Benefits and Management of Crop Rotation

- Crop rotation can be a valuable risk management tool.
- Crop rotation can help break disease, weed, and insect cycles.
- Incorporating a crop rotation can increase management needs.

Crop Rotation as a Risk Management Tool

Crop rotation can help spread the workload during the growing season and mitigate risk from weather events and crop prices. The importance of risk management is particularly evident during periods of drought. If a farmer has all his fields planted to the same crop, they may be at higher risk to potential losses associated with environmental stresses, such as disease or drought. However, if a variety of crops are planted, the impact on yield is likely to be varied and the risk may be spread out. Likewise, a farmer could diversify their portfolio and capture peaks in the market by having a variety of crops to sell.

In a 17-year study performed by the University of Illinois, adding wheat to a corn soybean rotation resulted in a 10-bushel advantage to corn yields compared to a corn-soybean rotation.¹ Online calculators have been created to help farmers compare rotation types and show economic returns of each. One such calculator is the Corn-Soybeans-Wheat Rotation Tool found at: http://www.farmdoc.illinois.edu/pubs/FASTtool.asp?category=farm. In the instance of canola, a long rotation is imperative to helping discourage the destructive blackleg disease from robbing both resistance and yield from the canola crop.²

Benefits of Crop Rotation

Crop rotation can be an effective disease management tool, particularly if the pathogen has a narrow host range and overwinters in crop residue. Crop rotation can decrease the level of inoculum present by introducing a crop that is not a host to the pathogen. When a non-host crop is planted, the pathogen is unable to reproduce causing inoculum in the soil, or previous crop debris to gradually die and levels to decrease.

Similarly, insect populations can be disrupted and reduced by utilizing crop rotations. Soybean cyst nematode populations can be reduced by as much as half when soybean is rotated with corn and wheat.³

Rotating different types of crops, such as a grass-broadleaf or grass-small grain rotation, allows farmers to diversify their herbicide program and select chemistries with different modes of actions. Utilizing a diverse herbicide program over multiple years may lead to better overall weed control and minimize the risk of developing weed resistance.

Soil physical properties can improve through the use of crop rotation. Over time, improved soil structure leads to an increase in the soil water-holding capacity and promotes new root growth in successive crops.⁴ Additionally, rotating crops with a high carbon to nitrogen ratio (corn, small grains) with low carbon to nitrogen ratio crops (soybeans) helps establish diverse community of soil micro-organisms.⁵ This improvement in soil tilth can lead to a more stable soil structure and a decrease in the susceptibility of soil erosion.

Selecting the Right Crops

Crops should be well suited for the soil, growing conditions, and market availability of the area. Consideration should be taken on what the current or previous crop was for the field in question. Allelopathy is the suppression of growth of a plant species by another plant species. Autotoxicity is a specific type of allelopathy and occurs when chemicals released from a specific crop, such as corn, affect that same crop. Studies at Iowa State University indicate that autotoxicity can delay corn germination and early season growth. While it is not thought to be a primary cause of yield penalties in corn following corn, it is likely a contributing factor.⁶ In certain regions water usage is a crucial consideration and selecting crops that balance water usage instead of depleting subsoil moisture is imperative to the success of crop rotation.

Management Considerations

Additional management practices may need to be incorporated to receive the benefits of crop rotations. Farmers may incur initial equipment costs to purchase the proper seeding and harvesting equipment for the additional crop(s). High residue crops, such as corn, can also add challenges to no-till or reduced tillage systems by making it difficult for the next crop to emerge. Where crop rotation can help alleviate time crunches during a tight planting window, it can add to in-season management time constraints. Different crops have different pest and disease threats which can impact crops at different times and require different treatment approaches. Herbicide carryover can impact the choices a farmer has for crops in the following season. Crops such as sugar beets don’t host beneficial fungi which could result in the following crop to suffer from nutrient deficiencies or be less resistant to drought stress.⁷ Harvesting and storing a variety of crops can also add cost and logistical challenges to a farmer’s management plan.

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Summary

Crop rotations can be a valuable tool for farmers to help manage pressure from disease, weeds, insects, weather and markets. At the same time, as offsetting risks, crop rotations can help improve soil health and soil properties. Determining the right crop for a specific field depends on several variables and may come at an increased cost initially. Equipment availability, markets, pest pressures and long term goals all play into determining which crops will work best in a farmer’s rotation plan. The previous year’s crop has a tremendous impact on the success of the following crop. Experiment with different rotations to find the best fit for each field.

<table>
<thead>
<tr>
<th>Region</th>
<th>Commonly Selected Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plains</td>
<td>Corn, Wheat, Sugar Beets, Canola, Sunflower, Field Pea</td>
</tr>
<tr>
<td>Midwest</td>
<td>Corn, Soybean</td>
</tr>
<tr>
<td>Southern</td>
<td>Corn, Soybean, Cotton, Milo</td>
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</tbody>
</table>

Table 1 Common crops used in crop rotations in various regions

Sources