SL205 Maize invertases: isolation, characterization of 4 cell wall invertase genes and expression of vacuolar and cell wall invertase under water stress condition.

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Invertases and sucrose synthase are key-enzymes for sucrose metabolism in plants. Firstly, four genes, Incw1, 2, 3 et 4 encoding invertases in maize were cloned and characterized. Incw1, 2 et 3 genes encode typical acid insoluble invertases (cell wall-bound), while Incw4 gene most likely encodes an acid soluble invertase located in the cell wall but in an unbound state, or an atypical vacuolar invertase, Incw1 et 2 genes present a typical plant invertase gene structure (6 introns/ 7 exons) while Incw3 et 4 possess 6 and 5 exons, respectively. The expression of Incw1(Chromosome 5) and Incw3(Chromosome 10) was observed in varlous vegetative and reproductive organs; Incw4 was expressed in all tested organs. In situ RT-PCR hybridization revealed that Incw3 mRNAs were localized in the central cylinder and meristem cells of roots, while Incw4 mRNAs were detected at low levels in root cells showing mitotic chromosomal segregation. Invertase and sucrose synthase expression were also analyzed in vegetative source and sink organs in water-stressed maize. Among six invertase genens tested, only the expression of Ivr2 gene encoding a vacuolar invertase was induced by water stress. This expression was accompanied by a correlated increase in vacuolar invertase protein, acid soluble invertase activity and an accumulation of hexoses. Glucose, fructose and, to a lesser extent, sucrose accumulated in all organs examined from water stressed plants. In situ localization studies showed that acid invertase activity, vacuolar invertase protein and Ivr2 mRNAs colocalized with glucose accumulation in a tissue/cell specific manner in mature leaf and roots. In addition, diumal changes in activity, protein and transcripts for vacuolar invertase were noted in shoots. The spatial/temporal regulation of invertase activity is discussed in relation to the invertase role during development or under water stress.

Key words: Zea mays, invertase gene, cloning, in situ RT-PCR hybridization, water stress, carbohydrate metabolism