

**Table S3.** A description of traits in this study

Trait	Abbreviation	Description
Yield per plant (g)	YPP	Grain yield divide by plant number harvested
Shoot dry weight per plant (g)	SDWPP	Shoot was dried at 65°C to a constant weight and divide by plant number harvested
All dry weight per plant (g)	ADWPP	Dried weight (ear and shoot) divide by plant number harvested
Seed P concentration (mg/g)	SePCc	The P content per gram of dried grain
Shoot P concentration (mg/g)	ShPCc	The P content per gram of dried shoot
Seed P content per plant (mg)	SePCPP	$YPP \times SePCc$
Shoot P content per plant (mg)	ShPCPP	$SDWPP \times ShPCc$
All P content per plant (mg)	APCPP	$SePCPP + ShPCPP$
Seed P utilization efficiency (g/mg)	SePUtE	inverse of SePCc
Shoot P utilization efficiency (g/mg)	ShPUtE	inverse of ShPCc
All P utilization efficiency (g/mg)	APUtE	$ADWPP \div APCPP$