Hidden Hunger...Even the Best Suffer

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PLANTS NEED PLANT FOOD. Farmers and the fertilizer industry strive to provide the nutrients that crop plants need for optimum productivity. Researchers have studied the response of crops to added nutrients and have developed recommendations for meeting crop needs. We continue to refine those recommendations as new information is learned, yield goals increase, and new technology is developed. But are we using the information to best advantage?

Late-season nutrient deficiencies, such as those shown for potassium (K) deficiency in these photos of corn and soybeans, are becoming more common in the Midwest as K application lags behind crop removal in many areas.

Potassium deficiency in corn. Late season shortage of K contributes to loss of stalk strength, increased lodging, and decreased yield.

Late season K deficiency in soybeans appears in the upper leaves. Depletion of K in the lower root zone is a common cause. Seed size and quality are reduced, resulting in lower yield

Potassium fertilizer usage has not kept pace with crop removal for the past several years. This explains the increased observation of K deficiency in the field. Part of the cause is rapid expansion of soybean acreage without adjusting fertilizer usage to compensate for the resulting increase in K removal. Shifting of input dollars to cover increased cash rents is another cause. Landlords who collect the higher cash rents need to be aware of the negative impact this has on productivity and thus land values.

We have refined nutrient monitoring and management at the field level. We know how to manage nutrients for attaining the economic optimum yield level, while using precautions to minimize the potential for negative environmental impact. Most farmers have developed a good management plan to meet crop nutrient needs. Through soil testing and plant analysis, improved crop management records, and better awareness of the interactions within the soil-crop-climate-management-environment system, great strides have been made to provide appropriate nutrient management plans for each crop and each field...at least on the average.

But can we be satisfied with average? When field-scale nutrient management plans are designed for the average yields and average soil tests, half or more of the field may have an inadequate nutrient supply, often resulting in ***hidden hunger...hidden within the variability of a field...even in some of the***

best fields on a farm. The plants may look healthy and normal, but still suffer from inadequate nutrients at some point in their growing season. Most often that point occurs too late in the season to take any corrective action. The goal should be to assure soil phosphorus (P) and K levels are not limiting at any time during the growing season. As Dr. Sylvie Brouder, Purdue University Soil Fertility specialist, points out, "We know what to do about low soil tests... fix them." The cost of good fertility is low compared to the risk of hidden hunger robbing yield potential.

If field average soil test recommendations have been carefully followed for many years, certain conditions are often found:

- Areas with above-average yield will likely have below-average soil tests because more nutrients have been removed over the years than have been replaced.
- Areas with below-average yields will have higher soil test levels because more nutrients have been applied than have been removed in the harvested crop.
- Yields often reach a plateau, in part because under field-average nutrient management, the more productive areas may not be receiving adequate nutrients to replace crop removal.

Beware of hidden hunger. A yield plateau may indicate that the crop growth is being limited at some point in the season by inadequate nutrient supplies, even though visible nutrient deficiencies are not yet present. Plant tissue analysis is probably the best tool to identify hidden hunger.

Each year that field-average management continues, an existing nutrient gap between the high and low yielding areas will tend to increase, and the probability of nutrient deficiencies will increase.

New tools now make it possible to further refine nutrient assessment and to make recommendations on a much smaller scale. Pockets of nutrient deficiency can be identified within well-managed fields and site-specific recommendations made to correct the deficiency. Increased overall yield and profit potential should result.

- Site-Specific nutrient management, using a uniform grid or management zones defined by other information, identifies areas within the field that require nutrient application rates that are higher or lower than the field average.
- Redistributing nutrients within a field to needed areas may or may not result in more fertilizer applied. Increases are likely if smaller, high testing areas have strongly influenced soil tests in the past and/or if buildup requirements have not yet been met.
- If higher yielding areas have mined soil tests to insufficient levels, fertilizer additions have good chances of increasing yields further.
- The higher testing areas of the field should maintain normal yield, even though they will receive less fertilizer under site-specific management.

