

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, haylage, green-chop, or ensilage.

PURPOSES

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

- Optimize the quality and quantity of harvested forage to meet the producer's management objectives.
- Promote vigorous plant regrowth.
- Maintain forage crop stand life for the desired time period.
- Maintain desired forage species composition of the stand.
- Use forage plant biomass as a nutrient uptake tool.
- Control insects, diseases and weeds.
- Maintain and/or improve wildlife habitat

CONDITIONS WHERE THIS PRACTICE APPLIES

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

CRITERIA

General criteria applicable to all purposes stated above

Forage harvest management shall comply with all local, state and Federal laws and regulations.

Forage shall be harvested at a frequency and height that will maintain a desired healthy plant community through its life expectancy. Harvest interval and minimum stubble heights are shown in Table 1 and Table 2.

Fertilizer shall be applied according to UF/IFAS recommendations and NRCS conservation practice standard Nutrient Management, Code 590. Applications of animal waste and bio-solids shall be in accordance with the NRCS, Agricultural Waste Management Field Handbook (AWMFH).

Forage shall be harvested at the stage of maturity that provides the best combination of quality and quantity to meet the producers management objective. Refer to section 600.0507 of the NRCS National Range and Pasture Handbook (NRPH) for additional information.

Forages shall be harvested in such a manner that will promote desired plant regrowth and protect the soil throughout the year to prevent water and wind erosion.

If plants show signs of short-term environmental stress (e.g. drought, flooding), management shall

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

be modified in a manner that ensures continued health and vigor of the forage species.

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

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

A. Stubble Height or Stage of Maturity.

Cut forage plants at a height that will promote the vigor and health of the desired species. Proper cutting heights provides 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. Tables 1 and 2 show the harvest recommendations and proper cutting heights for forages commonly grown in Florida. Harvest timing and cutting heights will be manipulated to ensure germination and establishment of desired reseeding or seeded annuals.

B. Moisture Content. Harvest silage/haylage crops at the optimum moisture range for the type of storage structure(s) being utilized (see below).

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

For optimal forage quality, rake, ted, or invert swaths, and bale when hay has sufficient moisture to prevent leaf loss.

Bale at optimum moisture levels to preserve forage quality and quantity. Approximate percent moisture should be as follows:

- Bale field-cured hay at 12 to 15 percent moisture. Hay baled at 16 to 20 percent moisture may result in the loss of quality due to heating and molding.
- Bale forced air-dried hay at 20 to 35 percent moisture.
- Rake hay at 30 to 40 percent moisture.
- Ted or invert swaths when moisture is above 40 percent.

C. Length of Cut.

When harvested for silage, or haylage the forage will be chopped to a size that allows adequate packing to produce the anaerobic conditions necessary to ensure the proper ensiling process.

D. Contaminants.

Forage shall not contain contaminants at levels injurious to the health of the livestock class and type being fed.

Contaminants are any objectionable matter or toxin that can cause illness, death, or rejection of the offered forage material by livestock.

Test harvested forages to be fed to pregnant animals or that were produced on fields fertilized with high levels of nitrogen or animal waste to determine the potential for poisoning by nitrates, prussic acid and grass tetany. Refer to the guidelines in Table 3 when feeding forages containing nitrates.

Additional criteria to promote vigorous plant regrowth or maintain the life of the stand for the desired time period.

Harvest forage plants at an interval 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.

Harvest 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.

Refer to Table 1 for the recommended stage of maturity and harvest intervals.

Additional criteria for forage crops used as nutrient uptake tools.

Employ a harvest regime that utilizes the maximum amount of available or targeted nutrients. For specific nutrient uptake, select species that can maximize uptake.

Forage harvest shall be managed to preserve the longevity of the forage species.

Additional criteria to control disease, insect, and weed infestations.

Fields will be regularly inspected to determine the level of disease, insects and weed infestations.

If a foliar disease, insects, or weeds threaten stand survival or production objective, schedule harvest periods as needed to control disease, insect, and weed infestations.

When disease, insect and weed infestations exceed the economic threshold and are uncontrollable by forage harvest management alone, appropriate control measures shall be planned and applied. Pesticide applications shall be planned and applied in accordance with NRCS conservation practice standard Pest Management, Code 595, and all pesticide label instructions

Additional criteria to maintain or improve wildlife habitat.

