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Phenotypic Plasticity of Rice Seedlings: Case of Phosphorus Deficiency

Delphine Luquet[1)], Bao Gui Zhang[2)], Michael Dingkuhn[1)], Amandine Dexet[1)] and Anne Clément-Vidal[1)]

1) CIRAD AMIS-Ecotrop, Agropolis Lavalette
2) CAU, College of Resources and Environment

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Abstract: The aim of this study is to characterize the plasticity of root and shoot morphology in rice, the genomic model plant for cereals, using P deficiency as environmental factor causing variability. A phytotron study on Nipponbare (*Oryza Sativa* L.) seedlings was conducted to analyze the effects of P deficiency on plant organogenesis (tiller and leaf appearance, root apex number) and allometric relationships (root/shoot weight ratio, specific leaf area (SLA) and specific root length (SRL), blade/sheath weight ratio). The results confirmed that the main effect of P deficiency is a reduction of shoot growth for the benefit of the root system. Reduced shoot growth was associated with reduced tiller production, longer phyllochron and reduced leaf elongation rate while final leaf size remained unchanged. The reduced leaf elongation rate might be a primary response to P deficiency and this caused lower phyllochron and tillering by feedback. Allometric parameters such as SLA, SRL, root apex number per unit length and leaf blade/sheath weight ratio remained largely stable under P deficiency. Increased root growth relative to shoot was associated with increased sucrose concentration in roots, and thus possibly resulted from assimilates liberated by shoot growth inhibition. The simple theory of multiple morphological changes resulting from slow leaf expansion under P deficiency requires further experimental confirmation, after which it may serve as a basis for a mechanistic model of rice phenotypic plasticity and certain genotype X environment interactions on morphology.

Keywords: Assimilate partitioning, *Oryza sativa* L., Phyllochron, Plant architecture, Rice, Root-shoot ratio, Source-sink relationships, Tillering

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