Phosphorus (P)

Rice Science for a Better World

rice fact sheets

What is the Role of Phosphorus (P) in Plants?

Phosphorous is an essential plant nutrient important for root development, tillering, early flowering, and ripening. It is mobile within the plant, but not in the soil.

How to Manage P?

- **P deficiency symptoms.** Stunted dark green plants with erect leaves and reduced tillering; thin and spindly stems; delayed maturity (and no flowering at all with severe P deficiency); and high levels of unfilled grains
- **Occurrence of P deficiency.** P is often deficient in sandy soils with low organic matter content; calcareous/saline/alkaline soils; degraded lowland soils; volcanic ash soils or acid upland soils with high P fixation capacity; peat soils; and, acid sulfate soils high in active iron and aluminum.
- **How much P to apply?** At optimum plant nutrition, the rice crop (straw plus grain) takes up around 6.4 kg P_2O_5 (2.8 kg P) per ton of grain yield (4.4 kg P_2O_5 in grain and 2.0 kg P_2O_5 in straw). Recommendations for P are based on yield goal and soil P status (see Table on opposite page) as determined by grain yield in P-omission plots (see also Fact Sheet on Nutrient Omission Plot Technique for P and K).
- **When to apply P fertilizers?** Incorporate all fertilizer P before the last soil puddling before transplanting or topdress all P within 10-15 days after direct seeding.

What are the Sources of P?

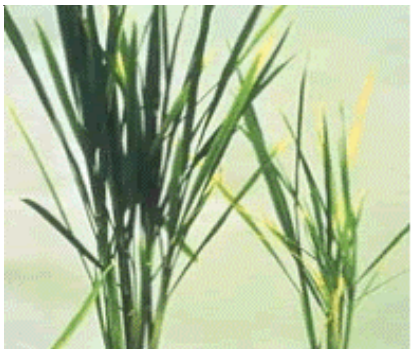
P fertilizer sources and fertilizer P_2O_5 equivalents.

		Fertilizer P_2O_5 (kg ha^{-1})				
P fertilizer	**% P_2O_5**	**15**	**20**	**30**	**40**	**60**
		Amount of fertilizer required (kg ha^{-1})				
Single super	16-18	88	117	176	234	352
Double super/SP36	36	42	56	84	112	168
Triple super	44-46	33	44	66	88	132
Diammonium phosphate (DAP)*	44-46	33	44	66	88	**

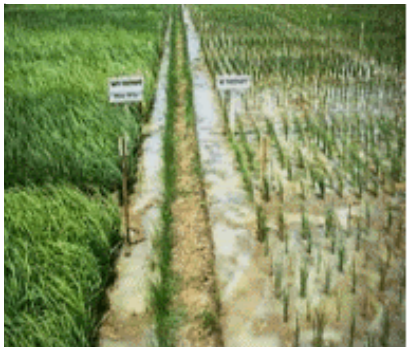
* Also contains 18% N. ** At high P_2O_5 rates, combine DAP with other P fertilizers to prevent over application of basal N. **Note:** 1 kg P_2O_5= 0.44 kg P and 1 kg P =2.29 kg P_2O_5

Yield target in t ha^{-1} →		**4**	**5**	**6**	**7**	**8**
Soil P status	**Yield in 0 P plot (t ha^{-1})**	**Recommended fertilizer P_2O_5 in kg ha^{-1}**				
Low	3	20	40	60	◄	◄
	4	15	25	40	60	◄
Medium	5	-	20	30	40	60
	6	-	-	25	35	45
High	7	-	-	-	30	40
	8	-	-	-	-	35

Fertilizer P_2O_5 recommendations based on yield targets and P-limited yield in P-omission plots (zero P plots). ◄ indicates possibly unrealistic yield goal.



P deficient plants are stunted,and have erect leaves compared with normal plants.



Tillering is reduced in P deficient crops. Photos: Dobermann & Fairhurst (2000).

Leaf discoloration is common to P deficient plants.

For more information:

To learn about site-specific nutrient management, visit http://www.knowledgebank.irri.org/ssnm.

To access a key to diagnose problems in the field, visit http://www.knowledgebank.irri.org/ricedoctor.

For an overall view of crop management practices, visit http://www.knowledgebank.irri.org/tropRice.

Developed with input from V Balasubramanian, C. Witt, RJ Buresh, and M Bell.

IRRI International Rice Research Institute