IPNI INSIGHTS
INTERNATIONAL PLANT NUTRITION INSTITUTE

What Are the Consequences of Not Maintaining Soil Potassium?

May 2009

There's no question that increases in potash prices have led to cutbacks in maintenance applications. Maintenance applications typically aim to replenish the K removed with the harvest of crops. Continuing cutbacks indefinitely will inevitably reduce yields, but producers want to know when and how much. This article attempts to answer those questions based on available data.

How fast will soil test K decline? A general rule of thumb is that K soil test declines by 1 ppm for each 8 lb/A of K_2O removed, if no fertilizer or manure is applied to replenish nutrients. (This rule assumes typical uptake for annual crops from the top 6 to 8 in. of soil. Some crops, particularly alfalfa, may take up a higher portion of their K from deeper soil, resulting in less change in soil test K than given below.) Using a crop removal chart and yield records, removals and consequent soil test declines can be calculated specifically. Generally, with good yields and assuming a decline of 1 ppm for each 8 lb/A of K_2O, here are the levels of soil test decline to expect annually, based on typical removals:

- Wheat grain: 4 ppm
- Corn grain: 5 ppm
- Soybeans: 8 ppm
- Potatoes: 20 ppm
- Corn silage: 20 ppm
- Alfalfa or legume hay: 36 ppm

At what point will the soil test decline reduce yields? Yields are reduced when soil test K declines into the responsive range. The upper limit of this range varies considerably by crop and by recommendation source. For example, the university-defined critical value for corn is 75 ppm in New York and 125 ppm in Ohio. Part of the reason for this may be that there is a wide range of soil test K in which responses occur, are often small, but are occasionally large. However, once well below the critical level, responses are more consistently large.

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How much will the soil test decline reduce yields? Expected yield reductions are shown in **Table 1**, based on field response research conducted in Ontario, Canada. The median response to applied K is the best estimate of the expected yield loss when K fertilizer is not applied, for each of three soil test categories. The maximum is the largest response observed in the total number (n) of field trials represented in the database.

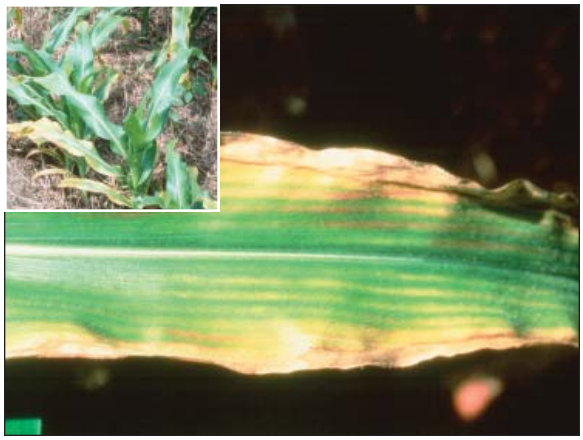
Can profitability of K use be improved with site-specific application? Within fields, there is spatial variation in the level of soil test K. The areas with low soil K can be identified with more intensive spatial sampling—either by zones or by grids—or by scouting for deficiency symptoms. If specific areas of the field are low in K, it will be more cost-effective to direct applications to those areas.

What do K deficiency symptoms look like? The pictures on the following page can aid in the identification of areas deficient in K. Generally, where deficiency symptoms occur, there is yield loss as well. Most plants will show chlorosis (yellowing) and necrosis (dead tissue) along the margins of leaves, beginning with the lower leaves.

Table 1. Response to applied K (or, expected yield reduction when no K is applied).

Soil test K	Corn, bu/A n=96		Soybeans, bu/A n=128		Alfalfa, ton/A n=53	
ppm	median	maximum	median	maximum	median	maximum
< 80	10	49	1.3	14	1.1	2.0
80-120	4	22	1.0	11	0.4	1.3
> 120	1	15	0.5	14	0.1	0.7

Abbreviations and notes for this article: K = potassium; ppm = parts per million.

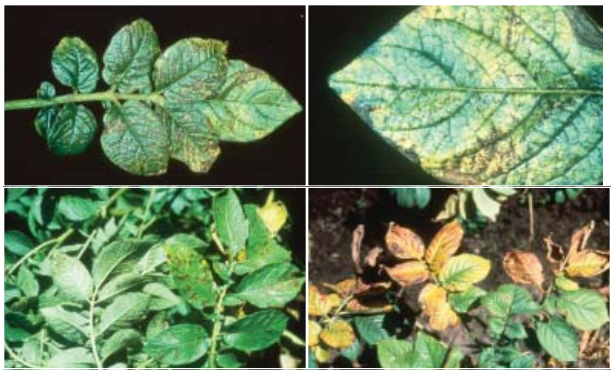


Corn K deficiency.

Soybean K deficiency.

Wheat K deficiency.

Alfalfa K deficiency.



Potato plants showing K deficiency.

IPNI Crop Nutrient Deficiency Photo Contest—2009

Once again, IPNI opens our crop nutrient deficiency photo contest as part of a continuing effort to encourage the art of field observation and increase understanding of the physical appearance of crop nutrient deficiencies and the varying conditions in which they may appear in the field.

Some specific supporting information is required for all entries, including: the entrant's name, affiliation, and contact information; the crop and growth stage, location, and date of the photo; and supporting and verification information related to plant tissue analysis, soil test, management factors, and additional details that may be related to the deficiency.

There are four categories in the competition: **Nitrogen (N), Phosphorus (P), Potassium (K), and Other**. Entrants are limited to one entry per category (one individual could have an entry in each of four categories). Cash prizes are offered in each of the four categories as follows: First place = US$150.00; Second place = US$75.00; and a Grand Prize of US$200.00 will be awarded to the entry with the best combination of photographic quality and supporting evidence across all categories.

Photos and supporting information can be submitted until December 15, 2009, and winners will be announced in January of 2010. Winners will be notified and results will be announced at the IPNI website.

Entries can only be submitted electronically as high resolution digital files to: >**www.ipni.net/photocontest**<.