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.
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.

“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

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.

Farmer profile:

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.
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.

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.

<table>
<thead>
<tr>
<th>Optimum</th>
<th>Phosphorus</th>
<th>Potassium</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>This farmer’s in-field average</strong></td>
<td>28</td>
<td>255</td>
</tr>
<tr>
<td><strong>Crop removal based on avg. corn yield of 195 bu/acre</strong></td>
<td>62.4</td>
<td>42.9</td>
</tr>
<tr>
<td><strong>Suggested nutrients to apply based only on 180 bu/ac grain removal (removing additional crop biomass)</strong></td>
<td>58</td>
<td>0</td>
</tr>
<tr>
<td><strong>Nutrients applied (units)</strong></td>
<td>31.2</td>
<td>33</td>
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Facebook: soilhealthpartnership
Twitter: @SoilPartners
Instagram: soilpartners
soilhealth@ncga.com
636-733-9004

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