How Grass Grows

Rationale

For the most part, small-acreage landowners often do not understand the basics of growing grass and legumes. They understand that they need to fertilize and water their lawns, as well as mow them when the grass gets too tall. However, in many cases, they do not give their pastures this same care. The first step is to understand how pasture plants grow. The next step is to identify the specific pasture plant species growing on their properties.

Many small-acreage owners also feel that their animals need to be out in the pasture 24 hours a day so that they can “get some exercise,” when in reality most animals do not exercise alone, nor do they need access to food 24 hours a day. Participants must understand that pasture plants need time to grow before grazing and they need rest before regrazing. If properly managed, the amount of bare ground and weeds in the pasture will decrease.

Objectives

Participants will:

1. Gain an understanding of the life cycle of forage plants from dormancy through spring and summer growing periods.
2. Be able to identify the vegetative and/or flowering parts of 10 to 14 common forage plants in their areas.
3. Learn how to estimate and calculate forage yield for their pastures.
4. Learn how to manage vegetation without grazing.

How Grass Grows – Lesson Plan

Time	Section	Goal	Activity	Instructor
15 min	Introduction and class agenda	Answer any questions or address any concerns from the last session. Provide an overview of this lesson.	Lesson agenda: • How plants make food • Legumes and legume growth • Grasses and grass growth • How pasture plants grow • Growth and reproduction • Managing growing points • Plant identification • Determining forage yield	There may be questions from the last class. If you were not the instructor for the last lesson, please interface with previous instructor before class starts. Depending on number of repeat participants and time between this and the last lesson, an icebreaker may be needed. PowerPoint slides 1-2
30 min	Plant physiology, legumes and grasses	Encourage participants to recognize that by properly caring for their pasture forage, they will care for their animals as well.	Participants learn or review how plants grow, basic plant physiology, plant growth cycles, plant needs and requirements for growth and the basic parts of plants. Some criteria are given for designating a 'Key Species'.	Instructor explains plant physiology, plant roots and plant parts. PowerPoint slides 3-26
30 min	Grass and legume plant ID	Help participants identify the forage species in their pastures.	Participants learn how to identify 10 to 14 of the most common forage plants in their area. Participants will then test their knowledge by identifying live plants that the instructor has brought in. Participants will write down the identifying characteristics of the samples and then try to ID the individual samples. An 'Identification of Plants Activity Sheet' is included in these lesson materials. This 'test' will coincide with a break.	Instructor presents the most common forage plants in the area, as well as individual grasses and legumes. Distribute Grass Plant Parts Information Sheet, Forage Plant Characteristics Information Sheet and Identification of Plants Activity Sheet. PowerPoint slides 27-83
15 min	BREAK	BREAK	Participants continue forage plant identification 'test'.	BREAK
30 min	Grass and Legume ID	Help participants identify the forage species in their pastures.	Continuation of grass and legume identification	Identification of Plants Activity Sheet is included in these lesson materials. PowerPoint slide 84

How Grass Grows – Lesson Plan (continued)

Time	Section	Goal	Activity	Instructor
30 min	Grass and Legume ID	Help participants identify the forage species in their pastures.	Continuation of grass and legume identification	Identification of Plants Activity Sheet is included in these lesson materials. PowerPoint slide 84
30 min	Determining forage yield	Participants learn methods for determining pasture forage yield.	Forage calculation demonstration using a clipping ring, scissors, bags, and scale. Provide sample problems to calculate forage yield. Other forage availability estimate methods are discussed. Participants are given a homework assignment to clip their pastures and calculate forage yields.	• Forage Yield Activity Sheet • Forage Availability Estimation Information Sheet • Stubble Height and Regrowth Recommendations Information Sheet • Potential for Pasture Production is High Information Sheet • Potential for Pasture Production is Moderate Information Sheet • Potential for Pasture Production is Low Information Sheet Data will become part of the notebook participants are developing for their own properties. PowerPoint slides 85-93
15 min	Managing vegetation without grazing	Help participants understand the different methods of managing vegetation without grazing.	Management methods: • Mowing • Leasing for pasture or hay • Burning	PowerPoint slides 94-98
15 min	Summary and Homework	Review materials presented and assign homework.	Summary, question and answer period. Homework assignment: • Identify three of the most common grass and legume species in each of your pastures • Select your key species • Calculate forage yields	Review homework assignment. PowerPoint slides 99-100

How Grass Grows

Materials/supplies to be requested from participants before class starts

1. Samples of unidentified forage plants from their pastures
2. Maps they have made of their properties
3. Production figures, if any, from forage in field i.e.: tons of hay/acre or soil survey crop production figures
4. Calculator, paper, writing utensils, rulers

Materials/supplies needed for class

1. Flip chart and markers (or dry-erase board, chalkboard or overhead projector)
2. Overhead or PowerPoint computer projection system
3. Pointer
4. Refreshments
5. Calculator

Local resources needed for class

1. Ten to 14 samples of most common forage plants in your area, removed from field and planted in containers for participants to observe. One plant per 3-pound coffee can works well.
2. Soil survey map and map units
3. The soil reports for the above units
4. Land capability and yields per acre of crops (introduced species)
5. Rangeland productivity and characteristic plant community (native species)

Background information for instructors

Dietz, H.E., 1989, GRASS, The Stockman's Crop, How to Harvest More of It, copies available from Sunshine Unlimited, Inc, 785-227-3880, 785-823-4541 or 785-823-4556, P.O. Box 471, Lindsborg, Kansas, 67456, http://www.cabnr.unr.edu/ag_risk_management/Presentations/Grass%20The%20Stockman's%20Crop.pdf

Holzworth, L, Mosely, J, Cash, D., Koch, D., and Crane, K., 2000, Dryland Pastures in Montana and Wyoming, MSU Extension Publications, EB19, revised Sept 2000, http://msuextension.org/publications/AgandNaturalResources/EB0019.pdf

Iowa State University Extension, 1998, How Pasture Plants Grow, http://www.extension.iastate.edu/Publications/PM1791.pdf

Iowa State University Extension, 1999, Guide for Year-Round Forage Supply, http://www.extension.iastate.edu/Publications/PM1771.pdf

How Grass Grows

Background Information For Instructors (continued)

Oregon State University, 2000, Grass Growth and Regrowth for Improved Management, http://forages.oregonstate.edu/projects/regrowth/default.cfm

Handouts needed for participants

1. Grass Identification Sheets (PowerPoint note pages)
2. Grass Plant Parts Information Sheet
3. Forage Plant Characteristics Information Sheet
4. Identification of Plants Activity Sheet
5. Determining Forage Yield Activity Sheet
6. Forage Availability Estimates Information Sheet
7. Potential Pasture Production is High Information Sheet
8. Potential Pasture Production is Moderate Information Sheet
9. Potential Pasture Production is Low Information Sheet
10. Stubble Height and Regrowth Recommendations Information Sheet

