



MAXIMIZING PHOSPHORUS Use Efficiency in Corn

For years the common practice to ensure that a crop was not deficient in phosphorous was to simply apply more phosphate fertilizer. But as the price of phosphate fertilizer has increased over the last few years this strategy is getting more expensive. An inoculant, called JumpStart, is a unique fertility efficiency tool that can help maximize the effectiveness of a grower's phosphate fertility program.

Mike Lipetsky, Agronomist, from Allied Agronomy in Kensal, ND puts it this way. "With the high price of fertilizer these days, we see the advantage of using the phosphate that's in the soil more efficiently, instead of having to put down extra."

"The more you understand how phosphorous (P) behaves in the soil and in the crop, the better you are able to understand whether JumpStart is a good agronomic fit for your operation," says Dr. Borges, Research Agronomist with Philom Bios. "Over the last few years, growers in North Dakota, South Dakota, Minnesota and Nebraska have increased their corn yields by an average 5 to 6% and winter wheat yields by 9 to 10% by adding JumpStart to their phosphate fertility program."



Dr. Roger Borges, Research Agronomist, Philom Bios

Phosphorous in the Soil

Understanding a few key points about P in the soil, says Dr. Borges, will help a grower maximize the efficiency of his P fertility program as well as understand where and how JumpStart works.

1. P is very immobile in the soil, as a result a crop's root system must grow to the P, the P does not move to the root.
2. Fertilizer P is easily and quickly bound by calcium (Ca), iron (Fe) and aluminum (Al) in the soil. Once the P is bound the P is unavailable to the crop.
3. Only 10 – 30% of the P fertilizer applied in a given year is used by the crop as a result of the P being bound. Much of the P fertilizer applied in a given year becomes unavailable and bound to soil Ca, Fe and/or Al molecules.
4. P availability for a crop is highest within a soil pH range of 5.5 to 7.0. Optimum availability is achieved at a pH of 6.0 to 6.5. At low pH values (i.e. less than 5.5), the availability of P decreases largely as a result of the P being bound by Al and Fe

compounds. In high pH soils (i.e. greater than 7.0) the Ca in the soil will be the primary P binding factor.

5. The soil solution typically contains only 2 to 4 days of P supply for a crop. Therefore, to achieve maximum P fertility, there must be a continual movement (solubilization) of P from the low solubility forms (i.e. the labile pool of phosphate in the soil) to the soil solution through-out the growing season.

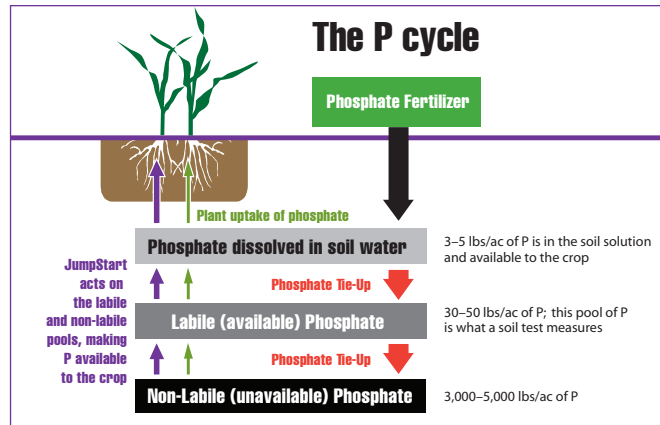
6. The release of P from the low solubility labile pool is facilitated by the natural action of micro-organisms in the soil and the release of organic acids from decomposing organic material (crop residue, manure) in the soil.

As the fungus colonizes around the root, it produces a number of organic acids that are the key to the success of the two-way relationship between the root and the fungus. The organic acids released by the growing fungus break the bonds that are holding P in a form that the crop cannot access – the result is an enhanced rate of P solubilization (release) from both the labile (temporarily bound) and the non-labile (unavailable) pools of P.

Therefore, the fungus ensures the P in the soil solution is rapidly replenished to meet the crops' needs. The fungus' ability to solubilize P from the non-labile pool gives a crop access to the very large pool of P that is in the soil and is typically not utilized.

and thus the fit and expected performance from JumpStart. "Fertilizer and manure applications as well as factors such as soil pH, soil temperature, soil organic matter and soil calcium levels all have an impact on the availability of soil phosphate and thus the expected performance from JumpStart", says Dr. Borges.

P availability is an obvious key indicator of performance. In low available P soils as measured by a soil test, the impact from JumpStart will be greatest. What is considered low or high is dependent on the soil test method used, says Dr. Borges. The table below provides a guideline of where to expect the maximum benefit from JumpStart based on the soil test method.



Soil Test Method	Measured P Availability (ppm) 0 – 6 inches	
	Maximum JumpStart Benefit	Limited JumpStart Benefit
Olsen	<11 ppm	>11 ppm
Bray P-1	<15 ppm	>15 ppm
Mehlich 1	<9 ppm	>9 ppm
Mehlich 2 or 3	<15 ppm	>15 ppm

The other key predictor of JumpStart performance is soil pH. At higher pH levels calcium is the primary cause for binding phosphate and the organic acids produced by the JumpStart organism are particularly adept at breaking calcium phosphate bonds.

Philom Bios currently has sales representatives in North Dakota, South Dakota, Minnesota, Nebraska and Kansas, but are expanding their geographic presence every year. "We are always looking for new growers interested in conducting side-by-side trials, says Dr. Borges, as the best way for a grower to appreciate the value that JumpStart creates is for him to try it on his farm." If you are interested in conducting a trial contact your local Philom Bios sales representative or in other areas of the United States contact Dr. Roger Borges at 1-888-744-5662.

JumpStart's Role in P Fertility Efficiency

JumpStart takes advantage of the action and attraction of a naturally occurring fungus, *Penicillium bilaii*, to counteract the binding of P into forms a crop cannot access. The fungus thrives around a crop's root system as it lives off the carbohydrates and other compounds given off by a root; hence the attraction of the fungus to the root. The close association between root and the fungus is important because of the immobility of P in the soil.

JumpStart increases the efficiency of a P fertility program in two ways: (1) it slows down the binding of the P applied as fertilizer that year; and (2) it solubilize P applied in previous years and that have been strongly bound by insoluble compounds such as calcium phosphate.

Maximizing the JumpStart Benefit

A number of interrelated factors affect the availability of phosphate fertility for a crop

JumpStart® on Corn: Yield Performance

farmer applied side-by-side trials (2003 to 2006)

