Dr. Ray Hoyum

Magnesium Builds Potato Profits and Quality

Nine-year study in irrigated field shows yield bump and net dollar increase per acre.

Summary: *Results from a nine-year study on irrigated potatoes in the Columbia Basin show that including supplemental Mg in potato fertility management can add quality, increase yields, increase crop value, cut production costs/ton, and increase profitability.*

Private industry research has shown that turning a good potato fertility program into a great one can mean big increases in profitability. Meeting potato requirements with most nutrients can place increasing importance on elements that may only be adequate for good yields, not great ones.

The same limitation can affect potato quality. Extensive information from the northwestern U.S. emphasizes how supplying adequate nutrients—nitrogen (N), phosphorus (P), sulfur (S), magnesium (Mg)—can increase yields, and have tremendous effects on potato quality and net returns.

Role of magnesium

Changes in plant nutrient management programs over the years have placed more emphasis on the secondary nutrients S, Mg, and calcium (Ca) as high-yielding crop needs for N, P, and K have been met by better fertility management. Increased rates of K application over the past 10 to 15 years, combined with split applications of N, have increased crop needs for supplemental Mg, even when soil test Mg levels seem adequate.

Potassium and the ammonium form of N interact with Mg uptake by plants. Potassium and ammonium-N tend to depress plants' abilities to absorb Mg, leading to nutritional problems in some species and effects on crop quality in others. Higher rates of K for potatoes, combined with multiple applications of N materials that contain or produce ammonium-N in the soil, should raise growers' attention to possible needs for supplemental Mg.

Magnesium has unique roles in plant physiology, including a key role as the central atom in the chlorophyll molecule. Consequently, Mg affects plant chlorophyll content and the production and use of carbohydrates. Magnesium is also important in the activity of a large number of enzyme systems in plants, systems that are particularly important in the metabolism of carbohydrates. Magnesium is mobile in the plant, moving to areas of new growth when Mg uptake is insufficient. That means that Mg deficiency symptoms appear first near the base of the plant and are characterized by interveinal chlorosis and sometimes by the accumulation of reddish pigments (anthocyanins) at the leaf margins.

Yield/value increase

Comparisons of results over nine years on irrigated fields indicate that Mg supplied at 20+ lbs/A increased potato quality and value through increased specific gravity, percentage over 6 oz, and percent US#1s (Table 1). Negative quality factors, including hollow heart brown center and internal discoloration, declined numerically but did not affect crop value.

Overall yields increased from 31.43 to 33.2 tons/A. Based on commercial contacts, specific gravity increases from 1.0784 to 1.0824 added $5/ton. Percentage over 6 oz increased from 57.16 to 62.15 for an increased value of $3/ton. Percent US#ls increased from 51.79 to 70.55, adding an additional $5/ton for a total quality effect of $13/ton.

While yields increased, percent usables rose from 80.46 to 85.35, resulting in a net usable ton yield of 28.14 compared to 25.29 for the controls.

Bottom line

Magnesium applications produced a 3.05 ton/A increase in usables. At $90/ton, a mid-range value, that added $274.50/A in returns. Quality premiums added $13/ton on all 28.34 tons/A usables for an increased return of $368.42/A. Figuring the cost of Mg as an add-on to the fertility program at $38.85/A (there was actually substitution in the program and a lower cost of $13 to $15/A) increased net/A a whopping $604.07.

Obviously, not every situation will generate an identical Mg benefit. Even if the Mg effects were only a sixth of that recorded from this study, the story is still the same. Providing adequate Mg affects both potato yield and, very importantly, *potato quality.*

Mg sources

Fertilizer magnesium sources are not all that common. The most common is K-Mag (potassium-magnesium sulfate) containing 20-22% K_20, 10-11% Mg, and 2 1-22% S. It is available in several grades, including a new readily available and highly soluble, less abrasive premium grade. Diamond K of Richfield, Utah has developed a system for delivery of fluidized K-Mag through sprinkler or drip irrigation systems. Another fluid source is magnesium chloride, containing 7.4% magnesium and 22.7% chloride. It is compatible with UAN and ammonium thiosulfate when mixed with UAN first. It is not compatible with any solution containing phosphorus.

Dr Hoyum is vice president of marketing at IMC Global. U

Table 1. Quality, profit, and yield response of Russett Burbank potatoes to magnesium applications in the Columbia Basin, Hoyum, 1989-1997.

	Mg rate, 0-2.5	lb/A 20+	Value, $/ton
Quality			
Specific gravity	1.0784	1.0824	5
%>6 oz.	57.16	62.15	3
%US #1s	51.59	70.55	5
% internal discoloration (IBS)	2.39	1.76	-
% hollow heart brown center	1.73	1.57	-
Total premium/ton on usable tons			$13
Yield			
Tons/A	31.43	33.20	
% usables	80.46	85.35	
Usable tons/A	25.29	28.34	
Increase in usable tons/A = 3.05			
Profits			
3.05 ton/A usable potato increase x $90/ton base	= $274.50/A increase		
Premium/A ($13 x 28.34 tons/A)	= $368.42/A increase		
Cost of Mg application/A	= ($38.85)		
Net $ increase/A	= $604.07		