

# Basic plant physiology for grazing

by Geoff Brink, Agronomist



**U.S. Dairy Forage  
Research Center**

Greener Horizons for  
Crops, Cows, and Communities



# Grazing-based livestock production involves a number of factors that the producer tries to manage.

**1** Cattle genetics



**2** Pasture quality



**3** Supplementation



**4** Management of pasture plants



**5** Nutrient cycling



**6** Stored feeds



**In this presentation we will emphasize management of pasture plants.**



**Without really knowing it, producers are often faced with the question:**



**Is pasture management based on what's best for the animal . . .**



**. . . or what's best for the plant?**

**Manage for  
the plant,  
because it is  
the basis of  
feeding.**





Uniformity

Predictability

**A grazing-based producer benefits most from having a **uniform and predictable** seasonal distribution of grass.**

**How does one achieve this?**

# Some background information, food for thought.



**“Successful pasture management practices are based on knowledge of *physiological* <sup>1</sup> and *morphological* <sup>2</sup> reactions of plants.”**

**Understanding Grass Growth:  
The Key to Profitable Livestock Production**

<sup>1</sup>-processes taking place inside the plant

<sup>2</sup>-what we can see on the outside of the plant



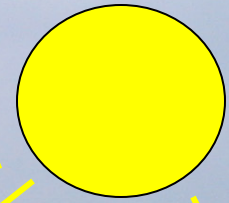
**Some background information,  
food for thought.**

**"Grass is a SOLAR PANEL."**

**Jim Gerrish  
Grazing 'guru' and consultant  
Idaho**



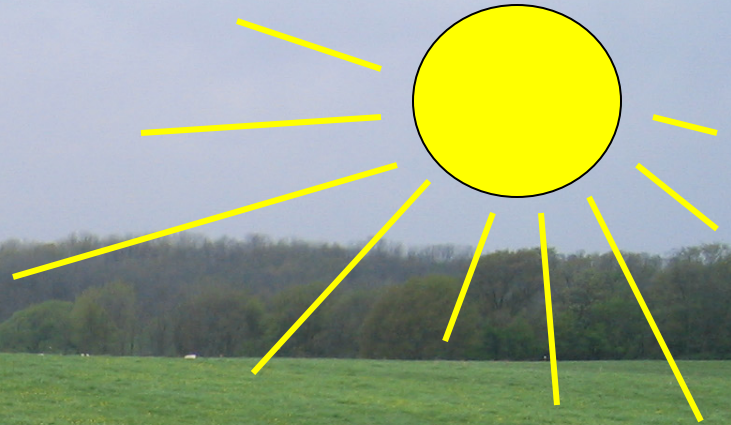
# A quick lesson in plant physiology . . .



**Photosynthesis** uses the sun's energy to produce carbohydrates in the plant.

**Fructose**, a sugar, is the primary carbohydrate.

# A quick lesson in plant physiology . . .

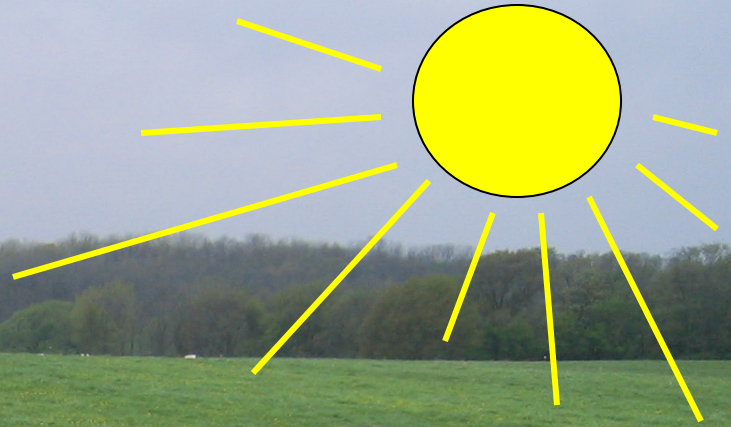


## Carbohydrates:

- are produced by photosynthesis;
- enable the plant to grow more leaves and tillers;
- are stored in stem bases, roots, and rhizomes;
- are consumed by grazing animals;
- keep the plant alive during stress (winter, drought).



