IPNI Nutrient Source SPECIFICS

No. 14

Triple Superphosphate

Triple superphosphate (TSP) was one of the first high analysis P fertilizers that became widely used in the 20th century. Technically, it is known as calcium dihydrogen phosphate and as monocalcium phosphate, [$Ca(H_2PO_4)_2 \cdot H_2O$]. It is an excellent P source, but its use has declined as other P fertilizers have become more popular.

Production

The concept of TSP production is relatively simple. Non-granular TSP is commonly produced by reacting finely ground phosphate rock with liquid phosphoric acid in a cone-type mixer. Granular TSP is made similarly, but the resulting slurry is sprayed as a coating onto small particles to build granules of the desired size. The product from both production methods is allowed to cure for several weeks as the chemical reactions are slowly completed. The chemistry and process of the reaction will vary somewhat depending on the properties of the phosphate rock.

Chemical Properties

Chemical formula:	$Ca(H_2PO_4)_2 \cdot H_2O$
Fertilizer analysis:	45% P_2O_5 (0-45-0)
	15% Ca
Water-soluble P:	Generally >90%
Solution pH	1 to 3



Triple superphosphate is available in granular (shown) and non-granular forms.

Agricultural Use

TSP has several agronomic advantages that made it such a popular P source for many years. It has the highest P content of dry fertilizers that do not contain N. Over 90% of the total P in TSP is water soluble, so it becomes rapidly available for plant uptake. As soil moisture dissolves the granule, the concentrated soil solution becomes acidic. TSP also contains 15% calcium (Ca), providing an additional plant nutrient.

A major use of TSP is in situations where several solid fertilizers are blended together for broadcasting on the soil surface or for application in a concentrated band beneath the surface. It is also desirable for fertilization of leguminous crops, such as alfalfa or beans, where no additional N fertilization is needed to supplement biological N fixation.

Management Practices

The popularity of TSP has declined because the total nutrient content (N + P_2O_5) is lower than ammonium phosphate fertilizers such as monoammonium phosphate, which by comparison contains 11% N and 52% P_2O_5. Costs of producing TSP can be higher than ammonium phosphates, making the economics for TSP less favorable in some situations.

All P fertilizers should be managed to avoid losses in surface water runoff from fields. Phosphorus loss from agricultural land to adjacent surface water can contribute to undesired stimulation of algae growth. Appropriate nutrient management practices can minimize this risk.

Non Agricultural Uses

Monocalcium phosphate is an important ingredient in baking powder. The acidic monocalcium phosphate reacts with an alkaline component to produce carbon dioxide, the leavening for many baked products. Monocalcium phosphate is commonly added to animal diets as an important mineral supplement of both phosphate and Ca.

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