The development of rice cultivars with enhanced P efficiency represents a sustainable strategy to improve the livelihood of low-resource farmers. We have found a novel allele for the P starvation tolerance (OsPSTOL1) gene in O. glaberrima, and developed allele-specific markers for single PCR and/or duplex PCR. Within the genus Oryza, this allele is more commonly distributed in O. glaberrima and its ancestor O. bartii. Furthermore, additional markers revealed variation at the Pup1 locus, which appears to predate domestication of rice. This information would be helpful for marker-assisted introgression of Pup1/PSTOL1 into rice megavarieties.