SeedSCOOP

BENEFITS AND MANAGEMENT OF CROP ROTATION

Crop rotation is a component of crop production and an implement for farm management as it balances agronomy and economic market realities. From an agronomic perspective, crop rotation can increase nutrient cycling and nutrient use efficiency, decrease plant diseases and insect pests, assist in managing weeds, reduce soil erosion and increase soil health. A common rotational system in the Corn Belt is corn followed by soybean for a two-year rotational program. Research at Iowa State University on extended multi-year rotations of three to four years, found that net economic returns did not differ among the cropping systems, corn and soybean yield potential increased, soil health improved, soil erosion decreased, herbicide and nitrogen (N) fertilizer use decreased, and some plant diseases were reduced.[1]

Managing Risk with Crop Rotation

Crop rotation can help reduce the risk of adverse environmental stress, such as drought, early frost, and wet springs that result in a delayed planting window. It can help reduce the risk of an economic insect infestation from insects that are specific to a crop for a part of their life cycle, such as the corn rootworm complex and soybean aphid. Most foliar plant diseases are specific to a certain crop species therefore, rotation can help reduce the risk of economic loss as the result of plant disease, such as Northern corn leaf blight, brown stem rot of soybean, and tar spot in corn.

The cropping sequence of the rotational system should also be considered as it may be detrimental and increase risk. For example, corn grown before wheat can increase the incidence of fusarium head blight (wheat scab) in wheat. Additionally, there are some root and crown diseases in wheat that can also increase with this rotation system as corn shares them as well.[2]

A tool to assist in determining the economic returns from a corn-soybean and a corn-soybean-wheat rotation has been developed at the University of Illinois and is available at https://farmdoc.illinois.edu/fast-tools/planting-decision-model.

Managing Resources with Crop Rotation

Crop rotation can help increase environmental resource use and producer time efficiency. Water use rate among crops can be very different, corn for example, is considered a high water use crop when compared to wheat and soybean.[2] Therefore; the crop following corn after drought should be one with a lower water use rate if soil moisture is not restored to full capacity during the off season.

Crop rotation can assist time management as it allows farmers to spread work load over a longer time period. Equipment and labor can be more efficiently used as different crops are planted, managed during the growing season, and harvested at different time periods.

Managing Weeds with Crop Rotation

Many weed management plans include crop rotation as a tactic to help manage weeds. Continuous cropping of a single crop can become infested with a weed species that has adapted to the crop and management system being used. Whereas, a crop rotation that is diverse can exert selection pressure on weeds, preventing any one weed species from becoming dominant and help slow the overreliance on a single herbicide that can result in herbicide resistance. A survey of scientific literature indicated that crop rotation resulted in weed densities that were lower in 21 cases, higher in 1 case, and equivalent in 5 cases when comparted to continuous cropping of a single crop. Additionally, in 12 studies where weed seed bank density was reported, crop rotation was lower in 9 cases and equivalent in 5 when comparing crop rotation with continuous cropping.[3]

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Carbon Sequestration with Crop Rotation

In a long-term study in Illinois, a continuous corn production system lost about 30% of the soil carbon when compared to a corn-oats-clover rotation system. However, recent studies have indicated that the tillage system, specifically no-till systems, in conjunction with crop rotation can play a major role in maintaining or increasing soil carbon content.[4]

Final Thoughts

Using cover crops is also a way to introduce diversity into the cropping system, please see Managing Cover Crops Prior to Planting Corn and How Can Cover Crops Benefit my Nutrient Management Plan? for more information.

From a planning perspective, farmers should consider the following when considering the addition of a rotational crop into the system.

- Do I have a market for the crop I am adding to the rotation?
- Is the crop a grass or broadleaf, which has implications for the herbicide program?
- Is the crop an annual, biennial, or perennial?
- Is the crop a cool-season plant or a warm-season plant?
- The seeding date, is it a fall seeded, early spring, or late spring planting window? Is it harvested once during the growing season or multiple times?
- What are the fertility and pH requirements of the rotational crop?
- Will my equipment match up with the what the crop requires for planting, maintaining, and harvesting?

Sources

[1] Liebman, M.Z., Chase, C.A., Johanns, A.M., Sundberg, D.N. 2013. Agronomic and economic performance of three crop rotation systems in Central Iowa. Iowa State Research Farm Progress Reports. 1889. https://lib.dr.iastate.edu/farms_reports/1889/.

[2] Beck, R. 2020. Crop rotation in farm management. South Dakota State University Extension. https://extension.sdstate.edu/crop-rotation-farm-management.

[3] Liebman, M. and Dyck, E. 1993. Crop rotation and intercropping strategies for weed management. Ecological Applications. 3:92-122.

[4] Al-Kaisi, M. 2008. Impact of tillage and crop rotation systems on soil carbon sequestration. Iowa State University Extension.

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