

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

FORAGE HARVEST MANAGEMENT

(Acre)

CODE 511

DEFINITION

The timely cutting and removal of forages from the field as hay, greenchop, or ensilage.

PURPOSES

- Optimize the economic yield of forage at the desired levels
- Promote vigorous plant re-growth
- Maintain stand life
- Manage for the desired species composition
- Use forage plant biomass as a soil nutrient uptake tool
- Control insects, diseases, and weeds
- Maintain and/or improve wildlife habitat

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where machine harvested forage crops are grown.

CRITERIA

General Criteria Applicable to All Purposes

Forage will be harvested at a frequency and height that will maintain a desired healthy plant community through its life expectancy. The University of Minnesota Extension Service forage harvest recommendations based on state of maturity, moisture content, length of cut, stubble height and harvest interval should be used to meet the following criteria.

Stage of Maturity: Harvest forage at the stage of maturity that provides the desired quality and quantity.

When intended use is for livestock consumption, harvest at the maturity stage that maximizes digestible dry matter (DDM) yield. See Table 1.

Quality standards represent forage quality determined at end of harvest. Use the Relative Feed Value (RFV) index to allocate the proper

forage to the proper livestock class. Performance of high producing dairy cows is most limited by intake of digestible dry matter and prime hay or haylage is recommended. Grade 1 is recommended for dairy cows after the first trimester, heifers, and stocker cattle.

When managing forage stands for multiple use objectives that include wildlife considerations and usage as livestock feed, harvesting at a later stage of maturity is acceptable. Feed to livestock class and type with lower nutritional needs or balance feed ration or both. See Table 2.

Delay harvest if prolonged or heavy precipitation is forecast that would seriously damage cut forage.

Where weather conditions make it difficult to harvest the desired quality of forage, use mechanical or chemical conditioners and/or ensile.

Base harvest of mixed grass-legume stands on the stage of maturity for legume forage quality except for trefoil, ladino and white clover. For these, base harvest on the grass component stage of maturity.

When green chopping summer annual grasses containing hydrocyanic acid (HCN), delay harvest until grass is greater than 18 inches tall. Test these forages, trefoil, and white clover for HCN if stressed by drought, frost, or other environmental conditions prior to green chopping.

When ensiled forages exhibit high levels of nitrates (>2500 ppm) delay feeding of the silage for 6-8 weeks.

Moisture Content: Harvest silage/haylage crops at the ideal moisture range for the type of storage structure(s) being utilized. A critical component for any silage system is to ensure air tight forage containment.

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Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the MN Natural Resources Conservation Service in your area, or download it from the electronic Field Office Technical Guide for Minnesota.

Treat direct cut hay cropsilage (moisture content > 70%) with chemical preservatives or add dry feed stuffs to avoid fermentation, seepage, and digestible dry matter losses.

For optimal dry hay quality, rake hay at 30 to 40 percent moisture and invert swaths when moisture is above 40 percent. Bale at optimum moisture levels to preserve forage quality and quantity. Approximate percent moisture should be as follows:

- Bale field cut cured hay at 15 to 20 percent moisture
- Bale forced air-dried hay at 20 to 35 percent moisture
- Bale balage at 50-70% moisture

Length of Cut: When harvested for ensilage, forage will be chopped to a size appropriate for type of storage structure (high moisture wrapped or tubed bales) that allows adequate packing to produce the anaerobic conditions necessary to ensure the proper ensiling process.

Contaminants: Forage shall not contain contaminants that can cause illness or death to the animal being fed or rejection of the offered forage.

Contaminants are any objectionable matter or toxin that can cause illness, death, or rejection of the offered forage. Common sources of contaminants include yellow star thistle, leafy spurge, broomweed, spotted knapweed, and kochia.

Additional Criteria to Improve or Maintain Stand Life, Plant Vigor, and Forage Species Mix

Stage of Maturity and Harvest Interval: Cut forage plants at a stage of maturity or harvest interval range that will provide adequate food reserves and/or basal or auxiliary tillers or buds for regrowth and/or reproduction to occur without loss of plant vigor.

Cut reseeding annuals at a stage of maturity and frequency that ensures the production of viable seed or ample carryover of hard seed to maintain desired stand density.

