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AGRONOMIC VALUE OF ALKALINE-STABILIZED BIOSOLIDS FOR CONTINUOUS SPRING BARLEY ON TWO CONTRASTING SOILS

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An organic amendment made by mixing de-watered biosolids with cement kiln dust and aerobic composting was applied at four rates to seven consecutive annual spring barley crops on two contrasting soils in two randomized block field experiments and compared with inorganic P or K fertilizer. One of the soils, a basaltic clay, was low in Olsen-P and the other, a shale clay-loam, was low in exchangeable K. All biosolid and fertilizer treatments gave higher yields than unamended controls, but there was no yield response to increasing application rate of biosolid or fertilizer P or K. Yields of biosolid amended or fertilized plots were therefore averaged over the seven annual crops. Biosolids gave higher grain and straw yields than fertilizer P, similar grain and straw yields compared with fertilizer K, and higher grain weights and more grains per ear than fertilizer P or K. These effects may have been due, at least in part, to higher soil pH and S inputs. Calculation of nutrient balances indicated that Olsen-P reserves should be maintained at ~9 mg l^{-1} in the basaltic clay and exchangeable K at ~110 mg l^{-1} in the shale clay loam to maintain adequate supplies for crop growth while minimizing the risk of losses to the environment. These values are substantially lower than current target levels, indicating that there may be scope for lowering current fertilizer recommendations. Although alkaline products can remediate heavy metal phytotoxicity by raising soil pH, there is concern about long-term accumulation of trace metals in agricultural soils. Soil samples collected at the end of the field experiments are currently being analysed for trace metal concentrations and speciation. Both Zn and Cu were well below their toxic thresholds of 100 and 10 mg kg^{-1} respectively in the barley shoots at the tillering stage. Grain and straw Cu and Zn were often higher in the biosolid treatments than in fertilizer or control, but the magnitude of the differences was small. Increasing soil pH with repeated biosolids application was associated with lower shoot Mn concentrations at tillering and lower grain and straw Mn concentrations and offtakes at harvest, but no Mn deficiency symptoms were observed. Shoot Mn tended to be lower in the biosolid treatments in later years, especially on the shale soil, but seldom below 10 mg kg^{-1}, the deficiency threshold. Concentrations of trace metals in grain and straw were similar to those in the control and fertilizer treatments despite the inclusion of excessive application rates of biosolids. The results indicate that relatively low application rates ($\leq$5 t ha^{-1}) of alkaline biosolids could be used for several years, even on soils with small reserves of available P to maintain crop production and control of soil pH in acid soils. Supplementary inorganic fertilizer N and K could also be applied to achieve optimum yields.

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