SOUTH DAKOTA

# *Investigating Potassium Deficiencies in Corn*

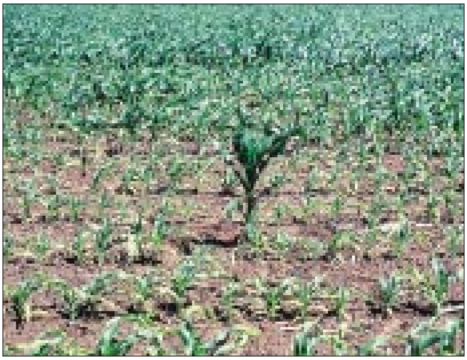
By James Gerwing, Ron Gelderman, and Anthony Bly

Potassium deficiencies have been occurring more frequently in South Dakota in the past few years. The occurrence of deficiency symptoms can vary widely. For instance, soils formed from glacial till may test lower in K and exhibit deficiencies on only side slopes or eroded areas. (See photo at left below.) Non-eroded areas are usually adequate in available K. On coarse-textured soils, such as those formed in glacial outwash, large areas or whole fields may be affected (photo at right below).

Several conditions can cause K deficiency. Compacted soil conditions restrict root growth and hinder a plant's ability to take up nutrients and water. Soils that are too loose make it more difficult for K to move through the soil to replenish the K taken up near the root. Excessively wet or dry soil conditions adversely affect plant growth and uptake of K, as do inadequate supplies of other essential nutrients such as nitrogen (N) and phosphorus (P). Certain tillage systems, such as no-till, may also make K positionally unavailable during part of the growing season under drier conditions.

> The far western Corn Belt has traditionally used little potassium (K) fertilizer because the dominant soils of the region are derived from parent materials high in plant available K. However, long-term cropping has depleted indigenous K reserves in some areas to the point where K deficiencies are becoming more common.

In South Dakota, many producers have not been overly concerned about their K soil fertility. The drier climate has historically kept K in good supply. However, decades of cropping without replacement of the K removed by harvested plant portions have depleted soil supplies to yield-limiting



**Small-scale variability** in K deficiency symptoms, representative of that seen in eroded areas. The large plant (center) was pulled from 15 rows back for relative size comparison.

**Larger areas showing** K deficiency on soils formed from glacial outwash.

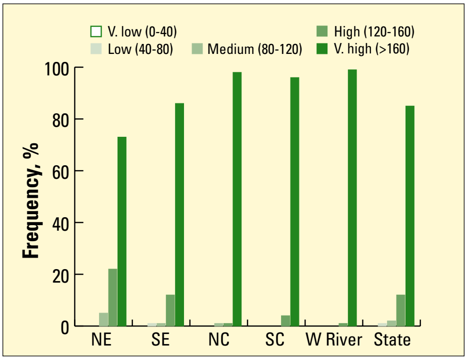



**Figure 1.** Potassium soil test summary for samples submitted to the South Dakota State University Soil Testing Laboratory, 1998-1999.

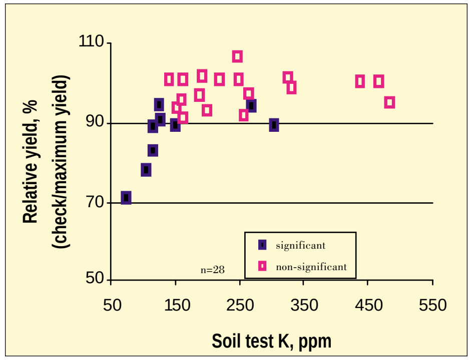



**Figure 2.** Corn grain yield response to added K as influenced by soil test K, South Dakota, 1996-2000.

levels in some areas. A recent survey of samples analyzed by the South Dakota State University (SDSU) Soil Testing Laboratory (**Figure 1**) reveals that 85 percent still test very high in K. However, primarily in the eastern part of the state, approximately 10 percent of the samples tested may be at levels that are yield limiting. In east central and northeast South Dakota, there are many cases where whole field samples test high or very high for soil test K but have areas that test low or medium. These areas can have severe K deficiency for corn and sometimes soybeans.

Current educational efforts at SDSU include meetings and field days to educate farmers, county Extension personnel, and agribusiness professionals on the causes, effects, and detection of K deficiency. Many in the state have never encountered it before. Our current research is focused on defining critical soil test K levels through correlation with yields and calibrating the rates needed to correct deficiencies for various nutrient placement methods.

An example of the data being collected for soil test correlation is shown in **Table 1**. This particular study investigates the effects of incremental broadcast K rates on corn grain yield. Of the five site-years studied in 1999-2000, the three testing below 140 parts per million (ppm) all showed significant yield increases from applied K. For these sites, average responses ranged from 10 to 25 bu/A. Considering all responsive and non-responsive sites studied so far, a preliminary assessment is that the critical range in soil test levels may be 140 to 150 ppm. The inclusion of future results could alter this range (**Figure 2**).

**TABLE 1.** Influence of broadcast potash (as potassium chloride, KCl) on corn grain yield in five site-years.

| | Site-year yields, bu/A | | | | |
|---|---|---|---|---|---|
| **$K_2O$ rate, lb/A** | **1999 A** | **2000 A** | **2000 B** | **2000 C** | **2000 D** |
| 0 | 99 | 134 | 127 | 100 | 81 |
| 60 | 112 | 148 | 122 | 119 | 86 |
| 120 | 124 | 149 | 137 | 117 | 83 |
| 240 | 122 | 156 | 134 | 115 | 80 |
| Prob > F[1] | 0.01 | 0.05 | 0.30 | 0.05 | 0.68 |
| Soil test K, ppm[2] | 106 (M) | 127 (H) | 152 (H) | 114 (M) | 141 (H) |

[1]Values of 0.05 or less are commonly considered to indicate a significant treatment effect.
[2]Soil test categories: M = medium, H = high.

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