NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

CONSERVATION CROP ROTATION
(Ac.)
CODE 328

DEFINITION

Growing crops in a planned sequence on the same field.

PURPOSE

This practice may be applied to support one or more of the following:

- Reduce sheet-and-rill or wind erosion.
- Improve soil quality.
- Manage the balance of plant nutrients.
- Increase cropping system diversity
- Manage crop consumptive use of water.
- Manage saline seeps.
- Manage plant pests (weeds, insects, and diseases).
- Provide food for domestic livestock.
- Provide food and cover for wildlife, including pollinator forage, cover, and nesting.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land where annually-planted crops make up at least one-third of the crop sequence.

For the purposes of this practice, a cover crop is considered a crop in the rotation.

CRITERIA

General Criteria Applicable to All Purposes

Crops shall be grown in a planned sequence as outlined in Plans and Specifications.

The crops grown shall produce a positive Organic Matter (OM) subfactor value over the life of the rotation, as determined by the Soil Conditioning Index procedure, with appropriate adjustments for additions to or subtractions from biomass on the field.

Additional Criteria to Reduce Water or Wind Erosion

The selected crops and the planned sequence shall produce sufficient quantities of biomass or crop residue at the appropriate times so that, when accounting for other practices in the management system, sheet and rill and/or wind erosion is reduced to the planned soil loss objective for the planning area.

The amount of biomass or crop residue needed shall be determined using current approved erosion prediction technology.

Additional Criteria to Improve Soil Quality

Fallow years shall not occupy more than 25% of the planned crop sequence. (For this practice, “fallow year” means a time that cropland is uncropped during a growing season, and on which vegetative growth is controlled by tillage or herbicides.)

The planned crop sequence will contain different crop types as specified below [crop types are: warm season grass (WSG); warm season broadleaf (WSB); cool season grass (CSG); cool season broadleaf (CSB)]:

- A two-crop sequence must contain a warm season and a cool season crop;
- A three-crop sequence must contain a warm season and a cool season crop, neither of which may be grown in consecutive years;
- A four-crop sequence must contain two different crop types, neither of which may occupy more than half of the sequence.
- Longer crop sequences may have more than two consecutive years of the same crop type, as long as that crop type does not occupy more than • of the crop rotation.

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In tropical regions or regions with distinct wet and dry seasons (Mediterranean climate), alternate grass crops with broadleaf crops.

See table 1 for a list of crop types.

Additional Criteria to Manage the Balance of Plant Nutrients

Crop selection and sequence shall be determined using an approved nutrient balance procedure.

When crop rotations are designed to add nitrogen to the system, nitrogen-fixing crops shall be grown immediately prior to or interplanted with nitrogen-depleting crops.

To reduce excess nutrients in the soil profile, use crops with:

- quick germination and root system formation,
- a rooting depth sufficient to reach the nutrients not removed by the previous crop, and
- nutrient requirements such that they can readily utilize the excess nutrients.

Additional Criteria to Manage Crop Consumptive Use of Water

Select crops and varieties and the sequence of crops on local climate potential and/or irrigation water availability, and an approved water balance procedure.

Additional Criteria to Manage Saline Seeps

Select crops to be grown in the recharge area of saline seeps that have rooting depths and water requirements adequate to fully utilize all plant available soil water. Do not use summer fallow. Crop selection and sequence shall be determined using an approved water balance procedure.

If excess subsoil moisture exists below the rooting depth of crops commonly grown in the recharge area, deep-rooted perennial crops shall be established for the number of years needed to dry the soil profile.

Crops grown in the discharge area of saline seeps shall be selected for their tolerance to salinity levels in the discharge area.

Additional Criteria to Manage Plant Pests (Weeds, Insects, Diseases)

Design the crop sequence to break pest lifecycles and/or to allow for the use of a variety of control methods.

Remove susceptible crops and alternate host crops from the rotation for the period of time needed to break the life cycle of the targeted pest.

Resistant varieties, listed in University of Minnesota publications or other approved sources, shall be selected where there is a history of a pest problem.

Additional Criteria to Provide Food for Domestic Livestock

Select crops that balance the feed supply with livestock numbers. Determine the required amount of selected crops using an approved forage-livestock balance procedure.

Additional Criteria to Provide Food and Cover for Wildlife

Select the crops and crop management activities that provide either food or cover for the targeted wildlife species using an approved habitat evaluation procedure.

Additional Criteria for Designing Organic Crop Rotations

Include at least one forage legume in the organic crop rotation.

Ensure a balance of cash crops and soil protecting cover crops.

Alternate between crops with high root biomass (such as fall rye) and low root biomass (such as oats) to improve soil structure and stimulate growth of soil organisms.

Alternate weed suppressive crops with crops that are poor competitors with weeds.

Include biennials or perennials within the rotation.

CONSIDERATIONS

Maximize crop diversity as much as possible within the environmental and economic constraints of your region.

When used in combination with Stripcropping (practice code 585), the crop sequence should be consistent with the stripcropping design.

Soil compaction can be reduced by adjusting crop rotations to include deep rooted crops that are able to extend to and penetrate the compacted soil layers.

Where improving water use efficiency on deep soils is a concern, rotating or combining deep-rooted crops with shallow rooted crops can help utilize all available water in the soil profile.

Where pesticides are used, use a combination of pesticide application methods and crop rotation to reduce the potential for pesticide carryover or adverse affects on aquatic wildlife or habitat through runoff.

