soil type but was more robust to OMW compared to Lepidium sativum.
Environmental conditions as well as soil type are key factors determining degradation of OMW organic matter and OMW derived ecotoxicity. Therefore, spring application (warm and wet) of OMW seems to be a compromise with regard to OMW recycling, OMW occurrence in winter and farmer considerations.