

Estimating Available Pasture Forage

The forage availability question asked most often by pasture managers who practice continuous, season-long grazing is, “Is there enough forage growth to last for the remainder of the grazing year?” As more pasture managers adopt rotational grazing management to extend grazing and improve livestock production, the same basic question is asked. But more frequently pasture managers are asking more specific questions:

- How many more days of forage are available on the current pasture being grazed?
- Is there enough forage in the next paddock or pasture to support the current group of animals being managed, and for how long?
- What is the regrowth rate of the forage in the most recently grazed pastures?

These latter questions are driven by the need for better information upon which to plan and make daily grazing management decisions. In the early planning stages of a grazing management system, rough estimates of productivity are useful in allocating paddock area or projecting carrying capacity. Once implemented, however, more accurate estimates often are needed to

- fine tune the allocation of animal numbers,
- project the availability of usable forage in a particular paddock to adjust the “period of stay,” or
- determine the total forage available in all paddocks for use in planning for reallocation of animal numbers, scheduling for longer rest periods, or adding supplemental feeding on paddocks.

Sources of general pasture production estimates

Average animal unit months

In most states there are estimates of average productivity for the commonly grown forage species and

combinations. In Iowa these estimates are available in ISU Extension publication *Guide for Year-Round Forage Supply* (PM 1771). Often these estimates are quoted in animal unit months (AUMs) or animal unit days (AUDs) per acre. An AUD (or AUM) is the amount of forage dry matter that a grazing animal weighing approximately 1,000 lbs. will consume in a day (month). These are general averages that cover a relatively wide range of stand densities, soil fertility, and rainfall conditions. Soil survey information for each county can provide slightly better estimates for the combination of more local soil and rainfall conditions.



Disk or plate meters help assess the density of the pasture and improve the accuracy of pasture forage estimation over height measurements alone.

Converting hay yield to pasture yield

Estimates of hay yields of different forage mixtures can be used to roughly estimate the amount of pasture forage that a field will provide annually. Due to lack of adequate regrowth periods (rest) under grazing, legumes and grasses managed as pasture may yield 15 to 35 percent less than the same field managed and cut for hay. In addition, grazing animals will waste some of the forage produced. Depending on stocking rate, type of grazing, and plant height at the start of grazing, this waste may amount to an additional 10 to 30 percent reduction in usable forage. The amount of forage actually used by grazing livestock may be 25 to 55 percent of the actual forage grown on the pastures.

Fine tuning — estimating pasture forage in a particular pasture

Pasture mass is a term used to describe the total forage dry matter per acre that is present at a certain time. The measurements made reflect the existing condition and can be used for daily or short-term decisions. These estimates can be totaled over the growing season to provide an annual productivity for the site.

Clipping and weighing method for pasture mass estimation

The present pasture mass is most accurately estimated by actually measuring the dry matter in the pasture. To do this, you must cut the forage from several areas in the pasture representing the variation in the vegetation found there. In very uniform pastures, three to four areas may be appropriate; in extremely variable pastures it would be best to take eight to ten. Cut the forage



Clip and weigh; the most tedious, but also the most accurate method for determining pasture yield.

from a known area (1 to 2 square ft. or 1 square yard) at about 1 in. from the soil surface (some researchers recommend ground level). Collect this clipped material into a paper bag(s) and dry it in the paper bags in an oven at about 100-120°F for one day or more. After the sample is oven-dry, its dry weight can be used in the conversion to pounds of dry matter per acre. Some researchers go further and separate the live material from the dead material so they can calculate and report “live forage mass.” This method is tedious and generally impractical for the individual livestock producer, but is a necessary step to develop the more rapid, user-friendly pasture mass estimation methods presented here.

Rapid pasture mass estimates

Producers need rapid methods for pasture mass estimation. These methods are less accurate but their convenience far outweighs the reduced accuracy.



Simple height measurements are related to forage yield, but don't take stand density into account.

Plant height

The taller the pasture forage the greater its yield. A simple method for estimation of pasture yield is to estimate it from measurements of plant height. One estimate that has frequently been used to relate pasture height to its mass is the rough estimate of **200 lbs. of dry matter per acre per inch of height**. This estimate will likely vary 50 lbs./A/inch or more based on grass type and season of the year. The height measurement is taken as the “natural, undisturbed height” of the pasture plants adjacent to the measure stick; not stretched or extended.

