

Measuring Forage Mass to Adjust Stocking Rate

► Understanding how to properly measure forage mass to adjust stocking rate can help optimize pasture yield, quality and longevity, and animal performance.

Measuring forage production is an efficient way to monitor the use of forage and help to estimate pasture stocking rate (SR) and carrying capacity (CC). Stocking rate is defined as the number of animals grazing within a unit of land over a specified period of time. When SR is incorrect, it can lead to issues such as overgrazing that compromises stand longevity (figure 1). Carrying capacity is defined as the maximum number of animals or animal units (AU) that a pasture can support over a period without compromising stand health. It is essential to maintain a balance between forage available and removal to support goals for animal gain on pasture and allow the stand to replenish carbohydrate reserves (the “engine” for regrowth after defoliation).

Measuring Forage Mass

In grazing systems, a general rule of thumb is to “take half, leave half” of the forage available. Properly estimating forage production can optimize forage utilization while accounting for plant and animal requirements. Experienced forage producers benefit from improved grazing management techniques because they maintain pasture productivity and persistence while supporting animal nutritional requirements and production goals. To reach this goal, we must address the question of How much forage do I have in my pasture? at a given time. Forage mass can be measured by the following methods:

Canopy Height

Measuring canopy height with a pasture ruler (figure 2) can give you an estimate of the pounds of grazeable forage mass per inch of standing forage in the field (table 1). However, this measurement alone does not consider canopy density, which can represent an issue in terms of the accuracy of the estimate.

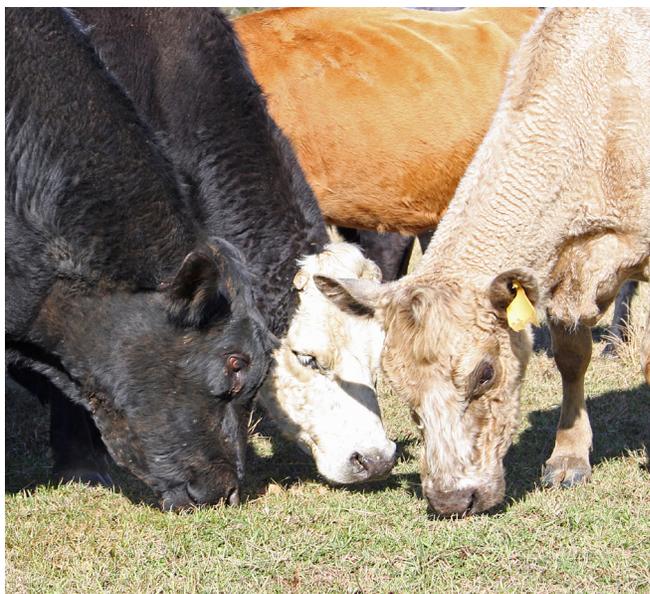


Figure 1. Overstocked pastures limit forage available for grazing.



Figure 2. Pasture ruler measurement on field.

Table 1. Pounds of Grazeable Forage Available per Inch in the Field

Forage Species	Average (lb)	Range (lb)
Alfalfa (grazing types)	225	45–400
Annual Ryegrass	250	75–400
Bahiagrass	200	100–350
Bermudagrass	260	150–500
Native warm-season grasses	100	50–250
Orchardgrass	180	75–300
Small grains	150	75–250
Tall fescue	210	100–350
Tall fescue + clover	190	80–325

Cut and Dry Sample Method— Using a Microwave

For this method, a reliable tool is to use a quadrat (an open frame with a known area; figure 3), which is a frame with a known area to estimate mass after forage is dried. You can build your own quadrat using PVC pipe, steel wire, or wood (Figure 3). The area of the quadrat must be known because it will be required to calculate forage mass per acre. After the quadrat is built, select few sites on your pastures to cut and dry forage samples. These sites should represent the general pasture condition (canopy height and density), so a good rule of thumb would be to establish a pre-determined number of steps to collect each forage sample from in each pasture to avoid bias.

