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Molecular analyses of glycerol-3-phosphate permease – G3P genes induced by phosphate stress in maize

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Many essential biological processes are carried out inside sub-cellular compartments such as plastids and mitochondria. These pathways often require an extensive transport mediated exchange of metabolites between compartments and surrounding cytosol. At some point almost all these processes require phosphate. Phosphate shortage may adversely affect transport across the membranes of these isolated compartments. The impact of Pi starvation may be more severe in compartments such as chloroplasts that are actively exporting organic-P metabolites in exchange for inorganic phosphorus. Chloroplasts, utilize a variety of sugar transporters to maintain normal biological activities. Interestingly, many of these are antiporters that couple the efflux transport of a sugar-phosphate to the influx of Pi. Among these include a hexose transporter that exports the products of starch degradation from the plastids, an ADP/ATP transporter that supplies plastids with energy for biosynthesis of a wide variety of compounds transporters belonging to the major facilitator superfamily (MFS) which function as antiporters exchanging Pi for C3 and C6 compounds. G3P, the topic of this study, is also a member of MSF. G3P is strongly induced under phosphate deficiency in maize. These genes exhibit temporal, spatial and phosphate deficiency associated patterns of expression. Although there were differences in the expression of phosphate starvation induced genes, no consistent pattern of expression associated with either phosphate efficient or inefficient genotypes of maize emerged. It appears that phosphate efficiency in maize is a complex trait mediated by coordinated action of groups of genes either induced or suppressed in response to nutrient deficiency.