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# Using Pasture Measurement to Improve Your Management

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The simple act of measuring and recording the forage mass in pasture fields can help with many management decisions graziers must make. Most graziers are familiar with using measurements related to animal production, such as reading from the bulk milk tank or the weight of animals sent to auction. These are good measures to take because they relate directly to income but they are not timely enough to help make grazing decisions. Grazing must be one of the few industries unable to measure their primary product.

Measuring and recording the forage mass of pasture fields can help make decisions during the grazing season. Measuring the fields on a regular basis can help producers see trends in forage growth and enable them to adjust their management accordingly. All measurements should be taken in the context of the operation's goals or areas targeted for improvement. Management guru Peter Drucker said, "What gets measured gets changed." Most graziers can easily identify some aspect of their forage production that they would like to improve. For the time and effort that can be invested in making forage measurements it is imperative there's an immediate benefit to the operation.

## How can you measure pasture?

There are many ways to measure forage such as using a pasture stick, falling plate meter, rising plate meter, electric (capacitance) pasture probe, and even

the tedious method of hand clipping and weighing. One problem with measuring forage is that it is a dynamic, living community of plants that is highly variable. To overcome the variability, many samples must be taken in order to accurately estimate how much forage is there. This can be time consuming and tedious. Usually 20–30 samples are recommended per pasture or paddock. The second problem is that the amount of forage available is changing on a daily basis; animals are consuming leaves, and plants are growing in response to the weather. To account for this constant change, measurements need to be taken on a regular basis, usually every seven to ten days.



The most accurate method used to determine the amount of forage available is hand clipping samples (photo by Jeff McCutcheon).

The most accurate method used to determine the amount of forage available is hand clipping samples. This is simply taking a known area, usually a one or two foot square, cutting all of the forage in that area, drying it down completely, weighing the sample, and converting it to pounds of dry matter per acre. Taking samples in this manner does take time. Most people use it to calibrate some other faster and easier method of measurement. In managing your operation, accuracy is not as important as consistency. Faster methods can give consistent and fairly accurate results.

The easiest measurement of forage we can do is height; however, this method has some significant limitations. Do livestock eat inches or pounds of forage? Actually they eat pounds, so measurements of height will need to be converted to pounds of dry matter to have the most usefulness. Since the primary function of forage is to be used as feed, then converting its measurement into feed terms makes sense.

Recommendations based on height also overlook the fact that pastures do not have uniform architecture. If you look closely at the profile of grass plants you should notice that there is more vegetative matter the closer you get to the ground. If you are ambitious you could cut and weigh each inch of plant material from the ground up. Depending on the grass species you would find that the first 2–3 inches has more dry matter than the next 6–10 inches.

One fact sheet from the University of Kentucky, “Using a Grazing Stick for Pasture Management,” and two from West Virginia University, “A Falling Plate Meter for Estimating Pasture Forage Mass” and “Estimating Pasture Forage Mass from Pasture Height” are good references for graziers on measuring forages. Rayburn and Lozier do a good job of discussing using a ruler, a falling plate meter, and a rising plate meter (<http://www.caf.wvu.edu/~forage/foragelstcenter.htm>). Any of those tools could easily give you consistent information to use in your grazing management.



Using a grazing stick (photo by Jeff McCutcheon).



Rising plate meter (photo by Jeff McCutcheon).



Using a rising plate meter (photo by Bob Hendershot).

### What will pounds of dry matter per acre tell you?

If you measure forage mass and calculate the average pounds of dry matter per acre for each paddock once a week, it would reward you with huge dividends. It will tell you how much forage you have in each paddock, which in itself is useful information. You will quickly see which paddocks need to be grazed next. If growth has stopped, you can quickly calculate how many days of forage you have left to graze.

For example, suppose you have 10 paddocks in rotation, it is late May and forage growth has been tremendous. Your measurements are in table 1. You have one goal of leaving enough residual forage when you pull out of a paddock to keep the plants growing. You plan on keeping 1,200 lb of DM/ac as the residual. Currently the cows are in paddock #10. Based on what your cows eat each day you have a target of turning the cows into a field that has at least 2,400 lb DM/ac.

