

### Proper Soil Fertility ... More Important Today than Ever!

#### Dr. Terry L. Roberts

President, Foundation for Agronomic Research (FAR) and Vice President, Potash & Phosphate Institute of Canada (PPIC)

**PROPER SOIL FERTILITY** is basic to soil productivity and plant growth...so basic that we sometimes take it for granted...so basic that we don't give it the attention it deserves and that crops demand.

Soil fertility in today's cropping systems is continuously changing. Soil nutrients are exported with every harvest. Some are lost from the soil through leaching or runoff while clays and minerals fix others. Some are temporarily tied up by organic matter and soil organisms and then released during decomposition. Nutrient balance is a constant concern—one that is crucial to efficient crop production and environmental protection and one that requires careful attention for profitable production.

Profitability is directly related to high yields that are efficiently produced. Why? Because higher yields cut unit production costs. But higher yields require more nutrients and better fertility management.

Consider some basics of soil fertility:

#### Essential nutrients and plant removal—

Plants need certain mineral nutrients to grow and to produce yield...nitrogen (N), phosphorus (P), and potassium (K) are required in the largest quantities and usually become deficient first in the soil. Sulfur (S), calcium (Ca), magnesium (Mg), and micronutrients are just as important, but are deficient less often and required in smaller amounts. Remember, crop demand for nutrients is directly related to yield. Wheat studies in Virginia provide an example of this relationship (**Table 1**). Higher yields will remove more nutrients from the soil, and more nutrients will need to be replaced through fertilization.

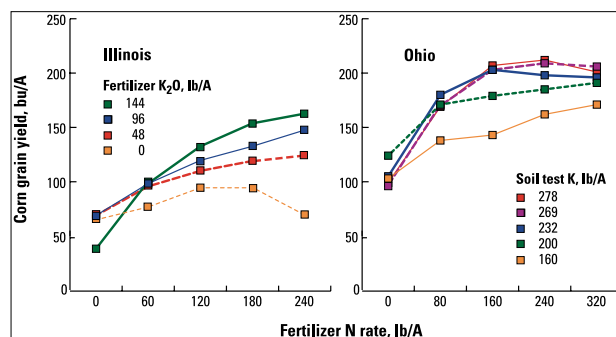
**Table 1. Nutrient removal increases with increasing wheat yields.**

N rate, lb/A	Grain yield, bu/A	Total nutrient uptake, lb/A		
		N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
0	61	55	30	59
80	107	117	53	117
120	120	147	59	142

Virginia

**Nutrient balance**— Nutrient balance is vital to soil fertility and productivity. Nitrogen is often

the first nutrient to limit yields. But without adequate amounts of other nutrients, N will not be used efficiently, and yield will suffer. Balancing N with P and K will ensure a higher yielding crop ... one that takes up more N. Corn data from the Midwest show how response to N fertilizer increases with available K (**Figure 1**). Maximum response to applied N and N use efficiency occur only when K is sufficient. Balanced fertilization lessens environmental risks from excessive nutrients remaining in the soil.



**Figure 1. Potassium improves yield response to N fertilizer and N use efficiency.**

#### Soil properties and soil-plant relationships—

Many factors directly, or indirectly, affect nutrient availability...soil moisture, texture, organic matter, pH, nutrient needs, cropping system, planting date, disease, weed and insect pressure, and yield goals. Good fertility can offset many yield limiting factors, but the most effective nutrient use is only possible when other yield limiting factors are recognized and where possible appropriately addressed.

#### Soil analysis—

Soil testing is a proven practice. It has been used successfully for over 50 years and is still the best tool available to estimate soil nutrient supply and to make fertilizer recommendations. Better sampling equipment and new technologies like GPS (global positioning systems) and GIS (geographic information systems) make it easier to sample and compare results, **but taking representative samples remains the key to a good soil testing program.** Soil properties, including fertility, are highly variable. Whether soil testing by grid, topography, soil type or field, sampling must be sufficient to reflect the fertility status of the field, or areas within the field. Fall is an ideal time to soil test for immobile nutrients like P and K. Sampling for N is better suited to spring prior to planting or fertilizer application.

### Fertilizer management and economics—

The approach to fertilizer management is nutrient dependent. Nitrogen must be managed on a yearly basis because it's readily lost from the soil through leaching or denitrification and because most of the return on investment is expected in the year of application. Phosphorus and K are different...only a fraction of the total return from their use occurs in the first year. These nutrients do not leach under normal conditions so remain available to future crops in most soils. Building soil fertility with P and K is a capital investment that affects crop production for years. Accordingly, it should be amortized over a period of time and not charged to one crop.

**Soil fertility status** — We can't afford to be complacent when it comes to soil fertility. A recent survey of 1.8 million soil samples from private and university laboratories shows many North American soils need P and K (**Figure 2**). Survey results indicate 46 percent of the 1.8 million samples tested medium or less in P, and 44 percent tested medium or less in K. Phosphorus was most deficient in the northern Great Plains where 60 to 80 percent of soils were medium or below. Potassium deficiency was most frequent east of the Mississippi River where 16 of 23 reporting states had 50 percent or more of the K tests in medium or lower categories. Most agronomists would predict a significant yield response to P and K fertilization when soil test levels are medium or below.

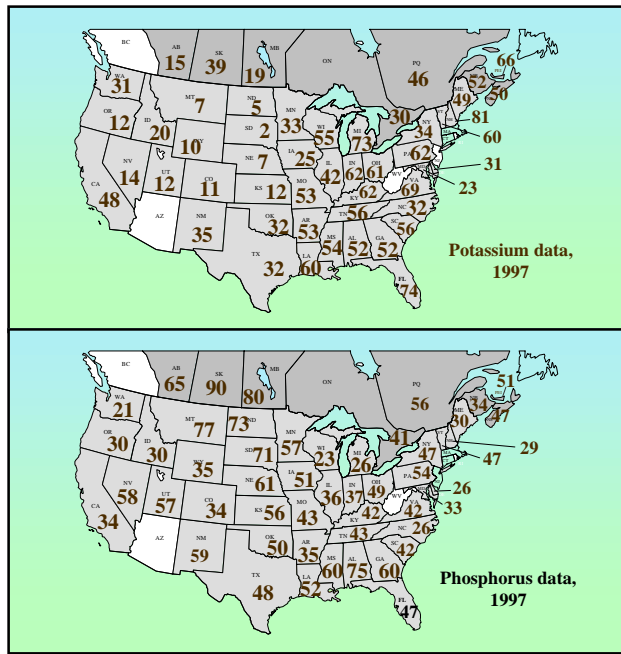


Figure 2. Percent of soils testing medium or lower.

Fertility is not the only factor that can limit crop yields and soil productivity, but it's one of the fundamentals that cannot be overlooked. And, it's one that must be managed carefully to make sure profits are maximized. ■

For further information, contact:

**Dr. Terry L. Roberts**

President,

Foundation for Agronomic Research (FAR)

655 Engineering Drive, Suite 110

Norcross, GA 0092-2837

Phone: (770) 825-8071

E-mail: troberts@ppi-far.org