



CONSERVATION ENHANCEMENT ACTIVITY

E328I

CONSERVATION STEWARDSHIP PROGRAM

Forage harvest to reduce water quality impacts by utilization of excess soil nutrients

Conservation Practice 328: Conservation Crop Rotation

APPLICABLE LAND USE: Crop (Annual & Mixed); Crop (Perennial)

RESOURCE CONCERN: Water

ENHANCEMENT LIFE SPAN: 1 Year

Enhancement Description

Establish a forage crop (single species or mix) following a primary annual crop to take up excess soil nutrients. Select forage known to effectively utilize and scavenge nutrients. Forage shall be harvested for forage, but not be grazed or burned.

Criteria

- This enhancement is applicable on fields where excess soil nutrients cause or increase water quality degradation concerns. Presence of excess nutrients must be identified in recent soil tests or increased risk to water quality documented by risk assessment tool. **(Refer to state specific guidance of options to maximize nutrient uptake in local climate and cropping systems)**
- Forage species, seedbed preparation, seeding rates, seeding dates, seeding depths, fertility requirements, and planting methods will be consistent with applicable local criteria and soil/site conditions. **(Refer to state specific lists of forage crops known to effectively utilize and scavenge nutrients)**
- Select forage crop (single species or mix of two or more species) and planting dates which will not compete with the other crop(s) yield or harvest. ***If legumes are part of the forage mix, consider that this may add nutrients to the system.***

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- Select forage crop that is compatible with other components of the crop rotation and for its ability to efficiently scavenge and utilize excess soil nutrients, specifically nitrogen or phosphorous, whichever is identified as a potential risk to water quality. Nutrient uptake only occurs when a crop is actively growing. Therefore, it is imperative that the crops in rotation be planted as soon as possible after forage crop harvest (hay/balage/haylage/etc.) to maximize nutrient cycling and minimize offsite transport of nutrients.
- Determine method and timing of forage crop harvest to meet client objectives. Harvest the forage crop as late as practical to maximize plant biomass production and nutrient uptake.
- Ensure any herbicides used in the crop rotation are compatible with forage crop selections.
- Do not burn forage or residue.
- Do not graze forage crop.
- Reduce or maintain soil erosion from water and wind to below soil tolerance (T) level (average annual soil loss).



Documentation and Implementation Requirements

Participant will:

- Prior to implementation, provide NRCS with the current and planned crop rotation and field operation(s) used for each crop.

Document excess nutrients identified in soil tests. *Soil tests should be taken as close to production crop harvest as possible.*

Field	Soil Test Date	Nutrient (Nitrogen or Phosphorus)	Soil Test Nutrient Result (ppm or lbs/ac)

Current Management Rotation

Field	Current Crops (in sequence)	Planting Date	Harvest Date

Current Field Operations for Each Crop

Field	Crop	Field Operation	Timing of Field Operation (month/year)



Planned Management Rotation including Forage Crop

Field	Planned Crops/Forage Crop (in sequence)	Planting Date	Harvest Date

Planned Field Operations for Each Crop

Field	Crop	Field Operation	Timing of Field Operation (month/year)

Planned Forage Crop and Seeding Rate *(forage crop may be single species or mix of two or more species)*

Species	Variety	Seed Size	Typical Seeding Depth	Seeding Rate (PLS lbs/acre)	Percent of Mix (%)

Forage Crop Establishment and Management Considerations:

- Establish forage crop mix as soon as practical prior to or after harvest of the production crop.
- During implementation, forage crop must not be grazed or burned.
- During implementation, notify NRCS of any planned changes in forage crop mix or crop rotation, or management to verify the planned system meets the enhancement criteria.



- After implementation, if changes were made, update the tables above to document the applied crop rotation for the contract period and provide to NRCS.

