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Using a Grazing Stick for Pasture Management

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Good management of livestock feeding enterprises requires an understanding of feed inventories and their use. Gathering this information is straightforward in grain-based feeding systems because bushels of stored grain are easily measured, and the amount fed per day is determined by the ration and the number of animals.

In pasture systems, however, keeping a forage inventory is more difficult. Feed may be allocated for more than one day, and feed quantity and quality are influenced by weather, fertility, stand density, and season. Not all of the feed available is consumed, and the plants continue to grow after they are grazed. Variation in feed quality and animal production status (pregnant, dry, lactating, growing, etc.) may also influence feed consumption.

This publication is intended to help producers meet animal forage needs in a rotational grazing system by mastering the use of a grazing stick to estimate pasture yield and pasture allocation.

Grazing sticks are useful for making immediate pasture management decisions, but good records of pasture yield, grazing days, and other data will provide a means to evaluate past efforts. Grazing sticks look like a simple measuring device, but are really a measurement system. They include a ruler for measurement, grazing guidelines, and conversion formulas for making immediate pasture management decisions. Grazing sticks are handy tools that simplify measuring pasture yield, allocating pasture to animals, and tracking productivity changes. These tasks are all critical aspects of good pasture management.

Grazing sticks vary somewhat from state to state. The Kentucky model consists of the following, shown on the stick itself:

- A ruler to measure forage height
- A quick guide to start and stop grazing on a paddock
- A table to convert stand density to dry matter per acre-inch
- Formulas for pasture allocation and management decisions
- General guidelines and planning information

Using the Grazing Stick Yield Estimation

Keep in mind the estimate is only as good as the sample. If the forage stand and the topography are uniform, a minimum of one sample per acre is recommended. Take more measurements for fields with variable soils, topography, or forage stands.



Figure 1. Ruler used to measure height.

Step 1—Use the ruler to measure forage height (Figure 1). With most forages, plant height taller than 18-24 inches is really better suited to hay than to grazing. This is particularly true with endophyte-infected tall fescue, because toxins increase with stem growth and seed head development. See *Sampling Tall Fescue Endophyte in Pasture or Hay Stands* (PPA-30) for more information on dealing with infected tall fescue.

Height is not a measure, but rather an average, of the tallest plants. Spread your hand and lower it onto the canopy. The average height is measured at the point where you feel very modest resistance from the plant canopy. In Figure 1, the height is 7 inches. Record the height for each sample location in the pasture and then calculate the average height for the pasture.

Step 2—Stand density is the amount of the ground surface covered with standing forage. Your goal is to place the pasture into one of three density categories (less than 75%, 75 to 90%, or more than 90%).

Visually estimate stand density by looking directly down at each location where you have just measured canopy height. Do not include ground residue, only plant material tall enough for the livestock to consume. Stand density measurements using the grazing stick are most accurate when canopy height is approximately 8 inches.

Record the density reading for each location, then calculate the average stand density for the pasture. The density yield table (Table 1) can now be used to estimate forage yield per acre-inch. The table is more accurate with denser stands.

Step 3—Determine the dry matter (DM) yield per acre-inch using the density measured in Step 2. For example, if you are measuring a tall fescue pasture and you estimate that the available forage covers 85% of the ground area, this pasture would be assigned to the middle density category of 75 to 90% cover. According to Table 1, this density rating would be between 150 and 200 lb of DM per acre-inch. Based on your assessment of the stand, assign a yield. The thicker the stand, the closer the yield will be to the upper end of the range. Since 85% is in the upper end of this density category, 200 lb of DM per acre-inch would be a good estimate. If the average stand height is 8 inches and you want to maintain 3 inches of stubble after grazing, available forage equals:

$$5 \text{ inches} \times 200 \text{ lb/acre-inch} = 1,000 \text{ lb DM/acre.}$$

Step 4a—Calibration (quick estimate): A periodic check of your measurements can help you be consistent in using the grazing stick. Harvest 1 square foot of forage (cut at soil level), weigh it in grams, and multiply it by 20. This calculation will give an estimate of lb per acre assuming the forage is 20% DM. While this method is useful for a quick check, the DM content of forage does vary throughout the year, so the yield estimate will be more accurate if the sample is actually dried.

