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Effect of Clinoptilolite Addition to Soil on Wheat Yield and Nitrogen Uptake

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Abstract

During the past years, appreciable amounts of zeolite-rich tuff that contains more than 70% clinoptilolite (Cp) have been discovered in Greece. The present study evaluates the ability of natural Greek Cp to increase the efficiency of nitrogen (N) fertilizer uptake in wheat. A pot experiment with winter wheat was conducted in a Typic Xerorthent that was fertilized with ammonium sulfate and amended with 0 to 60 ton/ha of Cp. Clinoptilolite application resulted in an increase of the cation exchange capacity of the soil from 9.5 to 13.6 meq/100 g (i.e., 43%). Soil ammoniacal N was greater in the samples amended with Cp at the boot stage, as was NO_3-N. Clinoptilolite addition increased total wheat yield (dry matter of hay plus seed) 52% (from 21.1 g/pot in the control to 32.0 g/pot) in the treatment with 60 ton/ha of Cp. The influence was greater for seed yield than hay yield. Clinoptiloite addition resulted in high increase in total N uptake, about 141% (from 156 mg/pot in the control to 376 mg/pot) in the treatment with the highest Cp rate. For hay, the increase was 133% (from 125 mg/pot to 291 mg/pot), whereas for seed it was 126% (from 31 mg/pot to 70 mg/pot) from control to the treatment with the highest Cp rate, resulting in a more efficient N fertilizer use. The optimum Cp addition rate was estimated as large as 15 ton/ha.

Keywords: Clinoptilolite, N efficiency, nitrate leaching, ammonium fixation