After implementation, complete the table below and provide to NRCS

Task	Provide information and details
Seedbed Preparation	
Seeding Date	
Seeding Depth	
Seeding Method	
Fertilizer, as needed	
Weed Management, as needed	
Harvest Date (window)	
Harvest Method	

NRCS will:

- As needed, provide technical assistance in selecting forage crop for the crop rotation or substitute species that would meet the criteria of the enhancement. Forage crop may consist of a single species or mix of two or more species.
- As needed, provide additional assistance to the participant as requested.
- Prior to implementation, verify the enhancement is being planned on fields where excess soil nutrients cause or increase water quality degradation concerns. Presence of excess nutrients must be identified in recent soil tests or increased risk to water quality documented by risk assessment tool. **<REFER TO STATE SPECIFIC GUIDANCE>**
- Prior to implementation, use information provided from the participant to calculate the average annual soil erosion value (water and wind) for each field using NRCS erosion prediction technologies.

Benchmark Management Soil Loss = _____ tons/acre/year

Planned Management Soil Loss = _____ tons/acre/year

- During implementation, evaluate any planned changes in forage crop selected, timing in crop rotation, management, or field operations to verify the new system meets the enhancement criteria.



- After implementation, if there were any changes to planned rotation or management evaluate the applied crop rotation using information provided from the participant to calculate average annual erosion value to document that the applied rotation meets the enhancement criteria.

Applied Management Soil Loss = _____ tons/acre/year

NRCS Documentation Review:

I have reviewed all required participant documentation and have determined the participant has implemented the enhancement and met all criteria and requirements.

Participant Name _____ Contract Number _____

Total Amount Applied _____ Fiscal Year Completed _____

NRCS Technical Adequacy Signature

Date



SOUTH DAKOTA (SD) SUPPLEMENT TO CONSERVATION ENHANCEMENT ACTIVITY

CONSERVATION STEWARDSHIP PROGRAM

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Additional Criteria for SD:

In addition to the criteria specified in the national job sheet E328I, the following additional criteria apply in SD:

- For Nitrogen, if at least one-third of the field is determined to be high-risk using either the Ksat or SD Leaching Tool method identified in SD Agronomy Technical Note No. 17, Determining Potential Leaching Risk of SD Groundwater, then excess Nitrogen poses a risk to water quality.
<https://efotg.sc.egov.usda.gov/references/public/SD/AgronomyTechNote17.pdf>
- For Phosphorus, if recent soil test phosphorus levels are identified as Very High (greater than 21 ppm Bray-1 or 16 ppm Olsen) per SD Fertilizer Recommendations Guide EC 750 or a High-Risk determination has been made using the SD Phosphorus Loss Risk Assessment identified in SD Agronomy Technical Note. 18, Assessing the Risk of Phosphorus Loss to SD Surface Water Resources, then excess Phosphorus poses a risk to water quality.
https://efotg.sc.egov.usda.gov/references/public/SD/Agronomy_Technical_Note_18.pdf
- For Perennial Grass and Legume species, utilize the SD Rangeland Technical Note #4 and the SD-CPA-4 for seeding rates, seeding dates, fertility requirements, and planting methods.
- For Annual Forages, refer to the attached Cover Crop Table 1 for seeding depth, seeding rate, and seeding dates.



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- Forage crops suitable for hay/balage/haylage in SD include:

Perennial Grasses

Altai wildrye
Big bluestem
Canada wildrye
Creeping foxtail
Crested wheatgrass
Green needlegrass
Green wheatgrass
Indiangrass
Intermediate wheatgrass
Little bluestem
Meadow brome
Orchardgrass
Prairie sandreed
Pubescent wheatgrass
Reed canarygrass
Russian wildrye
Sideoat grama
Slender wheatgrass
Smooth brome
Tall wheatgrass
Timothy
Virginia wildrye
Western wheatgrass

Perennial/Biennial Legume

Alfalfa
Alsike clover
Birdsoot trefoil
Cicer milkvetch
Red clover
White clover

Annual Forage Crops

Annual Oregon ryegrass
Millet
Oats
Rye
Sorghum X Sudan Hybrid
Sudangrass
Triticale
Wheat
Teff