Handouts needed for participants (in addition to lesson handouts)

1. Barnhill, J. and McKendrick, S., project coordinators, 2008, Small Pasture Management Guide, Utah State University Cooperative Extension, AG 508, http://extension.usu.edu/files/publications/publication/AG_508.pdf
2. Dietz, H.E., 1989, GRASS, The Stockman's Crop, How to Harvest More of It, 16 p., copies available from Sunshine Unlimited, Inc, 785-227-3880, 785-823-4541 or 785-823-4556, P.O. Box 471, Lindsborg, Kansas, 67456, http://www.cabnr.unr.edu/ag_risk_management/Presentations/Grass%20The%20Stockman's%20Crop.pdf
3. Cobourn, J. and Donaldson, S., 1995, Small Ranch Manual - A Guide to Management for Green Pastures and Clean Water, University of Nevada Cooperative Extension, EB-95-02, 775-784-4848, http://www.unce.unr.edu/publications/files/ag/other/eb9502.pdf
4. Holzworth, L, Mosley, J, Cash, D., Koch, D., and Crane, K., 2000, Dryland Pastures in Montana and Wyoming, MSU Extension Publications, EB19, revised Sept 2000, http://msuextension.org/publications/AgandNaturalResources/EB0019.pdf

Web sites for further information

Colorado State University Cooperative Extension, http://www.colostate.edu

Colorado State University Cooperative Extension Small Acreage Management, http://www.ext.colostate.edu/sam/

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Web sites for further information (continued)

Forage Information Systems, http://forages.oregonstate.edu/index.cfm

Kansas Wildflowers and Grasses, http://www.kswildflower.org

Montana State University Extension Publications, http://extn.msu.montana.edu/publications.asp

National Forage and Grasslands Curriculum, http://forages.oregonstate.edu/nfgc/default.cfm

NRCS Grazing Lands, http://www.glti.nrcs.usda.gov

NRCS Plant Characteristics and Plant Guide Service, http://plants.usda.gov/gallery.html

North Dakota State University Extension Service, http://www.ext.nodak.edu

Oklahoma Forages Home Page, http://forage.okstate.edu/index.htm

Purdue University Forage Information Service, http://www.agry.purdue.edu/ext/forages/links.htm

University of California Sustainable Agriculture Research and Education Program, http://www.sarep.ucdavis.edu

University of Nevada Cooperative Extension, http://www.unce.unr.edu/publications/

Homework assignment

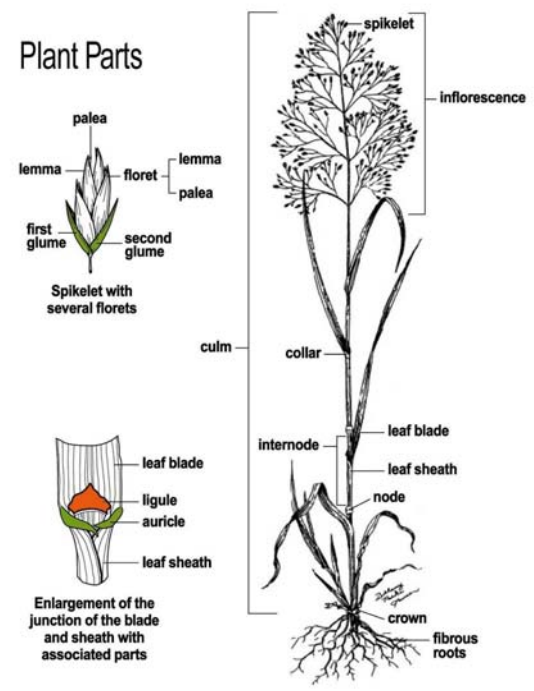
Have participants determine:

1. What plants are growing in their pastures.
2. One or two key species to use when monitoring their pastures.
3. Forage yield of their pastures.

Remember to bring in weed samples (if you are skipping lesson 2).

Grass Plant Parts Information Sheet

Grass plants consist of underground growth in the form of roots, which includes rhizomes, stolons, corms, bulbs, or fibrous masses; and above-ground growth consisting of stems, leaves and flowers/seeds. The collective name for the above ground portion of the grass plant is the culm or elongated internodes. The base of the above-ground portion of the grass plant is the crown, which is the junction between the roots and shoots. Growth begins here in the spring.



Graphic adapted from North American Range Plants, 4th edition, by J. Stubbendieck, S L. Hatch and C.H. Butterfield.

The stem of the grass is divided into several joints. The joints or nodes are punctuated by a knobby swelling. The portion of the stem between two joints or nodes is called the internode.

Each individual leaf of the grass has two distinct parts, the leaf sheath and the leaf blade. The leaf sheath is the portion of the grass blade that begins at the node below the collar and wraps around the stem. The leaf blade is above the collar and separates from the stem at an angle, usually less than 90 degrees. The point where the leaf separates from the stem is called the collar. The collar consists of two parts called the auricle and ligule. The auricle is the turned, reinforced portion of the leaf blade as it leaves the collar region. The ligule is the outgrowth of the upper and inner side of the grass leaf at the point where it joins the collar region. It provides additional support for the leaf as it grows away from the stem. Not all grasses have auricles and/or ligules. The shape of the auricles and ligules can be very distinctive for individual grass species and can be an important plant identification factor.

The flowering portion of the grass is called the inflorescence. The inflorescence is generally made up of many small branch-like clusters of flowers. These are termed spikelets. Spikelets consist of several florets or small flowers. At the base of the spikelet are glumes, which are dry chaff-like bracts or leaves. Often, these leaves or bracts provide protection for the florets above them. The glumes often have a sharp point or bristle termed an awn. The florets are the individual flowers, which will later form individual seeds. Each floret has two leaves or petals surrounding the actual reproductive plant parts. The outer leaf or petal is termed the lemma, the inner, smaller one is termed the palea.