Maintain appropriate harvest schedule(s), cover patterns, and plant height to provide suitable habitat for the desired wildlife specie(s).

Schedule forage harvests to avoid the peak nesting season or other critical periods in the life cycle of the desired wildlife species.

Pesticide use shall be reduced to the maximum extent possible while maintaining the health and vigor of the forage crop. All pesticides will be applied in accordance with the label instructions.

Leave a portion of the field (10 to 30%) unharvested to provide nesting, foraging and escape cover for wildlife if possible.

CONSIDERATIONS

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

Properly fertilized plants withstand more intense harvest schedules and may produce a higher quantity and quality of forage. Coordinate this practice with the NRCS conservation practice standard Nutrient Management, Code 590.

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.

Avoid harvesting forage if the ratio of Total Digestible Nutrients to Crude Protein (TDN/CP) is greater than 7. For example, over mature forage is usually low in Crude Protein and low in Digestible Organic Matter. The over mature forage will reduce animal performance and result in the producer importing supplemental feed to meet his/her management objectives.

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.

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

To reduce safety hazard, avoid operating harvesting and hauling equipment on steep field slopes (over 15 percent), particularly on cross slope traffic patterns.

Lessen incidence of disease, insect damage, and weed infestation by managing for desirable plant vigor.

PLANS AND SPECIFICATIONS

Plans and specifications for forage harvest management shall be site specific and shall be in keeping with this standard and shall describe the requirement for applying the practice to achieve its intended purpose(s).

Provide the landowner/manager detailed specifications in a site-specific job sheet, or in the practice narrative of the conservation plan.

All plans and specifications shall be consistent with this standard

OPERATION AND MAINTENANCE

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

Monitor weather conditions before and after cutting and take appropriate action to optimize the yield and quality of the harvested material.. This will optimize forage wilting or curing time to preserve feed quality, prevent forage swaths or windrows from smothering underlying plants, and prevent damage to fields or equipment.

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

Maintain all safety shields in place and in good working order during machine operation to prevent injury or death. Shut off machinery before working on or unclogging moving parts.

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 cutting height 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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- Taylor, N. L. Clover Science and Technology. 1985. American Society of Agronomy, Madison, WI.
- NRCS Conservation Practice Standards:
Nutrient Management, Code 590
Pest Management, Code 595
Prescribed Grazing, Code 528A
- National Range and Pasture Handbook
Agricultural Waste Management Field Handbook

Table 1 – Hay Harvesting Guide

Forage Species	Harvest	Growth Stage or Height to Harvest	Regrowth Period (days)	Minimum Cutting Height (inches)
Alfalfa ^{1/}	1st cutting	Full bud	30-35	3
	Other cuttings	1/10 bloom	30-35	3
Arrowleaf Clover	Only one cutting	Early bloom	---	2
AlyceClover	All cuttings	Early bloom (or just before flowering) 18-24 inches	---	3
Bahagrass ^{2/}	1st cutting	12 inches	28-35	2
	Other cuttings	Every 3 - 4 weeks or when regrowth is 12 inches high	21-28	2
Hybrid Bermudagrass	1st cutting	14 to 16 inches height	28-42	3
	Other cuttings	Every 4 to 5 weeks or when regrowth is 15 inches high	28-35	3
Carpon desmodium	All cuttings	Early bloom	---	3
Clovers	All cuttings	Early bloom	35-42	3
Dallisgrass	Usually only one cutting	Boot to bloom	---	3
Eastern Gamagrass ^{1/}	All cuttings	Boot to early head 16-36 inches	28-42	8
Fescue, Tall	1 st cutting	Boot to early head	28-42	3
	Other cuttings	When regrowth is 10 inches.	28-42	3
Indigo (hairy)	All cuttings	30-36 inches	---	4
Johnsongrass ^{1/}	All cuttings	Boot	---	8
Limpograss (Hemarthria)	All cuttings	16 to 24 inches	35-42	8
Lespedeza, Annual	Only one cutting	Early bloom & before bottom leaves begin to fall	---	2
Millet, Pearl	All cuttings	Height of 30 to 40 inches	---	6
Pangolagrass	All cuttings	12 to 18 inches height	28-35	3
Perennial Peanut	All cuttings	Early to full bloom or when regrowth is 10-12 inches	42-56	2
Rhodesgrass (callide)	All cuttings	14-16 inches	28-35	3
Ryegrass	One cutting	Boot to early head	---	2
Sericea Lespedeza ^{1/}	All cuttings	15 to 18 inches high	---	5
Small Grains	One cutting	Boot to early head	---	2
Soybean or Cowpea	All cuttings	Mid- to full bloom	---	
Stargrass	1st cutting	14 to 18 inches height	28-35	4
	Other cuttings	When regrowth is 15 inches tall	28-35	3
Sudangrass & Sorghum-Sudan Hybrids -	All cuttings	Height of 30 to 40 inches	---	6
Switchgrass ^{1/}	All cuttings	Boot	28-35	6