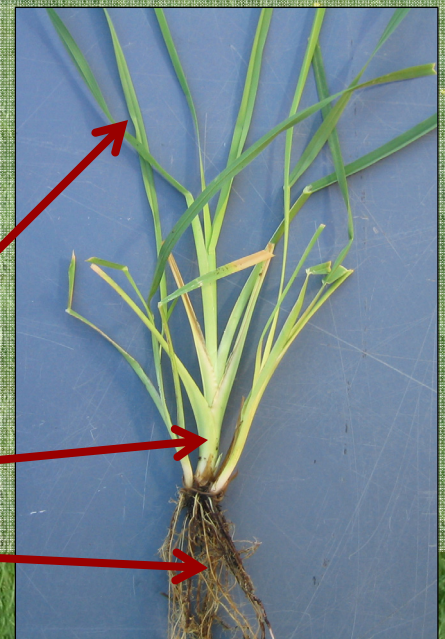
# A quick lesson in plant physiology . . .



## How does grazing affect the plant?

In order to regrow and make the necessary leaves, the plant uses two sources of energy:

- existing leaves, which make new carbohydrates via photosynthesis;
- stored carbohydrates.



When an adequate residual is left after grazing . . .

grazing height

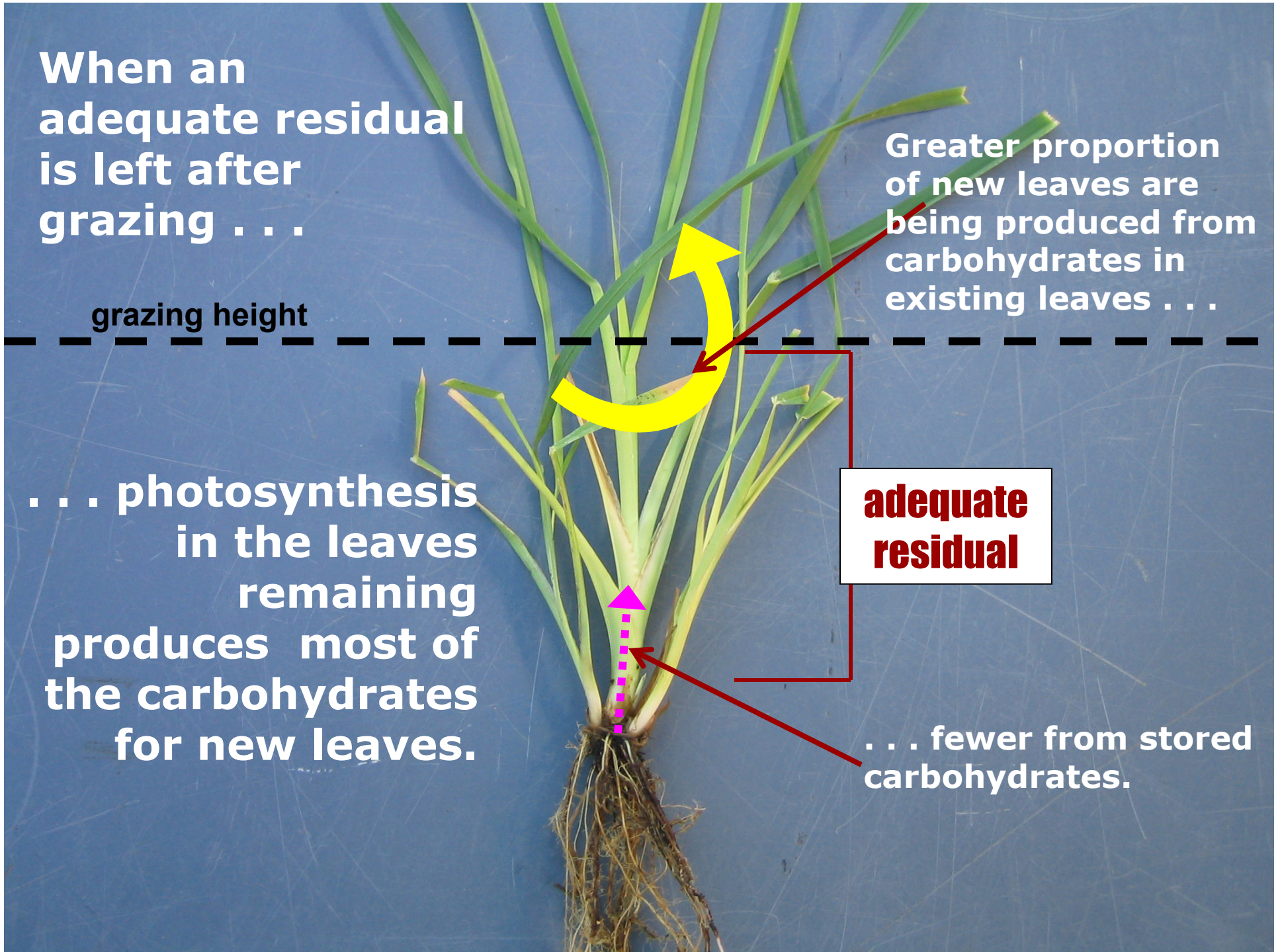
---