If plants show signs of short-term environmental stress, management will be applied in a manner that encourages the continued health and vigor of the stand.

For legumes, maintain a 30 day interval between

the last harvest and the first killing frost.

Stubble Height: Cut forage plants at a height that will promote the vigor and health of the desired species. Cutting heights will provide adequate residual leaf area; adequate numbers of terminal, basal or auxiliary tillers or buds; insulation from extreme heat or cold; and/or unsevered stem bases that store food reserves needed for full, vigorous recovery. Guidance regarding stubble height to leave is found in Table 3.

Manipulate timing and cutting heights of harvest to ensure germination and establishment of reseeding or seeded annuals.

Additional Criteria to use as a Nutrient Uptake Tool

Employ a harvest regime that utilizes the maximum amount of available or targeted nutrients. Harvest at intervals that will keep the plants in a vegetative stage of growth for as long as possible during the growing season.

Additional Criteria to Control Disease, Insect, Weed and Invasive Plant Infestations

Schedule harvest periods as needed to control disease, insect, and weed infestations. When a pesticide is used to control disease, insects or weeds, adhere to the specified days to harvest period stated on the pesticide label. To evaluate pest management options refer to MN conservation practice standard Pest Management, 595.

Lessen incidence of disease, insect damage, and weed infestation by managing for desirable plant vigor. Plan and schedule removal of invasive plants.

Additional Criteria to Improve Wildlife Habitat Values

If client objectives include providing suitable habitat for desired wildlife specie(s), then appropriate harvest schedule(s), cover patterns, and plant height to provide suitable nesting habitat for the desired specie(s) should be maintained. Consideration also must be given to the reproductive requirements of the species of concern on the site.

Refer to MN conservation practice standard

Wildlife Upland Habitat Management, 645 for recommended mowing dates and for herbaceous vegetation best suited to wildlife.

CONSIDERATIONS

When pastures produce forage in excess of livestock demand during high growth rate periods, preserve forage quality by machine harvesting a portion of the standing crop. Coordinate this practice with MN conservation practice standard Prescribed Grazing, 528.

Well fertilized plants withstand more intense harvest schedules and may produce a higher quantity and quality of forage. Coordinate this practice with MN conservation practice standards Nutrient Management, 590 or Waste Utilization, 633 as appropriate. An excess or improper balance of nutrients such as nitrogen can produce plant material that causes toxicity in some animals.

Select cultivars that are suitable for the harvest regime, species mix, and forage quality desired. For specific nutrient uptake, select species that can maximize uptake. See MN conservation practice standard Pasture and Hay Planting, 512.

When insect and disease outbreaks exceed economic thresholds and are uncontrollable by harvest management, pesticide applications may be needed. Another option is to select a resistant cultivar when the stand is replaced. See MN conservation practice standard Pest Management, 595.

To control forage plant diseases, insects, and weeds, clean harvesting equipment after harvest and before storing. Do not cut forages until dew, rain, or irrigation water on leaves has evaporated.

When weed infestation exceeds the economic threshold and is uncontrollable by forage harvest management alone, weed management should be planned and applied. See MN conservation practice standard Pest Management, 595.

Care should be taken to produce stored forages of the quality needed for optimum performance of the animal being fed. For instance, immature legume forages can be too low in fiber and lead to metabolic disorders in ruminants and an economic loss to the producer due to lower animal performance.

Direct cut grass and legume silage can create silage leachate (seepage). Consider the collection, storage, and disposal of this leachate as part of an agricultural waste management system.

In conjunction with harvest options, explore storage and feeding options that will retain acceptable forage quality and minimize digestible dry matter loss. Also consider storage location for large square or round bales/balage with regards to inside vs. outside, along hedgerows, winter/mud considerations, etc.

Where weather conditions make it difficult to harvest the desired quality of forage, use mechanical or chemical conditioners and/or ensile.

In regions where rainfall and/or humidity levels cause unacceptable forage quality losses in at least one harvest during the year, consider green chopping or ensiling the forage to reduce or eliminate field drying time. Other options are the use of desiccants, preservatives, conditioners, macerating implements, or barn curing methods to reduce field drying time. These techniques can improve the timeliness of harvest and preserve forage quality.

