

The dynamic responses of oil palm leaf and root metabolome to phosphorus deficiency

ABSTRACT

Inorganic phosphate (Pi) starvation is an important abiotic constraint that affects plant cellular homeostasis, especially in tropical regions with high acidic soil and less solubilizable Pi. In the current work, oil palm seedlings were hydroponically maintained under optimal Pi-supply and no Pi-supply conditions for 14 days, and metabolites were measured by gas chromatography–mass spectrometry (GC–MS), from leaves and roots, after seven and 14 days of treatment, to investigate biochemical pathways in relation to P-utilizing strategy. After seven days of limited Pi, plant leaves showed increased levels of most soluble sugars, and after 14 days, the sugars' level decrease, except for erythritol, mannose, fructose, and glucose, which showed the highest levels. Rather in root samples, there were different but overlapping alterations, mainly on sugars, amino acids, and organic acids. The leaf sample was shown to have the highest response of sugars with myo-inositol playing a vital role in the redistribution of sugars, while maltose levels increased, indicating active degradation of starch in the root. High levels of glycerol and stearate in both roots and leaves suggest the metabolism of storage lipids for cellular energy during Pi-deficient conditions.

Keyword: Inorganic phosphate (Pi); P-deficiency; Biochemical pathways; Organic acid; Lipid