^{1/} The last cutting should be early enough to allow for sufficient regrowth to store carbohydrates within the plant before frost. The regrowth may be cut or grazed, after frost or the dormant period begins

^{2/} Bahagrass is not recommended for hay or haylage due to the low quality at recommended harvest height.

Table 2 – Guidelines for Harvesting and managing Forages Harvested as Silage ^{1/}

Crop	Stage of Harvest		Yield potential tons DM/ acre/year	Dry matter at harvest %	WSCHO ^{a/} % DM	Management suggestions
	1 st harvest	Additional harvests				
Warm-season Annuals						
Corn	Grain in dent, black layer forming	---	4-8	28-35	10-20	Direct cut
Forage Sorghum	Boot or soft dough	---	3-8 per harvest	20-35	10-20	Select varieties with higher dry matter at harvest (>28% DM)
Sudan, Sorghum- Sudan, Millet	36" height to boot	36' height to boot	2-4 per harvest	15-30	10-15	Wilt if <25% DM
Soybeans	Pre-pod to bean fill, before leaf drop	Usually 1 harvest	1-3	25-40	2-4	Wilt if < 30% DM
Cowpea	Pre-pod to pea fill	Usually 1 harvest	1-3	15-30	5-8	Wilt if < 30% DM
Cool-season Annuals						
Rye, Oats, Wheat, Triticale	Boot to soft dough	---	2-4	20-30	8-12	Wilt if <25% DM
Ryegrass	Boot to heading	Every 30 days	2-4	15-30	8-12	Wilt if <25% DM
Warm-season Perennials						
Bermudagrass, Stargrass	Pre-head (12-15" tall)	Every 4-5 weeks	6/10	18-30	2-4	Wilt if < 30% DM
Bahiagrass	Pre-head	Every 4-5 weeks	3-5	20-30	<5	Wilt if < 30% DM
Limpograss (Hemarthria)	12-15" tall	Every 5-7 weeks	4-8	20-30	<5	Wilt if < 30% DM
Perennial Peanut	8-12" tall	Every 5-7 weeks	2-4	18-30	1-4	Wilt if < 30% DM
Cool-season Perennial						
Alfalfa	Bud to 10% flower	Bud to 10% flower	4-6	22-35	4-7	Wilt if < 30% DM

^{1/} Chambliss, C. G., ed. 1999. Florida Forage Handbook. SP 253. University of Florida, Gainesville, Florida

^{a/} Water-soluble carbohydrates – sugars fermented to lactic and other acids during ensiling.

Table 3 "Guidelines for nitrate in feedstuffs (% dry-matter basis) complete ration ^{a/ 1/}

Nitrate Content ^{b/}	Comments
0.0 - 0.44	This level is considered safe to feed under all conditions.
0.44 - 0.66	This level should be safe to feed non-pregnant animals under all conditions. It may be best to limit its use for pregnant animals to 50% of the total ration on a dry matter basis.
0.66 - 0.88	Feeds safely fed if limited to 50% of the total dry matter in the ration.
0.88 - 1.54	Feeds should be limited to about 35% to 40% of the total dry matter in the ration. Feeds containing over .88% nitrate should not be used for pregnant animals.
1.54 - 1.76	Feeds should be limited to 25% of the total dry matter in the ration. Do not use for pregnant animals.
> 1.76	These feeds are potentially toxic. Do <i>NOT</i> feed.

^{1/} Halsey, L. A., Nitrates in Forage Cause Cattle Deaths: A common Weed and Uncommon Circumstances. 1998 Florida Beef Cattle Short Course. Gainesville, FL

^{a/} (Faulkner & Hutjens, 1989).

^{b/} (% NO₃⁻)