



Vegetative Mining

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Definition:

The removal of phosphorus from the soil by the removal of crop biomass from a site.

Purpose:

Vegetative mining is a strategy to decrease the soil test phosphorus values of a soil by crop removal. The principle is to plant crops that accumulate significant amounts of phosphorus in their biomass. With time, the export of phosphorus with the crop harvest will reduce the soil test phosphorus values of the soil and reduce the potential impact on water quality.

It takes between two and three bushels of corn, for example, to remove one pound of phosphorus (as P₂O₅). In the Midwest, researchers estimated that it will require 10 years of corn removal to lower the soil phosphorus level from greater than 500 lbs to less than 150 lbs of phosphorus (as P₂O₅) per acre.

How Does This Practice Work?

The potential for phosphorus losses from a site is related to the amount of phosphorus in the soil. In general, soils that test higher for phosphorus po-

tentially generate higher phosphorus concentrations in runoff that can negatively impact surface water quality than soils with a lower soil test phosphorus value. So, reducing the soil test phosphorus by removing phosphorus from the site with vegetation will reduce the potential impact on surface waters.

On sites where high or very high soil test phosphorus values limit or restrict the continued application of fertilizer or manure phosphorus, a strategy of vegetative mining can help to draw down the soil test phosphorus.

In general, there is not a large difference in the concentration of phosphorus found in the aboveground harvestable portion of most crops. With the removal of greater quantities of a crop from a field, more phosphorus is removed, increasing the impact of vegetative mining on the soil test phosphorus. Forage crops such as silage and hay crops (where most of the above ground biomass is harvested) are recommended over grain crops, where a smaller percentage of the crop is removed from the field.

In its simplest form, this practice may involve

switching the management of a field from a forage pasture to a hay crop, or from grain to silage corn. Changing from a lower-yielding to a higher-yielding variety will increase the potential for vegetative mining of phosphorus.

Where This Practice Applies and Its Limitations:

The vegetative mining of phosphorus can be conducted on all sites where crops can be grown and harvested. It is not recommended for sites where soil phosphorus might be limiting. Vegetative mining is best suited to sites where the soils test high or very high for phosphorus. On soils with extremely high levels of high soil phosphorus, it may take many years or even decades to detect a change in soil phosphorus levels.

Vegetative mining will be most effective on soils that do not receive additional phosphorus. The effects will be more rapid on soils with low soil phosphorus reserves. Phosphorus removal will be faster in lighter (sandy) rather than heavier (clay) textured soils, in soils with a lower nutrient-holding or cation-exchange

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capacities and soils with lower soil organic matter contents.

Vegetative mining will have little if any effect on pasture systems or with low-yielding grain crops.

Effectiveness:

Vegetative mining is one tool that can enable phosphorus additions to sites where the addition of phosphorus is limited or restricted (for example, by results of a site risk analysis). The results of vegetative mining will not become evident in the short-term and, depending on the soil-type and the amount of soil phosphorus, may not be effective in significantly reducing the risk to nearby surface waters for many years. As with practices with similar objectives, vegetative mining is most effective when combined with other practices designed to prevent the movement of phosphorus from agricultural fields.

Cost of Establishing and Putting the Practice in Place:

The cost of implementing a program of vegetative mining does not require extra cost. The main thing is to choose crops that enable high exportation of phosphorus while being part of the farm's cropping system strategy. Switching production from one crop type to another and changing harvesting techniques may require the use of additional equipment and changes in management.

Operation and Maintenance:

As with all crops, attention should be paid to maintaining the optimum levels of all soil nutrients and ensuring the soil pH is within the recommended range for the crop.

References:

Eghball B., John F. Shanahan, Gary E. Varvel and John E. Gilley. 2003. *Reduction of High Soil Test Phosphorus by Corn and Soybean Varieties*. *Agron. J.* 2003 95: 1233-1239.

Details of soil phosphorus removal rates can be found at the following databases:

USDA Plants Database <http://plants.usda.gov>

NRCS Agricultural Waste Management Field book Table 6-6

Potash and Phosphate Institute Web site <http://www.ppi-ppic.org/> (click on "Nutrient Removal" under the Features heading on the screen).

For more state-specific estimates, contact your Cooperative Extension Service or NRCS office.

For Further Information:

Contact your local conservation district, USDA-NRCS or Cooperative Extension Service office.