This relationship has been determined by “calibration,” the research process that uses actual “clip and weigh” determinations from numerous sites where simple height measurements also were taken. Because pasture productivity varies so greatly among species, in pastures of differing plant densities (and over the grazing season) the relationship of a pasture’s average height to its pasture mass is not very consistent, and only moderately accurate. Table 1 was developed for the pastures of southern Iowa and northern Missouri. For other areas of the state, use the average 200 lbs./inch +/- 50; or a more accurate relationship developed from calibrations for your area.

Plant density

Pasture plants have different leaf and stem architecture. Some species have a significant amount of their growth close to the ground producing a relatively high yield per inch of height. Others have a taller, more open canopy, with less yield per inch of height. Plant height alone doesn’t accurately determine pasture mass. Researchers have taken this into consideration and have developed pasture yield estimation methods

that consider the forage mass relative to the density and bulk of the vegetation.

The rising plate meter (some refer to it as a falling plate or disk meter) has been evaluated in several countries and has been found to be quite reliable. It is constructed with a disk or plate that slides freely on a measuring stick. While the plates may be aluminum, wood, or Plexiglas, and may differ in size or shape, they all work on the principle that when the plate is allowed to settle down on the standing forage it compresses the forage relative to its density. This not only gives a sense of pasture height but also the more difficult factor of stand or sward density.

It is not much harder to estimate than plant height, but the improvement in accuracy is probably worth the extra work, at least for the beginner. For a disk meter to be useful, it must first be calibrated so that the user knows the relationship between the measured height that the disk has settled to and the amount of forage dry matter compressed under the disk. Calibrations are done by recording the compressed height and doing the tedious clipping and weighing method on the forage under the disk. When enough of these comparisons are made and the relationship determined, then the procedure is simply walking through a pasture or paddock and taking 10 to 30 disk meter readings, averaging these, and calculating the estimate of forage mass present.

Because the weight and area of the disk are important to the resulting compressed height measurement, each density or disk meter with a different shape or weight will give different compressed height readings for the same pasture area. For this reason each disk meter

Table 1. Estimated dry matter yield lbs. /A per inch of height for various forages.

Forage Type	Pasture Condition		
	Fair	Good	Excellent
Tall Fescue + N	250-350	350-450	450-550
Tall Fescue + Legumes	200-300	300-400	400-500
Smooth Brome + Legumes	150-250	250-350	350-450
Orchardgrass + Alfalfa	100-200	200-300	300-400
Bluegrass + White clover	150-250	300-400	400-550
Mixed Pasture	150-250	250-350	350-450

must be calibrated. If properly calibrated, disk meters, regardless of configuration, should give good density/ forage mass estimates.

The Plexiglas plate meter being used by the ISU agronomy and animal science grazing researchers has a sliding plate that is about 20x20 in. (50x50 cm.) square, weighing exactly 2.6 pounds, and provides about 1 lb./square ft. of compression. With this disk meter, each inch of compressed height represents about 263 lbs./A of green dry matter. Table 2 is a calibration for this meter.

What does high technology offer?

New Zealand researchers have developed an electronic capacitance meter to estimate the available forage in a pasture. The computerized, handheld "Pasture Probe" uses changes in electrical capacitance resulting from different plant surface areas to measure total amounts of standing forage dry matter. Thus far, research with the Pasture Probe in Iowa has proven quite variable with our variable and mixed pastures, and has not shown any great advantage over the height and compressed height measurement methods.

Table 2. Calibration Table for the ISU Pasture Disk Meter

Sward height Inches	Live forage DM lbs.A	Sward height inches	Live forage DM/lbs.A
0.5	136	10.5	2666
1	263	11	2793
1.5	389	11.5	2919
2	516	12	3046
2.5	642	12.5	3172
3	769	13	3299
3.5	895	13.5	3425
4	1022	14	3552
4.5	1148	14.5	3678
5	1274	15	3805
5.5	1401	15.5	3931
6	1528	16	4058
6.5	1654	16.5	4184
7	1781	17	4311
7.5	1907	17.5	4437
8	2034	18	4564
8.5	2160	18.5	4690
9	2287	19	4817
9.5	2413	19.5	4943
10	2540	20	5070

Conclusion

There are many good reasons for grazing managers to estimate pasture mass, among them, knowing when paddocks are ready to be grazed, when animals should be removed from paddocks, and how much the daily and seasonal forage yield is of each paddock and the entire pasture area. With some good experience with measured estimates, and a season or two of grazing observations, producers often gain the skill to visually estimate pasture mass as they walk through paddocks when moving livestock, or during their weekly, all-paddock assessment.

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File: Agronomy 2

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Jack M. Payne, director, Cooperative Extension Service, Iowa State University of Science and Technology, Ames, Iowa.

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