A Summary of Potato Research Data with Magnet®

Summary

With data spanning over 2 decades, 3 countries, and 7 varieties, Magnet has consistently shown yield increases when applied with dry and liquid starter fertilizers at 32–64 oz per acre. Tissue tests consistently showed significant increases in the levels of nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), manganese (Mn), and zinc (Zn). With the increase in nutritional uptake came an increase in marketable yields. Removing the high and low marketable yield increases, the increases ranged from 28.0 Cwts (hundredweights) where Magnet was first applied to granular MAP and then spread in the field, to 79.0 Cwts where Magnet was applied with a liquid 10–34–0 fertilizer. The following is an explanation and discussion of why growers see an increase when they apply Magnet with their phosphorus starter fertilizers.

More Than Phosphorus

Potato growers know that maintaining an adequate level of phosphorus in the soil is critical for potato plant development, tuber growth, and enhancing tuber maturity. To be taken up into the plant, phosphorus must be in solution in the form of phosphate (PO_4^{3-}—either as HPO_4^{2-} or HPO_4^{-}). With the bulk of phosphorus in the soil occurring as insoluble compounds with calcium (Ca), magnesium (Mg), iron (Fe), or aluminum (Al), most of the applied phosphorus to the soil readily precipitates with these minerals and is not available to the plant. When phosphorus is applied with Magnet, the anionic polymer adsorbs the calcium, magnesium, iron, and aluminum cations, which allows the phosphorus to remain in its available form longer, leading to an increase in uptake in the plant.

However, phosphorus is only part of the challenge when growing potatoes. Research shows that a 500 Cwts per–acre harvest of potatoes requires 269 lbs N, 90 lbs P_2O_5, and 546 lbs K_2O. With this in mind, optimizing nitrogen and potassium uptake is crucial for maximizing the genetic potential and yields of potatoes. Research has shown that Magnet increases the uptake of both nitrogen and potassium in plants. When nitrogen is applied in the form of ammonium (NH^{4+}), or urea (which converts to ammonium in the soil), Magnet can adsorb the positively charged ammonium ion, slowing its conversion to nitrate, and thereby reducing the loss to leaching. Similarly, Magnet adsorbs potassium in the soil, keeping it in solution longer, which increases its chances of being taken up into the plant. Finally, Magnet can also adsorb other positively–charged nutrients that may enter the soil solution transiently, and can slow their precipitation in the soil as well. Figure 1 shows a chart of the average nutritional levels from petiole samples taken once a week for a 6–week time period from a trial in Idaho.

	10–34–0 (Control)	10–34–0 + Magnet	% Increase
Nitrates	1.47%	1.61%	9.52%
Phosphorus	0.31%	0.42%	35.48%
Potassium	8.47%	9.85%	16.29%
Magnesium	0.51%	0.68%	33.33%
Zinc	27.83 ppm	37.50 ppm	34.74%
Manganese	60.33 ppm	89.17 ppm	47.80%

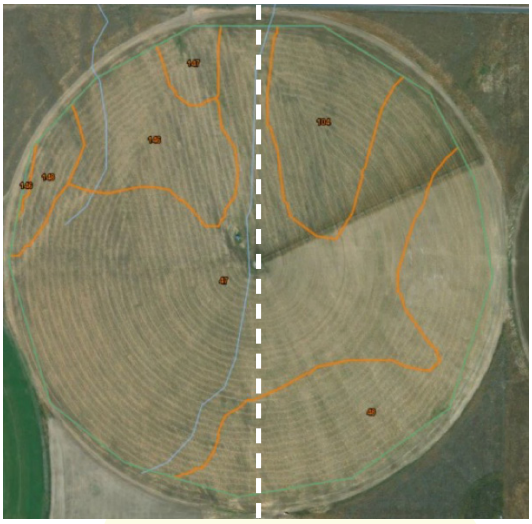
Figure 1. Idaho Nutritional Levels Trial Data

A Summary of Strawberry Research Data with Magnet®

Case Study

In the spring of 2018, a trial with 3 quarts of Magnet impregnated onto to 1 ton of 12–40–0 dry fertilizer was commenced in Washington State. The phosphate applied was at a rate of 650 lbs/acre, resulting in the equivalent of 1 quart of Magnet per acre. In addition to this, soil tests dictated that 76 lbs of nitrogen (N), 100 lbs of potassium (K), 107 lbs of sulfur (S), 2 lbs of manganese (Mn), 6.6 lbs of zinc (Zn), and 1 lb of boron (B) be applied.

A 120–acre field was split into two halves, with the left side of the field treated with Magnet, and the right side of the field without Magnet. Irrigation was via center pivot. The potato variety was 'Russet Burbank', and was planted in mid–April. Pesticide applications were made as needed to control weeds, insects, and diseases according to grower standard practice.



In season, potato petiole samples showed that most nutrients were in adequate supply. On June 13th, phosphorus (P), manganese (Mn), copper (Cu), and iron (Fe) nutrition levels were improved in the Magnet–treated plot (23.9%, 70.7%, 46.0%, and 50.0% respectively). However, by July 13th, nitrogen (N), phosphorus (P), and potassium (K) levels were all significantly higher than the untreated control (4.1%, 56.4%, and 53.3% respectively). In the short term, Magnet assisted with increasing the phosphorus and micronutrients in the plants—which helped with creating energy and enzymes crucial for plant growth and defense. In the long term though, when the potatoes really began to increase their tuber yield and size, Magnet significantly increased the inputs most vital for that function—nitrogen (4.1% increase), phosphorus (56.4% increase), and potassium (53.3% increase).

So how did this affect yields? The Magnet treated side resulted in a marketable yield of 548.4 Cwts, while the control side (grower standard) without Magnet yield 537.6 Cwts. This resulted in a marketable yield increase of 10.8 Cwts. What is more important in this particular trial though was the increase in the number of Grade 1 potatoes (where most of one's money is made). The Magnet treated side resulted in 451.4 Grade 1 Cwts, while the grower standard side yielded 418.0 Cwts. This resulted in a Grade 1 yield increase of 33.4 Cwts. Given the market price for each Grade 1 Cwt of potatoes, after subtracting the low cost per acre of Magnet, the grower realized a return on investment (ROI) of over 10:1.

Examples of Common Mineral Precipitates

Calcium Phosphate

$H_2PO^{4-} + Ca^{2+} = Ca(H_2PO_4)_2$

Aluminum Phosphate

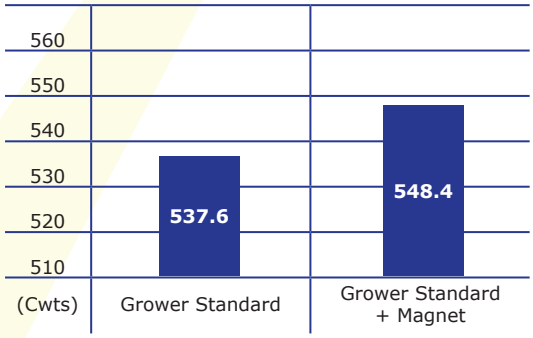
$PO_4^{3-} + Al^{3+} = AlPO_4$

Iron(II) Phosphate and Iron (III) Phosphate

$PO_4^{3-} + Fe^{2+} = Fe_3(PO_4)_2$

$PO_4^{3-} + Fe^{3+} = FePO_4$

Total Marketable Yield



Grade 1 Yield