Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

CONSERVATION CROP ROTATION

CODE 328

(ac)

DEFINITION

A planned sequence of crops grown on the same ground over a period of time (i.e. the rotation cycle).

PURPOSE

This practice is applied to support one or more of the following purposes:

- Reduce sheet, rill and wind erosion
- Maintain or increase soil health and organic matter content
- Reduce water quality degradation due to excess nutrients
- Improve soil moisture efficiency
- Reduce the concentration of salts and other chemicals from saline seeps
- Reduce plant pest pressures
- Provide feed and forage for domestic livestock
- Provide food and cover habitat for wildlife, including pollinator forage, and nesting

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland where at least one annually-planted crop is included in the crop rotation.

CRITERIA

General Criteria Applicable to All Purposes

Crops shall be grown in a planned sequence as outlined in Plans and Specifications. The crop rotation shall include a minimum of two different crops. For purposes of these criteria a cover crop is considered a different crop.

Where applicable, plan suitable crop substitutions when the planned crop cannot be planted due to weather, soil conditions, or other local situations.

Additional Criteria to Reduce Sheet, Rill and Wind Erosion

Select crops, a tillage system, and cropping sequences that will produce sufficient and timely quantities of biomass or crop residue which, in conjunction with other practices in the management system, will reduce sheet, rill and wind erosion to the planned soil loss objective.

Determine the amount of biomass or crop residue needed by using current approved erosion prediction technology.

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at https://www.nrcs.usda.gov/ and type FOTG in the search field.

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Additional Criteria to Maintain or Increase Soil Health and Organic Matter Content

Grow crops that will produce a positive trend compared to the benchmark crop rotation in the Organic Matter (OM) subfactor value for the rotation period, as determined by the Soil Conditioning Index in RUSLE 2. Make appropriate adjustments for additions to or subtractions from biomass. To calculate an accurate SCI for the planned crop rotation, it must be reasonable in terms of length and crop field operations, and must consider the management capabilities of the producer.

Additional Criteria to Reduce Water Quality Degradation Due to Excess Nutrients

To recover excess nutrients from 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 that readily utilize the excess nutrients.
- Credit nutrients provided by legumes and manure/compost.

Additional Criteria to Improve Soil Moisture Efficiency

Select crops, varieties of crops, and the sequence of crops based on local climate patterns, soil conditions, irrigation water availability, and an approved water balance procedure.

Additional Criteria to Reduce the Concentration of Salts and Other Chemicals from 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 available soil water. Do not use summer fallow. Use an approved water balance procedure to determine crop selection and sequence.

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

Select crops with a tolerance to salinity levels that matches the salinity of the discharge area.

Additional Criteria to Reduce Plant Pest Pressures

Design the crop sequence to suppress the pest(s) lifecycle of concern, which may include weeds, insects, and pathogens. Use land grant university or industry standards to determine a suitable crop sequence.

Additional Criteria to Provide Feed and Forage 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 Habitat for Wildlife, Including Pollinator Forage, and Nesting

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

CONSIDERATIONS

When used in combination with NRCS Conservation Practice (CPS) Stripcropping (Code 585), the crop sequence should be consistent with the stripcropping design.

Soil compaction can be reduced by adjusting crop rotations to include deep rooting crops with deep roots that extend to and penetrate 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.

Select crops that have the potential to provide larger amounts of biologically fixed nitrogen.

Considerations to Reduce Water Quality Degradation Due to Excess Nutrients:

- Include perennial or annual legume crops in the rotation to provide nitrogen for the non-legume crops, especially in fields where manure applications are restricted by high or excessive soil phosphorus or potassium levels.
- Use carbon/nitrogen ratio of 25:1 to 35:1 crop residues returned to the soil throughout the rotation. This ratio can build the soil's capacity to provide slow- release N to crops while minimizing N leaching.

Considerations to Increase Cropping System Diversity

Minimize the fallow years in the rotation and where the climate and soils are favorable establish cover crops during the fallow periods.

