Managing N,P,K excesses in soils, from applied fertilisers, using biochar; direct implications to tomato plant (Solanum lycopersicum L.) health and consequences to the mobility and uptake of trace elements

Luke Beesley & Marta Marmiroli
Department of Environmental Sciences, Section of Genetics and Biotechnologies, University of Parma

In northern Italy, tomato plantations contribute a significant proportion of both economical prosperity and food capital. Multiple threats exist which are compromising production and safety of the outputs of these plantation, as well as soil quality. Managing applied N,P,K fertilisers, to reduce leaching and improve plant yields whilst, on a finer scale, preventing antagonisms between fertilisers and soil residual heavy metals, needs to be examined to determine whether co-mobilisation is influencing the chemical equilibrium in fertilised soils and hence reducing soil quality, plant health and food safety.
Organic soil amendments have been applied to manage soil nutrition and element mobility for many years. More recently biochars (biological residues combusted under low oxygen conditions, resulting in a porous, low density carbon rich material) have gained credence for soil applications because their large surface areas and cation exchange capacities have enabled enhanced sorption of both organic and inorganic contaminants to their surfaces, reducing pollutant mobility when amending contaminated soils, whilst providing improved soil aeration, water holding capacity and soil nutrition.
A short term scientific mission (STSM) has been granted by COST 869 to determine the efficacy of biochar for regulating N, P, K, from fertiliser applications, to soils in terms of reducing excess leaching. Potentially toxic elements, especially Cd and As in soil pore water and edible plant parts will be measured to establish whether any antagonisms exist between added nutrients and potentially toxic elements which could compromise the use of biochar in this system. Solanum lycopersicum L. cultivars, chosen from previous screening, will be transplanted to biochar amended soils and maintained in controlled conditions in the laboratory. In the following 2 months, pore water samples taken from each replicate will determine the effect that the biochar addition has to N, P, K leaching and Cd and As mobility. Plant growth parameters will be measured as well as foliar Cd and As concentrations at the end of the experiment to plant health and safety. The initial aims, set-up and results will be reported at the COST 869 final meeting in Hungary with the aim of informing the action 869 of steps that could be taken to increase fertiliser use efficiency and reduce N leaching to waters, from soils.
Current address* Environmental and Biochemical Sciences (EBS) group, The James Hutton Institute, Craigiebuckler, Aberdeen. AB15 8QH. luke.beesley@hutton.ac.uk