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Crop Mn2+ Demand at Juvenile Phenophase of Growth

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Manganese is an most essential micronutrient throughout all stages of plant development. It is important for vital plant functions. Mn acts as the cofactor of various enzymes such as Mn-superoxide dismutase, and Mn-catalase. Mn is essential, particularly in photosynthesis, where Mn plays a critical role as an accumulator of positive charge equivalents in a reaction catalyzed in photosystem. Mn aids the synthesis of chlorophyll and assimilation of nitrate and activates enzymes of fat biosynthesis. It functions in the formation of riboflavin, ascorbic acid, and carotene. Plant species differ considerably in their normal or adequate Mn leaf concentrations from 30.0 to 500.0 mg Mn kg-1 dry mass, and in their susceptibility to Mn deficiency. The critical deficiency range in fully expanded leaves is reached when Mn concentrations drop below 10.0 to 20.0 mg Mn kg-1 dry mass. Mn2+ deficiency can be an important factor limiting plant growth, particularly in unfertilized sandy soils. The critical concentration for deficiency can vary within a very wide range, depending on plant species, genotypes, and crop growth stages. Manganese deficiency symptoms are more often observed in crops at early stages of growth since Mn2+ can be easily mobilized from the surface soil. A study was conducted under NPKCaMg induced field conditions at Experiment Station of Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences at Nyírlugos city (47° 44’ 60’’N, 22° 8’ 80’’E) in the so-called “Northern Great Plain” that is located in the Eastern-North-Eastern part of the Hungary. Field experiment was set up on a sandy acidic lessivated brown forest soil; Haplic Luvisol in 1962. Soil texture had a particle-size distribution in plow-layer (0-25cm) sand over 0.05 mm 70-85%, loam 0.05-0.002 mm 8-20%, clay under 0.002 mm 3-6%. Clay in colloid accumulation layers makes up to 10-18%. The saturation percentage was 25-30, pH (H2O) 5.4, pH (KCl) 4.3, organic matter 0.5-0.8%, CEC 3-5 meq 100 g-1. The trial covered five fertilizers (nitrogen, phosphorus, potassium,

calcium, magnesium) in 32 treatments, with four replications, and with a total 128 plots in randomised block design. Each plot had a 5x10=50m2 plot size. Sunflower (Helianthus annuus L.) was growed of 42.5 to 70.0 mg Na2EDTA + KCl extractable soil Mn2+ kg-1; of tobacco (Nicotiana tabacum L.) 23.7 to 33.7 mg Na2EDTA + KCl extractable soil Mn2+ kg-1; and of triticale (x Triticosecale W.) 10.2 to 32.7 mg NH4-acetate+EDTA extractable soil Mn2+ kg-1; and were grown for 73 d.; 50 d.; and 191 d. The minimum Mn2+ concentration required in soil nutrient contents was 42.5 mg kg-1 for sunflower; 24.3 mg kg-1 for tobacco; and 10.2 mg kg-1 for triticale. Sunflower, tobacco and triticale achieved optimum growth 48.0 to 65.0 mg Mn2+ kg-1; 24.9 to 32.1 mg Mn2+ kg-1 and 28.7 to 29.6 mg Mn2+ kg-1. Critical shoot Mn2+ concentration at early stages of growth was 53.6 mg kg-1 in sunflower; 458.0 mg kg-1 in tobacco, and 193.8 mg kg-1 in triticale. Our results demonstrate that the tolerance to low external Mn2+ (triticale $<$30.2 mg kg-1; sunflower: $<$56.2 mg kg-1; tobacco: $<$69.3 mg kg-1) and the critical tissue Mn2+ levels for deficiency varied significantly among crop species tested. Keywords: Crop, Manganese, Deficiency, Requirement, Tolerance