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Forage Species Characteristics Information Sheet, page 1 of 2

Plant Species	Growth Habit	Growing Point Location	Seedling Vigor	Yield Potential	Longevity	Winter Hardiness	Drought Tolerance	Flood Tolerance	Saline Tolerance	Alkaline Tolerance	Acid Tolerance	Compatability With Other Species	Palatability	Grazing Recovery Rate	Pasture	Hay	Other	Stop Grazing Height	Comments
Cool Season Grasses																			
Annual ryegrass	bunch	ground	excellent	moderate	annual	moderate	moderate	excellent	poor	poor	moderate	moderate	good	medium	X	X	cover crop		moderate shade tolerance
Basin wildrye	bunch	elevated	poor to moderate	high	long	excellent	excellent	moderate	good	good	moderate	moderate	good	slow	X				graze in winter, when dormant
Crested wheatgrass	bunch	ground	good	moderate	long	excellent	excellent	good	moderate	good	moderate	moderate	good	medium	X	X	wildlife	3 inches	competes with cheat grass
Garrison creeping foxtail	sod	ground	moderate	high	long	excellent	moderate	excellent	moderate	moderate	moderate	good	excellent	rapid	X	X	wildlife, filter		no dormancy period; can be invasive
Intermediate wheatgrass	bunch	elevated	good	high	medium	excellent	excellent	moderate	moderate	poor	moderate	good	good	medium	X	X	erosion control	6 inches	
Kentucky bluegrass	sod	ground	good	moderate	long	excellent	poor	good	poor	poor	moderate	poor	good	rapid	X	X	wildlife, recreation	2 inches	can be invasive
Meadow brome	sod	elevated	moderate	moderate	long	excellent	good	poor	poor	poor	moderate	good	good	rapid	X	X	wildlife	3-4 inches	
Orchardgrass	bunch	ground	good	high	medium	good	excellent	poor	poor	poor	moderate	good	excellent	rapid	X	X	wildlife		shade tolerant
Perennial ryegrass	bunch	ground	good	moderate	medium	poor to moderate	poor	moderate	moderate	moderate	good	good	excellent	rapid	X	X	lawn, silage	>2 inches	plant endophyte-free varieties; easily damaged when frozen
Pubescent wheatgrass	bunch	elevated	good	high	medium	excellent	excellent	moderate	moderate	poor	moderate	good	good	medium	X	X	erosion control	6 inches	
Reed canarygrass	sod	elevated	good	high	long	excellent	moderate	excellent	moderate	moderate	moderate	poor	good	rapid	X	X	filter, erosion	6-8 inches	can be invasive
Russian wildrye	bunch	ground	moderate	moderate	long	excellent	excellent	poor	good	good	poor	poor	good	rapid	X	X	wildlife		
Siberian wheatgrass	bunch	ground	good	moderate	long	excellent	excellent	moderate	moderate	moderate	poor	poor	good	rapid	X	?	wildlife, reclamation	3 inches	
Slender wheatgrass	bunch	elevated	excellent	moderate	short	good	moderate	poor	good	good	poor	good	good	medium	X	X	wildlife, reclamation		shade tolerant; allow to set seed every other year
Smooth brome	sod	ground	poor to moderate	moderate	medium	good	good	moderate	moderate	moderate	good	moderate	good	medium	X	X	silage		can be invasive
Soft chess/ blando brome	sod	ground	excellent	moderate	annual	N/A	moderate	poor	moderate	moderate	moderate	moderate	good	medium	X		wildlife	4 inches	can be invasive; let it set seed for the next year
Streambank wheatgrass	sod	ground	moderate	moderate	long	good	good	moderate	good	good	moderate	good	good	medium	X		wildlife		
Tall fescue	bunch	ground	excellent	moderate	long	excellent	poor	moderate	good	good	good	moderate to good	good	medium	X	X		2 inches	can be invasive, plant endophyte-free varieties
Thickspike wheatgrass	sod	ground	moderate	moderate	long	good	good	moderate	good	good	moderate	good	good	medium	X	X		2 inches	
Timothy	bunch	elevated	good	moderate	short	excellent	poor	moderate	moderate	moderate	good	good	good	slow	X	X		3 inches	
Western wheatgrass	sod	ground	moderate	moderate	long	excellent	moderate	moderate	moderate	moderate	poor	good	good	slow to medium	X			3-4 inches	

Forage Species Characteristics Information Sheet, page 2 of 2

Plant Species	Growth Habit	Growing Point Location	Seedling Vigor	Yield Potential	Longevity	Winter Hardiness	Drought Tolerance	Flood Tolerance	Saline Tolerance	Alkaline Tolerance	Acid Tolerance	Compatability with other species	Palatability	Grazing Recovery Rate	Pasture	Hay	Other	Stop Grazing Height	Comments
Warm-Season Grasses																			
Alkali sacaton	bunch	ground	moderate	moderate	moderate	moderate	good	good	good	excellent	poor	moderate	good	medium	X			50% starting height	graze during active growth in spring/summer
Big bluestem	bunch	ground	moderate	low	moderate	moderate	good to moderate	poor	poor	poor	moderate	good	excellent	medium	X	X	wildlife	8 inches	one month rest before freeze
Indiangrass	sod	elevated	moderate	moderate	moderate	moderate	moderate	poor	moderate	good	good	good	good	medium				8-12 inches	one month rest before freeze
Little bluestem	bunch	ground	moderate	moderate	moderate	moderate	excellent	poor	poor	moderate	moderate	good	good	medium	X	X	wildlife	8 inches	one month rest before freeze
Sideoats grama	bunch	ground	moderate	moderate	moderate	moderate	moderate	poor	moderate	moderate	moderate	good	good	medium	X		wildlife		one month rest before freeze
Sorghum-sudangrass	sod	elevated	high	high	annual	poor	moderate	poor	moderate	moderate	moderate	good	good	medium to rapid	X		cover crop		
Sudangrass	sod	elevated	high	high	annual	poor	moderate	poor	moderate	moderate	moderate	moderate	good	medium	X		cover crop		
Switchgrass	sod	elevated	moderate	high	long	good	moderate	moderate	moderate	moderate	moderate	moderate	good	medium	X	X	wildlife	depends on season	one month rest before freeze; can be invasive
Legumes																			
Alfalfa	erect	elevated	high	high	long	excellent	good	poor	good	good	poor	good	excellent	rapid	X	X		2 inches	bloat hazard; rest before freeze
Alsike clover	prostrate	elevated	moderate	moderate	short?	moderate	poor	good	poor	poor	good	good	good	medium	X	X	cover crop	>2 inches	bloat hazard; make sure to innoculate
Birdsfoot trefoil	erect	elevated	poor	moderate	moderate	good	moderate	good	poor	poor	moderate	good	excellent	medium	X	X		4-6 inches	non-bloat; allow to reseed every 3 years
Cicer milkvetch	erect	elevated	poor	moderate	long	excellent	moderate	good	moderate	moderate	poor	good	excellent	medium	X	X			
Red clover	erect	elevated	moderate	moderate	moderate	excellent	moderate	moderate	moderate	moderate	moderate	good	good	medium	X	X	silage	5 inches	do not use for sheep during breeding season
Sainfoin	erect	elevated	good	moderate	long	excellent	good	poor	moderate	moderate	moderate	good	excellent	medium to slow	X	?			non-bloat
Subterranean clover	prostrate	elevated	moderate	moderate to low	annual	moderate	good	good	poor	poor	good	good	good	rapid	X	X	cover crop		non-bloat; moderate shade tolerance
Strawberry clover	prostrate	elevated	moderate	low	moderate	good	poor	good	good	good	good	good	good	medium	X			2 inches	bloat hazard
White clover	prostrate	elevated	good	moderate	moderate	good	poor	moderate	moderate	moderate	moderate	good	excellent	rapid	X	X	wildlife	2 inches	
Yellow / white sweetclover	erect	elevated	poor	moderate	short	good	good	poor	moderate	moderate	moderate	moderate	good	medium	X	X	cover crop	6 inches	bloat hazard; can cause illness in animals