Putting those numbers on a graph will make it more visual (figure 1).

### You can see your grazing wedge.

This type of graph is what is typically referred to as the grazing wedge, due to the staggered growth of each paddock. The amount of forage in each field is the result of the number of days of regrowth (paddock

#10 being the most recently grazed and paddock #1 has had the longest regrowth). The line is the target based on the above goals (pull out at 1,200 lb DM/ac, turn in at 2,400 lb DM/ac) and as you can see, forage has grown above the target. The field that should be turned into based on those goals is paddock #6. Fields 1–5 could either be harvested for hay or mowed to help get them back in line.

This information can also be used to calculate how much feed is available (table 2). Let's say that growth has slowed to a crawl. If conditions do not change, how many days of grazing do you have left? Following the calculations in table 2, we have total forage available of 67,500 lb of DM.

To calculate the number of grazing days remaining we also need to know how much is being consumed. If we had 50 dairy cows weighing 1,100 pounds each, and we estimate they are consuming 5% (4% consumed and 1% waste) of their body weight each day, then the herd is eating 2,750 lb of DM each day. If no new forage is produced then 24 days of feed are left.

### You can calculate growth.

Measuring your pastures on a weekly basis also allows you to calculate more useful information. Two consecutive weekly measurements can be used to calculate how fast the forage is growing. By taking the difference between the two measurements and

Paddock	Total lb DM/ac
1	3,900
2	3,600
3	3,300
4	3,000
5	2,700
6	2,400
7	2,100
8	1,800
9	1,500
10	1,200

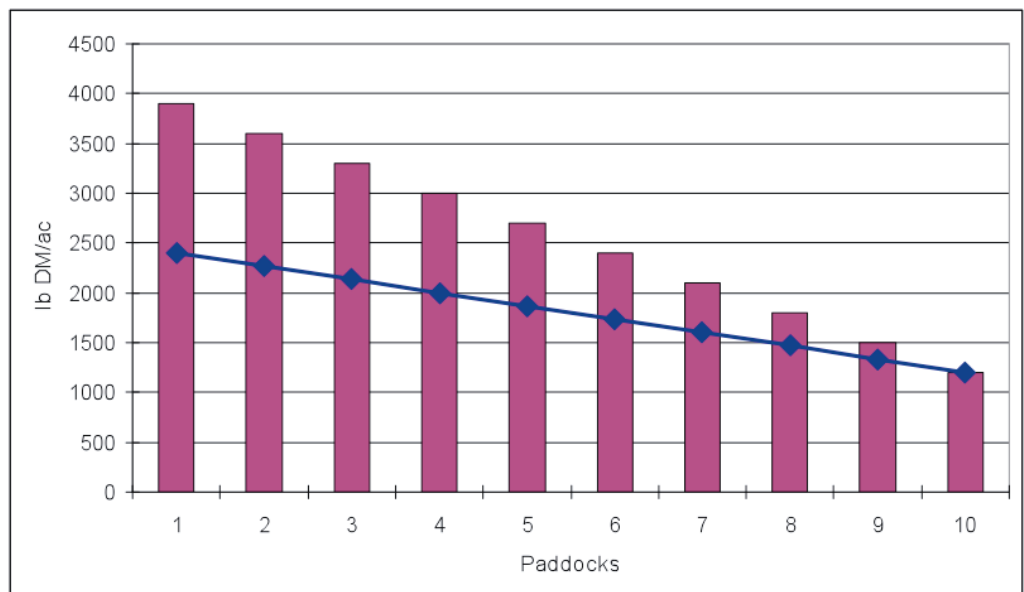


Figure 1. Total forage in paddocks with target forage mass identified (grazing wedge).

