

FORAGE HARVEST MANAGEMENT

CONSERVATION DESIGN SHEET - Hayland Series

511



Natural Resources Conservation Service

Michigan



WHAT IS FORAGE HARVEST MANAGEMENT?

Forage Harvest Management is a conservation practice that is defined as timely mechanical cutting, removal, and storage of forages from farm fields. This forage may be harvested as hay, green-chop, or ensiled. This conservation sheet is a planning tool. Guidelines for managing hay production systems can vary considerably with environmental extremes. Producers should monitor their hayfields for minimum stubble

height and stage of maturity at harvest in order to maintain vigorous, healthy stands and produce quality hay.

MANAGEMENT OBJECTIVES

Forage Harvest Management may be applied as part of a management system to accomplish one or more of the following objectives:

- Optimize the economic yield of forage at the desired quality and quantity.

- Promote vigorous plant growth.
- Maintain stand life for the desired time period.
- Maintain desired 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.
- Improve air quality through carbon sequestration.

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

GENERAL SPECIFICATIONS AND CRITERIA

- Forages will be harvested at a frequency and height that will maintain a desired and healthy plant community through its life expectancy.
- Forage will be harvested at the stage of maturity that provides the desired quality and quantity while maintaining optimum regrowth conditions or stand persistence.
- Forage will be harvested at the optimum moisture levels for the desired quality and for the storage system being used.
- Forage harvested for ensilage will be chopped to the appropriate length of cut for the storage system being used and proper digestion of the livestock species being fed.
- Stubble heights will be left that not only harvest for quantity, but will protect plant regrowth and vigor as well.
- When managing forage harvest for maximum quantity and nutrient uptake, consider the effects on perennial forages.
- When the client's objective is providing wildlife habitat for a desired wildlife species then appropriate harvest schedules, cover patterns, and plant heights should be used. Contact the NRCS State Biologist or Michigan

Department of Natural Resources for more information.

- For disease, insects, and weeds, adjust harvest schedules for their control. Use integrated pest management practices according to Michigan State University Extension guidelines.

IMPORTANCE OF GROWTH STAGE

The single most important producer-controlled factor influencing hay or silage quality is the stage of maturity at harvest. Weather conditions and fertility of the soil for plant uptake at time of harvest significantly impact hay quality and quantity. The type of forage crop, storage system used, moisture content, and length of chop are also important factors affecting forage feed quality and quantity.

The stage of maturity at harvest influences palatability, crude protein content, digestibility, and relative feed quality. Forage plants tend to produce higher quality forage just before they begin seed production. Delaying harvest past Michigan State University Extension recommendations results in higher fiber content and lower digestible energy. While quantity of harvested material may increase by delaying harvest past MSUE recommendations, quality and resulting animal performance will almost always decrease.

IDENTIFICATION OF GROWTH STAGES

Grasses

Late Vegetative - seed bearing stem elongates.

Boot - seed bearing stem elongated and its top is swollen.

Early Bloom - seed heads (flowers) begin to emerge.

Mid Bloom - at least 25 percent of seed emerged, pollen beginning to shed.

Full Bloom - most seed heads emerged, peak pollen shed.

Milk - all seed heads emerged, seed is forming, soft and immature.

Dough - seed is becoming harder but is dough-like in consistency.

Legumes

Vegetative - no buds.

Bud - buds begin to swell and become apparent at a few nodes.

Late Bud - several nodes with buds, buds more swollen.

Early Flower - a few buds open, flower color apparent.

Late Flower - many flowers apparent.

Early Seed - green seed pods apparent on a few flowers.

Late Seed - many green seed pods apparent, some turning brown.

Mature - seed pods brown to black, dry, ready for seed harvest as its moisture content permits.

TABLE 1 - Recommended Stages to Harvest Various Hay Crops

Species	Stage of Harvest
Alfalfa	Late bud stage for first cutting, late bud for second and later cuttings. Allow one cutting to come to 1/10 th bloom. For spring seedings, allow the first cutting to reach mid bloom.
Tall Fescue, Orchardgrass, Timothy, Smooth Bromegrass, Reed Canarygrass	Boot to early head stage for first cut, afterwards follow intervals on Table 5.
Small Grains	Boot to early dough stage depending on forage quality needed.
Soybeans	Mid to full bloom and before bottom leaves fall off.
Ladino, Red and White Clover	Cut at the correct stage for the companion grasses growing with them.
Sudangrass ¹ , sorghum/sudan hybrids ¹ , Millets	Height of 30 to 40 inches but before heading.
Ryegrasses	Late boot stage.
Birdsfoot Trefoil	Early bloom (1/4 of plants in flower).

* For Warm Season Grasses, see MSUE bulletins or the Plant Materials Center Conservation Sheet.

¹ If grazed when these plants are lower than 18 inches tall, Prussic Acid levels are high and will have a negative impact on livestock. This can also happen when these plants are stressed by frost, drought, etc.