To reduce safety hazards, avoid operating harvesting and hauling equipment on field slopes over 20 percent, particularly on cross slope traffic patterns.

PLANS AND SPECIFICATIONS

Place the detailed specifications in a site-specific job or design sheet, or in the practice narrative in the conservation plan.

These plans and specifications shall be consistent with this standard and shall describe the requirement for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Before forage harvest, clear fields of debris that could damage machinery, or if ingested by livestock, lead to sickness (for example, hardware disease) or death.

Monitor weather conditions and take action accordingly before and after cutting to optimize forage wilting or curing time to preserve feed quality and prevent forage swaths or windrows

from smothering underlying plants.

Inspect and repair harvesting equipment following manufacturer's preventative maintenance procedures.

All shields shall be in place during machine operation to prevent injury or death. Shut off machinery before working on or unplugging moving parts.

Select equipment sizes and capacities that will, in a timely and economically feasible manner, handle the acreage normally harvested.

Operate all forage harvesting equipment at the optimum settings and speeds to minimize loss of leaves.

Set shear-plate on forage chopper to the proper theoretical cut for the crop being harvested. Keep knives well sharpened. Do not use recutters or screens unless forage moisture levels fall below recommended levels for optimum chopping action.

Regardless of silage/haylage storage method, ensure good compaction and an airtight seal to exclude oxygen and mold formation.

REFERENCES

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TABLE 1
QUALITY STANDARDS FOR LEGUME, GRASS, AND
GRASS/LEGUME MIXED HAY

QUALITY STANDARD		RFV	ADF	NDF
% DRY MATTER				
Prime	pre-bloom	>151	<31	<40
1	early bloom	151-125	31-35	40-46
2	mid bloom	124-103	36-35	47-53
3	full bloom	102-87	41-42	54-60
4	rain damaged	86-75	43-45	61-65
5	severe damage	<75	>45	>65

RFV = Relative Feed Value

ADF = Acid Detergent Fiber

NDF = Neutral Detergent Fiber

Table 2
Forage Quality Needs of Cattle and Horses

Animal Type	Relative Feed Value (RVF)
Heifer, 18-24 Mo. Dry cow Idle Horse	100 – 115
Brood Mare Working Horse	110 – 125
Heifer, 12 – 18 Mos. Beef Cow with calf	115 – 130
Nursing mare Hard-working horse	120 - 135
Dairy, last 200 days Heifer, 3-12 mo Stocker cattle	125 - 145
Dairy, 1 st trimester Dairy calf	140 - 160

TABLE 3
CUTTING FORAGES FOR OPTIMUM HARVEST

SPECIES	WHEN TO CUT	HEIGHT OF STUBBLE
A. Smooth bromegrass		3 inches
Intermediate wheatgrass	1st cutting: medium to full head	
Pubescent wheatgrass		
Timothy	2nd and succeeding cuttings:	
Creeping foxtail	When basal sprouts appear	
Bluegrass		
Redtop		
B. Orchardgrass	Boot to early heading; and when regrowth is 14-20 inches	3 inches
C. Reed canarygrass	1st cutting: early boot Later cuttings when basal sprouts appear	3 inches
D. Alfalfa	1st cutting: Late bud to early flower 2nd, 3rd - 10% bloom	2 inches
E. Birdsfoot trefoil	1st cutting: early flower to 1/4 bloom. Later cutting when 8-12 inch regrowth has occurred but 4-6 weeks before killing freeze.	3-4 inches
F. Red clover	3/4 bloom to full bloom	2-3 inches
G. Crownvetch	When mixed with grasses, harvest when grass is ready. If harvested for hay, a crimper is recommended.	2 inches
H. Switchgrass	One Cut System: at heading	6 inches
Big bluestem	Two Cut System: first harvest at boot or early heading, second harvest in August	

Definition of Growth Stages

Boot—Most of the heads are in the upper sheath. Prior to emergence of the head.

Early head—Tips of the heads emerging on not more than 10% of the heads.

Medium head—Approximately 50% of heads emerging.

Full head—Most heads fully emerged but prior to flowering.