



Agronomic Spotlight

Crop Rotation Management and Benefits

- Crop rotations may increase soil properties and break disease, weed and insect cycles.
- Risk from weather and markets may be mitigated with crop rotations.
- Management practices may need to be altered to incorporate crop rotations.

Benefits of Incorporating Crop Rotations

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.¹

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 action. 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.² Additionally, rotating crops with a high carbon to nitrogen ratio (corn, small grains) with low carbon to nitrogen ratio crops (soybeans) can help establish a diverse community of soil micro-organisms.³ This improvement in soil tilth can lead to a more stable soil structure and decrease the susceptibility of soil erosion.

Using Crop Rotation to Mitigate Risk

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 their fields



Figure 1. Multi-crop rotation plot. Photo courtesy of Jeremy Singer, USDA-ARS National Laboratory for Agriculture and the Environment.

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.⁴ 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.⁵

Crop Selection for Crop Rotations

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.

Successful Crop Rotation Management

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

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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.

Region	Commonly Selected Crops
Plains	Corn, Wheat, Sugar Beets, Canola, Sunflower, Field Pea
Midwest	Corn, Soybean
Southern	Corn, Soybean, Cotton, Milo

Table 1. Examples of crops used in crop rotations by region

Conclusion

Crop rotations can be a valuable tool for farmers to help manage pressure from disease, weeds, insects, weather and markets. Crop rotations also 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.

Sources

1 Kleczewski, N. 2013. Basics to soybean disease management. University of Delaware Cooperative Extension.<http://extension.edel.edu> 2 Cavigelli, M.A., Teasdale, J.R., and Spargo, J.T. 2013. Increasing crop rotation diversity improves agronomic, economic, and environmental performance of organic grain cropping systems at the USDA-ARS Beltsville farming systems project. <https://dl.sciencesocieties.org/> 3 Boquet, D. Louisiana conservation tillage handbook. Chapter 1: Crop rotation. <http://www.lsuagcenter.com> 4 Nafziger, E., Johnson, M., Mansfield, B. and Peltier, A. 2015. The effects of long-term rotation and tillage on corn, soybean and wheat yields. University of Illinois Department of Crop Sciences. <http://web.extension.illinois.edu> 5 Markell, S., Rio, L.D., Halley, S., Mazurek, S., Mathew, F., and Lamey, A. 2008. Blackleg of canola. North Dakota State University. PP-1367. The CropSite News Desk. 2011. Blackleg risk rises with tight canola rotations. Global Crop Industry News. www.thecropsite.com 6 Elmore, R. and Abendroth, L. 2007. Allelopathy: a cause for yield penalties in corn following corn? Integrated crop management. Iowa State University. <http://www.ipm.iastate.edu> 7 Overstreet, L.F., Cattanach, N.R., Gegner, S. and Franzen, D. 2008. Crop sequence effect in sugarbeet, soybean, corn and wheat rotations. North Dakota State University Department of Soil Sciences and Sugarbeet Research and Education Board. <http://www.sbreb.org/>

For additional agronomic information, please contact your local seed representative. **Individual results may vary**, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. **ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS.** ©2017 Monsanto Company. 170512121735 052417 MRD