Step 4b—Calibration (better estimate):

1. Harvest 1 square foot of forage (cut at soil level) and chop the forage into 1- to 2-inch lengths.
2. Weigh the forage (in grams) then place it on a microwave-safe dish. Place the dish in a microwave oven along with a cup of water, which helps reduce the risk of burning the forage.
3. Heat on high for two minutes.
4. Weigh the forage.
5. If the forage is not dry, place it back in the oven and heat it for 30 seconds more.
6. Repeat steps D and E until the weight does not change. If the forage is charred, use the last weight.
7. Multiply the dry weight in grams by 100 for an estimate of dry matter yield in lb per acre.

Table 1. Estimated dry matter yield per acre inch based on density and forage type.

Forage	Density		
	<75%	75-90%	>90%
	Dry Matter Yield (lb)		
Tall fescue or orchardgrass	50-150	150-200	200-300
KY Bluegrass	50-100	100-175	175-250
Cool-season grass (clover)	50-125	125-200	200-275
Bermudagrass	100-200	200-300	300-400
Alfalfa	75-150	150-225	225-300
Red clover	75-125	125-175	175-250

Allocate Forage

Your pasture system will determine how you apportion forage for your animals. If you are using temporary electric fencing and allocating acreage to feed your animals for a specific number of days, you will need to calculate the acres needed per day. If you have a slow rotation with modest-sized paddocks, you will have to determine how many days a particular paddock will carry your herd. If you can vary animal numbers to fully utilize your available pasture, you will have to determine how many animals are required. Each situation will require you to estimate yield and to make the appropriate allocation. In addition to forage yield, the formulas for calculating pasture allocation require values for percent utilization (Table 2), animal weights, and animal intake (Table 3).

Table 2. Percent utilization of available forage based on grazing system.

System	Utilization
Continuous	30-40%
Slow rotation (3-4 paddocks)	40-55%
Fast rotation (8+ paddocks)	55-70%

Source: The Kentucky Grazing Stick.

Table 3. Forage intake guidelines.

Livestock Class	Dry Matter Intake as Percent of Body Weight
Dry beef cow	2
Lactating beef cow	3-4
Lactating dairy cow	2.5-5*
Stockers	2.5-3.5
Horses	2.5-3
Sheep & Goats	3.5-4

*May include grain.

Utilization is defined as the percent of the available forage that animals consume. Utilization rates vary with the intensity of the grazing system (Table 2).

Animals will only use 30-40% of the forage on a continuously grazed pasture because they have excess forage and graze selectively. The forage they do not eat may become mature and unpalatable. In addition, much of the available forage becomes waste because it is trampled or fouled with dung or urine.

With pasture rotation, the grazing period is shortened, animals cannot be as selective, and less forage is wasted (Table 2). With a slow rotation (three to four paddocks, animals moved every seven to 10 days), the utilization increases to 40-55%. A faster rotation will increase utilization to 55-70%. It is possible to achieve higher utilization (70-80%) with intensive rotational systems (animals moved once or twice a day).

Livestock species, class, and physiological condition all have profound effects on intake (Table 3). Forage intake may also be influenced by the stage of plant growth. Mature plants are a low-quality feed because they have high fiber content. Fiber digests slowly and limits the amount an animal can consume. See American Farm Bureau publication *Understanding Forage Quality* (pub. no. 1-01) for more detailed information. Lactating dairy cows need a high level of nutrition to maintain high levels of milk production and, as indicated in Table 3, some supplementation with grain may be necessary to provide sufficient intake for these animals.

Pasture Allocation Examples Using Formulas from the Grazing Stick

Calculate: The paddock size needed to feed a set number of animals.

