IPNI Nutrient Source SPECIFICS

Single Superphosphate

No. 21

Single superphosphate (SSP) was the first commercial mineral fertilizer and it led to the development of the modern plant nutrient industry. This material was once the most commonly used fertilizer, but other phosphorus (P) fertilizers have largely replaced SSP because of its relatively low P content.

Production

The modern fertilizer industry was launched in the 1840s with discovery that the addition of sulfuric acid to naturally occurring phosphate produced an excellent soluble fertilizer, given the name superphosphate. Ground animal bones were first used in this reaction, but natural deposits of rock phosphate (apatite) soon replaced the limited supply of bones. Making SSP is similar to what naturally occurs with bones or apatite in acid soils. The basic technique has changed very little in the past century. Ground phosphate rock is reacted with sulfuric acid to form a semi-solid which cools for several hours in a den. The plastic-like material is then conveyed to a storage pile for several weeks of additional curing. The hardened material is then milled and screened to the appropriate particle size or granulated. The general chemical reaction is:

$Ca_3(PO_4)_2$ [rock phosphate] + 2 H_2SO_4 [sulfuric acid] → $Ca(H_2PO_4)_2$ [monocalcium phosphate] + 2 $CaSO_4$ [gypsum]

SSP can easily be produced on a small scale to meet regional needs. Since SSP contains both monocalcium phosphate (MCP, also called calcium dihydrogen phosphate) and gypsum, there are no issues with phosphogypsum by-product disposal as occurs with the manufacture of other common P fertilizers.

SSP is also known as ordinary superphosphate and normal superphosphate. It is sometimes confused with triple superphosphate (TSP) production, which is made by reacting rock phosphate with phosphoric acid.

Chemical Properties

Phosphorus content:	7 to 9% (16 to 20% P_2O_5)
Calcium (Ca) content:	18 to 21%
S content:	11 to 12%
pH:	< 2



Granular single superphosphate

Agricultural Use

SSP is an excellent source of three plant nutrients. The P component reacts in soil similarly to other soluble fertilizers. The presence of both P and sulfur (S) in SSP can be an agronomic advantage where both of these nutrients are deficient. In agronomic studies where SSP is demonstrated to be superior to other P fertilizers, it is usually due to the S and/or Ca that it contains. When locally available, SSP has found wide-spread use for fertilizing pastures where both P and S are needed. As a source of P alone, SSP often costs more than other more concentrated fertilizers, therefore it has declined in popularity.

Management Practices

No special agronomic or handling precautions are required for SSP. Its agronomic effectiveness is similar to other dry or liquid phosphate fertilizers.

The loss of P in surface runoff from fertilized fields can contribute to water quality problems. Farm practices that minimize this loss should be implemented.

Non Agricultural Uses

SSP is primarily used as a crop nutrient source. However MCP and gypsum (the two primary ingredients in SSP) are widely used in many products. For example MCP is commonly added to enrich animal feed. It is also routinely used as a leavening agent to cause baked goods to rise. Gypsum is widely used in the construction industry, as well as in the food and pharmaceuticals.

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