TABLE 2 - Recommended Stages to Harvest Various Silage Crops

Species	Stage of Harvest
Corn	65-68 percent moisture
Grain Sorghum	Late milk to late dough
Forage Sorghum	40 inches or late boot stage
Sudangrass, sorghum/sudangrass hybrids, Millets	40 inches or boot stage, whichever appears first
Small Grains	Boot to early dough
Soybeans	Late bloom, seed forming in pods and before lower leaves fall off
Alfalfa, Red clover	Late bud to early bloom
Tall fescue, Orchardgrass, Timothy, Smooth Bromegrass, Reed Canarygrass	Boot for Tall fescue, Orchardgrass, Reed Canarygrass, and at early heading for Timothy and Smooth Bromegrass. After first cutting, see Table 5.
Legume-Grass Mixtures	Boot to early heading of the grass component
Birdsfoot Trefoil	10 to 30 percent plants blooming
Ryegrasses	Boot stage

TABLE 3 - Estimated Dry Hay Yields for Common Michigan Forages¹

Key Forage Species	Annual Yield (tons/acre)
Alfalfa	3-6
Millets	1-4
Orchardgrass, Bromegrass, Tall Fescue	2-4
Ryegrasses, Red and White Clovers	2-4
Sudangrass, sorghum/sudan hybrids	2-5 ²
Small Grains	2-4
Soybeans	2-3
Birdsfoot trefoil	2-4

Based on average weather patterns, see county soil surveys or NRCS technical guide on yields.

¹ These are based on average yields from north to south in the state as reported in the Michigan Agricultural Statistics 2003-2004 report. Some farms may yield considerably lower or higher based on management and other site specific conditions. Site specific yields should always be used whenever possible.

² Silage Yields will be higher - 3 to 11 wet tons.

TABLE 4 - Estimating Hay Needs

Type of Livestock	Approximate lbs. hay/animal/day¹
Dairy cattle	See MSUE recommendations as part of diet
Dry, pregnant beef cows	15-20
Beef Cows with calves	25-28
Replacement heifers	10-12
Bred Yearling heifers	18-23
Mature Bull	28-30
Stocker (weaned to yearling) steers	10-14
Horses	24-30
Ewes	4-6
Lambs	1-4
Pounds per day X days of feeding = total pounds hay needed per animal	
Total pounds hay needed ÷ 2000 = tons needed per animal	

¹ Yields are based on grass-legume mixture hay of average quality. These values should only be used as guides. Considerable variation can exist within and among categories, type of livestock, type of hay, and quality.

TABLE 5 - Recommended Stubble Height and Approximate Recovery Period After Hay Harvest of Common Grasses and Legumes

Species	Recommended Stubble Height Left after Harvest (inches)	Approximate Recovery or Rest Period¹ (days)	Lowest Height Left Before Killing Frosts (<28°F)
Orchardgrass, Tall Fescue	4	21-30	8
Timothy, Smooth Bromegrass	4	21-30	6
Ryegrasses, Bluegrass	2	14-21	6 ²
Reed Canarygrass	4	28-35	6
Sudangrass, Sorghum/sudan hybrids	6-8	21-30	N/A
Small Grains	3-4	14-25	N/A
Alfalfa	2	20-25	10
Red Clover	2	18-25	8
Birdsfoot Trefoil	4	30-35	6
White, Ladino Clovers	2	15-25	4

¹ Recovery and Rest Periods are based on averaged 70 years of weather records. Extreme drought, heat, precipitation, or abnormally cool weather episodes could cause these periods to be much longer or shorter. Site and real time specific data should be used.

² After a few killing frosts, Perennial Ryegrasses should be grazed or mowed to 2 inches as it is susceptible to late winter diseases such as snow mold.

TABLE 6 - Forage Moisture Range for Silage/Baylage/Haylage/Hay by Storage System

Trench Silos	65% - 70%
Bunker, Horizontal Bag, and Top Unloading Upright Silos (such as Concrete Stave)	60% - 68%
Oxygen-Limited Upright (tower) Silos	50% - 60%
Balage (Well Wrapped)	50% - 60%
Bottom Unloading Upright Silos	45% - 55%
All Corn Silage Regardless of Structure	63% - 68%
For Dry Hay, Rake the Hay at:	30% - 40%
Bale In-Field Cured Dry Hay at:	15% - 20%
Bale Dry Hay with Preservatives at:	25% - 30%
Bale Dry Hay for Forced Air Drying at:	20% - 35%

If a forage is harvested too wet, butyric acid fermentation can happen as well as seepage or leachate, which can become a pollutant. If a forage is harvested too dry, the proteins can be bound and the possibility of smoldering can take place in the storage system.

Two references may be helpful in estimating moisture levels.

1. Use of microwave Drying to Determine Moisture Content in Forages by Purdue found at <http://www.agry.purdue.edu/ext/forages/index.html> under publications.
2. On Farm moisture Testing of Corn Silage by University of Wisconsin found at <http://www.uwex.edu/ces/crops/uwforage/uwforage.htm>

FORAGE HARVEST MANAGEMENT PLAN AND DOCUMENTATION

Client: _____

County: _____

Tract No.: _____

Planner: _____

Site Specific Information						
The fields planned for Forage Harvest Management are indicated below. (See Table 1 or 2 to complete column D. See Table 5 to complete columns E and F.)						
	(A)	(B)	(C)	(D)	(E)	(F)
Field No.	Type Of Forage Making¹				Minimum	Recovery
		Moisture	Forage	Maturity	Stubble	or Rest
		Content	Species	Stage To	Height	Period
		Needed²	Harvested³	Harvest	(inches)	(days)⁴
¹ Such as dry hay, silage, baleage, direct-cut, etc. ² See Table 6. ³ Refers to the dominant species in the stand. ⁴ Approximate recovery period dependent on local weather conditions (see Table 5).						

Comments in Planning the Practice: _____

DOCUMENTATION OF APPLIED PRACTICE

Field No.	Type Of Forage Made	Harvested	Forage	Harvested	Stubble	Actual Rest
		Moisture	Species	Stage	Height Left	Period
		Percentage	Harvested		(inches)	(days)

Comments on Practice Application: _____