Identification of Plants Activity Sheet, page 1 of 2

1. Identifying characteristics: _____

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Identity: _____

2. Identifying characteristics: _____

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Identity: _____

3. Identifying characteristics: _____

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Identity: _____

4. Identifying characteristics: _____

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Identity: _____

5. Identifying characteristics: _____

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Identity: _____

6. Identifying characteristics: _____

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Identity: _____

7. Identifying characteristics: _____

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Identity: _____

8. Identifying characteristics: _____

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Identity: _____

Identification of Plants Activity Sheet, page 2 of 2

9. Identifying characteristics: _____

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Identity: _____

10. Identifying characteristics: _____

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Identity: _____

11. Identifying characteristics: _____

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Identity: _____

12. Identifying characteristics: _____

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Identity: _____

13. Identifying characteristics: _____

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Identity: _____

14. Identifying characteristics: _____

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Identity: _____

15. Identifying characteristics: _____

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Identity: _____

16. Identifying characteristics: _____

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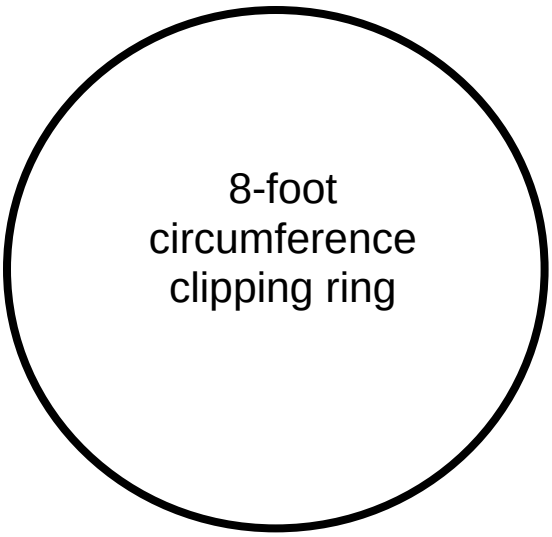
Identity: _____

Determining Forage Yield Activity Sheet, page 1 of 5

Forage yield is the actual amount of forage dry matter available in a pasture or rangeland on a per acre basis. When you calculate forage dry matter, it is comparable to cutting and drying hay. Rather than mowing drying, and weighing all of the useable forage in an acre of your pasture, we will sample from a small area to estimate the total forage yield.

Equipment needed:

- Hoop
- Grass clippers
- Small to medium sized paper grocery bags, pre-weighed. Write the weight on bag. Brown paper lunch bags weigh 6-8 grams.
- Hand-held spring scale that weighs in grams. A 300- to 500-gram scale works best.



It's easiest to construct a cable hoop by bolting together the ends of an eight-foot-long, one-quarter-inch cable. This cable is available at most farm and ranch supply stores for a cost of about $5. A hand-held spring scale is available from forestry, animal health or surveying equipment stores. A 300- to 500-gram scale works best. Forestry Suppliers has the clippers and scale for reasonable prices, 1-800-647-5368, www.forestry-suppliers.com. The Pesola Medio-Line Spring Scale, 300 grams, stock #93013 and model #40300, is $34.50. They also have clipping shears for smaller hands, stock #81191, at $16.95. Ben Meadows, 800-241-6401, has Corona Grass Trimmers for $21.95.

Now we have an 8-foot-circumference circle. This circle is roughly 30 inches in diameter. We want to check the actual forage in our pasture. For simplicity, clip areas that are not grazed. **Use a representative area of the pasture, not the high or the low producing areas, but the moderate areas.** We also want to take three or so different samples and then average the results for greater accuracy.

Determining Forage Yield Activity Sheet, page 2 of 5

- Preweigh and label your paper bag.
- Throw the cable hoop in the area determined to be representative of the forage in the pasture.
- Clip all the forage within the circle down to the ground and place it in the preweighed paper bag. Depending on how much forage is clipped, you may need more than one bag for each hoop. Be sure to label the bags with the pasture number, date, and whether it is you first, second, third, etc. throw of the hoop.
- Forage requirements are based on air-dry weight, so let the forage dry several days in the bags, allowing the bags to remain open. Another option is to dry the forage on a cookie sheet in an oven at 100 degrees. The forage should look and feel like hay when it is dry.
- The next day, weigh the bag(s) using the gram scale. Be sure to subtract the weight of the bag from the weight of the bag plus the forage.
- Clip, dry and weigh forage from several different locations in the pasture. Average the weights in grams. This is the weight of forage, in grams, for an 8-foot circumference circle or a 30-inch diameter circle of your pasture.
- To convert the grams of forage available in an 8-foot circumference circle to the pounds of forage per acre, multiply the gram weight by 20. This measurement is the **total** pounds of forage per one acre of pasture.
- Once you have determined the average pounds of forage per acre for this pasture, multiply by the number of acres in the pasture to calculate the total pounds of forage.

As we discussed before, the best management practice for grazing is to take half and leave half. That means grazing about half of the plant from the top down. This leaves the plant plenty of vegetation to continue making food for itself from sunlight (photosynthesis) and plenty of cover to protect the soil from drying out during the growing season. In order to graze either pasture or rangeland in a sustainable manner, a ‘key species’ should be predetermined. This is the forage specie that you manage for. When the suggested grazed height is reached, it is time to rest the pasture. The idea is to evenly graze the forage so that some plants are not left ungrazed. When plants are not grazed initially, they usually are not chosen the rest of the growing season. Instead, previously grazed plants are regrazed after a rest, over and over. On some rangelands, shrubs may be the dominant plants. If your grazing animals, such as cows or horses, cannot eat the shrubs, there may not be much useable forage.

