Public Abstract
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Title:MANGANESE NUTRITION AND PHOTOSYNTHESIS IN NAD-MALIC ENZYME C-4 PLANTS

Based on their photosynthetic pathways, plants can be divided into three major groups: C-3, CAM, and C-4. In C-4 plants, the release of CO2 for Calvin cycle reactions in bundle sheath cells (BSC) involves one of the three principal enzymes: NADP-malic enzyme (NADP-ME), PEP-carboxykinase enzyme (PEP-CK), and NAD-malic enzymes (NAD-ME). Of these three decarboxylating enzymes, only the activation of NAD-ME has an absolute requirement for manganese (Mn), therefore, leaf Mn concentrations could be critical for maximum NAD-ME activity and the continued supply of CO2 to for Calvin cycle reactions in C-4 plants utilizing this enzyme.
The objective of this research was to determine the Mn requirement for maximum photosynthesis and plant biomass production for two agriculturally important NAD-ME C-4 species, pearl millet (Pennisetum glaucum L. R. Br) and purple amaranth (Amaranthus hypochondriacus L.). Results showed that pearl millet and purple amaranth required 20-fold higher Mn concentrations in hydroponic media for maximum photosynthetic rate and biomass production compared to C-3 wheat (Triticum aestivum L.), squash (Cucurbita pepo L.), and NADP-ME C-4 corn (Zea mays L.) and sorghum (Sorghum bicolor L. Moench). Also Mn fertilization of a high pH soil, increased leaf Mn concentration, photosynthetic rates and seed yield in field grown pearl millet and purple amaranth. This is, to my knowledge, the first experiment to show that NAD-ME C-4 plants have a higher Mn requirement for optimum photosynthesis and biomass production than C-3 and NADP-ME C-4 species.