IMPACT
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# Phosphorus uptake study provides critical information for nutrient planners

## The Situation

With increased applications of phosphorus-rich dairy manure to agricultural lands in southern Idaho, growers need to be confident that the current phosphorus removal rate estimates for specific crops are accurate. Corn silage is of particular interest, as this crop receives more dairy manure than any other crop in Idaho. The maximum acceptable concentration of soil test phosphorus in Idaho is 40 ppm (160 lbs.) per acre. Research suggests corn silage can remove no more than 35 ppm (140 lbs.) of phosphorus per acre from the soil in a growing season. Nutrient management planners and Natural Resources Conservation Service representatives in Idaho question the use of these phosphorus recovery rate recommendations. Because most phosphorus recovery estimates are based on data from crops grown in the Midwestern and Eastern regions of the United States, it is quite possible that the unique characteristics of Southern Idaho calcareous soils would have an effect on phosphorus movement and root adsorption rates. University of Idaho Extension faculty discovered that this is indeed true and the corn silage phosphorus uptake value was changed in the Idaho OnePlan program to reflect this finding.

## Our Response

A study was conducted to determine actual phosphorus uptake of corn grown for silage in southern Idaho. A total of 42 fields were sampled during the 2008 and 2009 growing seasons. Efforts were made to select fields ranging widely in soil test phosphorus levels by selecting sites that had either low, moderate, high, or very high rates of manure applied to their fields in the past. A small percentage of the fields did not have a history of manure application, allowing us to include potentially deficient soils in the study.

A pivot irrigates a silage corn crop on a dairy in the Magic Valley. Corn is the primary crop used in southern Idaho for removing excess phosphorus from the soil.

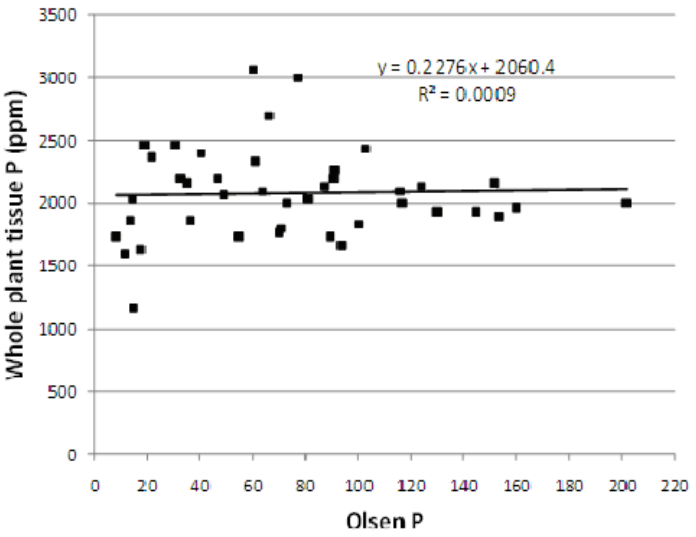
All the field work was conducted within a week of actual harvest. Fields were sampled at three subplot locations. Soils were sampled to a depth of 12 inches and analyzed for phosphorus content. The corn stalks were cut and weighed for yield estimation and a few were selected for plant tissue phosphorus analysis.

## Program Outcomes

The findings of this study indicate that silage corn tissue contains an average of 2087 ppm (4.2 lbs.) of phosphorus per ton of dry matter. This equates to an average of 46 lbs. of phosphorus removed per acre in a growing season by corn. Nutrient management plans written before June 2007 used a silage tissue concentration value of 2600 ppm (5.2 lbs.) of phosphorus per ton of silage dry matter. Plans written

after June 2007 use a silage tissue concentration value of 1850 ppm (3.7 lbs.) per ton of silage dry matter. The new value of 2087 ppm (4.6 lbs.) will allow nearly another pound of phosphorus to be calculated for removal per ton of silage dry matter. At the field level this means an average of 46 lbs. of phosphorus is actually removed per acre instead of the current 37 lb. average used in plans written since June 2007.

As the dairy industry expands, more acres of farmland will have manure applied to it. Understanding the relationship between phosphorus in the soil and plant removal rates will become increasingly important to protect vital surface and ground water supplies. The Idaho OnePlan program was improved due to the findings of this study and producers whose nutrient manage plans were written after June 2007 will be able to add additional manure to their fields.




This graph shows the relationship between phosphorus in the soil (Olsen P) and phosphorus in the corn plant (whole plant tissue). Indicated here, as the level of phosphorus in the soil increases the level of phosphorus in the plant does not necessarily increase. Corn is not a luxury consumer of this nutrient.

### The Future

This study raised several questions about how phosphorus interacts in high pH, high lime soils and how it interacts with other soil nutrients. More research needs to be conducted to help researchers and agronomists better understand these interactions. Information such as this is vital to help technical advisors and land managers do the best job to manage the land and water resources of Idaho.

## FOR MORE INFORMATION

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