Table 1: Cover Crop - Common Species and Properties

Cover Crop	Full seeding rate lbs/acre/4	Seeding depth inches	Reduce erosion	Increase soil organic matter	S cavenge nutrients	Biological N fixation	Suppress weeds	Provide supplemental hay	Provide supplemental grazing	Rooting depth / Plant water use /1	Minimize / Reduce surface soil compaction	Minimize/ Reduce subsoil compaction	Seed size (Large or Fine)	Crop type and seeding dates /2 /3	Winter Survival	Salinity Tolerance	CN Ratio	Mycorrhizal fungi association	Seeds/lb	Shade Tolerance
Alfalfa	6.5	.25 - .75	G	G	G	Y	G	G	F	DH	G	G	F	CB	Y	P	L	M	210,000	F
Barley	50	.75 - 2.0	G	G	G	N	G	G	G	MM	G	F	L	CG	N	G	M	M	14,000	F
Brassica hybrids	7	.25 - .5	F	F	G	N	G	F	G	MM	G	G	F	CB	N	G	L	N	180,000	P
Buckwheat /5	50	.5 - 1.5	P	P	F	N	F	P	P	SL	F	P	L	WB	N	P	L	N	19,000	G
Cabbage, African	5	.25 - .75	F	F	G	N	F	F	F	MM	G	G	F	CB	N	G	L	N	180,000	F
Camelina, Winter	3	.25 - .5	F	F	F	N	P	P	P	ML	P	F	F	CB	S	P	L	N	400,000	P
Canola	5	.25 - .75	F	F	G	N	G	F	F	MM	G	G	F	CB	S	G	L	N	140,000	F
Clover, Balansa	5	.25 - .75	F	P	F	Y	P	P	F	SL	P	P	F	CB	N	P	L	M	500,000	F
Clover, Crimson	15	.25 - .75	F	F	F	Y	P	F	F	SM	P	P	F	CB	S	P	L	M	150,000	F
Clover, Red	5	.25 - .75	G	F	F	Y	F	F	F	SL	F	F	F	CB	Y	P	L	M	275,000	G
Clover, Sweet	4	.25 - 1.0	G	G	F	Y	G	F	F	MM	G	G	F	CB	Y	F	L	M	260,000	G
Collards or Kale	5	.25 - .5	F	F	G	N	G	F	G	MM	G	G	F	CB	N	G	L	N	175,000	F
Corn	12	1 - 1.5	G	G	G	N	G	F	G	DH	G	G	L	WG	N	P	H	H	2,500	F
Cowpeas or Dry Beans	30	1 - 1.5	P	F	F	Y	P	P	F	SL	F	F	L	WB	N	P	L	M	4,000	F
Fava beans	75	1 - 1.5	F	F	F	Y	F	G	G	DM	F	F	L	CB	N	F	L	P	2,500	P
Flax	30	.25 - .75	F	F	F	N	P	P	P	SM	F	P	F	CB	N	P	H	H	80,000	P
Lentils	30	1 - 1.5	P	P	P	Y	P	P	P	SL	P	P	F	CB	N	P	L	M	20,000	P
Millet, hay	15	.5 - 1.0	G	G	G	N	G	G	G	SL	G	F	F	WG	N	P	M	H	180,000	P
Millet, proso	25	.5 - 1.0	G	G	G	N	G	G	G	SL	G	F	F	WG	N	P	M	H	80,000	P
Mustard	6	.25 - .75	F	F	F	N	G	F	P	MH	G	F	F	CB	N	P	L	N	140,000	P
Oats	70	.5 - 1.5	G	G	G	N	G	G	G	MM	G	F	L	CG	N	F	M	H	16,000	F
Peas	70	1.5 - 3.0	F	P	P	Y	F	G	G	SL	F	F	L	CB	N	P	L	M	3,500	F
Phacelia	4	.25 - .5	F	F	F	N	P	P	P	DH	F	P	F	CB	N	P	L	M	225,000	F
Radishes	8	.25 - .75	F	F	G	N	G	P	G	DH	G	G	F	CB	N	P	L	N	25,000	P
Rapeseed	5	.25 - .75	F	F	G	N	G	F	G	MM	G	G	F	CB	Y	G	L	N	140,000	F
Rye, Cereal	60	.75 - 2.0	G	G	G	N	G	G	G	MH	G	G	L	CG	Y	G	H	M	18,000	G
Ryegrass, Annual	15	.5 - 1.5	G	G	G	N	F	G	G	MM	G	F	F	CG	S	F	M	M	190,000	G
Safflowers	30	.5 - 1.0	F	F	G	N	F	P	P	DM	F	G	L	WB	N	F	M	M	15,000	P
Sorghum, Forage and Sudan Hybrids	15	.5 - 1.5	G	G	G	N	G	G	G	MM	G	G	L	WG	N	F	M	H	17,000	P
Sorghum, Grain	5	.5 - 1.5	G	G	G	N	G	G	G	MM	G	G	L	WG	N	F	M	H	17,000	P
Soybeans	35	1 - 1.5	F	P	F	Y	F	F	F	SM	F	F	L	WB	N	P	L	M	3,000	F
Sudangrass	20	.5 - 1.5	G	G	G	N	G	G	G	MM	G	G	L	WG	N	F	M	H	25,000	P
Sugar beets	4	.25 - .5	F	P	G	N	F	P	G	DH	G	G	F	CB	N	G	L	N	22,000	P
Sunflowers	7	.5 - 1.0	F	F	G	N	F	P	G	DM	F	G	L	WB	N	F	M	M	8,000	P
Sunn hemp	15	1.5 - 2.0	F	F	F	Y	F	P	F	DM	F	F	L	WB	N	P	L	M	15,000	P
Teff grass	5	.13 - .25	G	G	F	N	F	G	G	SM	G	F	F	WG	N	P	M	H	1M	N
Triticale	60	.5 - 1.5	G	G	G	N	G	G	G	MH	G	F	L	CG	Y	G	M	M	15,000	F
Turnips	4	.25 - .5	F	P	G	N	G	P	G	DH	G	G	F	CB	S	P	L	N	175,000	P
Vetch, Chickling	50	.5 - 1.5	F	F	F	Y	F	F	P	SL	F	F	L	CB	N	P	L	M	2,500	F
Vetch, Common	25	.5 - 1.5	F	F	F	Y	F	F	G	SM	F	F	L	CB	N	P	L	M	8,000	F
Vetch, Hairy	15	.5 - 1.5	G	F	F	Y	F	F	F	SM	G	F	L	CB	Y	P	L	M	14,000	G
Wheat, Spring	60	.5 - 1.5	G	G	G	N	G	G	G	MH	G	F	L	CG	N	G	M	M	15,000	F
Wheat, Winter	60	.75 - 2.0	G	G	G	N	G	G	G	MH	G	F	L	CG	Y	G	M	M	15,000	F



