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Early manganese-toxicity response in *Vigna unguiculata* L. – a proteomic and transcriptomic study

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The apoplast is known to play a predominant role in the expression of manganese (Mn) toxicity in cowpea (*Vigna unguiculata* L.) leaves. To unravel early Mn-toxicity responses after 1–3 days Mn treatment also in the leaf symplast, we studied the symplastic reactions induced by Mn in two cultivars differing in Mn tolerance on a total cellular level. Comparative proteome analyses of plants exposed to low or high Mn allowed to identify proteins specifically affected by Mn, particularly in the Mn-sensitive cowpea cultivar. These proteins are involved in CO₂ fixation, stabilization of the Mn cluster of the photosystem II, pathogenesis-response reactions and protein degradation. Chloroplastic proteins important for CO₂ fixation and photosynthesis were of lower abundance upon Mn stress suggesting scavenging of metabolic energy for a specific stress response. Transcriptome analyses supported these findings, but additionally revealed an upregulation of genes involved in signal transduction only in the Mn-sensitive cultivar. In conclusion, a coordinated interplay of apoplastic and symplastic reactions seems to be important during the Mn-stress response in cowpea.