



## The phosphite truth!

Phosphate has been used by many producers as a fertiliser to provide phosphorous (P) to the plants as it is an essential element required by most living organisms. Phosphites can be made from phosphorous acid ( $H_3PO_3$ ) containing one less oxygen than phosphate. Many fertiliser formulations containing phosphate such as monopotassium phosphate, super phosphate or others have as main source phosphoric acid ( $H_3PO_4$ ).

Phosphites have long been believed to have fungicidal effects and strong evidence exist to demonstrate such effect but there is a lot of confusion as to how phosphites work. Currently, phosphites are sold as fertilisers, biostimulants and fungicides. These claims are to an extent all true. The fungicidal effect on Oomycetes is widely accepted and several publications are available providing evidence. However, the modes of action vary between studies and several explanations are given under different methodologies. The most debate exists in the supply of P to the plant as phosphite. Latest studies have confirmed that phosphite provides very little P to be utilised by the plant causing deficiency if this is the only supplied source. Plants cannot utilise phosphite directly, so it has to be converted typically by soil microorganisms to phosphate before it is used.

It is well known that crop nutrition elements such as Mn, Cu, Al, Ca and Zn are associated with fungicidal properties, with varying modes of action, either as fungistats, direct suppression or by boosting the plant's own defence mechanism. Literature has also suggested that phosphate itself in certain forms has shown fungicidal properties. Generally, this should not come as a surprise as a healthy plant would be able to protect itself better than a plant with deficiencies. There are no much evidence of direct comparisons between phosphate forms and phosphite. Work is still required to quantify and compare such differences. Crop Intellect is performing trials to provide insights in such direct comparisons and increase the public knowledge. This comparison is also taking into account the existing evidence of the effect of phosphate and phosphite on the plant's rooting system. Several phosphite forms are used as starter fertilisers to boost rooting with varying results.

Another difficulty with phosphites is the detection and quantification. The methods available are typically lengthy, costly and complex, and not offered by many laboratories. Crop Intellect has devised a method which has been adopted, and uses photometric technics to quantify phosphites in liquid solutions. This technique has been proven to provide a detailed analysis of the quantity of phosphite present. During the development it became apparent that the stability of phosphite is very critical. The issue is not during the formulation but during spraying. When phosphites are bottled at their concentrate form they degrade very slowly. But when they are added to water in a tank of a sprayer they react very quickly turning into phosphate. This can be replicated in the lab if tap water is used for dilutions or if the phosphite is mixed prior to the analysis with other micronutrient or fungicide products. These reactions occur rapidly and they cause oxidation of the phosphite turning it into phosphate. This explains some of the claims made that phosphite provides phosphate to the plant. Therefore, stabilising phosphites is vital in order to obtain the benefits. Several companies provide evidence of stability by quick methods in beakers which are meaningless since they don't perform any analysis to quantify the phosphite present and they are typically not sampling at the point that the product finds the plant, which is sometime after it has been aerated and agitated in the sprayer tank in the presence of other nutrition products.

But the question as to how phosphites provide fungicidal benefits has not been answered yet. Studies performed in very recent years provide evidence that phosphites are fungistats and when

used above certain levels are effective in petri dish studies (in vivo). This clearly suggests that if phosphites are accumulated in the plant tissue at these levels they will be effective to control certain fungal attacks. A huge issue in such instance is that of phytotoxicity. Phosphites can cause severe phytotoxicity in several plant species and this has been reported widely. Such a limitation requires a good understanding of the quantity to be accumulated in the plant tissue in order to effectively utilise the fungicidal properties of phosphites. This is directly relating to knowing how stable a product is to approximate the number of applications in order to match the accumulation requirement to be effective. Another issue is the allowable concentration of phosphite by the EU detectable in fresh produce as MRL (maximum residue level) which is 2ppm for certain formulations. Multiple applications will be required to increase the accumulation of phosphite which may prove not viable from an economic sense.

Several other studies with detailed analysis into plant proteomics before and after applications of phosphite have proven that they stimulate the plant's own defence mechanism by regulating up or down specific proteins and those gene clusters that relate directly to the defence mechanism of the plant. This is a plausible explanation considering the evidence from several studies and experience from field evidence supported by producers under varying circumstances. The concentration of a stable phosphite is critical for its efficacy as typically stimulants will not work at high concentrations or in fact low ones. Crop Intellect has a patent pending method of stabilising phosphite at the form that has had the most success. The analytical method developed has been vital to understand the robustness of the phosphite. Therefore the levels of phosphite used are minimal and known, applied at the appropriate level to stimulate the immune system of the plants. A specific recommendation for different plant species is given to ensure effectiveness, derived from greenhouse and field studies. The product has been named Cropearnicus for its different view point and it is embedded in a nutrient formulation containing many vital elements to promote a healthy plant growth. The product is commercially available and offered through a limited distribution network.

Questions such as the ones following are common when phosphites are discussed with growers; do producers know why they use phosphites; when, how and where phosphites should be used; what are the benefits of using phosphites on a crop; are producers buying an expensive and overrated phosphate! The answer in many such questions is that growers are misinformed and biased by well marketed products rather than evidence and proper instructions of use to achieve the benefits that phosphites can offer.

Please contact Crop Intellect with any enquiries on this article and we will be happy to provide details for your own benefit on using phosphites. We also offer the analysis of phosphite as part of our services. Contact us at [info@cropintellect.co.uk](mailto:info@cropintellect.co.uk) or call 07500794140 / 01522 837268.

(References include: Crop Protection 2014, 56 (74-81), Crop Protection 2012, 32 (1-6), J. of Proteomics 2013, 93 (207-223), New Ag International, Analytical Biochemistry 2011, 412 (74-78)