NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

CONSERVATION CROP ROTATION

(Acre)

CODE 328

DEFINITION

Growing crops in a recurring sequence on the same field.

PURPOSES

This practice may be applied as part of a conservation management system to support one or more of the following:

* Reduce sheet and rill erosion.
* Reduce irrigation induced erosion.
* Reduce soil erosion from wind.
* Maintain or improve soil organic matter content.
* Manage the balance of plant nutrients.
* Improve water use efficiency.
* Manage saline seeps.
* Manage plant pests (weeds, insects, and diseases).
* Provide food for domestic livestock.
* Provide food and cover for wildlife.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland and other land where crops are grown.

This standard does not apply to pastureland, hayland, or other land uses where annual row or close growing crops are grown occasionally only to facilitate renovation or reestablishment of perennial vegetation. It does not apply to land devoted to orchards, vineyards, or nurseries.

CRITERIA

General Criteria Applicable To All Purposes Named Above

Crops shall be grown in a planned, recurring sequence except as outlined in Plans and Spe cifications.

Crops shall be adapted to the climatic region and the soil resource. Irrigated crops need to be adapted to the water resource.

A conservation crop rotation may include crops planted for cover or nutrient enhancement.

Additional Criteria to Reduce Sheet and Rill Erosion

Crops shall be selected that produce enough above and below ground plant biomass to control erosion within the soil loss tolerance (T) or any other planned soil loss objective.

The amount of biomass needed shall be determined using current approved erosion prediction technology. Where needed, cover crop should be considered to increase biomass (see Cover Crop 340)

Calculations shall account for the effects of other practices in the conservation management system.

Additional Criteria to Reduce Irrigation Induced Erosion

When plants are used to reduce erosion induced by furrow irrigation, crops or cover crops shall be selected that are grown within the wetted perimeter of the furrow, or which produce the amount of residue needed to be maintained in the furrow to achieve the soil loss objective unless effective chemical additives will be used. The amount of residue needed shall be determined by approved research.

NRCS, CA
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To reduce erosion induced by sprinkler irrigation, crops or cover crops shall be selected that develop surface cover or canopy rapidly, or that produce the amount of residue needed to be maintained on the soil surface to achieve the soil loss objective. The amount of residue needed shall be determined by approved research.

Additional Criteria to Reduce Soil Erosion from Wind

Crops shall be selected that in combination with any residues produce biomass in amounts adequate, and at the appropriate time, to control erosion to within the soil loss tolerance (T) or other planned soil loss objective.

The amount of biomass needed shall be determined using current approved wind erosion prediction technology. Calculations shall account for the effects of other practices in the conservation management system. Where needed, cover crop should be considered to increase biomass (see Cover Crop 340)

Additional Criteria To Maintain Or Improve Soil Organic Matter Content

Crops shall be selected that produce the amount of plant biomass needed to maintain soil organic matter content, as determined using the current approved Soil Conditioning Index Procedure.

If partial removal of residue by means such as baling or grazing occurs, enough residue shall be maintained to achieve the desired soil organic matter content goal.

Cover and green manure crops planted specifically for soil improvement may be grazed, as long as grazing is managed to retain adequate biomass.

Additional Criteria to Manage Deficient or Excess Plant Nutrients

Nutrient Management (590) will be used to avoid accumulation of excess nutrients.

Irrigation water management (449) will be used to limit deep percolation of water under irrigated conditions.

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 deep leaching of excess nutrients, crops or cover crops having rooting depths and nutrient requirements that utilize the excess nutrients may be grown.

Additional Criteria to Improve Water Use Efficiency

For non-irrigated conditions, selection of crops and varieties, sequence of crops, or the annual decision to plant a crop or to fallow, shall be based on an approved water balance procedure.

For irrigated fields, irrigation water management (practice 449) or crop selection will be used to reduce gross or net water requirements.

Additional Criteria to Manage Saline Seeps

Crops grown in the recharge area of saline seeps shall be selected for rooting depths and water requirements adequate to fully utilize all plant available soil water. Summer fallow will not be used. Crop selection and sequence shall be based on 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 included in the rotation, where feasible.

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)

Crops shall be alternated to break the pest cycle and/or allow for the use of a variety of other control methods or pesticides when compatible with IPM principles. Affected crops and alternate host crops shall be removed from the rotation for the period of time needed to break the life cycle of the targeted pest.

Resistant varieties, listed in appropriate university publications or other approved sources, shall be selected where there is a history or pest problems.

Additional Criteria to Provide Food for Domestic Livestock

Crops shall be selected to balance the feed supply with livestock numbers. The needed amount of selected

crops shall be determined using an approved forage-livestock balance procedure.

Additional Criteria to Provide Food and Cover for Wildlife

Crop selection shall be determined using an approved habitat evaluation procedure.

CONSIDERATIONS

When used in combination with CROSS WIND STRIPCROPPING (589B) or STRIPCROPPING CONTOUR (585), the crop sequence should be consistent with the stripcropping design.

When used in combination with RESIDUE MANAGEMENT practices, 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.

Where sheet and rill erosion is a concern, providing close growing field crops during the rainy season and maintaining and managing residue on the surface from previous crops are effective ways of treating this problem. Supporting practices are contour farming; stripcropping, contour; and vegetative buffer strips.

Where erosion induced by furrow irrigation is a concern, irrigating only alternate furrows may reduce the erosion hazard and provide better soil aeration. Also consider use of PAM in the irrigation water. Cover crops, mulching, fast growing crops and residue management can also reduce erosion losses. Long-term solutions require higher amounts of high residue crops in the rotation and/or applications of manure or other carbonaceous material. Gypsum usually has a positive effect where dispersion is created from an imbalance of Ca-Na-Mg.

