On Farm Testing to Determine Optimum Copper Placement and Sources for Wheat

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BACKGROUND
- Copper is an essential micronutrient for crops, with spring wheat being one of the most responsive crops.
- Many sources of copper fertilizer are marketed and several application methods are recommended.
- The following study was conducted to identify the optimum application method and source of copper fertilizer.

TREATMENTS
- Copper fertilizer treatments included 4 different products (liquid and dry chelates and copper sulphate) and 4 combinations of application placement and timing - for a total of 7 treatments.
- application rates were according to manufacturer directions.

RESULTS & DISCUSSION

Wheat Yield and Quality
Overall wheat yields were very high and were not influenced by a lack of copper (Figure 4) and results are summarized in Figure 5.

- The highest yield advantage over the check was just 2 bu/ac for soil-applied Cu chelate at one site.
- Yield reductions with foliar treatments, were possibly due to crop trampling.
- There was no impact of Cu application on any grain quality parameters: fusarium (FDK), ergot, grade, dockage, protein or sprouting.
- Copper had no impact on wheat yield or quality on these soils with initial copper levels of 0.8 ppm or greater.
- Previous Manitoba studies would indicate soils as Cu deficient below 0.2 ppm Cu and marginally deficient below 0.4 ppm Cu (1,2).

Tissue Levels
- Flag leaf Cu levels were greatest in plots with the late POST foliar treatment at the 6 leaf stage (Figure 6): Since tissue sampling was only 17 days after application, some copper fertilizer residues may still have been present on plants.
- Tissue Cu was slightly greater with seed-placed than broadcast & incorporated Cu - but this was not reflected in yield.

Soil Copper
- Soil Cu levels were increased only with the copper sulphate application, which supplied 2.5 lb actual Cu/acre (Figure 7).
- All other treatments supplied only 0.25 - 0.41 lb Cu/ac and were insufficient to affect soil levels.

PROFITABILITY
- Since there was no yield increase over the check, treatments reduced net returns by $8-30/ac (Table 2).
- Only the copper sulphate application might be expected to offer residual benefits to future crops.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Cu Rate (lb/ac)</th>
<th>Yields</th>
<th>Cu Costs</th>
<th>Profitability</th>
<th>Profitability *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check</td>
<td>0.0</td>
<td>60.6</td>
<td>315.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ruff’n Tuff 5%G Cu chelate, broadcast</td>
<td>0.3</td>
<td>60.9</td>
<td>312.0</td>
<td>$12 ($3)</td>
<td>$5.14-$5.19/ bu.</td>
</tr>
<tr>
<td>Nortrace 7.5% EDTA Cu chelate, broadcast</td>
<td>0.3</td>
<td>60.6</td>
<td>312.0</td>
<td>$12 ($3)</td>
<td>$5.14-$5.19/ bu.</td>
</tr>
<tr>
<td>Stoller 5% Liquid Micro-Plus Copper, broadcast</td>
<td>0.3</td>
<td>60.9</td>
<td>312.0</td>
<td>$12 ($3)</td>
<td>$5.14-$5.19/ bu.</td>
</tr>
<tr>
<td>Copper sulphate (25% Cu), broadcast</td>
<td>0.3</td>
<td>61.6</td>
<td>320.0</td>
<td>$22 ($24)</td>
<td>$5.14-$5.19/ bu.</td>
</tr>
</tbody>
</table>

* Estimated price for 2001-02, adjusted by protein level = $5.14-$5.19/ bu.

** Cost includes product and application, from Table 1.

ON-FARM TESTING (OFT) PROCEDURE
- This testing system performed very well:
- Coefficient of variation or CV is the level of non-treatment variation within the experiment. The greater the CV, the more errors (soil variability, sampling error, etc) are present, and the less likely the test will identify real differences.
- CV’s for yields ranged from 2.6 to 4.3% for individual sites and was 3.5% for the combined site analysis.
- Yield differences as low as 1.3 bu/ac were identified as significant (well below the practical level). Thus when properly conducted, OFTs can identify significant differences even when they are very small - and perhaps undetectable in conventional small plot research relying on sub-sampling for yield, etc.

SUMMARY
- Wheat did not respond to applied copper in this study, probably due to the presence of sufficient soil copper.
- Foliar copper treatments tended to have lower yields.
- Soil applied copper sulphate at 2.5 lb Cu/ac increased soil copper levels.
- No copper applications were profitable and no optimum Cu source or placement method was identified.
- OFT did an excellent job at indicating small significant differences when they occurred.
- Replication is the key to being able to isolate such small differences.
- Considerable time, labour and application machinery is required to conduct a valid on-farm-test.

REFERENCES


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