Greater proportion of new leaves are being produced from carbohydrates in existing leaves . . .

. . . photosynthesis in the leaves remaining produces most of the carbohydrates for new leaves.

**adequate residual**

. . . fewer from stored carbohydrates.



When there is an inadequate residual left after grazing . . .

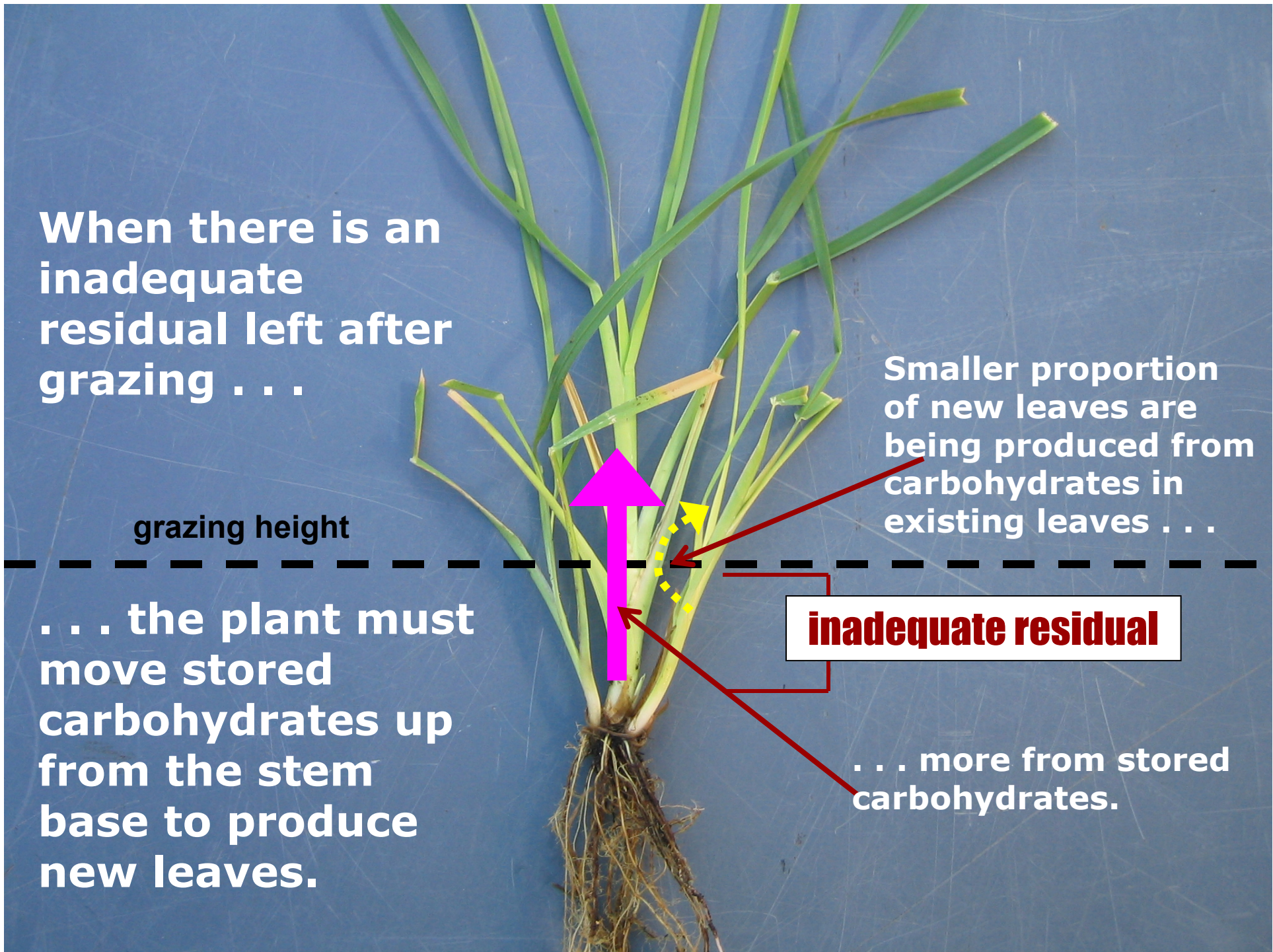
Smaller proportion of new leaves are being produced from carbohydrates in existing leaves . . .