Additional Considerations to Reduce Sheet and Rill or Wind Erosion.

When used in combination with the Residue and Tillage Management practices (practice codes 329, 345, and 346), selection of high-residue producing crops and varieties, use of cover crops and adjustment of plant population and row spacing can enhance production of the kind, amount, and distribution of residue needed.

Crop damage by wind erosion can be reduced with this practice by selecting crops that are tolerant to abrasion from windblown soil or tolerant to high wind velocity.

If crops sensitive to wind erosion damage are grown, the potential for plant damage can be reduced by crop residue management, field windbreaks, herbaceous wind barriers, intercropping, or other methods of wind erosion control.

Additional Considerations to Improve Soil Quality

Soil organic matter levels are more sensitive to tillage than to long rotations with perennial vegetation. Therefore, reducing or eliminating tillage from a management system will increase soil organic matter quicker than rotations with several years of perennial vegetation.

The effects of this practice can be enhanced by utilizing animal wastes or applying mulches to supplement the biomass produced by crops in the rotation.

Additional Considerations to Manage Plant Pests

Include a sod crop in the rotation and leave this crop for at least two years to control perennial weeds.

Include allelopathic crops that have natural weed germination inhibitors in the rotation.

Grow mixed hay stands, fall rye or buckwheat to choke out persistent annual weeds.

Additional Considerations for Wildlife, Beneficial Insects, and Pollinators

Crop residues may be a valuable food source for wintering wildlife where winter browse is sparse. Leaving several rows unharvested around the edges of the field, or planting borders of various forbs will provide protection and/or food for overwintering wildlife and for beneficial insects and pollinators.

Crop plantings may be developed to benefit particular communities, species or life stages of wildlife. Food plots or crops for wildlife could be provided as part of a habitat restoration project as an initial food and cover source for wildlife until food and cover producing vegetation becomes established.

Retaining bolting or flowering crops for some time after harvest may provide beneficial insects with an important nectar source when and where pests are active.

Biological control of various crop pests can be provided by:

- crop rotations that include forbs such as buckwheat or *Phacelia;*
- the use of insectory field borders, and
- intercropping of species that provide forage and nesting resources for beneficial insects.

Careful consideration should be given to pesticide use if applied to crops raised for wildlife, particularly if nesting habitat or pollinator forage species are present.

When insect-pollinated crops are part of the rotation, planting them no more than 800 feet from their previous location may help maintain local populations of native bees that have become established because of the presence of that crop.

To maintain stable pollinator and beneficial insect populations, ensure that the same overall density of floral resources is maintained from year-to-year. For example two years of flower-rich plantings, followed by a year of only grasses, will cause a rapid decline in pollinator populations. Such a scenario is undesirable.

Additional Considerations for Organic Rotations

Consider the labor requirements and timing of field operations for each potential crop in the rotation to avoid labor bottlenecks during the growing season.

Inclusion of livestock in the farming system or cooperation with neighboring farms in supplying feed for livestock can increase options for diversification in the rotation.

When making a change from conventional to organic farming, the best crops to start the crop rotation with are pasture, a hay crop or annual legume. Buckwheat, as a green manure crop, provides excellent weed control and improves soil structure in cash crop rotations.

PLANS AND SPECIFICATIONS

Plans and specifications shall include:

- field number and acres
- purpose(s) of the crop rotation
- the sequence of crops to be grown,
- the crop types to be grown
- length of time each crop/crop type will be grown in the rotation, and
- total length of rotation

Specifications shall be recorded using approved specification sheets, job sheets, narrative statements in the conservation plan, or other acceptable documentation.

OPERATION AND MAINTENANCE

Rotations shall provide for acceptable substitute crops in case of crop failure or shift in planting intentions for weather related or economic reasons. Acceptable substitutes are crops having similar properties that will accomplish the purpose of the original crop.

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Table 1. Crop Types

Cool Season Grass (CSG)	Warm Season Grass (WSG)	Cool Season Broadleaf (CSB)	Warm Season Broadleaf (WSB)
Barley	Corn	Alfalfa	Amaranth
Durum wheat	Sorghum	Clovers	Buckwheat
Oats	Sudangrass	Canola	Chickpea
Spring Wheat	Millet	Crambe	Dry Edible beans
Winter Wheat	Sweet Corn	Field pea	Potatoes
Winter Rye	Corn silage	Flax	Safflower
		Lentils	Sunflower
		Lupine	Soybean
		Mustard	
		Sugarbeets	
Cool Season Vegetables	**Warm Season Vegetables**		
Asparagus	Bush beans		
Beets	Pole beans		
Broccoli	Lima beans		
Brussel sprouts	Cantaloupe		
Cabbage	Cucumber		
Cauliflower	Eggplant		
Carrots	Okra		
Celery	Peppers		
Horseradish	Pumpkins		
Kohl rabi	Summer squash		
Onions	Snap beans		
Parsnip	Sweet potatoes		
Peas	Tomatoes		
Spinach	Watermelon		
Turnips	Zucchini		
Lettuce	Snap beans		
Radish	Sweet potatoes		
Carrots	Tomatoes		
Mustard	Watermelon		
Horseradish	Zucchini		

Table 2. High Residue Producing Annual Crops

- Barley
- Buckwheat
- Cereal Rye
- Corn (grain)
- Flax
- Millet
- Oats
- Popcorn
- Sorghum
- Sorghum/Sudangrass
- Spring Wheat
- Triticale
- Winter Wheat

All other annual crops are low residue crops.