PHOSPHORUS REMOVAL BY SILAGE CORN IN SOUTHERN IDAHO

By Amber Moore, Steve Hines, Brad Brown, Mario de Haro Martí, Christi Falen, Mireille Chahine, Tianna Fife, Rick Norell—UI, and Jim Ippolito-USDA ARS

Corn silage is the predominant crop in Idaho used for recovering phosphorus (P) that has accumulated in soils from dairy manure applications. However, little is known about how much P and other nutrients are being recovered under Idaho conditions. The objective of the study is to estimate P removal by irrigated silage corn cultivated throughout southern Idaho with variable soil test P concentrations, and to identify effects of increasing soil test P on tissue P concentrations and plant P uptake.

Forty-two different corn silage fields in 2008 and 2009 were selected throughout southern Idaho for soil and whole plant sampling at harvest. Soils were analyzed for Olsen P, plant tissue was measured for total P content, and dry and wet yields were calculated based on field weights and drying of plant tissue.

The year did not appear to have a significant effect on yield, dry matter percent, P concentrations in the corn plant tissue, or P uptake, therefore the results from 2008 and 2009 were combined for this discussion. Average dry yield, wet yield, and dry matter % were similar to current averages for

MEASURING MANURE APPLICATION RATES ON THE FARM

By Rick Norell—UI

Nutrient management plans frequently specify variable manure application rates between fields. Achieving these variable application rates is challenging for on-farm and commercial applicators. On-farm procedures can be used to determine ballpark application rates and to assess appropriate overlapping of spreader loads. A general discussion of the commonly recommended procedures is provided below.

Tarp Method. For rear discharge spreaders, the maximum manure application rate typically occurs directly behind the manure spreader. The tarp method takes advantage of this fact. To run the test, three to five tarps of known size are placed in the field down range and the applicator drives the spreader over the tarps while applying manure.

Tarps are weighed after application and rate is calculated by equation (expressed in tons/acre). If application rate is outside the planned range, a second set of tarps is used and the applicator varies ground speed or discharge rate from the spreader. Through trial and error, the applicator finds the appropriate speed and discharge rate to achieve desired application rate.

The tarp method has several key advantages: 1) application rate can be tested at any time, 2) the procedure estimates maximum application rate, 3) does not require on-farm scales to measure load weight, and 4) the process is suitable for any size operation. There are a few disadvantages as well including: 1) process is time consuming, 2) does not

Continued on page 3

Continued on page 4
Idaho. Yield (on a dry matter basis) was not affected by increasing Olsen P from 3 to 200 ppm.

Average P concentration in the whole plant tissue at harvest was 0.21 %, with 39 of the 42 fields sampled between 0.15 and 0.25 %. Increasing levels of Olsen P in the soil from 3 to 200 ppm had no significant effect on tissue P over 20 ppm, therefore there is little potential for luxury P uptake with higher Olsen P (figure 1).

Based on our findings, it appears that the corn tissue % P value used in all nutrient management plans derived from the Idaho OnePlan June 2007 will likely underestimate P removal by corn silage. Using updated values based on our findings, these producers will be able to account for more P removal from corn silage, and therefore apply more manure to their fields.

However, producers who have nutrient management plans that were written before June 2007 were grandfathered in with P uptake based on a tissue P of 0.26 %. As only 3 of the 42 fields measured at or above 0.26 % tissue P, producers using this estimate for P removal are most likely overestimating P uptake by corn silage, over-applying manure, and therefore increasing Olsen P concentrations. Producers with older nutrient management plans should use the 0.21 % value for tissue P supported by this study, or actual values measured from the harvested corn chop, when estimating P removal by silage corn. Silage corn P removal estimates that are more accurate should lead to better balance between manure P, applied P, and crop P removal. This will help to avoid further enrichment of southern Idaho soils.

For more information, contact Amber Moore at 208-736-3629, or amberm@uidaho.edu.

### Table 1. Whole plant tissue analysis, yield, dry matter, and uptake for corn silage harvested from 21 fields in 2008 and in 2009 throughout Southern Idaho with varying fertilizer and manure application histories. Soil test P varied from 3 to 300 ppm Olsen P.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (wet ton/acre)</td>
<td>31.7</td>
<td>7.0</td>
<td>15.7</td>
<td>47.2</td>
</tr>
<tr>
<td>Yield (dry ton/acre)</td>
<td>11.2</td>
<td>2.6</td>
<td>5.2</td>
<td>17.4</td>
</tr>
<tr>
<td>% dry matter</td>
<td>33.8</td>
<td>6.4</td>
<td>23.8</td>
<td>54.5</td>
</tr>
<tr>
<td>Tissue P (ppm)</td>
<td>2078</td>
<td>361</td>
<td>1163</td>
<td>3067</td>
</tr>
<tr>
<td>P uptake (lb/acre)</td>
<td>43.7</td>
<td>11.7</td>
<td>17.0</td>
<td>76.3</td>
</tr>
</tbody>
</table>

"Silage corn P removal estimates that are more accurate should lead to better balance between manure P, applied P, and crop P removal."