ULTRA GRO

**Too much or too little? The power of P**

One of the most overlooked nutrients in agriculture is phosphorus. Being one of the big three (NPK) a grower would think it deserves much more attention than it receives. Phosphorus is the key nutrient for energy production which drives the metabolic processes, enzymatic responses, nutrient movement, and cellular function. However, not all phosphorus is created equal. How we apply the different forms of phosphorus and the rates we use greatly enhance or hinder the response we get and the absorption of the nutrient.

Organic chemistry is probably not something many of us care to revisit or have even thought about outside of us having to pass those old college tests. However, a quick refresher will help to highlight some of the important characteristics of what makes phosphorus so important to agriculture. Phosphorus is very unstable by itself and therefore highly reactive. It's what makes up most of the tip of match sticks and causes them to burn. In agriculture, phosphorus exists in our fertilizers as oxidized forms of phosphates. We mine this phosphorus in forms of apatites that are formed with chlorides, florides or calcium. These rocks are similar to the structure of bones and teeth. After crushing these rocks, adding sand, heat and oxygen, we get phosphoric acid which allows us to make fertilizer. In nature, phosphorus is the key ingredient to Adenosine Triphosphate (ATP). That's energy. Phosphorus flows three times through the Krebs Cycle in an elaborate chemical process to create energy. This energy makes life happen.

That's enough of the chemical jargon. You're probably thinking, "Please just tell me why I care, and how it is going to help me make better crops." You are recommended multiple forms of phosphorus fertilizers to push growth, set crops and sustain your livelihood. Forms like single super phosphate, triple super phosphate, Monoammonium Phosphate (MAP), Diammonium Phosphate (DAP), and phosphoric acids are readily available to us as farmers. How we use them and more importantly how the plants use them is what concerns us.

The two forms of phosphorus fertilizers that we deal with on a daily basis are polyphosphates and orthophosphates. Plants can only take in phosphorus in the orthophosphate form. The majority of the fertilizer we buy consists of 60-70% polyphosphate and 30-40% orthophosphate. Fertilizers with 100% orthophosphate are rare because of the cost of making the plant ready material. They can be made with a spent industrial application producing a green, less pure orthophosphate, or a white, smelted furnace grade, cleaner and more expensive form of orthophosphate. Here's the good news. Polyphosphate, under normal conditions in season, with ample moisture, will convert to orthophosphate in 4-5 days according to most research. The bad news is early applications of polyphosphate fertilizers are usually made under less than ideal conditions. Cold soils with lethargic microbiology will hinder

transformation of polyphosphate to orthophosphate for as much as 90 days. That's too late for the optimal growth pattern we see in spring.

Many phosphorus fertilizers are reacted with nitrogen to form compounds with 7-20% N. These reactions many times produce products with some heavy metals and acids that can harm tender young roots. In row crops we typically side dress these fertilizers to allow the soil to buffer and dilute the nutrients a bit before the roots reach them. Often times this is sufficient to start a crop or give it the bump it needs to ensure its vigor. Many farmers choose to spend a little more per unit on their fertilizer that has a higher concentration of orthophosphate in hopes that when the soil solution comes in contact with the roots, the plant is available to immediately absorb that form of phosphate. Cleaner mixes with more orthophosphate should allow a plant to readily take in more of the P in colder, saturated spring soils. Phosphorus is very immobile in soil so after that initial rinse of fertilizer in a fertigation event, P stays put and roots must intercept it.

In the last few years, I have made the argument that we are leaving a bit of our yield potential on the table because of our methods of phosphorus fertilization. Farmers that weren't able to apply ample amounts of phosphorus in their post harvest program can find their plants deficient in the spring. As the root ball expands during root flush, any remaining phosphorus that roots have intercepted has been used up. Applying fertilizer in the polyphosphate form that a plant can't take in, especially when it's cold and can't convert it, won't allow an ample energy supply to be absorbed for our trees. One analogy can be that our trees step on the gas but the tank is empty. If we have fertilized an ample amount, but with a form unavailable to the roots we will still find ourselves deficient.

We can easily and unintentionally tie up our phosphorus as well. Unless a significant amount of acid has been compounded or is applied phosphorus cannot be applied with calcium. The two very easily revert back to their rock phosphate origin. Heavy fall applications of calcium with low solubility can very easily reduce the effectiveness of spring phosphorus applications. As soon as the irrigated water buffers itself back to near neutral pH levels we see our reactions happen. The remaining insoluble calcium reacts with the polyphosphate that hasn't been absorbed by the plants. The excess phosphorus applied with the previous heavy application of low soluble calcium makes both nutrients unavailable to our plants. We put plenty out there but tied it all up. A soil test with a water solution analysis will show us the immediate effect. We may see a parts per million base saturation analysis of Calcium at 2000 ppm and 65% after an acetate extraction. But having our lab perform an analysis of a water extraction may only yield 5% calcium. We have rendered most of it useless to the plants until mother nature and the soil biology has provided its slow weathering process.

The bottom line, to affect your bottom line: Ask your plant nutrition expert to provide you with the plan of attack early in the season. Make sure the fertilizer form you are applying will promote the best uptake of the targeted nutrient. It will take a more detailed approach to your fertigation plan to spoon feed your nutrition and match plant demand to application. However, the results should be beneficial to your return on investment. Don't forget the importance of

your post-harvest P applications.  After your trees run their marathon, feed them!  They'll reward you for it next spring.