grazing height

. . . the plant must move stored carbohydrates up from the stem base to produce new leaves.

**inadequate residual**

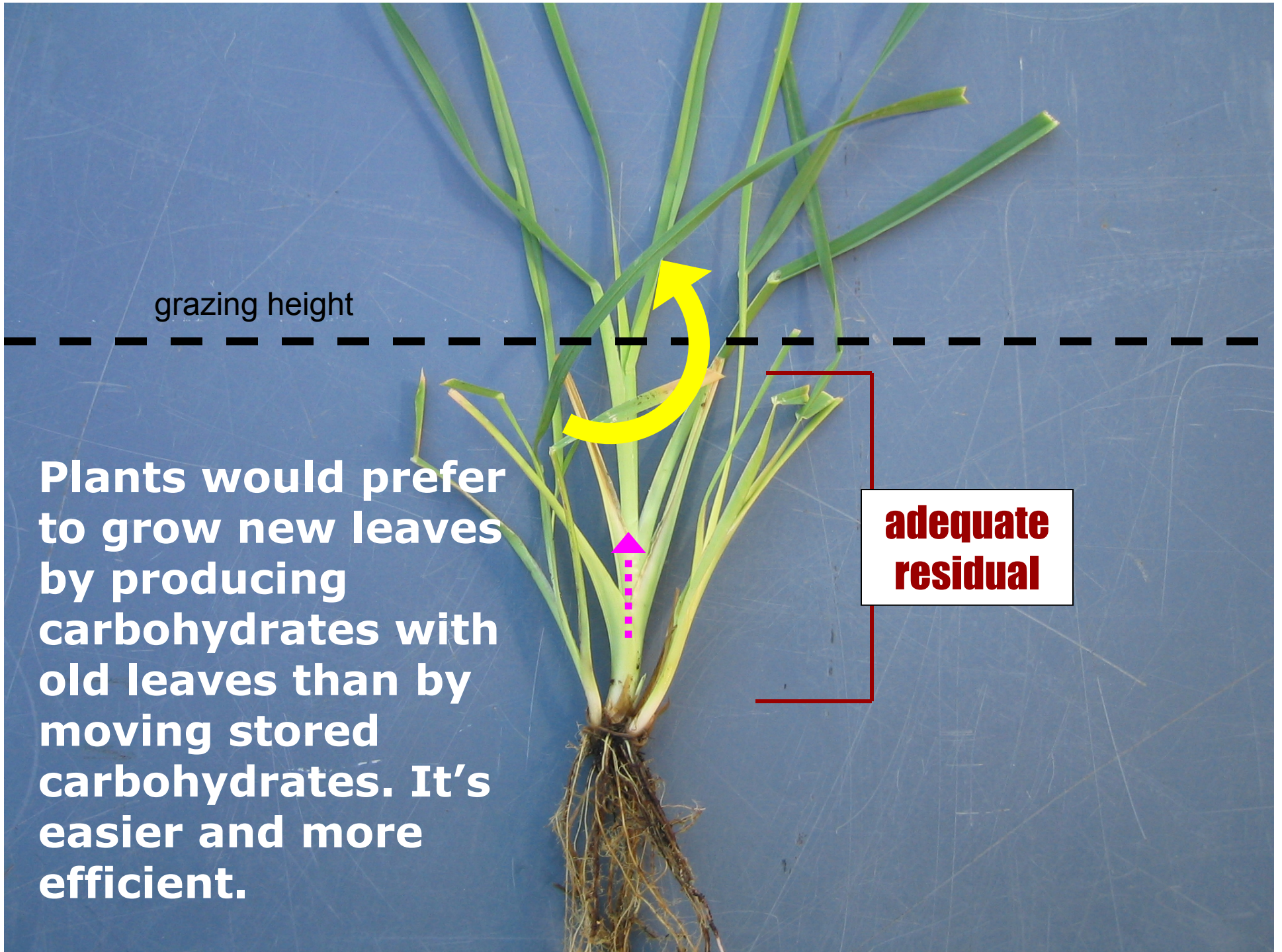
. . . more from stored carbohydrates.



