

# Evaluation of Commercial Micronutrient Fertilizer Packages for Corn, Soybeans, and Rice

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Essential plant nutrients for crops are usually divided into macronutrient and micronutrient categories. Carbon, hydrogen, and oxygen, are supplied from air and water. Other primary macronutrients are phosphorus, potassium, and nitrogen. Secondary macronutrients are sulfur, calcium, magnesium and silicon.

The eleven micronutrients are iron, molybdenum, boron, copper, manganese, sodium, zinc, nickel, chlorine, cobalt, and aluminum. These elements are required in small amounts relative to macronutrients (Table 1). In most cases, enough micronutrients are supplied by soil organic matter decomposition to meet crop needs. But there are exceptions. On black sand soils near Benton, Missouri, soybeans yields were increased by applying manganese fertilizer (Stevens et al., 2002). Minerals in these soils were found to fix manganese. On rice, boron fertilizer increased grain yields at Qulin, Missouri (Dunn et al., 2005). Private organizations have reported yield increases from zinc on cotton.

Table 1. Macro and micronutrient content in major agronomic crops.

	N	P	K	Ca	Mg	S	Si	B	Cu	Fe	Mn	Mo	Zn
	-----pounds per acre-----												
Corn	214	91	107	38	52	27	na	0.03	0.02	0.11	0.03	na	0.05
Cotton	179	51	85	13	21	18	na	0.11	0.10	0.13	0.17	0.002	0.43
Rice	112	60	116	21	14	19	230	0.05	0.02	0.72	0.54	0.002	0.19
Soybean	313	58	161	26	24	20	na	na	na	na	na	na	na
Wheat	116	41	161	16	18	15	na	0.03	0.04	0.34	0.11	0.00	0.16

Source: International Soil Fertility Manual, P&K Institute, 1995; na= not available

**Objective:** To compare various commercial packages of micronutrients on rice and soybeans based on label recommendations for application timings and rates.

**Procedure:** Micronutrient products from Stoller, Helena, United Suppliers, Rosen, AgXplore, Mosaic (and any other brands that we can find) will be purchased with this grant. No funding will be accepted from companies to avoid bias. Product labels will be read for recommended rates and timings of applications. Similar rates of product, based on nutrient concentrations, will be applied for comparisons. Plots of corn, soybean, and rice will be planted at the University of Missouri-Fisher Delta Research Center and Missouri Rice Research Farm. Micronutrient treatments will tested in randomized, replicated plots on each crop. Some micronutrient products will be soil applied at planting and others applied foliar during the season. Plots will be harvested with a combine and grain milled for properties.

**Relevance and Economic Impact:** Many agricultural chemical dealers sell branded cocktail mixtures of micronutrients. These packages provide insurance in case organic matter in a soil fails to supply enough of an essential element. On a per acre basis they are inexpensive but the cost adds up when applied over the whole farm. There is a danger of phyto-toxicity if applied incorrectly. Excessive iron in the soil does not affect plant growth, but the other micronutrients can cause yield losses when applied in high doses. David Dunn and Tim Schnakenberg found corn yield losses from excessive Zn fertilizer in on-farm demonstrations at Charleston, Missouri.

**Timetable for proposed research:** Field research could start in the Spring 2015 and go for three growing seasons.

### References

Stevens, G, P. Motavalli, P. Scharf, M. Nathan, and D. Dunn. 2002. Crop nutrient deficiencies and toxicities. University of Missouri- Extension, IPM 1016.

Dunn, D., G. Stevens G., and A. Kendig. 2005. Boron fertilization of rice with soil and foliar applications. Crop management. doi:10.1094/CM-2005-0210-01-RS.

### Proposed Budget

	2015	2016	2017	Total
Labor- research assistant	\$14,000	\$14,000	\$14,000	\$42,000
MU Soil Lab tissue testing	\$1000	\$1000	\$1000	\$3,000
Supplies and travel	\$1500	\$1500	\$1500	\$4,500
Total	\$16,500	\$16,500	\$16,500	\$49,500