**Table 2. Forage available.**

Paddock	Total lb DM/ac	Available lb DM/ac	Acreage in paddock	Total lb DM
1	3,900	2,700	5	13,500
2	3,600	2,400	5	12,000
3	3,300	2,100	5	10,500
4	3,000	1,800	5	9,000
5	2,700	1,500	5	7,500
6	2,400	1,200	5	6,000
7	2,100	900	5	4,500
8	1,800	600	5	3,000
9	1,500	300	5	1,500
10	1,200	0	5	0
Total	25,500	13,500	50	67,500

dividing it by the number of days between measurements we can get an average of how much the forage is growing each day. The Ohio Pasture Measurement Project (PMP) reports average daily growth from participants' fields. It was started in 2005 in an attempt to help producers understand the value of timely measurement of their forages. It involves graziers from across Ohio measuring at least one pasture field each week during the grazing season with a commercially available rising plate meter (Filip's Plate Meter, Jenquip, Feilding, NZ). They also take measurements before and after grazing or clipping of that field. Results from five years are reported in table 3. Notice the wide variation each week. One interesting note is that the fields that produced the minimum and maximum growth were not the same each week.

You can use this information to compare how your fields are growing under current conditions. You can also analyze how your growth compares to what you planned. We know that cool season forages do not grow at the same rate every day. The growth pattern is represented in table 4. Many times in planning grazing systems we use a conservative annual production number of 3.5 tons of DM per acre, because we lack data. It is better to use more realistic numbers based on actual measurements over several years on your own farm. If we calculate daily growth based off of that growth pattern we can compare the two values

**Table 3. 2005–2009 growth per day in lb of DM/ac by week.**

Week of the year	Growth per day in lb DM/ac		
	Minimum	Maximum	Average
14	3	52	23
15	11	167	66
16	2	166	63
17	5	189	65
18	5	239	74
19	7	353	102
20	6	253	88
21	3	306	81
22	0	172	59
23	0	192	58
24	2	239	56
25	1	239	44
26	2	180	50
27	2	131	44
28	1	174	42
29	0	171	34
30	0	190	45
31	1	340	49
32	0	172	34
33	0	217	37
34	2	169	38
35	1	93	27
36	0	129	38
37	1	75	20
38	0	181	36
39	0	96	27
40	0	100	27
41	0	55	17
42	3	42	21
43	1	34	13
44	1	67	16
45	3	186	38
46	10	23	15

and see if production is progressing as planned. Figure 2 shows the monthly growth from the PMP compared to the 3.5 ton planning yield. The first thing you notice is that we produce more forage per day than the 3.5 ton yield. But you should also notice the differences in the curves. This becomes more apparent when you look at figure 3. Figure 3 shows the four-year average from one field compared to the producer's planned yield of 5.5 tons/acre.

