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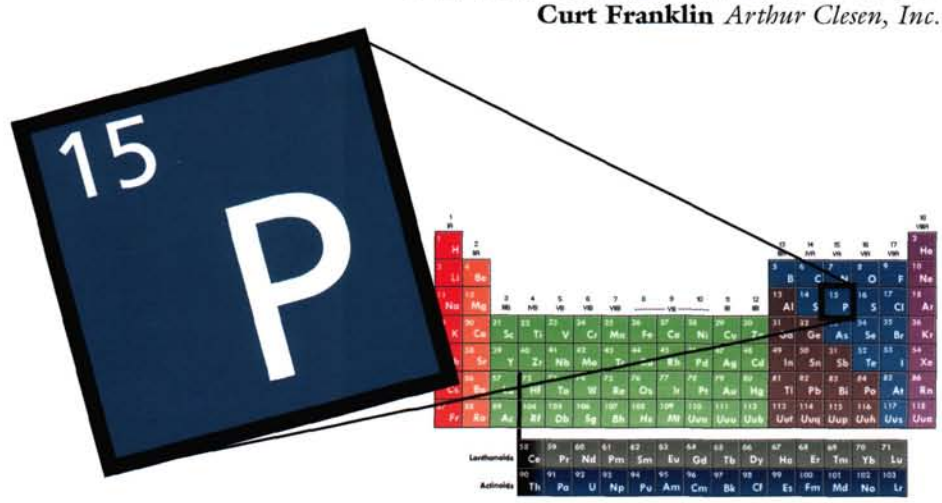
The Spin on P



Phosphorus (P) is one of the big three nutrients (N- nitrogen, P- phosphorus, K-potassium). Lately, it has been a hot topic in our industry because of all the new P products hitting our market. These new P products have given rise to some new terms and concepts that might be confusing. Here, I will attempt to decipher the terms and hopefully give you a better understanding of all the P sources that are available in the marketplace.

First, where does P come from and why do plants need it? Next, what are the different forms of P and their availabilities to the turf? Finally, how can superintendents utilize the different types of P on their golf courses?

Phosphorus (P) is the plant world's equivalent of carbohydrates—it provides the energy that a plant needs to grow. The marketplace currently affords several options for delivering P to your turf.

Fossilized marine animals are the main source of P found in the United States and other countries around the world. This element is mined as a raw ore (phosphorite or phosphate rock) and is mainly processed to create water-soluble compounds for fertilizers. One example is super phosphate (calcium hydrogen phosphate), which makes P available to the plant. The plant needs these readily available P sources so it can convert and store light energy to chemical energy during photosynthesis by ATP transformations and carbohydrate transformations. This allows the plant to enhance its root growth for better uptake of water during drought stress, but it also helps in the wear tolerance of the plant by increasing the recuperative potential of the plant. P is the plant world's equivalent of carbohydrates—it provides the energy that a plant needs to grow.

How many choices of P do you have? The answer is "several." Here are some options that the marketplace currently affords with an explanation of each.

1. **Phosphates**. Salts that are formed by neutralizing **phosphoric acid** with a base like potassium hydroxide (KOH) or ammonium hydroxide (NH_4OH).
   Examples:
   a. Super phosphates (calcium phosphates 0-46-0)
   b. Ammonium phosphates (monoammonium, MAP 11-50-0 and diammonium, DAP 21-52-0)
   c. Potassium phosphates (monopotassium phosphorous 0-32-52)
   d. Ammonium polyphosphates (10-34-0)
   e. Phosphoric acid (0-55-0)
2. **Phosphoric Acid (H_3PO_4)**. Normally referred to as a **phosphate**, interchangeable.

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3. **Phosphorous Acid (H_3PO_3).** Normally referred to as a **phosphite**, interchangeable.
4. **Phosphonate.** An organic derivative of **phosphorous acid**, it breaks down into a phosphonic acid.
5. **Phosphites.** Salts that are formed by neutralizing **phosphorous acid** with a base like potassium hydroxide or ammonium hydroxide. Two forms of **phosphite** salts are formed, one containing dihydrogen phosphite ion (H_2PO_3) and the other containing a hydrogen phosphite ion (HPO_3). The hydrogen phosphite ion is an unstable compound that easily converts to **phosphoric acid** in the presence of oxygen. Therefore, when making a foliar application of phosphite products, part of the product is reduced to readily available **phosphates** or **phosphoric acid** that is utilized by the plant as a nutrient and the other portion of the **phosphite** is used by the plant for possible fungicidal capabilities. The dihydrogen phosphite ion is more stable and reacts with oxygen at a slower pace, therefore allowing it to stay in phosphite form to act as a possible fungicide.

Getting P to the Plant

How available are these forms of P to the plant? Granular fertilizers (**phosphates**) are the most readily available forms of P, but they have difficulties being absorbed by the plant due to soil pH. Alkaline soils, usually calcareous soils, tie up P with their high calcium content to form insoluble precipitates unavailable to the plant. On the other hand, acidic soils tie up P by combining it with aluminum to form insoluble precipitates unavailable to the plant also. Therefore, your soil test may read high phosphorus levels, but your pH levels may have an adverse affect on P availability. The fixation of P is most prevalent in older soils that are high in 1:1 type clays and hydrous Fe and Al oxides. Foliar fertilizers (**phosphates** or **phosphites**) might be a better, more efficient alternative of P sources for the plant than granular fertilizers, because they are usually absorbed by the plant before they reach the soil surface, which makes them less likely to form insoluble precipitates in the soil profile.

Making P Work for You

How do I utilize these different forms of P? Usually, during the spring and fall seasons, the cool-season grasses are more efficient in the uptake of nutrients from the soil; thus, granular forms of P (**phosphates**) are the best alternative because you can apply larger amounts of P at one time instead of multiple applications of the more expensive foliar fertilizers. Although that works for spring and fall applications, summer stress periods require a different scenario. The plant is not as efficient with nutrient uptake during the summer because of heat and drought stress; it needs a more efficient method of P uptake for photosynthesis. Foliar fertilizers are a perfect fit during these stressful months to provide the plant with the P that it needs from feeding the plant P through its foliar membranes and not its roots, where the fixation of P may occur from high or low pH levels. This (timely application of nutrients) is probably the single most important aspect of providing excellent plant health.

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Good luck on choosing your P sources wisely and remember, your membership and/or customers could probably care less about the differences between a phosphate, phosphite or fungicide!