

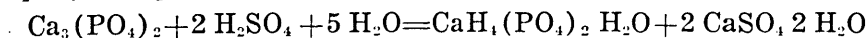
Superphosphates (Acid Phosphate)

Some of the readers of the Bulletin are apparently confused as regards the terms "acid phosphate" and "superphosphate" as used by fertilizer dealers. Phosphorus is one of the three important elements in any complete fertilizer, and on many golf courses this element appears to be an important factor in turf production. In the fertilizer trade the phosphorus content of any mixture which is accessible to plants is expressed as available phosphoric acid (P_2O_5). The relative values of any fertilizer from the phosphorus standpoint can therefore be determined by comparing the percentages of available phosphoric acid.

There are four common names (acid phosphate, superphosphate, double superphosphate, and treble superphosphate) which are used to designate two closely related products with widely differing contents of phosphoric acid. These names probably account for some of the confusion in purchasing phosphoric acid in the form of a superphosphate. The following definitions of acid phosphate, superphosphate, double superphosphate, and treble superphosphate are therefore given, taken largely from the American Fertilizer Handbook for 1928, which is the official organ of the fertilizer industry.

Superphosphate (acid phosphate).—The fertilizer industry and State fertilizer control officials generally have agreed that the term "acid phosphate," which has been used to denote the product formed by mixing ground phosphate rock with sulphuric acid, is a misnomer, and that the term "superphosphate," as used in Europe, is preferable and more properly descriptive. The term "acid phosphate" suggests the possibility of the material making the soil acid, which is not true; while the term "superphosphate" is free from this objection. Superphosphate is the chief material supplying phosphoric acid in fertilizers, and may be considered the basis of the modern fertilizer industry. It is made by mixing about equal weights of finely ground phosphate rock and sulphuric acid. The charge is mixed in cast iron pans, equipped with stirring apparatus, which rapidly mixes the rock and acid. From these pans the mixture, while still fluid, is dropped into a "hot den," where it soon solidifies. After remaining in the den from 15 to 30 minutes the reaction has usually proceeded to the point where the material can be removed with a pick and shovel or some special mechanical device. However, frequently the material is left in the den 24 hours. Superphosphate is valuable principally for the percentage of available phosphoric acid contained, and is usually sold on a unit basis.

The chief reaction between the sulphuric acid and the rock, whereby the phosphoric acid is rendered soluble, may be summarized by the following equation, in which $Ca_3(PO_4)_2$ is insoluble phosphate rock, $CaH_4(PO_4)_2$ is available or superphosphate, $CaSO_4$ is gypsum, H_2SO_4 is sulphuric acid, and H_2O is water:



The mixture of the available or superphosphate with the gypsum formed in this process is the ordinary commercial superphosphate (acid phosphate).

Various other chemical reactions take place between the acid and the impurities in the rock.

The analysis of superphosphate is as follows:

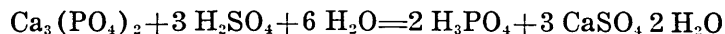
Moisture	10	to	15	per	cent
Available phosphoric acid....	14	"	20	"	"
Insoluble phosphoric acid....	.3	"	2	"	"
Total phosphoric acid.....	1.5	"	21	"	"

The Association of Official Agricultural Chemists has approved (November, 1927), for the first year as tentative, the following definition submitted by its committee on definitions of terms and interpretation of results on fertilizers:

"Superphosphate (acid phosphate) is the ground product that results from mixing finely ground rock phosphate and crude sulphuric acid. As several grades are known to the trade, the grade should always be a prefix to the name. Example: 16 per cent superphosphate. It is recommended that the use of the term 'acid phosphate' be discontinued."

Double superphosphate.—This resembles superphosphate (acid phosphate) in appearance, but usually contains from 2½ to 3 times as much available phosphoric acid (P₂O₅). The process of manufacture differs from the manufacture of superphosphate in that phosphoric acid (H₃PO₄) is used instead of sulphuric acid (H₂SO₄) for treating the phosphate rock. The process is carried out in two stages, briefly as follows:

Ground phosphate rock is first treated with weak sulphuric acid, according to the following reaction:



The gypsum is separated by filtration and discarded, and the phosphoric acid is concentrated by evaporation and used for treating additional phosphate rock as follows, in which equation CaH₄(PO₄)₂ is double superphosphate:



This latter treatment is carried on in the same equipment used for the manufacture of superphosphate, except the final product is generally dried in a direct-heat dryer.

The analysis of double superphosphate is as follows:

Moisture	4	to	8	per	cent
Available phosphoric acid....	40	"	50	"	"
Insoluble phosphoric acid....	.5	"	4	"	"
Total phosphoric acid.....	42	"	52	"	"

In short, double superphosphate may be regarded as ordinary superphosphate from which the gypsum has been removed.

Treble superphosphate.—A new name recently applied to the product previously generally called double superphosphate.

Besides superphosphates, there are several other fertilizers which contain available phosphoric acid. These include Ammo-Phos, basic slag (Thomas slag, Thomas phosphate), bone ash, bone black, bone meal, calcium phosphate, and many mixed fertilizers.