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Monitoring nitrogen deficiencies in corn

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Abstract
Corn plants need adequate nitrogen (N) at all stages of growth to attain their yield potential. Meeting N requirements can be a management challenge when weather conditions promote losses of N early in the season and high plant demand for N later in the season. Chlorophyll meters can be used to detect deficiencies in N at any stage of growth. These meters are hand-held devices that measure the plant greenness when clamped on leaves. N-deficient plants have low concentrations of chlorophyll and, therefore, less greenness.

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Corn plants need adequate nitrogen (N) at all stages of growth to attain their yield potential. Meeting N requirements can be a management challenge when weather conditions promote losses of N early in the season and high plant demand for N later in the season.

Chlorophyll meters can be used to detect deficiencies in N at any stage of growth. These meters are hand-held devices that measure the plant greenness when clamped on leaves.

N-deficient plants have low concentrations of chlorophyll and, therefore, less greenness.

Use of the meters usually involves comparisons of plants grown under conditions that are identical except for amounts of fertilizer N applied. Plants having above-normal rates of N are used as a reference. This procedure works because the meters do not detect excesses of N.

Figure 1 shows results from a study in which the meters were used to monitor the N status of corn in 1998. Fertilizer N (28 percent solution) was injected midway between rows at various rates in mid-May. No effects of these treatments were detected through the first 3 weeks of June.

Corn often shows no early effects of N in May and early June because soils usually supply adequate N for the small plants. In this study, however, the plants were N deficient. It seems the plant roots did not reach the fertilizer before the last week of June. This finding could be explained by an extended period of heavy rainfall, which probably reduced root growth and moved the fertilizer downward.

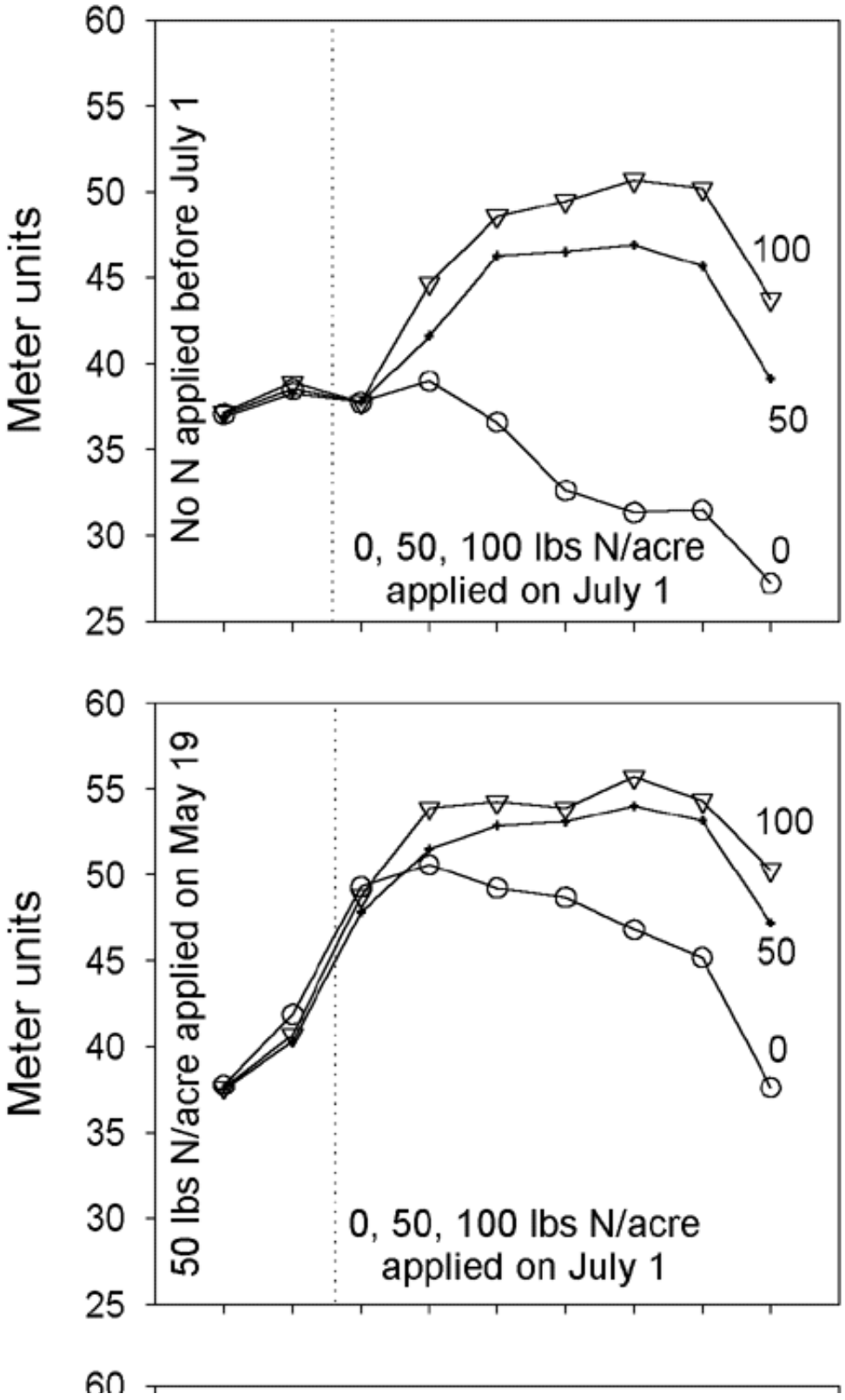
Clear effects of the May-applied N were detected on July 6. Corn without this N was severely deficient. Application of more N on July 1 dramatically reduced the intensity of these deficiencies. However, both chlorophyll meter readings and yield measurements indicated permanent effects of the period of N deficiency.

