

SOIL NUTRIENT MINING: GOOD OR BAD?

I will frequently be asked when talking about issues of plant nutrient management, “so, is that good or bad?” Experience tells me that most complex issues do not have a clear distinction between good and bad, but require a little more exploring on how to make the difference clear.



<https://3c1703je6d.site.internapcdn.net/newman/gfx/news/lives/2017/healthysoil.jpg>

Nutrient mining is an agronomic concept that gets discussed as either good or bad, but the real answer lies somewhere in between depending on the circumstances and the specific nutrient. The discussion here mainly refers to the more immobile nutrients, such as phosphorus (P) and potassium (K), but some of the same concepts apply to the more mobile nutrients.

Nutrient balances are measured by the difference between nutrient additions and removals. As nutrients are removed more quickly than they are replaced, a negative balance results in nutrient depletion (a.k.a. mining). When more nutrients are added to the soil than are removed, a positive balance results in accumulation or buildup.

The Bad

Nutrient mining and depletion of low-fertility soils exhausts the crop-producing

potential of the soil, harms soil health, and degrades the valuable natural resource. On soils that are already low in crop nutrients, further depletion results in lost economic opportunities too. Continual nutrient depletion is a major soil-degrading practice that persists in many parts of the world.

Nutrients are not really “lost” from soil, but they are harvested and transported off of the field, eroded, leached beneath the root zone, or sometimes burned as crop residues. At some point, it is necessary to replenish the nutrients to avoid excessive soil mining and severe nutrient depletion.

Recycling on-farm residues (e.g., crop residues, compost, green manures, animal manures) will help return nutrients to the production fields. But these organic additions will not eliminate soil nutrient mining if they are produced on the same farm where they are used.



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On fields where all of the crop residue is removed, the extent of soil nutrient mining is accelerated, compared with fields where the residue remains on the soil and the nutrients are recycled. If the residues are removed for animal feed, returning the manure to the field would slow the process of nutrient mining to some degree.

The Good

When a soil testing program is carefully followed, there may be fields that have an adequate nutrient concentration for healthy plant growth and fertilization can be temporarily halted.

There are two major philosophies concerning interpretation of soil test results. There is no simple answer of which approach is superior, since there are many factors that determine what is the appropriate route for you.

Nutrient Sufficiency: Apply only the minimum amount of nutrient required to maximize profits in the year of application.

Build and Maintenance: Build the concentration of nutrients to a


non-limiting range and then apply sufficient nutrient to maintain that desired concentration.

The Build and Maintenance approach allows farmers to take a break in fertilizer application if economic circumstances change. An investment has previously been made to boost the soil nutrient concentrations and soil mining can be allowed to occur for a period of time without devastating results.

Many fields that receive repeated applications of animal manure eventually accumulate high concentrations of P in the soil. When manure is applied to meet the nitrogen requirement of crops, the amount of added P far exceeds crop uptake and removal, resulting in soil P build up. This accumulated P, often termed “legacy phosphorus” can be viewed as a valuable resource, but may also become a source of pollution to nearby water bodies through runoff and erosion. In this case, P application may need to cease and soil mining adopted to lower the P concentration and environmental risk.

The key to managing soil nutrient

mining is to understand the balance between inputs and outputs. Where available, a comprehensive soil testing program should be used to maintain nutrient concentrations above their critical value. When nutrient concentrations are less than recommended, a phase of nutrient build up is needed to avoid loss of crop yield and quality. At soil test concentrations far greater than recommended, fertilizer applications less than crop nutrient removal may be appropriate.

Soil testing services are not available in many parts of the world. IPNI has developed easy-to-use software (Nutrient Expert® ) that allows farmers to make fertilizer recommendations in the absence of local soil testing information.

So, is soil nutrient mining good or bad? It can have devastating effects leading to soil degradation, or it can have significant economic and environmental benefits. Begin by understanding the nutrient budget for each field and then adopt specific practices appropriate for your conditions.



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