grazing height

Plants would prefer to grow new leaves by producing carbohydrates with old leaves than by moving stored carbohydrates. It's easier and more efficient.

**adequate residual**



**This graph shows the rate at which grass grows depending on the residual height. The rate increases as residual increases – until the grass is long enough to start shading the underside of the plant and slowing down the growth.**

### **Residual height affects pasture growth rate**

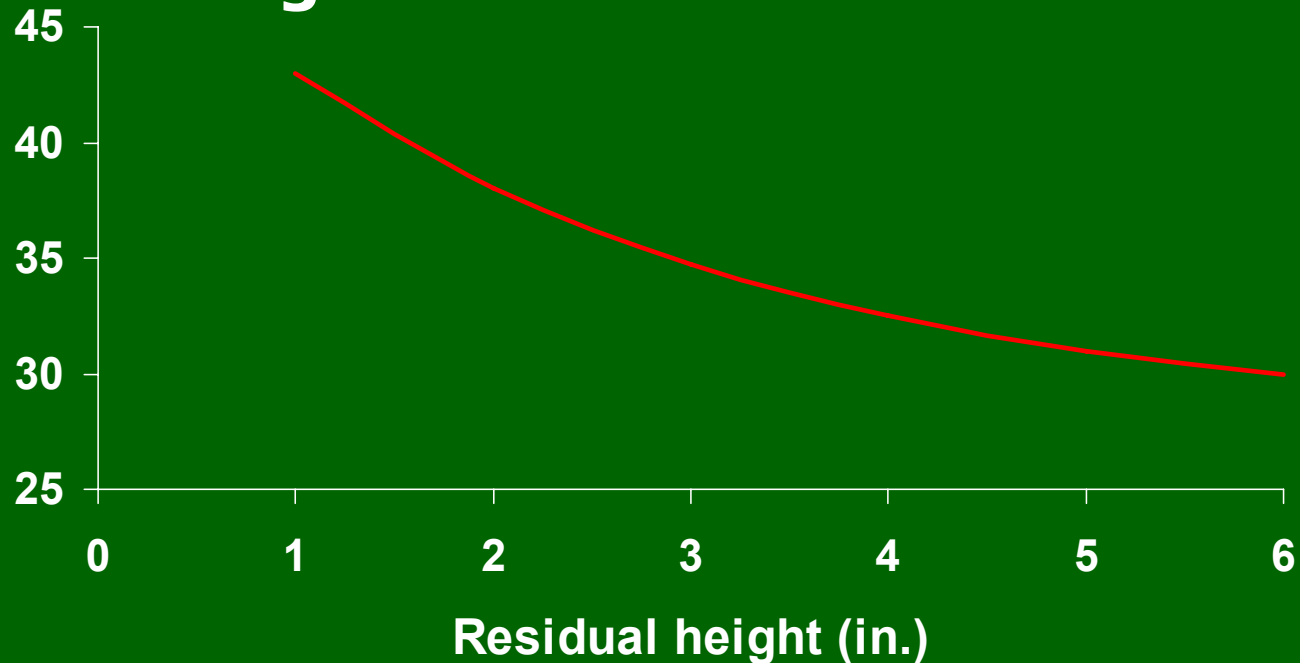


Gerrish, 1999

**An adequate residual height, which promotes quicker regrowth, also shortens the length of time before cattle can graze in the same pasture again.**

### **Residual height affects rotation time**

**Days until next grazing**



Gerrish, 1999





## **Shorter residual height:**

- **will increase the length of rest periods;**
- **may change pasture composition;**
- **may encourage weeds.**

# Grasses differ . . .

. . . in their response to defoliation, their ability to grow back after being grazed.



Comparing these two grasses, the orchardgrass stem bases (where carbohydrates are stored) are higher in the canopy – so they are more likely to be eaten.

