USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Conservation Crop Rotation Options for Optimizing Live Plant Cover

NRCS Fact Sheet

Introduction

NRCS supports the implementation of agricultural practices to optimize nutrient and water use by crops, protect water and air quality, and enhances the soil upon which food production depends. Producers can implement a system of conservation practices which work together to reduce soil disturbance (i.e. tillage) and maximize live plants in the soil. These systems can increase carbon storage in the plants and soil, while also enhancing agricultural resilience and adaption to climate change on farms across the country. Crop rotation is a key practice for these systems.

Creating Crop Rotations

In a cropping system, each crop is planted, grown, and harvested often leaving a period of time when the soil is not occupied by living plants. Creating a climate-smart cropping sequence to optimize live plant cover means diversifying crop type and number. Conservation crop rotations are a scheduled sequence of crops grown in combination with other annual crops, or with perennials, intermediate crops, or cover crops. Benefits can include:

- Reduced pressure from weeds, insects, parasitic nematodes, and plant diseases when using crop rotations compared to monocultures.
- Adding forage crops and short-term perennials into the rotation provides crop diversity and increases the amount of time there is live plant cover on the soil.
- When legumes are part of the crop rotation, nitrogen is supplied to the succeeding crop.

Increasing Diversity in Crop Rotations

Rotations can be simple, (e.g., corn followed by soybeans) or very complex including more crop types and a longer duration. Increasing the crop rotation diversity provides opportunities to integrate planting that optimizes live plant cover. When the rotation length increases, soil protection from wind and water erosion is extended while also increasing soil organic matter.

Table 1 shows that adding cover crops to a simple row crop rotation can add diversity. Cover crop is the most widely utilized NRCS conservation practice for conserving and improving soil health in annual crop production.

Cover crops are annual plants that are planted before or after cash crops. Cover crops provide multiple benefits to soil health and may also increase the yield of cash crops. Cover cropping can also help maintain or improve the quality of surface and groundwater, prevent soil erosion, suppress weeds, and break pest cycles.

Conservation crop rotation diversity is increased when row crops, close grown crops (drilled or broadcast) or perennial crops are included in the system as shown in Table 1. Crops such as winter wheat, and intermediate oilseed crops such as camelina, carinata, and domesticated pennycress can be planted following the first cash crop. Short-term perennial legumes, grasses, and small grains are commonly grown for two to five years of the crop rotation. Benefits of perennials in a cropping system result from the reduction in soil disturbance that lessens organic matter depletion while the biomass above and below ground build soil physical properties such as soil structure and aggregate stability.

Learn More about Conservation Crop Rotation and Cover Crop at NRCS

The Natural Resources Conservation Service (NRCS) and its partners provide financial and technical assistance for producers and landowners to restore, enhance, and preserve the Nation's productive landscapes and natural resources.

Find your local USDA Service Center at farmers.gov/working-with-us/USDAservice-centers.

A more diverse conservation crop rotation may provide similar conservation benefits as a cover crop provides while also adding the potential for additional cash crops. In a recent Conservation Effects Assessment Program report, conservation rop rotations with a minimum of two harvested crop types were compared to crop rotations which included cover crops that were terminated. Both rotations showed uniform benefits across the landscape, neither clearly dominated the other. Both rotations showed significant impacts on reducing sediment and nutrient losses on cultivated cropland. Both can be very effective as a conservation measure.

Crop Rotation Diversity	CROP YEAR A		CROP YEAR B	
Simple	Crop 1- Annual, Harvest	Cover Crop, Annual Terminal	Crop 2- Annual, Harvest	
Enhanced (grain)	Crop 1- Annual, Harvest	Crop 2- Winter Annual, Planting	Crop 2- Winter Annual, Harvest	Crop 3- Double Crop or Cover Crop, Annual Terminal
Enhanced (intermediate oilseed)	Crop 1- Annual, Harvest	Crop 2- Winter Annual, Planting	Crop 2- Winter Annual, Harvest OR Crop 2- Spring Annual, Harvest	Cover Crop, Annual Terminal
Enhanced (perennial)	Crop 1- Annual, Harvest	Crop 2- Perennial, Establish	Crop 2- Perennial	Crop 2- Perennial, Continues into Crop Years C and D

Table 1 Crop Rotation Examples Simple and Enhanced Diversity

Is any crop planted as a second crop in a conservation crop rotation considered a cover crop?

All plant species provide cover as they emerge, grow, develop leaves or blades which provide the protective canopy that is the function of a cover crop. When an annual crop is harvested, there is an opportunity to plant:

- Cover Crop- Planting an annual plant species for seasonal vegetation providing cover and improving the natural resource condition. Cover cropping is considered by USDA Risk Management Agency (RMA) to be a Good Farming Practice when growers follow the NRCS Conservation Practice Standard Cover Crop (340) and the NRCS Termination Guidelines.
- Double Crop- Producing at least 2 crops for harvest from the same acreage in the same crop year. This does not include cover crops that have been managed and terminated following the NRCS Conservation Practice Standard Cover Crop (340) and the NRCS Termination Guidelines.
- Relay Crop- The practice of interseeding a second crop into the first crop well before the first crop is harvested. The relay cropping strategy is used to enable production of a second crop in areas where time for seeding the second crop following harvest of the first is considered inadequate for double cropping. This is not considered a cover cropping practice, but a method of double cropping and may fall under the RMA first crop-second crop rules.
- Winter Annual Cash Crop- Winter annuals are generally planted in early fall and germinate and grow in the fall. Winter growth may be slow or dormant until spring. In the spring, the plants grow, flowers and set seed. Harvest of grain or seed occurs in early to mid-summer. Examples of winter annual cash crops include small grains, such as winter wheat, and intermediate oilseed crops such as camelina, carinata, and domesticated pennycress.

When would you include a cover crop in a conservation crop rotation?

A conservation crop rotation is a minimum of two different crop types grown on the same footprint according to a schedule. Include a cover crop in a conservation crop rotation when:

- Crop residue cover or distribution can be improved for conservation benefits.
- No other cash crop or crop intended for harvest is planned in the crop rotation.
- Live plant material above and below ground is needed to build soil health.