For crop diversity, the planned crop sequence should contain different crop types; for example a mix of the following: warm season grass; warm season broadleaf; cool season grass; cool season broadleaf.

- A two-crop sequence that contains a warm season and a cool season crop;
- A three-crop sequence that contains warm and cool season crops. The same crop species should not be grown in successive years in the same field.
- A four-crop sequence that contains two different crop types, neither should occupy more than half of the sequence;
- Longer crop sequences (four or more years) are more effective with no more than two consecutive years with the same crop;
- In tropical regions or regions with distinct wet and dry seasons (Mediterranean climate), grass crops should alternate with broadleaf crops.

Additional Considerations to Reduce Sheet and Rill or Wind Erosion

When used in combination with NRCS CPSs for Residue and Tillage Management (Codes 329 and 345), selection of high-residue producing crops and varieties, use of cover crops and adjustment of plant density and row spacing can enhance production of the kind, amount, and distribution of residue needed.

When used in combination with NRCS CPSs Stripcropping (Code 585) or Contour Buffer Strips (Code 332) on steeper slopes, the effectiveness of each practice is significantly enhanced by inclusion of the other practice(s) in the conservation system.

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 Health

Consider including perennial sod crops with deep or extensive fibrous root systems to build organic matter throughout the soil profile.

In semiarid regions, where seasonal fallow is often used to store moisture in the soil for a subsequent crop, consider leaving sufficient residues to protect the soil surface during fallow, or growing a shallow-rooted cover crop that allows deep moisture storage. Reduce the intensity of tillage and increase soil surface coverage with vegetation and crop residues.

The effects of this practice can be enhanced by utilizing animal wastes, green manure crops (cover crops), or applying non-synthetic mulches to supplement the biomass produced by crops in the rotation.

Other considerations for soil health/organic matter management include:

- For at least one-third of the crop sequence (time basis) include high- biomass annual or perennial crops.
- Utilize cover crops and high residue production crops comprising at least one-half of the rotation sequence.
- For rotations dominated by low- residue crops, such as vegetables, include sufficient cover crops and high residue crops for one-half the rotation.

Additional Considerations to Reduce Plant Pest Pressures

Consider lengthening the rotation to include several years of perennial cover to break pest life cycles.

Use a mix of crops from at least three different plant families, and allow three years or longer between successive plantings of production crops within the same family.

Enhance biological pest control by designing the crop rotation to:

- Include flowering annuals or perennials that provide food and habitat for beneficial insects, such as buckwheat, clovers, or Phacelia.
- Include plant species that release into the soil natural substances that suppress plant pathogens, nematodes or pests (biofumigation).
- Include crops in the rotation that provide habitat for natural enemies of pests.
- Retain bolting or flowering crops after harvest to provide food for beneficial insects.

Additional Considerations to Provide Food and Cover Habitat for Wildlife, Including Pollinator Forage, and Nesting

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 can provide part of a habitat restoration, an initial food and cover for wildlife until food and cover producing vegetation becomes established.

Retaining bolting or flowering crops after harvest may provide beneficial insects with an important food source.

Careful consideration should be given to pesticides 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 the insect-pollinated crop 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.

PLANS AND SPECIFICATIONS

Develop plans and specifications for each field or treatment unit according to the Criteria and Operation and Maintenance requirements of this standard. Specifications shall describe the requirements to apply this practice to achieve the intended purpose. Record the following specification components in an

approved Conservation Crop Rotation, 328, Implementation Requirements document. The following items will be documented as a minimum.

- Field number and acres,
- Purpose(s) of the crop rotation,
- The sequence of crops to be grown,
- The crop types to be grown,
- Tillage type and times,
- Length of time each crop/crop type will be grown in the rotation, and
- Total length of rotation
- Suitable crop substitutions to address weather, soil conditions, market, or other situations that may prevent the planned crop from being planted.

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.

Evaluate the rotation and the crop sequence to determine if the planned system is meeting the planned purposes.

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