Where erosion induced by sprinkler irrigation is a concern, the hazard can be reduced by basin tillage (dammer-diker), contour farming, contour stripcropping, or residue management.

Where soil erosion from wind is a concern, providing close growing field crops during the windy seasons and maintaining residue on the surface from previous crops are effective ways of treating this problem in non-irrigated areas. Providing moisture from irrigation and normal tillage and cropping practice significantly reduces wind erosion losses on most irrigated soils. Some of the more erosive sandy soils need protective crops that are actively growing during the windy season. Avoid leaving land in a smooth, dry, pulverized condition especially during the windy season. Supporting practices are windbreaks, cross wind strip cropping, cross wind ridges, cross wind trap strips, and surface roughening.

Crop damage by wind erosion can be reduced by this practice by selecting crops that are tolerant to abrasion from wind blown 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.

Where maintaining or improving soil organic matter content is an objective, the effects of this practice can be enhanced by managing crop residues, utilizing animal wastes, or applying mulches to supplement the biomass produced by crops in the rotation. Not burning residues, using high residue grain crops, and adding manure's or composts are also methods used to maintain or improve organic matter. The organic matter cycling rate increases when soils are well aerated, have hot aridic climatic conditions and adequate to high nitrogen levels. This prevents OM levels from increasing beyond a set level that is normal for the soil. The attainable organic matter levels to manage for under cultivation should correspond to those normal for the soil in its native state unless the natural soil was developed under saturated or wet conditions, then the OM level to manage for would be less if the soil is now well aerated. Intensively managed row crop rotations where nutrient levels, aeration and temperatures are high should be based on monitoring of OM levels and soil structure as these rotations need more high residue crops or manure's than the Soil Condition Index Procedure indicates due to the faster OM cycling rate.

Where excess plant nutrients or soil contaminants are a concern, rotating deep rooted crops or cover crops with shallow rooted crops can help recover the nutrient or contaminant from the soil profile. It is always preferable to apply sound nutrient management practices (practice 590) to avoid accumulating or placing excess nutrients in the soil. Using green manure crops, legumes in the rotation, composts, manure and commercial fertilizers are effective ways to increase low nutrient levels. Water management practices should be evaluated to determine if leaching is a problem, especially with shallow rooted crops. Waste utilization, nutrient management and irrigation water management are supporting practices.

Where precipitation is limited, seasonal or erratic, moisture can be conserved for crop use by maintaining crop residues on the soil surface to increase infiltration and to reduce runoff and evaporation. Where winter precipitation occurs as snow additional moisture can be obtained for crop use by trapping snow with standing residue, windbreaks, or other barriers.

Where improving water use efficiency on deep soils is a concern, rotating deep-rooted crops with shallow rooted crops can help utilize all available water in the soil profile. Where water is limited in irrigated areas, consider the amount of water the crop needs, salt tolerance of the crop, salt levels managed for season of use and efficiency and management of the irrigation system. Utilize cooler season plants in the rotation that use rainfall and are mature before the high water use season arrives. In selecting cover crops in the rotation, the shorter more drought tolerant species can be used that can survive on rainfall alone. Some crops such as alfalfa can be managed for seed, which uses about a third less water than if managed for hay.

Soil compaction can be reduced by this practice when rotations including deep rooted crops (able to extend to and penetrate the compacted soil layers) are used in combination with deep tillage, controlled traffic, or management of grazing animals to prevent, or breakup, compacted layers. In irrigated areas that are contributing to saline seeps or to a water table the crops selected should be able to utilize deep water and intercept losses before they become a problem offsite. Alfalfa and safflower are examples of crops used in strips or fields to intercept lateral moving groundwater as well as deep rooted agroforestry tree plantings.

Crops in the rotation should be selected and managed to break the pest cycle, provide habitat for natural controls, be resistant or not affected by the pest and to reduce the effects of the pests. Cropping patterns with highly diversified crops and small areas vs. monocultures and large fields are conductive to better-integrated pest management.

Crops should be selected and managed to provide the quantity and quality of feed desired for the animals that will be using it. Aftermath can be grazed if compaction is controlled and erosion is prevented with no damage to growing crops.

Providing food and cover for wildlife will be consistent with landowner objectives and program requirements. Which crops are grown, where they are grown and how they are managed are key to providing food and cover for wildlife. The rotation can be managed to provide cover throughout the year, provide seasonal food or provide many other alternatives to meet the needs of the species and kind of wildlife being managed for.

Endangered Species Considerations

Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Some species are year-round residents in some streams, such as, freshwater shrimp. Other species, such as steelhead and salmon, utilize streams during various seasons. Be aware that during critical periods, such as spawning, eggs in gravels, and rearing of young may preclude activities in the stream that may directly affect the stream habitat during those periods. For example there should be no disturbance of stream gravel beds that may have eggs in them. That could include any equipment in the stream or even walking in the stream or work upstream that may result in sediment depositing in the gravel beds. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Water Quantity

1. Effects of increasing organic matter on water holding capacity of the soil.

2. Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation and groundwater recharge.

Water Quality

1. Effects of both growing and decaying vegetation on nutrient balance in the root zone.

2. Effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that could be carried by runoff.

3. Effects on the use and management of nutrients and pesticides and their effect on surface and ground water quality.

PLANS AND SPECIFICATIONS

Specifications are to be prepared for each field or treatment unit according to the Criteria, Considerations, and Operations and Maintenance sections and include the sequence of crops to be grown, length of time each crop will be grown, and total length of the rotation.

Specifications shall be recorded using approved specification sheets, job sheets, 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 meet the criteria for all the resource concerns identified for the field or treatment unit.

REFERENCES