The existence of hidden hunger even in well-managed fields is illustrated in an example from the Midwest, where nutrient management philosophy seeks to build soil test levels to eliminate hidden hunger.

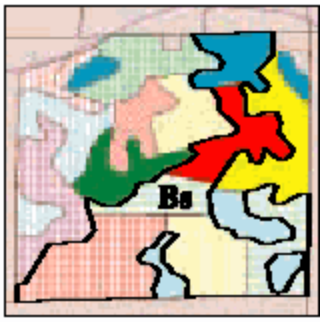


Figure 1. Management zones defined by soil tests, soil survey, and yield maps.

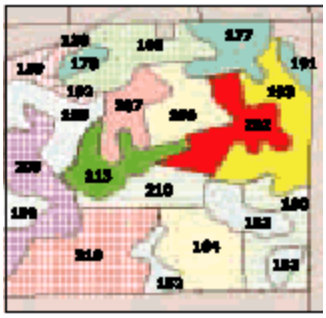


Figure 2. Corn yield based on variation by management zone, average of last three years, bu/A

Figure 1 illustrates management zones defined by a farmer and his crop consultant. They first divided the field by soil type, then subdivided soil mapping units into zones of 1 to 19 acres using other available information and experience with the field. These zones were used for soil sampling (15 to 30 geo-referenced cores in each zone). **Figure 2** shows the average yield for the last three corn production years, which was used in setting yield goals.

Figures 3 and 4 show K soil test levels and recommendation for the fields in Figures 1 and 2.

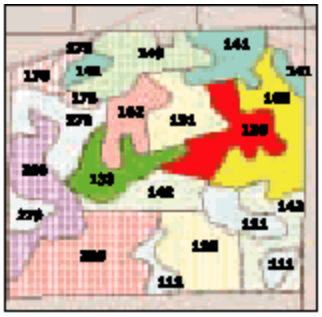


Figure 3. Soil test K level for each management zone, parts per million (ppm).

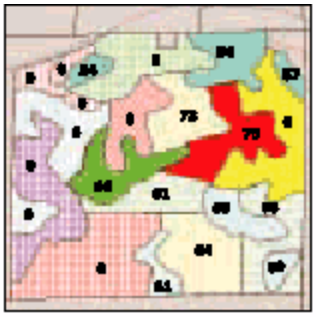
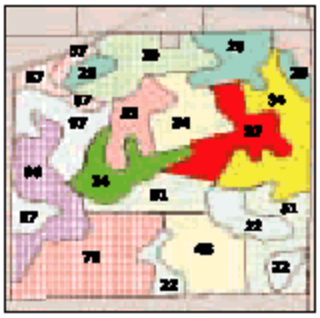


Figure 4. Potash fertilizer recommendations by management zone, lb K_2O/A

In a field where whole field management indicated that nutrient levels were sufficient, site-specific management revealed significant areas of hidden hunger for both P and K. **Figures 3 and 4** show the variability in soil test K and the associated recommendations. Site-specific management revealed hidden K hunger on 48 percent of the acres. The same field also had 46 percent of the acres with hidden P hunger.

Phosphorus soil test levels and fertilizer recommendations are illustrated in **Figures 5 and 6.**



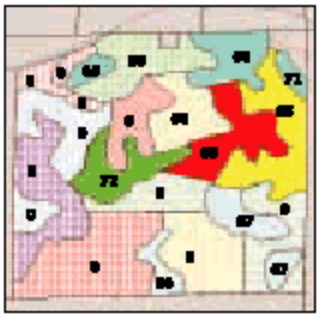


Figure 5. Soil test P level for each management zone (Bray P-1 ppm).

Figure 6. Phosphorus fertilizer recommendations by management zone, lb P_2O_5/A

Applying needed nutrients provided new yield and profit opportunity for the farmer-opportunities previously hidden under field-average management. For years, agronomists have tried to eliminate hidden hunger. Today's technology offers us a fresh look at the fertility in our fields. Seeing with "new eyes" has helped us realize that even in some of our best fields, crops have been too hungry to reach their fullest potential.