grazing height



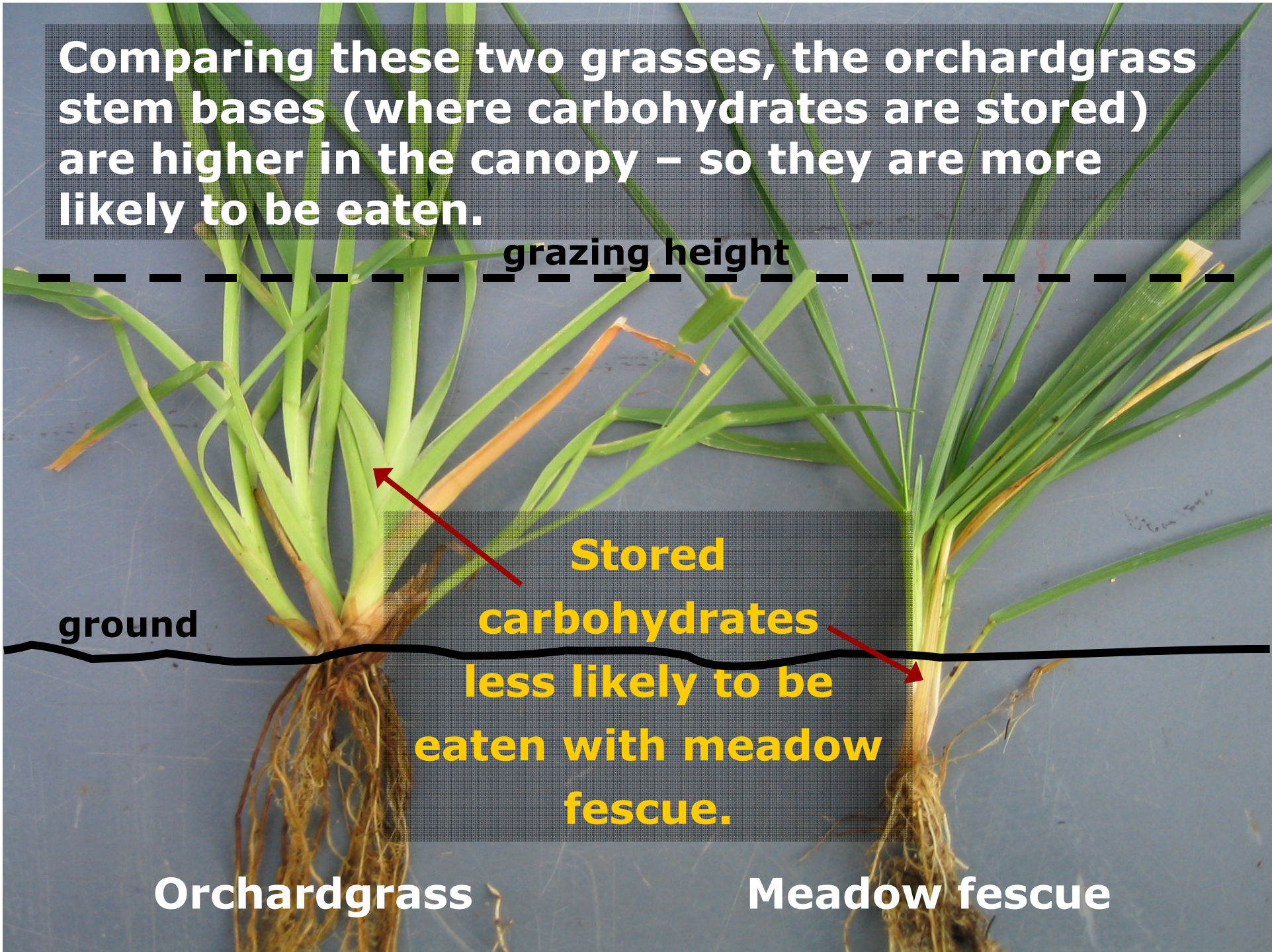
ground



Stored carbohydrates less likely to be eaten with meadow fescue.

Orchardgrass

Meadow fescue



In addition, the meadow fescue maintains more leaf area below grazing height than the orchardgrass, which also encourages regrowth.