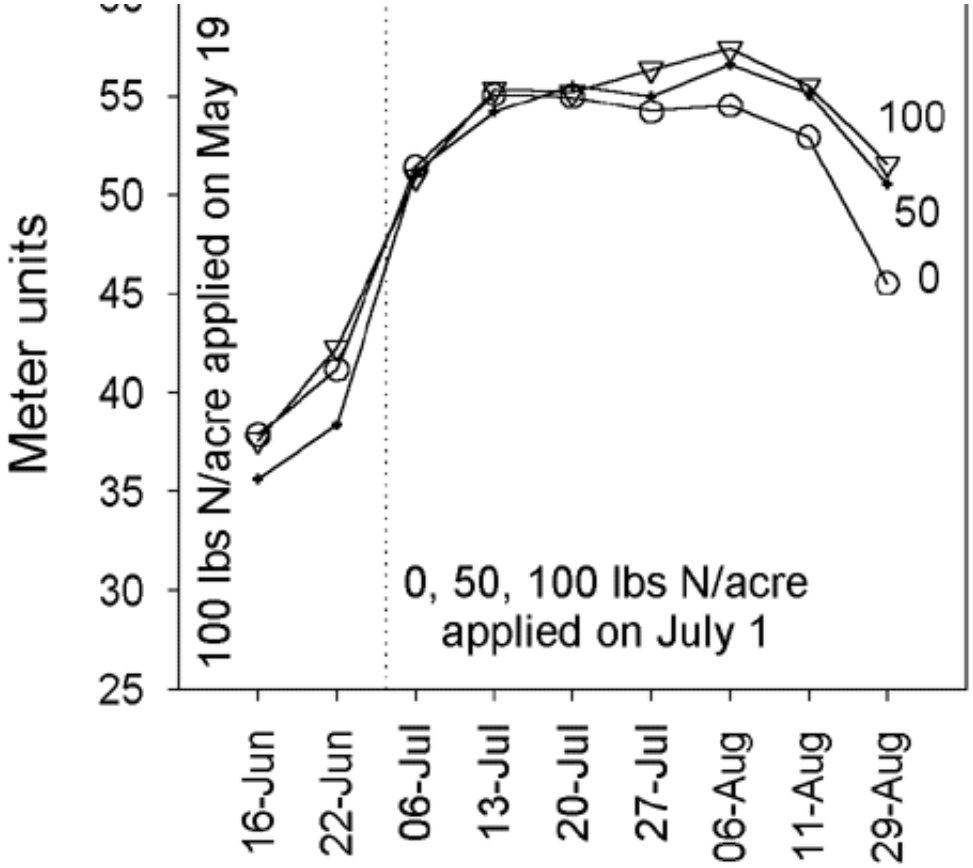
Comparisons of the meter readings in Figure 1 indicate that the corn ran out of N during the season where N was added early and more was not applied. Results of precision farming trials at many sites are showing that N deficiencies often first appear in mid-to-late July. The percentage of fields showing such deficiencies varies greatly with weather conditions.

Monitoring fields for N deficiencies as corn grows offers great potential for identifying management practices that avoid periods of yield-limiting deficiencies of N without extravagant use of fertilizer N. Such precision management of N offers new opportunity for addressing the effects of year-to-year variability in weather. One benefit may be higher average yields with lower average rates of fertilization.

Chlorophyll meters can now be used to monitor fields for N deficiencies as crops grow. These meters, however, have limited ability to address spatial variability within fields. Thus, remote sensing methods currently being developed are more likely to be the tool of choice for precision N management in the future.

Figure 1: **Chlorophyll meter readings taken on corn plants in an experiment having various fertilizer N treatments in 1998. These and other data are being used to evaluate and improve remote sensing techniques used on the same fields.**





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