/1 Rooting Depth/Water Use		/2 Crop types		Ratings		
SL=	Shallow rooted/Low water use	Shallow=	6 - 18 inches	CG = cool season grass	L= Low	G= Good
SM=	Shallow rooted/Medium water use	Medium=	18 - 24 inches	CB = cool season broadleaf	M= Medium	F= Fair
SH=	Shallow rooted/High water use	Deep=	24 + inches	WG = warm season grass	H= High	P= Poor
ML=	Medium rooted/Low water use			WB = warm season broadleaf	Y= Yes	
MM=	Medium rooted/Medium water use				N = No	
MH=	Medium rooted/High water use				S = Sporadic	
DL=	Deep rooted/Low water use				N/A= Not Applicable	
DM=	Deep rooted/Medium water use					
DH=	Deep rooted/High water use					
/3 Seeding Dates		/4 Full Seeding rates		/5 Buckwheat contamination		
May 1 through August 5 – warm season winter kill species		Multiply by the percent desired if mixtures are used.		To reduce chances of buckwheat contamination in wheat		
Early spring through August 20 – cool season winter kill species				do not rotate to wheat for grain for 2 years		
August 1 through Winter – species that do not winter kill						
Seeding dates fluctuate annually. Seeding dates may be adjusted up to 15 days by the District Conservationist, based on local weather and site conditions.						