Steps for Drying Samples Using the Microwave Method

Supplies Needed: For this method, you will need a glass of water, a plate with samples, and a bathroom or kitchen scale.

First, weigh approximately 3.4 ounces (100 g) of harvested forage and place on a plate. If weighing the plate and the sample together, remember to tare (zero) the scale with the plate beforehand. Then, put the glass of water inside the microwave and set it to high for 2 minutes. The water helps to avoid combustion and throughout this process, it should be changed if boiling. After 2 minutes, allow the sample to cool to room temperature and weigh. Repeat this process in increments of 2 minutes until sample weight remains constant. Keep in mind that samples with higher initial moistures will require a longer time to achieve a constant weight (silage or baleage samples). For a more accurate measurement, you can dry two or more of the forage samples from the same area, then average the weights. To calculate forage mass per area, use the correct formula for the quadrat you used [dry weight (ounce)/quadrat area (feet²)] and then convert to pound/acre (to convert ounce/feet² to pound/acre multiply by 2,722.5). This method requires harvesting multiple sites in the pasture to obtain a better estimate.



Figure 3. Quadrat detail (left) and in use (right) on alfalfa-bermudagrass pasture.

Once the forage is harvested, it can be dried using a microwave. The microwave method is often used on the farm because it is easy to access and simple. However, it is not recommended when the sample is to be submitted for nutrient analysis, and it is best to have a separate microwave to dry samples only, not use for food purposes.

Visual estimation

With practice, some people can visually estimate forage mass in a stand. Usually, this skill can be developed with training which requires harvesting few forage samples from an area of known size (see method #2) to check the accuracy of visual estimates.

Considerations To Adjust Stocking Rate

Once you have measured forage mass on a given pasture, below are simple formulas and steps to make animal stocking decisions on your farm.

- Number of paddocks (NP): $\frac{\text{day of rest}}{\text{days of grazing}} + 1$

Example: $\frac{28 \text{ day of rest}}{4 \text{ days of grazing}} + 1 = 8 \text{ paddocks}$

- Acres required per paddock (AP):

$$\frac{\text{weight} \times \text{DMI} \times \text{number animals} \times \text{days per paddock}}{\text{DM available} \times \% \text{ forage utilization}}$$

whereas DMI= dry matter intake; DM = dry matter

Example:

$$\frac{(600 \text{ lbs} \times 3\%) \times 40 \text{ head} \times 4 \text{ days}}{2,700 \text{ lbs/ac} \times 60\%} = 1.8 \text{ acres}$$

Then, total acres required per cycle=number of paddocks x acres required per paddock.

Example: 8 paddocks x 1.8 acres = 14.4 total acres required

- Stocking rate (SR): $\frac{\text{number of animals grazing}}{\text{total acres grazed}}$

Example: $\frac{40 \text{ head}}{14.4 \text{ acres}} = 2.8 \text{ head per acre}$

- Stocking density (SD): $\frac{\text{number of animals grazing}}{\text{paddock size in acres}}$

Example: $\frac{40 \text{ head}}{14.4 \text{ acres}} = 2.8 \text{ head per acre}$

Supplemental resources

Dubeux, J.D.; Wallau, M.; Vendramini, J.; Silva, L.S.; Griffin, J.; DiLorenzo, N.; Santos, E. 2019. SS-AGR 434/AG434 - Estimating Herbage Mass on Pastures to Adjust Stocking Rate.

Burns, J. C., H. Lippke, and D. S. Fisher. 1989. "The Relationship of Herbage Mass and Characteristics to Animal Responses in Grazing Experiments." In *Grazing Research: Design, Methodology, and Analysis*, CSSA Spec. Publ. 16., edited by G. C. Marten. 7–19. Madison, WI: CSSA and ASA. doi:10.2135/cssaspecpub16.c2



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