Use your calculations from clipping or soil survey production estimates in order to apply the calculations below. A method for preliminary estimates on usable forage for rangeland and pasture is provided.

Determining Forage Yield Activity Sheet, page 3 of 5

On rangeland, if we start with 100 percent of the plants and take half and leave half (100 percent x 50 percent), then 50 percent remains usable. Animals will not eat 25 percent of the available species that grow on the rangeland (50 percent x 75 percent), reducing usable forage to 37.5 percent. Of the 37.5 percent that is left, the animals will trample or destroy another 25 percent (37.5 percent x 75 percent) leaving only 28 percent. For ease of calculation, we'll round the number to 25 percent. **The actual useable forage in a rangeland setting may be only about <u>25 percent</u> of the available forage! Note that the terms "available" and "usable" are two different concepts. Available forage includes all plant material growing in a pasture that animals have access to, while useable forage is what the grazing animal will actually eat.**

For pasturelands, the calculations are a little different. First, on pastureland as on rangeland, starting with 100 percent of the plants and grazing half (100 percent x 50 percent) leaves 50 percent. However, on pasture, animals will usually eat all of the available species unless the pasture is overrun with weeds. If this is case, weed control measures and/or renovation may be options. Assuming the pasture is in good condition, only about 25 percent will be spoiled with trampling or manure (50 percent x 75 percent) yielding 37.5 percent, which we'll round to 35 percent. **The actual usable forage in a healthy pasture is only about <u>35 percent</u> of the available forage. Your goal is to rest the pasture after the 'key specie' has been grazed down to the appropriate height for that species.**

Determining Forage Yield Activity Sheet, page 4 of 5

Sample calculation

The average clipping weight (total weight less the bag weight, averaged for several samples) is 200 grams. To convert from 200 grams per 8-foot circumference circle (30 inch diameter) to pounds per acre, multiply 200 by 20 to get 4,000 pounds per acre of total forage.

4,000 pounds multiplied by 25 percent = 1,000 usable pounds per acre for rangeland
4,000 pounds multiplied by 35 percent = 1,400 usable pounds per acre for pasture
To calculate total forage in a given pasture, multiply the pounds per acre times the number of acres in the pasture.

Determining forage yield – sample problem

You have clipped three representative areas in Pasture 1. The pasture is 3 acres in size. The three samples you took weighed 251 grams, 191 grams and 281 grams. The lunch bags weigh 8 grams each.
How many pounds of forage are useable in Pasture 1 per acre? Assume Pasture 1 is a pasture in reasonably good condition.

How many useable pounds of forage per acre would Pasture 1 provide if it were a rangeland or native pasture?

How many pounds of forage are useable in the entire introduced species pasture? How many pounds of forage are available in the entire native pasture?

Determining Forage Yield Activity Sheet Answer Key, page 5 of 5

The actual weights of the three samples from Pasture 1, after subtraction of the 8-gram bag weight, are:

251 – 8 = 243 grams
191 – 8 = 183 grams
281 – 8 = 273 grams

The average weight of forage, in grams is: $\frac{(243 + 183 + 273)}{3} = \frac{699}{3} = 233$ grams

Converting grams to pounds per acre: 233 x 20 = 4660 pounds total forage

Available forage = 35 percent of total forage or 4660 pounds x 35 percent (0.35) = 1631 useable pounds per acre

Available forage per acre for rangeland or native pasture would be 4660 x 25 percent (0.25) = 1165 useable pounds per acre

Available forage for all 3 acres of “reasonably good condition” pasture = 1631 x 3 = 4893 useable pounds of forage

Available forage for 3 acres of rangeland or native pasture = 1165 x 3 = 3495 useable pounds of forage

Total forage, available forage, and usable forage are three completely different concepts. Total forage includes everything growing in a pasture. Available forage is what the grazing animals have access to and could potentially eat. Usable forage is what they prefer to eat and what they do not damage. Forage on very steep slopes may not be available to some animals. Usable forage that has been urinated on is no longer useable. Total forage would include shrubs/forbs that the animals would not eat. On range and pasture, the 25 percent and 35 percent estimates (respectively) take much of these factors into account.

Forage Availability Estimates Information Sheet

If you cannot clip your pasture, there are other methods for estimating available forage. The forage availability estimates provided below are for use with rotational grazing systems on pasturelands. These figures do not apply to native or rangeland pastures. The numbers come from a County Soil Survey Report, 'Land Capability and Yields.' They are based on the figures for 'optimum production with a high level of management for tons of hay.'

Forage Availability Estimates – Pasturelands

Hay yield (tons/acre/year)	5.5	4.5	4	3.5	3	2.5	2	1.5	1
Forage availability (pounds/acre/year)	3850	3150	2800	2450	2100	1750	1400	1050	700

Whenever possible, it is best to clip the grasses to provide accurate forage production figures. Native or rangeland pastures must be clipped to provide good estimates. The soil survey report has a section on 'rangeland productivity,' but this data is for specific plant species and relative percentages of those species found on that particular soil in a pristine condition. In other words, the species and the percentage of that species in the plant community listed reflect species composition on the range **before** the introduction of domestic grazing animals. Due to grazing pressure, the type and relative abundance of species present today will differ from that listed.

Seasonal grazing lengths

Suggested grazing duration in **spring** is four to five days; regrowth period is 10 to 14 days while the grasses are growing fast.

Suggested grazing duration in **summer** is nine to 10 days; regrowth period is 21 to 30 days. Grass growth is slowing down, and much of the plant energy is devoted to seed production.

Suggested grazing duration in **late summer** is 12 to 15 days; regrowth period is 30 to 45 days. The grass plants are preparing for dormancy by storing food reserves in the root.

The length of regrowth period is shorter for irrigated pastures and longer for dryland pastures. In many western regions, there may not be any summer regrowth on dryland pastures, although some fall regrowth may occur. Note that the above suggestions are simply guidelines for grazing and resting. Watch the grazed height of your key specie carefully to help you determine when to rest a pasture. You can graze the pasture again when most of the key specie has reached suggested grazing heights. If there hasn't been any regrowth, then there shouldn't be any regrazing.

Potential for Pasture Production is High Information Sheet

These pastures have adequate soil depths with more than 20 inches for effective root growth; desirable soil textures (silty, sandy or clay loams); good soil tilth; good soil-moisture-holding capacity; and free of significant amounts of salts or alkali. Topography permits good distribution of irrigation water. **NRCS soil reports, map unit descriptions, engineering soil properties, physical properties plus rangeland production or irrigated yields by map unit will provide the necessary information about soil limitations**

These assessments apply to irrigated or subirrigated pastures, or pastures that receive more than 20 inches of annual precipitation.
This is one method for determining your pasture condition and estimated production. Note that pasture grazing efficiencies are not considered in this chart.

