
Micronutrients for the Farmer – A Retail Perspective

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Introduction

Micronutrient fertilization is often an issue in agronomy that is met with skepticism by farmers. Retail distributors of fertilizer and their farmer customers rely on limited research from reputable sources and are faced with strong salesmanship from micronutrient fertilizer companies. A poor understanding of micronutrient fertility has led to frequent unwarranted and inefficient application of micronutrient fertilizers. This paper will outline the essential information that retail agronomists and farmers must know to develop best management practices for micronutrient fertilizers. Priorities for research groups and regulatory agencies are suggested.

The Essential Questions

Retail agronomists must have a comprehension of basic fertility principles to answer questions and adequately advise farmers on micronutrient management. The answers to some of these questions are well understood, while others require better information.

What are Micronutrients?

Micronutrients are essential nutrients required in very small amounts for plants to grow and reproduce. The micronutrients that have been documented to be deficient for at least one site in western Canada are copper, boron, manganese, chloride, iron and zinc. Of these, only copper has produced crop yield increases on a significant area, and our focus should not be diverted to other micronutrients with insignificant economic impact.

Which Micronutrients are Most Likely Deficient?

Sufficient research has shown good potential for copper responses in Saskatchewan on some soils (Karamanos et al, 1985a, 1986, 1991; Kruger et al, 1984). Limited research has measured response of crops to manganese (Karamanos et al, 1984, 1985a, 1991; Martens et al, 1977), zinc (Singh et al, 1986, 1987), boron (Nuttall et al, 1987), and chloride (Innovative Acres, 1985, 1986; Mohr and Flaten, 1990) in some soils. Overall, copper is the only micronutrient that has significant areas of deficiency in western Canada, and most research has focused on this nutrient. Except to better define soil and tissue tests, further survey work to identify deficient areas is not necessary.

What do Micronutrient Deficiencies Look Like?

Micronutrient deficiencies symptoms are well described in current extension material (Saskatchewan Agriculture and Food, 2000; Alberta Agriculture, 1999, Westco Fertilizers, year unknown). Unfortunately, good photographic references are not published as extension material except for copper deficiency in wheat. If micronutrient deficiencies in other crop x nutrient combinations do occur in western Canada, images should be collected to help define the associated symptoms. It is more likely that the lack of available images indicates there are few other micronutrient deficiencies.

What is the Potential Yield Response?

There have been few attempts to develop crop yield response curves to micronutrients for various crops. It is difficult to justify recommendation of micronutrient fertilizers if the potential yield response is not predicted. At least, we need to know the relative response of different crops to a micronutrient deficient soil. For example, if a 30% yield response to copper fertilizer is measured for wheat in a soil, what is the potential yield response for canola in the same soil? The fundamentals of economic yield responses to fertilizers seem to have been lost in micronutrient fertilizer management.

How is Micronutrient Fertilizer Quality Measured?

Fertilizer retailers are faced with choosing the best micronutrient fertilizers among a wide range of suppliers and product types. Unfortunately, product description is often inadequate to predict the product plant availability or handling characteristics.

The information required by the Fertilizer Act (Agriculture Canada, 1992) for micronutrient fertilizer labels is not adequate to provide information to retailers on fertilizer value. Two sections of the Canadian Fertilizers Act (1992) have impact on micronutrient fertilizers:

- 1) *Section 19.1(1) All Product Claims must be supportable. Companies must be prepared to submit efficacy data to substantiate claims or nontraditional uses of fertilizers for evaluation.*

Considering the deficit of research with micronutrients in western Canada, adequate efficacy data is not likely available.

- 2) *Section 15 The amounts of each micronutrient are expressed as a percent on the elemental basis and are required to be guaranteed on an actual basis.*

Expression on an elemental basis with no indication of chemical form, solubility, plant availability or corrosiveness provides inadequate information to the retailer and farmer. Among the fertilizers sold in western Canada, the soil applied dry copper fertilizers have the most need for improved labels.

- 3) *Section 15 If a micronutrient is chelated, it must be noted in the guaranteed analysis. If only part of the micronutrient is chelated, the degree of chelation should also be shown.*

This is valuable information that provides an indication of micronutrient availability.

There has not been sufficient research to compare current products in the marketplace. Kruger et al (1984) provided some comparison of copper products, and Dr. S. Mahli of Agriculture Canada at Melfort is currently assessing the value of a wide range of copper products (Mahli, S.S., unpublished data). If research can better establish which fertilizers are most efficient for plant response, and improvements are made to product assessment and labeling, farmers will be better served with the best products in the marketplace.

How Can We Predict a Micronutrient Deficiency?

Farmers often rely on soil or tissue tests to assess the potential response of a crop to micronutrients. For this purpose, soil or tissue samples are sent to commercial laboratories for assessment. Farmers place confidence in the value of these tests since they should provide an unbiased opinion of micronutrient availability. Unfortunately, the recommendations from laboratories are often based on weak databases. Except for copper availability for wheat, there are very little data from western Canada to predict fertilizer requirements. Despite this weakness, a farmer is able to submit soil or tissue from any plant type for analysis and receive predictions for fertilizer requirements for any of the micronutrients. This discrepancy between database quality and fertilizer recommendations has led to excessive sale and application of micronutrients in many cases.

As noted, there has been good research to predict sufficient soil levels for copper. The criterion of deficiency at 0.4 ppm soil (approximately 0.8 lb copper per acre on a 6 inch depth) has been well defined in research (Kruger et al. 1984; Ridley et al, 1986). Yet, this critical value has been increased without explanation in recent years. For example, the current Envirotest level for copper deficiency is now 0.6 ppm soil. This change was made without supportive published research, nor consultation with retailers or farmers.

Tissue analysis is also often used to determine copper availability. Research in Alberta on copper deficient soils has shown weakness in the value of individual plant tissue tests (Owuoche, 1994, 1995). Tissue copper was shown to vary with growing season, wheat cultivar, and crop growth stage. Furthermore, tissue tests did not reflect copper fertilizer treatments applied at the site. The true value of tissue analysis must be better investigated to determine if it has any role in predicting copper deficiency.

Boron deficiency for canola is also often assessed by soil or tissue analysis. Again, recommendations for boron application to canola are frequently provided, though soil or tissue test criteria have never been well documented for this deficiency, and there has never been a documented predicted response of canola to boron in western Canada. Recent research has not measured response to boron fertilizers by canola, despite careful selection of research sites according to soil tests (Mahli, S.S., unpublished data).

The long-term effect of micronutrient fertilizer recommendations based on poor databases is loss in faith for soils tests in general, plus frequent use of fertilizers when not required. Recommendations also have no basis in economic return, an unfortunate circumstance when micronutrient fertilizers are expensive and net farm income is at record lows.

What are the Best Management Practices for Micronutrient Fertilizers?

The most important question that must be answered is how to best supply crops with micronutrients with fertilizer application. The focus of this research should be copper, since there is a very broad range of copper fertilizer types and application methods, and because copper is our only significant micronutrient deficiency. Recent and current research has taken strides to better manage both copper and boron fertilizers (Mahli, S.S., unpublished data). This is essential research that must be encouraged and continued.

Conclusion

Micronutrient fertility management is not well understood in western Canada. Farmers and farm supply businesses do not have sufficient information to efficiently manage these nutrients. Perspective must be kept in the relatively small role that micronutrient deficiencies play in western Canada. Where warranted, research should focus on micronutrient management questions that impact farm income. The key questions that must be answered relate to the validity of diagnostic soil and tissue tests and the best methods of applying various micronutrient fertilizers.

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