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Application of *Pup 1* gene based markers for the varietal screening of phosphorus deficiency tolerance in rice under hydroponics

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In the present day rice industry, researches are focused on developing rice varieties for the efficient usage of soil nutrients in order to reduce the cost of production. Phosphorus is one of the most unavailable and inaccessible macro nutrients in rice due to the tight binding to soil-forms that are not readily available to the plant. Marker-assisted breeding is a useful tool for breeders to track the agronomically favorable genes of plants during the variety development process. The major quantitative trait locus (QTL), *Phosphorus uptake 1 (Pup1)*, confers tolerance to phosphorus deficiency in soil and is currently considered as one of the most promising QTLs for the development of phosphorus deficiency tolerant rice (*Oryza sativa*) varieties. It has been revealed that *Pup1* K-46 and *Pup1* K-52 are markers that are associated with *Pup1* gene to confer phosphorus deficiency tolerance. Therefore, this study was conducted to detect the possibility of applying the *Pup1* gene based markers for the phenotypic assessment of Sri Lankan rice varieties on phosphorus deficiency tolerance.

PCR conditions were optimized for the amplification of *Pup1* K-46 and *Pup1* K-52 markers. Twenty varieties including improved and traditional were selected and genotyped by using *Pup1* K-46 and *Pup1* K-52 dominant markers. Root length, shoot length, root width, root volume, dry weight of root and dry weight of shoot were measured under phosphorus deficient and supplemented condition of hydroponics.

The PCR profiles revealed that 15 out of 20 varieties were *Pup1* positive genotypes while other five varieties were *Pup 1* negative genotypes. The results showed that root width and root volume were significantly different between the varieties possessing *Pup 1* gene and lacking *Pup 1* gene. The results prove that *Pup1* K-46 and *Pup1* K-52 markers are useful in detecting phosphorus deficiency tolerance in Sri Lankan rice varieties. Therefore, the varieties tested in this study would be useful in selecting parental lines in developing rice varieties for efficient usage of phosphorus.