

Introduction

Tropical soils generally contain low contents of plant available phosphorus (P) and high fixation of P (precipitation and/or specific adsorption to soil clay particles), which makes difficult for plants to access the necessary amounts of the nutrient for high crop yields. Proper use of P as a plant nutrient should consider adequate nutrient stewardship, which in practical terms means applying the **right source**, at the **right rate**, **right place** and **right time**.

Main factors affecting the efficient use of P in tropical soils

Fertilizer Properties

- Type (gas, solid or liquid; **1, 3, 4**)
- Granule size (**1, 3, 4**)
- Granule hardness (**1, 4**)
- Fluidity (**1**)
- Density (**1**)
- Blending with other sources (**1, 4**)
- Source chemical composition (**1, 2, 3, 4**)
- P concentration (**1, 2**)
- Other compounds present (**1**)
- Reaction in terms of soil pH
- Solubility (**1, 2, 3, 4**)
- Hygroscopicity (**1, 3**)
- Particle or granule compaction (**1**)
- Salt index (**1, 3**)

Soil Properties

- Soil pH (**1**)
- Soil P fixation capacity (**2, 3**)
- Soil organic matter

Fertilizer Management

- Placement (**1, 2, 4**)
- Storage
- Studies of correlation, calibration and response curves (**2, 3, 4**)

Crop or Cropping System

(**1, 2, 3, 4**)

How to use P efficiently

- ✓ Define your **source** according to items marked as 1, and more importantly those as 1.
- ✓ Define your **rate**, **placement** and **timing** according to items marked, respectively, as 2, 3 and 4.

Examples for the adequate use of P sources

1. Evaluation of the soil available P: Studies and/or models should be regionally developed. The ion exchange resin showed to be a very good approach for regions in Brazil (Figure 1).
2. Crop rotation: Better P fertilizer use efficiency can be obtained when adequate cropping systems are adopted. In Brazil research show that the use of certain types of forage grasses in the crop rotation significantly increase such efficiency (Table 1).
3. Soil pH versus P source: Soluble P sources as SSP, TSP, MAP, DAP should be applied preferably in soils with pH in water ranging from 6.0 to 6.8, while Phosphate Rock (PR) must be applied in soils with pH in water no higher than 5.4.
4. Soil placement versus P source: Soluble P sources should preferably be applied to minimize contact of fertilizer to the soil particles, while PR should be applied maximizing such contact.

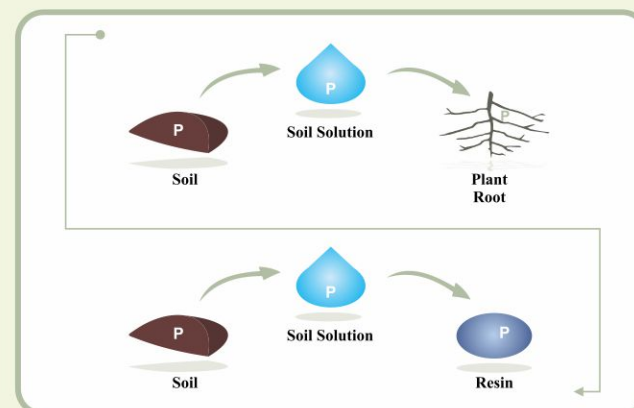


Figure 1. Schematic demonstration of P extracted from soils by ion exchange resin.

SSP	P RECOVERY	
	Annual Crops	Annual Crops + Brachyaria grass
P ₂ O ₅ (kg/ha)	----- % -----	
100	44	85
200	40	82
400	35	70
800	40	62

Table 1. P Recovery from SSP, oxisol, 22 years of data
Source: Sousa et al., 2007.

In Summary (Home take message):

Carefully select the **right source**, **right rate**, **right place** and **right time** for P fertilization based on site specific scientific principles. This involves the development of regional knowledge.