MANAGEMENT LEVEL	HIGH Condition/Production	GOOD Condition/Production	FAIR Condition/Production	LOW Condition/Production
GRAZING MANAGEMENT				
1. Intensity of rotation	7 or > pastures grazed for 2 to 4 days per rotation or stripped grazed	4 or 5 pastures grazed for 4 to 10 days per rotation	2 or 3 pastures grazed for 10 to 20 days per rotation	1 pasture grazed for long periods or continuously
2. Available forage (average height with leaf in vertical position)	Foliage height at beginning of grazing season is 12 inches or more	Foliage height at beginning of grazing is 8 - 10 inches	Foliage height at beginning of grazing is 6 inches	Foliage height at beginning of grazing is 4 inches or less
3. Degree of use	Stubble height end of graze season is 4 inches or more	Stubble height at end of graze season is 3 to 4 inches	Stubble height at end of graze season is 2 to 3 inches	Stubble height at end of grazing season is < 2 inches"
4. Maintain stand (average height with leaf held in vertical position)	Foliage height regrowth at freeze-up is 8 inches or more	Foliage height regrowth at freeze-up is 5 to 8 inches	Foliage height regrowth at freeze-up is 3 inches	Foliage height regrowth at freeze-up is less than 2 inches
5. Regrowth period	4 or more weeks regrowth between grazings	3 weeks regrowth between grazings	2 weeks regrowth between grazings	Continuous graze w/out regrowth period
IRRIGATION				
1. Frequency of irrigation cycles	Soil moisture maintained. 2 or more irrigations during regrowth period	Soil moisture usually adequate,1-2 irrigations during regrowth period	Plants are stressed between irrigation cycles, rarely more than one irrigation cycle during regrowth period	Too much or too little irrigation
2. Time	Irrigated immediately after livestock are removed from pasture	Irrigated several days after livestock are removed from pasture	Irrigation frequently delayed a week after livestock are removed	Too much or too little irrigation
3. Time lapsed after irrigation before grazing	Soil is firm when grazed	Soil is more firm than not before grazing resumes	Soil frequently wet and soft when grazed	Soil is Irrigated while the pasture is grazed
COMPOSITION				
1. Legumes	50 percent of yield from high producing legumes	30 to 40 percent high yielding legumes	20 percent legumes, usually alfalfa	< than 10 percent legumes, usually white clover
2. Grasses	Good stands of highly adapted and productive grass species	Good stands of well adapted and productive grass species	Stands lack vigor, poorly adapted/low producing species that include weeds	Poor stand and production with low vigor, weeds and bare ground
FERTILIZER				
1. Nitrogen (N)	Regular soil testing:120-200 lbs actual N per acre applied in 2-3 applications	Regular soil testing: 100-120 lbs actual N per **acre** applied in 2 applications	Occasional soil testing: 30-60 lbs actual nitrogen per acre applied to grass	Never test soil; no nitrogen applied
2. Phosphorus (P)	Regular soil testing: applied to supply 55-65 lbs P_2O_5 per year	Regular soil testing: applied to supply 45-55 lbs P_2O_2 per year	Random soil testing: < 30 lbs P_2O_2 applied at seeding but rarely thereafter	Never test soil; no phosphorus applied
MAINTENANCE				
1. Clipping	Rough, stemmy growth clipped as needed	Rough, stemmy growth clipped as needed	Stemmy growth rarely clipped	Never clipped
2. Dragging	Manure spread by dragging spring/summer	Manure spread by dragging spring/summer	Manure seldom spread by dragging	Never dragged
Expected Production - Animal Unit Months per acre per year, based on a 180-day growing season	**9.1 + AUM /acre or 9,100 + lbs/acre, based on 1,000-pound animal (9.1 x 1,000). See soil map unit report for estimated production.**	**6.1 to 9 AUM/acre or 6,100 to 9,000 lbs/acre, based on 1,000-pound animal (6.1 x 1,000). See soil map unit report for estimated production.**	**3.1 to 6 AUM/acre or 3,100 to 6,000 lbs/acre based on 1,000-pound animal (3.1 X 1,000). See soil map unit reports for estimated production.**	**1 to 3 AUM/acre or 1,000 to 3,000 lbs/acre based on 1,000-pound animal (1 X 1,000). See soil map unit reports for estimated production.**

Irrigated Pasture Management Guide, adapted from SCS-MT-JS-110, September 1969 and revised by Wendy Williams, Montana NRCS, 2008

Potential for Pasture Production is Moderate Information Sheet

Moderate, but limited by one or more of the following soil factors: soil depth is between 10 and 20 inches for effective root development; soil texture includes sticky clays more than 10 inches deep; salt and/or alkali moderately inhibits growth; soils with desirable textures but low water storage capacity due to gravel or cobbles; or a combination of slope and texture that makes good water management impractical to achieve. **NRCS soil reports, map unit descriptions, engineering soil properties, physical properties plus rangeland production or irrigated yields by map unit will provide the necessary information about soil limitations**

These assessments apply to irrigated or subirrigated pastures, or pastures that receive more than 20 inches of annual precipitation.
This is one method for determining your pasture condition and estimated production. Note that pasture grazing efficiencies are not considered in this chart.