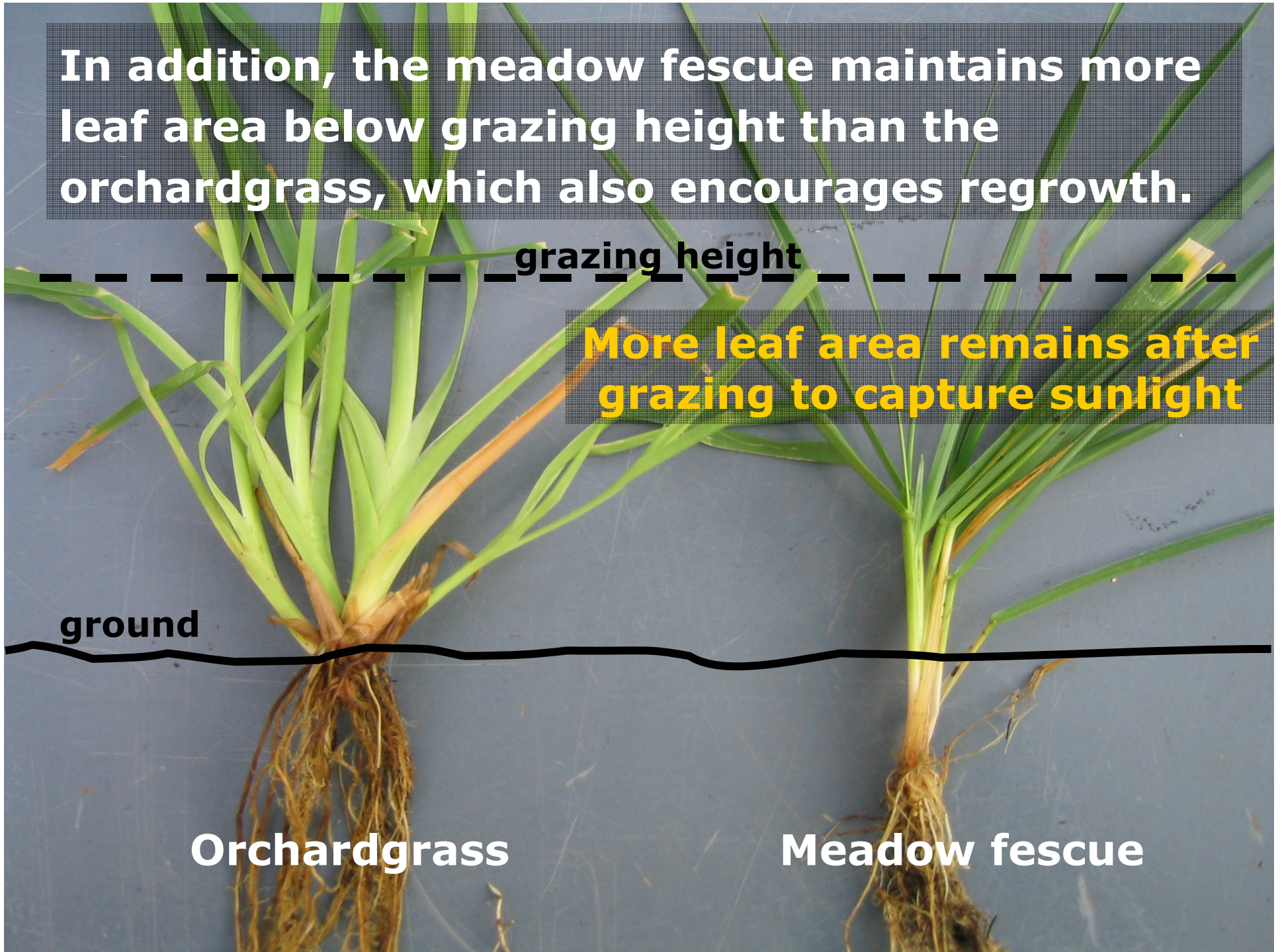
grazing height

More leaf area remains after grazing to capture sunlight

ground

Orchardgrass

Meadow fescue



# **Grazing During Drought**

**During dry weather, be on the lookout for early signs of moisture stress.**

**During moisture stress, plants are more dependent on stored carbohydrates for growth.**

**Increase residual height of the grazed plants and lengthen the rest periods between rotations. This way there are more leaves present to help supply the plant with carbohydrates.**



# **Grazing During Drought**

**If the drought persists, consider a sacrifice pasture.**

**Remove the animals from all paddocks except this sacrifice pasture and feed them hay.**

**You know that the plants in the sacrifice paddock may die from overgrazing, but you'll be saving the rest in the process.**



# **The importance of the late-season grazing period**

**In late summer and early fall, temperate grasses produce new tillers that will be the basis for growth in the following spring.**



**Because growing conditions may be less than optimum during this time, control grazing pressure to insure productive pastures next year; severe defoliation near the end of the growing season will reduce future forage production.**

# The importance of the late-season grazing period

**Let grasses grow (uninterrupted) 3 to 4 leaves before a killing frost to store sufficient carbohydrates, and leave a 3 - 4" residual.**





## **Final thought . . .**

"Animals delight most to feed on fresh plants. Cattle supplied with this kind of food would be quickly fattened if a farmer divided his land into 15 to 20 equal divisions, stopped his beasts from roaming indiscriminately, and put the whole number of his beasts into one of these divisions. Have the numbers of beasts so great as to consume the best part of the grass in one day. Give them a fresh park every morning to repeat the same repast. Have so many parks as days required to advance the grass to the proper length after being eaten far down, so the first field would be ready to receive them after going over all the others, so they might be carried round in a constant rotation."

**James Anderson, Scottish Agriculturist, 1777**

This material courtesy of:

# U.S. Dairy Forage Research Center

USDA-Agricultural Research Service

1925 Linden Dr. West

Madison, WI 53706

608-890-0050

Contact: [Lori.Bocher@ars.usda.gov](mailto:Lori.Bocher@ars.usda.gov)

<http://ars.usda.gov/mwa/madison/dfrc>

Material may be copied and used for educational purposes.



**Greener Horizons  
for Crops, Cows,  
and Communities**



**Madison, WI**



**Prairie du Sac, WI**



**Marshfield, WI**



**Institute for Environmentally  
Integrated Dairy Management**