MEASURE AND MANAGE

Pasture Management for Rotational Grazing

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Evaluating Yields

Contrary to cash crops, yields of pastures are rarely determined. It is often difficult to assess yields. Rarely do we think in terms of pasture yield. The information simply is not gathered. It is difficult and time consuming. As a consequence pasture potential is often not maximized.

Why do we want to know pasture dry matter yields?

An evaluation of pasture dry matter yield can lead to better **knowledge-based** decisions. Knowing the estimated yield will allow for assessment of pasture mixtures, stocking rates, feed inventory, creep feeding decisions, fertilizer needs and cost benefit analysis to fertilizer applications.

How to determine pasture yield

There are a number of ways to determine yields, **both direct and indirect methods** For this discussion I will focus on a single indirect method that is rather easy to use, the pasture ruler.

"Pasture ruler: This method works on the principle of relating the plant height to yield. Therefore we need to calculate the average pasture height. **Walk through the paddock in a "W pattern" and record the plant height at a 25-footstep interval and record at** least 20 locations. It is important to take the measurement at the same space interval regardless of the spot. The height of both bare spots and dense (manure effect) spots must be recorded. Avoiding spots will lead to a biased average height value and yield will be miscalculated. Once the height data is collected simply average the height (sum of all heights recorded divided by the number of samples). DM **(dry matter**) accumulation could average as much as 300 lb per inch of plant height this will vary considerably with pasture management and plant species (100 to 300). To convert the average plant height to yield, simply multiply it by 300 lb DM/inch for well-managed lush pastures. The pasture ruler method is fast, simple, and cheap. However it may not be as precise as other direct methods such as actual clipping of small areas and weighing. It is a good start at realizing pasture potential"

Examples of Pasture Yield Calculations

To estimate how much forage **the grazing animals consume** you need to estimate the DM before and after each grazing event. The subtraction of pre-grazing DM minus post-grazing DM will be the actual forage consumed.

Using Pasture Ruler *

Pre-Grazing		Post-Grazing	
Sample Number	Plant Height (in)	Sample Number	Plant Height (in)
1	5	1	1.5
2	10	2	2
3	12	3	5
4	7	4	3
5	6	5	2
6	11	6	3
7	13	7	3.5
8	9	8	2
9	6.5	9	1.5
10	9	10	2
11	10	11	2.5
12	8	12	1
13	11	13	3.5
14	7	14	2
15	12	15	3
16	13	16	4
17	7.5	17	2
18	9	18	1.5
19	5.5	19	1
20	9	20	2
Sum = 180.5 in		Sum = 48 in	
Average height = 180.5/20= 9.025		Average height = 48/20= 2.4	
Pre-grazing yield = 9.0*300 lb DM//in/A		Post-grazing yield = 2.4*300 lb DM//in/A	
Pre-grazing yield = 2700 lb DM//A		Post-grazing yield = 720 lb DM//A	

Total forage consumed = Pre-grazing DM – Post-grazing DM
Total forage consumed = 2700 lb DM/A - 720 lb DM/A = 1980 lb DM/A

Thus during this grazing event 1980 lb DM/A were consumed.

*Marvin Hall, PSU Forage Specialist
*Rotational Grazing is also assumed

Estimating Fertilizer Requirements

Establishing a pasture requires planning and soil testing. For this discussion we will assume that good management practices such as soil sampling were done. Further information on establishment practices will be in another document.

Once we have an estimate of dry matter yield we can determine the nutrient removal for the grazing period. During production years keeping pace with nutrient removal is both economical and environmentally acceptable practice. Multiple applications in season of fertilizer allow for matching of nutrient removal. Small application rates are economical and in the case of Nitrogen applications it is beneficial to match the application with the need for Nitrogen during rapid growth cycles. During drought periods fertilizer can be withheld until favorable moisture conditions return. In shallow bedrock areas small applications done frequently will reduce the nutrient load at anyone time that could move potentially to ground water.

In a grazing situation the total dry matter consumed does not leave the grazing area, Cows usually only convert at best 12% of what they consume the balance is deposited as manure of course. In the previous example of 1980 lbs grazed (1980 x 12%) or 237 lbs is all that is going to be removed. The following table shows an estimate of crop nutrient removal per ton of grass hay expressed as lbs actual per ton. A feed analysis of pasture will of course provide a definitive measure of actual nutrients.

Estimated Lbs actual nutrient per dry ton

Crop	Nitrogen	P_2O_5 (Phosphorus)	K_2O(Potassium)
Grass Hay	*50	25	49

*assumes 18% protein in immature clipped pasture grass

Using this information the actual removal of fertilizer in 237 lbs of dry matter per acre can be determined by 237/2000 x the appropriate nutrient content. The exception is Nitrogen. Most of the excreted Nitrogen will be in organic form and slowly available for recycling in season so we are using only 20% availability of the N component. In this example the removal of P_2O_5 is 3 and K_2O is 6 lbs actual nutrient.

	Nitrogen	P_2O_5	K_2O	
Nutrient required for 237 lbs DM	31	3	6	
Fertilizer				
Urea	66			
MAP		6		
Potash			10	
Total application lbs / acre	66	6	8	80
Grade	38	4	8	

A grade of 38-4-8 at 80 lbs per acre will provide 31, 3 and 6 lbs of N;P:K on a custom blend basis. If you had 50 acres of pasture then you need 50 x 80 = 4000 lbs of this fertilizer blend.

Estimating the value of fertilizer relative to live weight gain

Once you know the cost of fertilizer and the estimated dry matter yield and feed conversion on pasture you can calculate the cost benefit on investment in fertilization. At current fertilizer prices of approximately $0.58 for N $0.45 for P and $0.40 for K this fertilizer costs $21.73 per acre plus $8.00 per acre for application results; a total applied cost of $29.73. Using a feed conversion of 8 to 1 on dry matter to gain the estimated live weight gain is 237 lbs/acre for the grazing period. Live cattle price at $0.90 per lb results in a total value of $213.00 per acre.

A grazing gain of $213 per acre certainly provides ample value for replacement fertilizer cost of only $29.73 per acre per grazing period. The cost of fertilizer per pound of gain $29.73/237 = $0.09

All that remains is to keep track of the grazing periods and assess fertilizer applications accordingly.

**WARNING **
You can refine the Pasture Ruler by calibrating in your actual conditions. It requires clipping samples from a defined area (so you determine yield per area) while you measure height and then weigh the fresh sample. Drying, weighing and calculating the dry matter (DM) also needs to done.
Yield then is fresh weight x %DM / divided by average height to obtain DM per inch. You may discover that your yields differ from 300 lbs per inch that was used in this example.
Non rotational pasture management may result in yields of less than 100 lbs of Dry Matter per inch of plant height. In this example that would mean only 1700 lbs of dry matter. With only a 70% utilization for grazing efficiency a net of only 1190 lbs or 148 lbs of gain per acre would be realized.

Maintaining healthy, rapid growing pastures, measuring the yields and tracking the economic gains will lead to better knowledge based decisions on the management of one the most valuable resources for the growth phase of young cattle.