MANAGEMENT LEVEL	GOOD Condition/Production	FAIR Condition/Production	LOW Condition/Production
GRAZING MANAGEMENT			
1. Intensity of rotation	4 or 5 pastures grazed for 4 to 10 days per rotation	2 or 3 pastures grazed for 10 to 20 days per rotation	1 pasture grazed for long periods or continuously
2. Available forage (ave ht with leaf in vertical position)	Foliage height at beginning of grazing season is 8-10 inches	Foliage height at beginning of grazing is 6 inches	Foliage height at beginning of grazing is 4 inches
3. Degree of use	Stubble height at end of graze season is 3 to 4 inches	Stubble ht end of graze season is 2 to 3 inches	Stubble heightt end of graze season is < 2 inches
4. Maintain stand (average height with leaf held in vertical position)	Foliage height regrowth at freeze-up is 5 to 8 inches	Foliage height regrowth at freeze-up is 3 inches	Foliage height regrowth at freeze-up is < 2 inches
5. Regrowth period	3 weeks or more regrowth between grazings	2-3 weeks regrowth between grazings	Continuously grazed w/out regrowth period
IRRIGATION			
1. Frequency of irrigations	Soil moisture usually adequate. 1 or 2 irrigations during regrowth period	Plant stress between irrigations, rarely more than 1 irrigation cycle during regrowth period	Too much or too little irrigation
2. Time	Irrigated several days after livestock are removed from pasture	Irrigation frequently delayed a week after livestock are removed	Too much or too little irrigation
3. Time lapse after irrigation before grazing	Soil usually firm before grazing resumes	Soil frequently wet and soft when grazed	Irrigated while grazed
COMPOSITION			
1. Legumes	30 to 50 percent legumes, usually alfalfa	20 percent legumes, usually alfalfa	< than 10 percent legumes, usually white clover
2. Grasses	Good stands of well adapted and productive grass species	Stands lack vigor, poorly adapted/low producing species that include weeds	Poor stand and production with low vigor, weeds and bare ground
FERTILIZER			
1. Nitrogen (N)	Regular soil testing: 100-120 lbs of actual N/ac applied in 2 applications	Occasional soil testing: 30-60 lbs of actual N/acre applied in late spring	Never test soil; no nitrogen applied
2. Phosphorus (P)	Regular soil testing: applied to supply 45-55 lbs P_2O_5 per year	Random soil testing: < 30 lbs P_2O_5 applied at seeding but rarely thereafter	Never test soil; no phosphorus Applied
MAINTENANCE			
1. Clipping	Rough, stemmy growth clipped as needed	Stemmy growth rarely clipped	Never clipped
2. Dragging	Manure spread by dragging spring/summer	Manure seldom spread by dragging	Never dragged
Expected Production - Animal Unit Months per acre per year, based on a 180-day growing season	**3.5 to 5 AUM/acre or 3,500 to 5,000 lbs/acre, based on 1,000-pound animal (3.5 x 1,000). See soil map unit report for estimated production.**	**2.1 to 3.5 AUM/acre or 2,100 to 3,500 lbs/acre, based on 1,000-pound animal (2.1x 1,000). See soil map unit report for estimated production.**	**1 to 2 AUM/acre or 1,000 to 2,000 lbs/acre based on 1,000-pound animal (1 X 1,000). See soil map unit reports for estimated production.**

Irrigated Pasture Management Guide, adapted from SCS-MT-JS-110, September 1969 and revised by Wendy Williams, Montana NRCS, 2008

Potential for Pasture Production is Low Information Sheet,

Even under good management practices, potential is low because of one or more of the following factors: soil depth for effective root development is less than 10 inches; soil texture is coarse or sandy with little water-holding capacity; sodium is present, causing crusting; poor water intake characteristics; salt and/or alkali is severely limiting; or slopes are so steep that application of irrigation water is irregular and not very effective. **NRCS soil reports, map unit descriptions, engineering soil properties, physical properties plus rangeland production or irrigated yields by map unit will provide the necessary information about soil limitations**

These assessments apply to irrigated or subirrigated pastures, or pastures that receive more than 20 inches of annual precipitation.
This is one method for determining your pasture condition and estimated production. Note that pasture grazing efficiencies are not considered in this chart.

MANAGEMENT LEVEL	GOOD Condition/Production	LOW Condition/Production
GRAZING MANAGEMENT		
1. Intensity of rotation	More than 1 pasture grazed for 10 to 20 days per rotation	1 pasture grazed continuously
2. Available forage (average height with leaf in vertical position)	Foliage height at beginning of grazing season is 4 inches or more	Foliage height at beginning of grazing is less than 4 inches
3. Degree of use	Stubble height at end of grazing season is at least 3 inches	Stubble height at end of grazing season is less than 3 inches
4. Maintenance of stand (average height with leaf held in vertical position)	Foliage height regrowth at freeze-up is 3 inches or more	Foliage height regrowth at freeze-up is less than 3 inches
5. Regrowth period	2 weeks or more for regrowth between grazings	Continuously grazed with no regrowth periods
IRRIGATION		
1. Frequency of irrigations	Soil moisture usually adequate. 1 or 2 irrigation cycles during regrowth period	Too much or too little irrigation
2. Time lapse after irrigation before grazing	Soil is sometimes wet and soft when grazed. Occasionally irrigation occurs during grazing	Grazing pastures during irrigation is a common practice
COMPOSITION		
1. Legumes	Very few or no legumes	Very few or no legumes
2. Grasses	Mostly desirable species	Low producing species, mostly weeds, invaders, and/or bare ground
FERTILIZER		
1. Nitrogen	Usually not used	No nitrogen applied
2. Phosphorus	Usually not used	No phosphorus applied
MAINTENANCE		
1. Clipping	Stemmy growth rarely clipped	Never clipped
2. Dragging	Droppings are seldom spread by dragging	Never dragged
Expected Production - Animal Unit Months per acre per year, based on a 180-day growing season	**1.6 – 2 AUM/ac or 1,600-2,000 lbs/ac, based on 1,000-pound animal (1.6 x 1,000). See soil map unit report for estimated production.**	**.05 - 1.0 AUM/ac or 50-1,000lbs/ac, based on 1,000-pound animal (.05 x 1000). See soil map unit report for estimated production.**

Irrigated Pasture Management Guide, adapted from SCS-MT-JS-110, September 1969 and updated by Wendy Williams, Montana NRCS, 2008

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Stubble Height and Regrowth Recommendations Information Sheet, page 1 of 2

	Suggested Height at Start of Grazing (inches)	Growth Stage at Start of Grazing	Minimum Stubble Height (inches)
Grasses			
Tall fescue	8	Early boot	4
Orchardgrass	8	Boot	3
Smooth bromegrass	8	Early boot	4
Meadow bromegrass	8		3
Meadow foxtail	10		4
Basin wildrye	10		8
Crested wheatgrass	4	Vegetative	2
Tall wheatgrass	10	Vegetative	6
Intermediate wheatgrass	8	Early boot	4
Pubescent wheatgrass	8	Early boot	4
Timothy	8	Boot	3
Kentucky bluegrass	6	Vegetative	3
Reed canarygrass	12	Vegetative	4
Legumes			
Alfalfa	6-18	Mid to late bud	2
Red clover	6	Early bloom	3
Alsike clover	6	Early bloom	2
Sweetclover	8		6
Ladino clover	4-8	Early bloom	3
Strawberry clover			2
Broadleaf birdsfoot trefoil	8	Early bloom	3
Narrowleaf birdsfoot trefoil	8		3
Sainfoin	12	Early bloom	6
Cicer milkvetch	8	Early bloom	4

These figures are from Nevada. Each state may need to tailor this information to local climate and growing conditions.