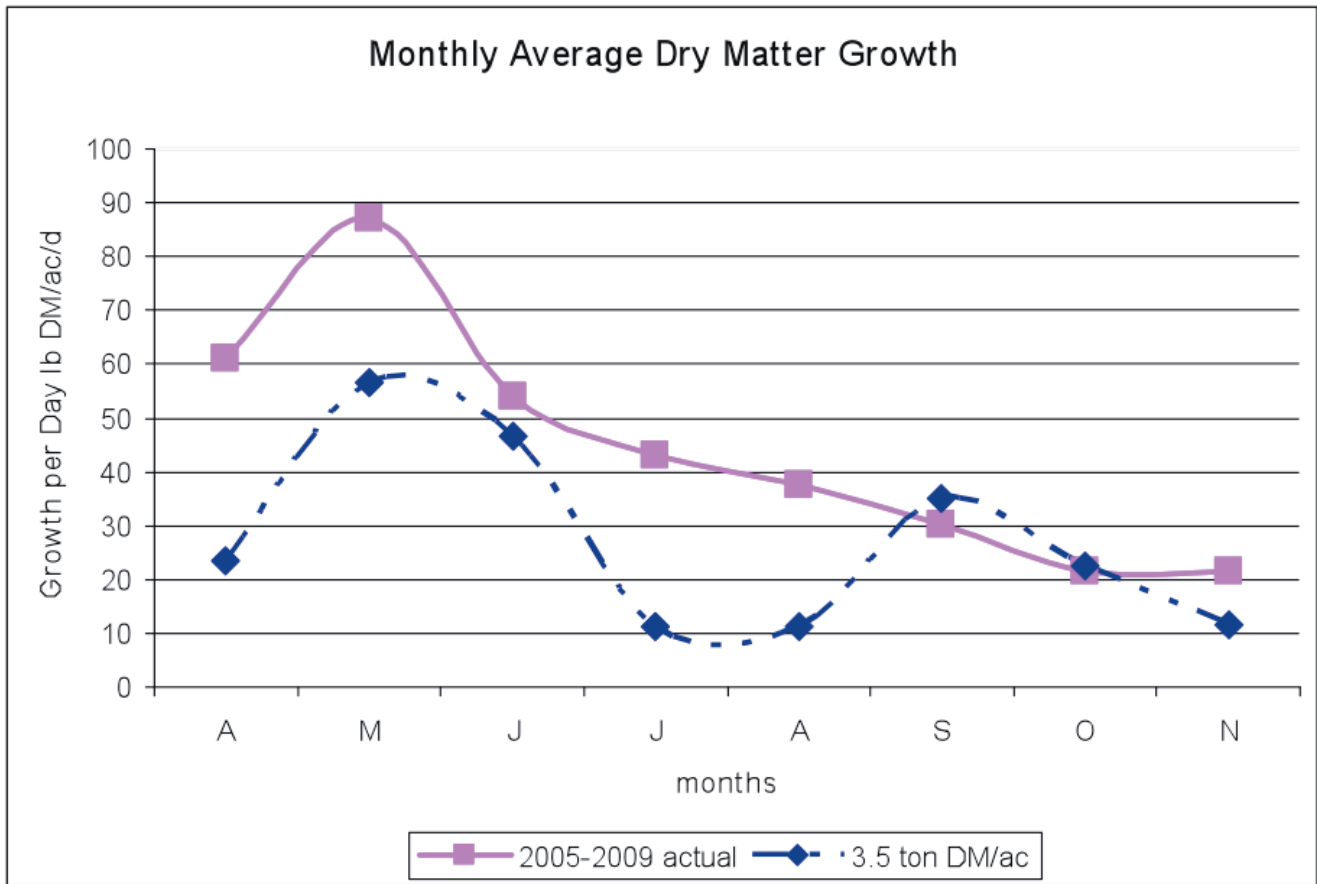


Figure 2.

