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Effect of land improvements on agricultural soils in the Alps

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Human-induced land transformations in the mountain regions often cause chemical, physical and biological alterations of the soil properties. Land improvement is one of the most frequent options used by farmers to more easily cultivate and increase the mechanisable surface. Even though the effects on soils of some common practices like rock removals, levelling and milling are frequently unknown also to the professionals. The aims of this study are: a) the assessment of impacts on soil properties of land improvements in the Alps; b) the comprehension of the relationships between soil and plant species; c) the detection of the best pedotechniques and practices of restoration. Moreover an important purpose of this study is the dissemination of the results to the professionals and later to the farmers, and the publication of a comprehensive handbook on land improvements. We investigated the effects of the land improvements in 3 study areas in the Aosta Valley Region (North Western Italy); two of them, Verrayes (VE) and Saint Denis (SD) are located in the central part of the Region and the third, Gaby (GA) is located in a lateral valley, characterised by a higher amount of precipitation (1000 mm versus 600 mm). In VE and SD the soil sampling was carried out in three and four sectors of different age and in a control, where the land improvements were not conducted. A soil profile was dug in each sector and in the control (VE: 3 soil profiles + 1 control; SD: 3 soil profiles + 2 controls). In GA, where the land improvements were recently carried out (summer 2010), 1 profile was excavated in the area of intervention and 1 in an undisturbed site (control).). In this site we have monitored all steps of land improvement (rocks removal, levelling, sowing.....). Therefore we took additional soil samples, from the milled material and of the allocthonous soil distributed on the surface. Moreover in a little surface of the study site (100 m2), we are evaluating the effect on soil quality of a compost obtained by plant residues. Also at GA we opened two trenches to see if the land improvement practices had any role in the failure of the grassing and in the diffusion of a dangerous weed (Senecio inaequidens). All the soil samples have been analysed for total organic carbon (TOC), total nitrogen (TN), pH, electrical conductivity (CE), cation exchange capacity (CEC), exchangeable cations, colours, % of skeleton). In VE, where the land improvements finished in 2008, we have observed a TOC content lower in upper than in deeper horizons. The situation was completely different in the areas where the land improvements finished in 2000, where the TOC content decreased from the surface to the deeper soil horizons. In GA the land improvements caused a decrease of the TOC content in comparison with the control. Moreover results from sampling the two trenches in GA, suggest that soil properties were not responsible for the failure of the grassing and the spreading of the Senecio inaequidens. In this site the soil pH was not influenced only by the lithology, but probably also by the works executed during the land improvement. The use of an allocthonous soil with a higher pH significantly influenced the soil properties in comparison with the control. The definition of best practices for land improvements in these mountain areas and the estimation of their effects on soil properties are key achievements for both farmers and professionals to reduce impact, costs and provide better technical solutions.

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