Stubble Height and Regrowth Recommendations Information Sheet, page 2 of 2

Species	Regrowth time (days)
Alfalfa	28-40
Trefoil	24-30
Clover	20-26
Sainfoin	28-40
Milkvetch	24-30
Orchardgrass	20-36
Tall fescue	20-36
Timothy	28-36
Intermediate wheatgrass	24-30
Smooth bromegrass	24-30

These figures are estimates for Nevada. Each state may need to tailor this to local climate and growing conditions.

The values are for dryland conditions. Regrowth rates for irrigated pastures will be different. The data is representative of hot summer conditions when plant growth slows considerably. The above figures do not apply during the early spring when grasses are growing fast. At that time of year, regrowth may occur in as little as 10 to 14 days. As the weather gets warmer and rainfall slows down, so does grass growth.

How Grass Grows Glossary, page 1 of 2

Annual: Plant that completes its life cycle, growing from a seed to producing seed, in one growing season.

Auricle: The turned, reinforced portion of the leaf blade as it leaves the leaf sheath at the collar region.

Awn: Bristle-like growth extending from the lemma of a floret.

Biennial: A plant that completes its life cycle in two years. First year growth consists of low growing leaves; the second season growth includes flowers and seeds.

Bunchgrass: Grass that propagates by seed and basal tillering only (no rhizomes), forms clumps, not sod.

Collar: The point where the leaf separates from the stem; the collar consists of two parts called the auricle and ligule.

Cool-season grass: Grass species adapted to rapid growth during the cool, moist period of the year; this type of grass is usually dormant during hot weather.

Crown: The base of the above-ground portion of the grass plant at the junction of roots and shoots.

Culm: The collective name for the above-ground portion of the grass plant; jointed stem of a grass plant, the true stem, and elongated internodes.

Forage yield: The actual amount of useable forage, generally reported on a per acre basis.

Forbs: Broad-leaved, flowering, herbaceous plants.

Florets: The individual flowers on a spikelet, which will later form individual seeds on a grass. On a legume, it is an individual flower, usually belonging to a cluster.

Glabrous: Smooth, devoid of hair or pubescence.

Glumes: Dry chaff-like bracts or leaves at the base of the spikelet; often these leaves or bracts provide protection for the florets above them.

Herbaceous: Plants that do not produce wood; a plant having little or no woody tissue

Inflorescence: The flowering portion of the grass, generally made up of many small branch-like clusters of flowers called spikelets. Also called a seed head.

Internode: The portion of the stem between two joints or nodes.

Leaf blade: The portion of the grass blade that separates from the stem at an angle (usually less than 90 degrees), above the collar.

Leaflet: Subdivision of compound leaves, an individual leaf petal.

Leaf sheath: Portion of the grass blade that begins at the node and that wraps around the stem below the collar.

Legume: Plant of the pea family, generally has the ability to fix nitrogen from the atmosphere into the soil, where it becomes available to plants.

How Grass Grows Glossary, page 2 of 2

Lemma: Chaffy bract or scale opposite the palea, the outer leaf or petal of the floret; it surrounds the actual reproductive plant parts.

Ligule: The outgrowth of the upper and inner side of the grass leaf at the point where it joins the leaf sheath. It provides additional support for the leaf as it grows away from the stem.

Nodes: Joints of the grass stem, each supporting a new leaf , punctuated by knobby swelling.

Paddock: Aka sacrifice area. Small field or enclosure used to confine animals when they are not grazing, generally for horses.

Palea: Chaffy bract or scale opposite the lemma, the inner leaf or petal of the floret; it surrounds the actual reproductive plant parts.

Pasture: Ground or field suitable for grazing.

Perennial: Plant that lives for three or more years, even though some perennials die down to the ground each year.

Petiole: Leaf stalk that attaches legume leaf blade to the stem.

Pubescence: Hair, hairy.

Raceme: Inflorescence in which flowers or spikelets are singly supported along a main axis.

Rangeland: Land that is dominated by native vegetation.

Rhizome: Underground stem, usually horizontal, capable of producing new shoots and roots at the nodes.

Sod: Top few centimeters of soil permeated by and held together with plant roots.

Sod-forming grass: Grass that propagates by seed and vegetatively by rhizomes and/or stolons to form a sod.

Spikelets: Small branch-like clusters of flowers, each consists of several florets or small flowers.

Stipule: One of the small, paired leaf-like appendages at the base of a legume leaf.

Stolon: Trailing or lateral stem forming at or below the soil surface, capable of rooting and sending up new shoots at the nodes.

Tillering: To put out new plant shoots from the root.

Toothed: Sawteeth-like projections on the margins of a leaf blade

Warm-season grass: Grass species that makes its major growth during the warmer part of the year.

How Grass Grows Evaluation

(Circle your answer.) Was this lesson:	Not at all	----------→			Very much so
Current, up-to-date?	1	2	3	4	5
Understandable?	1	2	3	4	5
Presented in an interesting way?	1	2	3	4	5
Did the program answer any questions you had?	1	2	3	4	5
Did it help you learn how to do new things or how to do something better than you knew before?	1	2	3	4	5
Do you intend to use any of the information from this lesson?	1	2	3	4	5
Overall, was this program worth your time to attend?	1	2	3	4	5

What was the most informative part of this session?

Which part was too technical and why?

Which part was too easy and why?

On which part(s) do we need to spend more or less time?

On which topic(s) would you like more information?

What one practice from this lesson will you implement within a year?

How Grass Grows Post-class Mini-test

1. T or F The growing point of a grass is situated at the base of the grass plant all year long.

2. T or F Regular removal or grazing of the first few leaves of a grass plant in the spring is an acceptable grazing practice.

3. T or F Plant roots stay healthy when grazing periods are short and rest or recovery periods are long.

4. T or F Plants store enough carbohydrates in their roots for all of the next year's growth.

5. T or F Seasonal growth patterns are the same for all grasses.

6. T or F All grasses grow at the same rate all through the growing season.

7. Serious damage to plant roots occurs at what percentage of leaf volume removal?

   a. 40 percent
   b. 50 percent
   c. 60 percent
   d. 70 percent

8. Plants need to replace what percentage of their root system each year, just to maintain the same size and production capacity?

   a. 10 percent
   b. 20 percent
   c. 30 percent
   d. 40 percent

9. Available forage in a pasture is what percentage of the total forage in a pasture?

   a. 55 percent
   b. 45 percent
   c. 35 percent
   d. 25 percent

10. Available forage in a rangeland setting is what percentage of the total forage in a pasture?

   a. 55 percent
   b. 45 percent
   c. 35 percent
   d. 25 percent

How Grass Grows Post-class Mini-test Answer Key

1. F
2. F
3. T
4. F
5. F
6. F
7. c. 60 percent
8. c. 30 percent
9. c. 35 percent
10. d. 25 percent