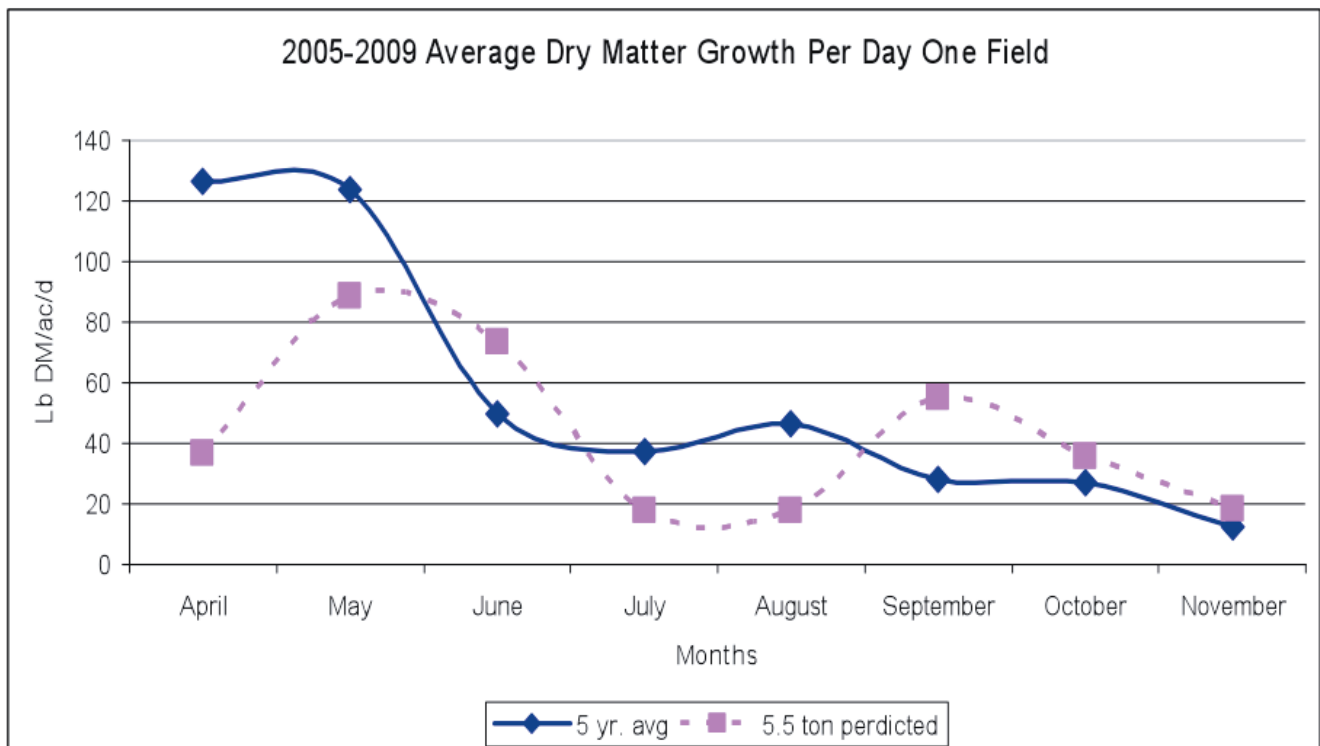


Figure 3.

**Table 4. Monthly growth of cool season forage.**

Month	Percentage of total yearly growth	Predicted growth per day at 3.5 ton annual yield (lb/ac/d)
January	0%	0
February	0%	0
March	3%	6.77
April	10%	23.33
May	25%	56.45
June	20%	46.67
July	5%	11.29
August	5%	11.29
September	15%	35
October	10%	22.58
November	5%	11.67
December	2%	4.52

### You can determine your feed budget.

Another application for this data is feed budgeting. Feed budgeting is the allocation of forage according to growth rate and animal demand. Feed budgets can be thought of as regular financial budgets with income and expenses. Income for a feed budget includes available forage, expected growth, and supplemental feed available. Expense includes animal class(es), animal production targets, and total feed demand.

A feed budget can help answer a lot of questions. For example, will supplementation be required? Will there be excessive forage that needs to be harvested? How long should my rotation length be? What stocking density should I use? Will nitrogen help fill in the low periods?

### Income

So how do you do a feed budget? The first step is measuring forage. We need to determine how much forage is out there. We need total acreage in rotation, number of days for the budget, total forage in lb DM/acre, forage growth in lb DM/acre/day, and desired residual forage in lb DM/acre. All these numbers can come from weekly measurements.

### Expense

Feed demand is the primary expense. Live weight is the main factor determining maintenance feed requirements. Production levels will add additional requirements such as gestation, lactation,

and growth. Total feed demand = feed requirement for average live weight of group multiplied by the number of animals and the number of days for the budget period. Numbers we need include total head and feed demand in lb DM/head/day.

From these numbers we can see where we have excesses or shortages and can plan what to do. Using the numbers from table 2 we can run a sample feed budget for June. From that we can see that we will head into July with the 95,500 lb DM. We will not get into our residual forage. If we take those numbers out for a few months we can see what the next five months should look like (table 5).

<b>Pasture available</b>	
Total acreage	50
Total forage	2,550 lb DM/ac
Minus planned residual	1,200 lb DM/ac
Available pasture	1,350 lb DM/ac
Plus pasture growth (30 days in June 46.67 lb/ac/day)	1,400 lb DM/ac
Available pasture	2,750 lb DM/ac
<b>Total available pasture for period</b>	<b>137,500 lb DM</b>

<b>Livestock requirements</b>	
Average animal weight (beef cows)	1,400 lb
Estimated intake: (* + 1% waste)	4% of body weight
Dry matter intake per head per day	56 lb DM
Total head	25
Feed demand per day	1,400 lb DM/day
<b>Feed demand for period</b>	<b>42,000 lb DM</b>

