Summary: In 1993, all iron (Fe) treatments except foliar application produced significant yield increases on both hybrids selected at the 8.6 pH site in North Platte. Most Fe treatments produced significantly higher yields at the 8.2 and 8.6 pH sites but not at the 7.7 pH site. In 1994 and 1995, most Fe treatments produced significantly higher yields at the 8.6 pH site. However, the tolerant hybrid selected consistently yielded higher than the non—tolerant. Proper hybrid selection and site-specific treatment on high pH areas with seed row-applied ferrous sulfate (FeSO4 • 7H2O) can significantly improve corn yields.

Iron For Improved Corn Yield?

You bet. Nebraska researchers are showing that under proper pH conditions and hybrid selection, corn yield responds positively to iron applications.

Studies were initiated during 1993 to determine the influence of several seed-applied Fe fertilizers on corn growth, using a tolerant and non-tolerant hybrid selected from previous research. The objective was to determine if any combination of genotypes and/or fertilizer treatments would permit corn yields on high pH soil to approach or equal the performance on lower pH (7.0 to 7.4) soil.

Methodology

Plot size was individual rows 15 feet long with row width of 30 inches. A factorial design was used, with an untreated check and four replications. In 1993 and 1994, the experiment was established on three sites within one mile of each other. In 1995, only the high pH site was used.

Hybrids. In 1993 and 1994, hybrids Pioneer brand 3362 (tolerant to high pH) and Pioneer brand 3398 (non-tolerant to high pH) were selected for the response studies. In 1995, hybrids were changed because the two selected were phased out by Pioneer. Based on other research, the new hybrids selected for the 1995 experiments were Pioneer 3332 and Pioneer 3582.

Table 1. Soil properties (0-8 inches) of three experimental sites, Hergert, et al., University of Nebraska, 1993-1995.

<table>
<thead>
<tr>
<th>Site</th>
<th>pH</th>
<th>OM</th>
<th>P</th>
<th>K</th>
<th>Zn</th>
<th>Fe</th>
<th>EC</th>
<th>SAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.6</td>
<td>17</td>
<td>25</td>
<td>768</td>
<td>0.78</td>
<td>2.9</td>
<td>1.1</td>
<td>0.71</td>
</tr>
<tr>
<td>2</td>
<td>8.2</td>
<td>15</td>
<td>16</td>
<td>544</td>
<td>2.35</td>
<td>3.6</td>
<td>0.6</td>
<td>1.24</td>
</tr>
<tr>
<td>3</td>
<td>7.7</td>
<td>20</td>
<td>33</td>
<td>587</td>
<td>2.65</td>
<td>5.7</td>
<td>0.7</td>
<td>1.48</td>
</tr>
</tbody>
</table>

OM = organic matter; EC = saturated paste extract electrical conductivity (mmho/cm); SAR = sodium absorption ratio.
were: Pioneer brand 3279 (somewhat tolerant to Fe chlorosis) and Pioneer brand 3489 (sensitive to Fe chlorosis).

Applications. The plot areas received 180 lbs/A of N as a preplant application in mid-April. In 1993 and 1994, a ridge-till planter was run through the areas prior to planting to block out row locations, and apply a band of 10-34-0 + 1% Zn at the rate of 10 gal/A to the side of the future seed location. In 1995, a new two-row planter was used that placed Fe fertilizer directly in the seed furrow during planting and applied 10-34-0 + 1% Zn two inches to the side of the seed.

In 1993 and 1994, two foliar sprays of 1.5% FeSO₄•7H₂O, plus 5 lbs/A urea-N, were applied directly over the corn row in mid-June and early July at the rate of 20 gal/A at 20 psi.

In 1995, one foliar spray of 1.5% FeSO₄•7H₂O, plus 5 lbs/A urea-N, was applied directly over the corn row in late June at the rate of 20 gal/A at 20 psi.

Planting. Corn was planted two inches deep in early May each year, using a 7-inch seed spacing.

Soil. The studies were conducted on soils ranging in pH from 7.7 to 8.6 (Table 1). Soil at the high pH site is classified as Cozad silt loam, saline-alkali and has thin bands of very high pH (>8.5) within the root zone. Soils at the calcareous and non-calcareous sites are both Cozad silt loam.

Site problems

Chlorosis. Significant growth differences and plant population effects among Fe treatments and hybrids were evident in 1993 and 1994 due to severe chlorosis on one high pH site, but not on the other two sites. On the high pH site, plant population of the non-tolerant hybrid was significantly lower than the tolerant variety due to plant death (data not shown).

Hail storms. A hail storm in late July 1993 damaged the crop on the high pH plot (Site 1), which limited yield potential. In 1994, Site 1 was hit by hail when plants were 8 inches tall (early June) and had some further hail damage in late July. Sites 2 and 3 had
severe leaf shredding from hail seven days before tasseling in late July, which decreased yield potential.

**Yield response varies**

1993. There were significant yield differences between hybrids at each of the three sites (Figures 1, 2, and 3). Corn yields were significantly different with Fe treatments at Site 1 (pH 8.6) and Site 2 (pH 8.2). The foliar sprays of FeSO₄•7H₂O at the 8.6 pH site (Figure 1) were effective on the tolerant but not on the non-tolerant hybrid, producing more growth and greening on the tolerant than on the non-tolerant hybrid. It is an inexpensive treatment, but may be effective only if a tolerant hybrid is planted. The seed row-applied FeSO₄•7H₂O produced more growth and chlorosis correction than the foliar treatment.

1994. Due to hail, Site 2 and Site 3 showed no significant treatment effects, but Site 1 did (Figure 1).

1995. Grain yields showed similar increases (Figure 1). The 100-lb/A rate of FeSO₄•7H₂O was sufficient to correct chlorosis on the tolerant hybrid, but the 150-lb/A rate was required for the non-tolerant hybrid. There were no marked differences in final plant population with the highest rate of FeSO₄•7H₂O (data not shown).

**Chlorophyll readings**

Chlorophyll meter readings were significantly increased by Fe treatment on Site 1, but not on Site 2 and Site 3. The range of chlorophyll meter readings is significantly wider than those reported for nitrogen (N) deficiency. Therefore, the readings defined chlorosis sufficiently to map chlorosis severity in whole fields that could be used as a basis for selecting different corn hybrids and Fe treatments.

Chlorophyll meters are expensive (U.S. $1,200). However, measuring plant height may provide sufficient information to produce maps of severely chlorotic sites. Correlation of plant height and chlorophyll meter readings with final grain yield of the tolerant Pioneer brand 3362 were both significant. Response was similar for the Pioneer brand 3398.

The relationship between grain yield and mid-season chlorophyll meter readings, as influenced by Fe treatments, shows the potential for determining chlorosis severity and projected yields (Figure 4).

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