Example 1: 100 dry cows, average weight 1,350 lb.

$$\text{Acres required/paddock} = \frac{(\text{weight}) \times (\text{intake in \% body weight}) \times (\text{animal \#}) \times (\text{days/paddock})}{(\text{available DM/acre}) \times (\% \text{ utilization})}$$

Step 1—Animals will be moved every three to five days in an eight-paddock system, so utilization is estimated to be 60% (Table 2).

Step 2—Set intake—because they are dry cows, use 2% (Table 3).

$$\frac{(1,350 \text{ lb/cow}) \times (0.02/\text{day}) \times (100 \text{ cows}) \times (4 \text{ days})}{(1,000 \text{ lb/acre}) \times (.60)} = 18 \text{ acres}$$

Calculate: The number of animals needed to utilize the available forage.

Example 2: The paddock size is 20 acres and the grazing period is 4 days.

$$\# \text{ of animals required to graze a paddock} = \frac{(\text{DM/acre}) \times (\text{acres}) \times (\% \text{ utilization})}{(\text{animal weight}) \times (\text{intake in \% body weight}) \times (\text{days})}$$

$$\frac{(1,000 \text{ lb/acre}) \times (20 \text{ acres}) \times (.60)}{(1,350 \text{ lb}) \times (0.02/\text{day}) \times (4 \text{ days})} = 111 \text{ cows would be needed to graze these pastures down in 4 days.}$$

Calculate: The number of days a paddock will last.

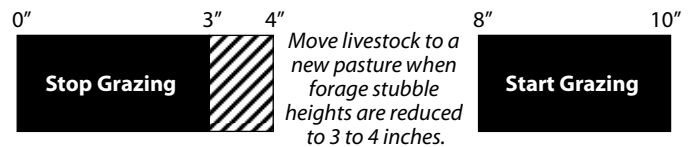
Example 3: A herd of 100 cows on a fast rotation.

$$\text{Days of grazing per paddock} = \frac{(\text{DM/acre}) \times (\text{acres}) \times (\% \text{ utilization})}{(\text{animal weight}) \times (\text{intake in \% body weight}) \times (\# \text{ animals})}$$

$$\frac{1,000 \text{ lb/acre} \times 20 \text{ acres} \times .60}{1,350 \text{ lb} \times 0.02/\text{day} \times 100 \text{ cows}} = 4.4 \text{ days}$$

The grazing stick also has a quick guide (Figure 2). If you carry the stick with you whenever you check animals or move fences, you can quickly assess pasture regrowth and readiness for grazing. The suggested starting height for grazing cool-season grasses is 8 to 10 inches, which ensures that forage is in a high-quality vegetative stage. The stop-grazing limit applies to grass or grass-legume pastures. The 3- to 4-inch stubble height ensures that some leaf tissue is available for grass regrowth. Removal of basal leaves will slow grass regrowth and limit yield. If pastures are growing quickly in the spring, you may need to harvest or clip them to keep them productive and in high-quality condition.

Figure 2. Quick grazing guide.



The guidelines for grazing vary according to the plant species (Table 4). For example, grazing is normally delayed until bud stage for alfalfa so that the plants can restore root reserves that were used in regrowth. Consistently grazing forages before the indicated height or stage may thin the stand. Overgrazing so that too little stubble remains after grazing may limit pasture yield because the plants will not have enough leaf tissue for photosynthesis and rapid growth. Rest periods and forage removal must be carefully balanced to keep pastures productive. One of the best ways to achieve this balance is by frequently observing pastures and the amount of pasture regrowth. In spring, pasture growth is often too rapid for optimum grazing, so rotations may need to be accelerated to maintain good pasture quality. In summer, cool-season plants grow more slowly, and the rotations may need to be slowed to allow full recovery from grazing. When planning grazing systems, you can calculate the number of paddocks necessary to provide a desired rest period.

$$\text{Number of paddocks} = \frac{(\text{days of rest})}{(\text{days of grazing})} + 1$$

Table 4. Guidelines for Optimum Grazing Height (in inches).