\*Estimated forage intake as a percentage of body weight:

Beef cows	= 1.5–3.0%
Stockers	= 2–4%
Dairy	= 3–4.5%
Sheep	= 2–5%
Goats	= 3–5.5%

**Table 5. Example feed budget.**

	June	July	Aug.	Sept.	Oct.
Feed demand (lb DM for month)	42,000	43,400	43,400	42,000	43,400
Pasture growth (lb DM for month)	70,000	17,050	17,050	52,500	34,100
Change in total forage (lb DM)	28,000	-26,350	-26,350	10,500	-9,300
Total forage available at end of month (lb DM)	95,500	69,150	42,800	53,300	44,000

## You can determine feed consumption.

Animal production is affected by how much they eat. Determining if animals are eating enough forage while grazing can be challenging. Measuring pasture mass when you turn animals into a paddock will give what you offered them. Measuring the residual forage when you pull them out of the paddock would allow a quick calculation to determine dry matter intake. This can be useful if you need to supplement to meet production targets.

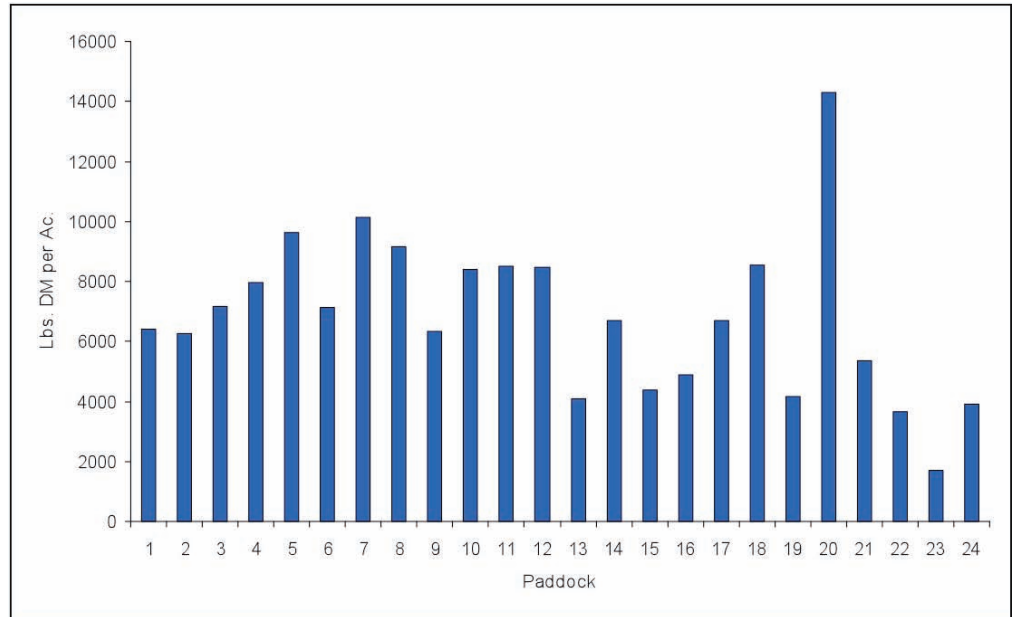


Figure 4. Annual production by paddock.

## You can determine if changes actually worked

Looking at a year's worth of data you could calculate how much forage you actually grew and if you can carry more animals. It can help you identify the top-yielding paddocks, the lowest yielding paddocks, and the yield difference between them. You can determine ways to make the lower yielding paddocks produce more. For example, figure 4 is the annual production by paddock from one farm. Determining why paddock #23 yielded only one ton of forage and correcting that could pay dividends. Using measurements next year will help you determine if what you tried actually worked.

## Conclusion

Measuring pastures will add work to a grazing system. The calculations may not be exciting to many producers. It usually involves using a computer. However, the time involved will reduce the risk of grazing, allow for more efficient use of the forage

resource by identifying surpluses and deficit periods, and allow a grazier to make more informed decisions in a more timely manner.

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