
Relative Effectiveness of Various Cu Fertilizers in Improving Grain Yield of Wheat After Two Annual Applications on a Cu-Deficient Soil

S. S. Malhi¹, L. Cowell², D. Leach¹ and R. Kutcher¹

¹Agriculture and Agri-Food Canada, P.O. Box 1240, Melfort, Saskatchewan, Canada S0E 1A0

²WESTCO, Saskatchewan Wheat Pool, Tisdale, Saskatchewan

BACKGROUND

- Copper (Cu) deficiency is often associated with coarse-textured soils.
- Wheat is probably the most sensitive cereal to Cu deficiency, though some cultivars of wheat are less affected by the Cu deficiency than others.
- The deficiency of Cu is not wide spread in Saskatchewan, but it can cause a serious reduction in grain yield and quality of wheat when it occurs.
- Yield responses of cereals to Cu fertilization have been investigated in western Canada, but information is lacking on the effects of different Cu sources, formulations, methods and times of application in correcting Cu deficiency on wheat.

OBJECTIVE

- To determine the relative effectiveness of various sources, formulations, methods, times and rates of Cu on grain yield of wheat.

MATERIALS AND METHODS

- Location: Porcupine Plain
- Soil: Dark Gray
- Mean Precipitation: 450 mm

- Growing Season: May to August
- Crop (Cultivar): Hard Red Spring Wheat (AC Barrie)
- Cu Sources:
 - Cu Fert 1 Cu Chelate Granular
 - Cu Fert 2 Cu Sulphate Granular
 - Cu Fert 3 Cu Oxysulphate I Granular
 - Cu Fert 4 Cu Oxysulphate II Granular
 - Cu Fert 5 Cu Chelate-EDTA Liquid
 - Cu Fert 6 Cu Sequestered I Liquid
 - Cu Fert 7 Cu Sulphate/Chelate Powder (Soluble)
 - Cu Fert 8 Cu Sequestered II Liquid

- Times and Methods Cu Application:
 - Incorporated (Prior to Seeding)
 - Seed-placed (at Seeding)
 - Foliar (4-Leaf and Flag-Leaf)
- Rates of Cu: Various (Table 1)
- Other Fertilizers: Blanket Application of N, P, K and S Fertilizers
- Data Recorded: Grain Yield, Protein Content and Total Cu in Grain

SUMMARY AND CONCLUSION

1999:

- Grain yield of wheat increased substantially with foliar application of Cu at the flag-leaf growth stage with Cu Fertilizers 5, 6 and 7 in the initial year of application.

2000:

- Zero-Cu check produced grain yield of 1620 kg/ha.
- Grain yield increased to 2676, 2812, 2697 and 2574 kg/ha with foliar application of Cu Fertilizers 5, 6, 7 and 8 at the flag-leaf growth stage, respectively.
- With foliar application at the 4-leaf growth stage, Cu Fertilizer 5 increased grain yield moderately to 2440 kg/ha and Cu Fertilizers 6 and 7 tended to increase grain yield.
- Cu fertilizers, when incorporated into soil or placed in seedrow were not effective in correcting Cu deficiency on wheat (except Cu Fertilizer 1 incorporated into soil at 2.0 kg Cu/ha tended to increase grain yield, but not significantly).
- In treatments where Cu application increased seed yield, quality of seed was also improved compared to the Cu-deficient wheat.
- In conclusion, the preliminary results suggest Cu deficiency in wheat can be corrected and grain yields improved by foliar application of some Cu fertilizers at flag-leaf growth stage.

ACKNOWLEDGEMENTS

- The authors would like to thank WESTCO (Calgary), NEXUS Inc. (Saskatoon) and Tiger Industries (Calgary) for financial assistance; and C. Hutchison, K. Fidyk, T. Donald, K. Hemstad-Falk and N. Evenson for technical help; and ENVIROTEST Laboratories Saskatoon for soil and plant analyses.

Grain yield of wheat with different sources, rates, times and methods of Cu application at Porcupine Plain 1999 (0.5 mg Cu/kg in 0-15 cm soil) (1st year results).

Treatment	Grain yield			
	CuFer	CuFer	CuFer	CuFer
Incorporated (0.5 kg Cu/ha)	156	1680	1523	146
Incorporated (2.0 kg Cu/ha)	182	1591	1655	145
Seedrow (0.25 kg Cu/ha)	86		1271	188
Seedrow (1.0 kg Cu/ha)	158	1831	1441	134
	<u>CuFert</u>	<u>CuFer</u>	<u>CuFer 7</u>	<u>CuFer</u>
Foliar-4 Leaf (0.25 kg Cu/ha)	184	1849	1572	152
Foliar - Flag Leaf (0.25 kg	270	2571	2555	134
Control (no Cu)	156			

Grain yield of wheat with different sources, rates, times and methods of Cu application at Porcupine Plain in 2000 (second year results).

Treatment	Grain yield			
	CuFer	CuFer	CuFer	CuFer
Incorporated (0.5 kg Cu/ha)	177	1914	1211	126
Incorporated (2.0 kg Cu/ha)	223	1958	1651	175
Seedrow (0.25 kg Cu/ha)	804		1602	180
Seedrow (1.0 kg Cu/ha)	180	1898	1252	142
	<u>CuFert</u>	<u>CuFer</u>	<u>CuFer 7</u>	<u>CuFer</u>
Foliar-4 Leaf (0.25 kg	244	2062	2131	174
Foliar - Flag Leaf (0.25 kg	267	2812	2697	257
Control (no Cu)	162			