Forage	At Beginning of Grazing	At End of Grazing
Cool-season grasses and legumes other than alfalfa	8-10	3-4
Alfalfa	Bud stage	2-3
Annual warm-season grasses	20-24	8-10
Native warm-season grasses	18-22	8-10
Bermudagrass	6-8	1-2

Good Record Keeping

You'll find the grazing stick a handy tool, but keep in mind that it provides only an estimate of pasture yield. You can improve your grazing system with good records of pasture yield, grazing days, and other data because they allow you to evaluate past efforts. If you keep good records and compare yield estimates with data from actual grazing days, you will be able to more closely calculate the actual yield for your farm and your conditions.

Grain producers determine the number of inputs to use based on the yield they will gain from each one. Because inputs and the resulting yield are easily measured, grain production systems can be quickly refined and improved. Good pasture records are slightly more difficult to collect, but they can also contribute to rapid improvement of pasture systems. One objective of pasture improvement is to increase yield, but changes in pasture management may also target herbage quality, yield distribution, or persistence. Pasture improvement may result in improved gains, increased carrying capacity, or reduced need for supplementation during summer months. Records help a manager place a value on improvements and make decisions on where to spend limited resources to maximize the benefits. These improvements are not necessarily obvious unless producers keep good records and study them.

More specific information about grazing, pasture management, and forage species is available in UK Cooperative Extension publications such as *Rotational Grazing* (ID-143). A list of recommended publications is included at the end of this document.

All your record information should be entered in a timely manner and regularly reviewed. It should include record year, paddock identification, paddock size, monthly rainfall, date and amounts of fertilizer, seed and pesticide inputs, and the most recent soil test data. In addition, each time a paddock is grazed, record the number and average size of animals, dates in and out, pasture height at the beginning and end of grazing, and yield estimate and stand density at the start of grazing.

Using Your Records for Planning

Records must be studied. Some people diligently keep records and file them at the end of the season. It will take some work to compile records into a form that you can use efficiently, but this effort is worthwhile. If you are going to keep records, commit yourself to using them.

Here are a few questions that might be answered by studying your pasture records:

- How much did legumes increase animal grazing days per acre during the summer?
- How much did fertilizer improve animal grazing days per acre?
- Which pastures and forages performed best in a dry year?
- How severe is the summer slump? Do you need to increase production during this period?
- Are your pastures improving or declining? Do you need to increase or decrease stock density to improve your pastures?
- Did your stockpile run out before spring growth began? How many more acres of stockpile do you need to support the herd? Can you fill gaps in forage production by grazing crop residues?
- Did your pasture management improvements result in reduced costs, increased carrying capacity, or better gains?

The following is a selection of the publications on forages and grazing available online at www.uky.edu/Ag/Forage/ForagePublications.htm or from your extension agent.

AGR-59—*Tall Fescue*

AGR-85—*Efficient Pasture Systems*

AGR-108—*Tall Fescue in Kentucky*

AGR-119—*Alternatives for Fungus Infected Tall Fescue*

AGR-162—*Stockpiling for Fall and Winter Pasture*

AGR-175—*Forage Identification and Use Guide*

ID-74—*Planning Fencing Systems for Intensive Grazing Management*

ID-97—*Grazing Alfalfa*

ID-143—*Rotational Grazing*

AE 2005-04—*The Economics of Renovating Pastures with Clover*

AE 2005-05—*The Economics of Using Improved Red Clover Varieties*

AE 2005-06—*The Economics of Pasture Fertilization*

PPA-30—*Sampling for the Tall Fescue Endophyte in Pasture or Hay Stands*

Tall Fescue Endophyte Concepts—Don Ball et al., 2003, Oregon Tall Fescue Commission, Spec. pub. No. 1-03

Understanding Forage Quality—Don Ball et al., 2001, American Farm Bureau pub. No. 1-01

Additional Useful References

Ball, D.M., C.S. Hoveland, and G.D. Lacefield. 2002. *Southern Forages*. 3rd ed., Potash and Phosphate Institute, Norcross, GA 30092.

Determining Forage Moisture Content Using a Microwave Oven