Nutrient Management and Soil Health:

IMMUNE MACRONUTRIENTS – PHOSPHORUS AND POTASSIUM

Implementing nutrient and soil health best management practices

Properly managed nutrients and soil health can provide economic and environmental benefits; however, cropping systems are complex. Nutrient management decisions must support or align with soil health management decisions for optimal results.

4R Nutrient Stewardship provides a framework to achieve cropping system goals, such as increased production, increased farmer profitability, enhanced environmental protection and improved sustainability.

- **Right Source**: Matches fertilizer type to crop needs.
- **Right Rate**: Matches amount of fertilizer type to crop needs.
- **Right Time**: Makes nutrients available when crops need them.
- **Right Place**: Keep nutrients where crops can use them.
Potassium & phosphorus

Potassium helps strengthen the plant’s abilities to resist disease and plays an important role in increasing crop yields and overall quality, including strengthening the plant’s root system. Phosphorus is linked to a plant’s ability to use and store energy, and is necessary for growth and normal development. Phosphorus and potassium nutrients are typically lost through surface water washing away the fertilizer source or erosion. (Source: 4R Nutrient Stewardship)

Here, we highlight the stories of two U.S. farmers who incorporate 4R practices into their soil health management system to keep the phosphorus and potassium they apply in the soil.

Farmer profile:

Erosion conscious in Iowa

- Uses soil testing as one tool to help determine the **right rates** of potassium and phosphorus to apply.
- Incorporates cover crops and no-till into their soil health management system.
- **Key Takeaway:** Nutrient application can be complex in soil health management systems, so soil test levels play an important role in determining application rates.

Profitable no-tiller in Illinois

- Soil health practices have changed the **right rate** and **right placement** of nutrient application over time.
- Incorporates cover crops and no-till into their soil health management system.
- **Key Takeaway:** Adopting a soil health management system can have beneficial impacts on nutrient management and farm economics.

“Keeping the soil in place means that cover crops pay for themselves. I need to apply less fertilizer because the nutrients stay in place with the soil.”

Illinois farmer
Erosion conscious in Iowa

Environmental stewardship is a primary objective of this farmer’s operation, including managing for soil health. This farmer uses cover crops and no till as part of his soil health management system to keep the soil in the field, along with valuable nutrients such as phosphorus, which binds to soil particles. Incorporating diverse cover crop mixes into his corn-soybean rotation also provides a valuable source of forage for this farmer’s cattle. Cover crop mixes typically include species such as cereal rye, radish, rapeseed, and sweet clover.

Grazing, cover crops, and no-till make this farmer’s system complex, which makes it difficult to determine the optimal nutrient application rates based upon standard crop recommendations. In order to account for these factors, this farmer considers Iowa State University recommendations* and soil test results, while accounting for higher grain yields (195 bu/acre), and any cover crop biomass or stover removed through grazing. Anhydrous ammonia, MAP, and potash are all applied in the spring to meet the crop need with an average of 1 bushel of corn produced for every .80 units of nitrogen applied on a silty loam soil. Potassium and phosphorus are applied based on Iowa’s crop rate of removal and soil test results, which suggest that soil levels of phosphorus are optimal (on average), and that soil levels of potassium are very high. In a complex soil health management system like this example, it is important to pay attention to soil testing levels to adjust application rates as needed.

<table>
<thead>
<tr>
<th></th>
<th>Phosphorus</th>
<th>Potassium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimum</td>
<td>26-35</td>
<td>161-200</td>
</tr>
<tr>
<td>This farmer’s in-field average</td>
<td>28</td>
<td>255</td>
</tr>
<tr>
<td>Crop removal based on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>avg. corn yield of 195 bu/acre</td>
<td>62.4</td>
<td>42.9</td>
</tr>
<tr>
<td>Suggested nutrients to apply</td>
<td>58</td>
<td>0</td>
</tr>
<tr>
<td>based only on 180 bu/ac grain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>removal (removing additional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>crop biomass)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutrients applied (units)</td>
<td>31.2</td>
<td>33</td>
</tr>
</tbody>
</table>

Profitable no-tiller in Illinois

This farmer grows corn and soybeans, and also plants cover crops such as cereal rye, radish, and crimson clover. He has been transitioning to a soil health management system since the 1990’s. When his family farm transitioned to no-till 20+ years ago, it allowed him to start dropping his phosphorus and potassium application levels by banding fertilizer at a 2” x 2” pattern, compared to broadcast spreading. Within the last 10 years he also added cover cropping to his management system. No-tilling reduced nutrient usage, and now cover crops are reducing nutrient losses.

There was a marked improvement in reducing erosion with the addition of cover crops to the system. This farmer explains, “Keeping the soil in place means that cover crops pay for themselves. I need to apply less fertilizer because the nutrients stay in place with the soil.” Overall this farmer estimates he has reduced phosphorus and potassium fertilizer usage by 20%, attributing some of this reduction to his adoption of a soil health management system, as well as technological advances and soil testing.

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The Soil Health Partnership promotes the adoption of soil health practices for economic and environmental benefit.

The Fertilizer Institute represents, promotes and protects the fertilizer industry.

Learn more about the Soil Health Partnership by visiting soilhealthpartnership.org or contacting soilhealth@ncga.com

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