PHOSPHORUS FACTSHEET

December 2003

PHOSPHORUS IN SOILS

Australian soils are characteristically low in phosphorus in their native state, with the exception of a few soils of basaltic origin and some alluvial soils. Agriculture can further deplete soil fertility, even in soils that initially are high in phosphorus.

Most of the phosphorus in soils is associated with organic matter. Even in mineral soils, between 20% and 80% of the total phosphorus will be present in organic forms.

Phosphorus is most available for uptake by plants in the pH range 6.5 - 7.5. At pH below 5.5, slowly soluble oxides of iron, aluminium and manganese form, reducing phosphorus availability, while at pH above 7.0, slowly soluble calcium phosphate is formed.

Phosphorus in the soil is relatively immobile. Phosphorus applied as fertilizer rarely moves any great distance in the soil without some form of physical mixing, e.g. cultivation. The distance that the phosphorus front moves in the soil from fertilizer granules is rarely much more than 4 - 5 cm.

PHOSPHORUS IN PLANTS

Phosphorus (P) is one of the primary nutrients, along with nitrogen (N) and potassium (K). It is required in large quantities by plants.

Most plants take up the bulk of their phosphorus requirement early in their life, in the seedling stage of annuals and early regrowth of perennials. While phosphorus is not mobile in soils, it is one of the more mobile nutrients in plants. It is readily moved within the plant from old to young tissue. Phosphorus is required for cell division at growing points, and is particularly important in stimulating root development.

Consequently, the best responses to phosphorus fertilizer are obtained if it is applied early, e.g. banded with or near the seed at planting in annual crops, and at the start of the main growing season in perennial crops and pastures.

VAM (Vesicular arbuscular mycorrhiza), a beneficial fungus which grows in association with plant roots, enhances plant uptake of immobile nutrients such as phosphorus and zinc.

DEFICIENCY SYMPTOMS

Symptoms of phosphorus deficiency include:

- Poor legume growth, and loss of the legume component in mixed pastures.
- Slow emergence and growth of annual crops. Plants look stunted and spindly, cereals tiller poorly.
- Off-green (often dark, not light green or yellowish) foliage with purplish veins and purplish petioles.
- Low yields.

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PHOSPHORUS FERTILIZERS

Phosphorus fertilizers marketed by Incitec Pivot Limited are listed in the following table. Single superphosphate is manufactured at Portland, Geelong and Newcastle. The other products are either imported or sourced from the WMC Fertilizers complex in north Queensland.

Incitec Pivot Product	Common Name	Analysis			
		%N	%P	%S	%Ca
SuPerfect/Super	Single Superphosphate (SSP)	-	8.8	11	19
Triple Superphosphate (TSP)		-	20.7	1.0	15
MAP	Monoammonium Phosphate	10	21.9	1.5	-
DAP	Diammonium Phosphate	18	20	1.6	-

Single Superphosphate (SSP) is manufactured by treating phosphate rock with sulfuric acid. A fully granulated and dried product, known as **SuPerfect**, is produced and marketed in Victoria. Molybdenum and sulfur-fortified grades are available. SSP is particularly popular on perennial pastures, where both phosphorus and sulfur are normally required. It is also used in legume grain crops.

Triple Superphosphate (TSP) is manufactured by treating phosphate rock with phosphoric acid. It has a higher phosphorus content than SSP, but contains very little sulfur. It is used in cropping, in blended NPK fertilizers, and in legume–based pastures if sulfur is not required.

MAP is manufactured by reacting ammonia with phosphoric acid. It is popular as a planting fertilizer in grain and cotton crops on neutral to alkaline soil types, to supply all the phosphorus the crop requires plus some starter nitrogen. It is usually preferred to DAP in such situations as it is less likely to harm germinating seeds and emerging seedlings, on account of its lower nitrogen content.

DAP is also manufactured by reacting ammonia with phosphoric acid. Because it has a high nitrogen and phosphorus content, DAP allows savings to be made in storage, freight and application. It is a very economical nitrogen and phosphorus fertilizer and is widely used throughout the world. In Australia, DAP is used in cropping and on grass pastures, both on its own and in blends, e.g. for sugarcane and horticulture.

These granulated phosphorus fertilizers are unsuitable for use in solution, e.g. in fertigation programs. Incitec Pivot Limited markets two water-soluble (Solution Grade) phosphorus fertilizers for such use. These are **Liquifert P** (monoammonium phosphate) and **Liquifert MKP** (monopotassium phosphate).

APPLICATION

Because phosphorus is required for early root development and is mobile in plants, it is best applied early, e.g. at planting in annual crops.

In pastures and tree crops, phosphorus is normally applied at the start of the main growing season. For pastures in southern Australia, phosphorus is commonly applied in the autumn, but can also be applied in the spring.

Because phosphorus does not leach readily, there is usually no need to apply it more frequently than each time a crop is planted, or once per year in perennial tree crops and pastures.

FURTHER READING - An Agritopic on “Phosphorus” is available if more detailed information is required.

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