

Soil Testing – Key to Profitable Forage & Grazing Program

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Pasture plants require many soil nutrients, yet some farmers only focus on one or two and overlook others (e.g., phosphorus, potassium, calcium, sulfur, micronutrients). Nutrient availability depends on soil pH. Knowing pH and nutrient levels is key to making decisions affecting profit (may not need to fertilize as much as you think; lack of fertility may be causing poor pasture areas). Regular soil sampling is the most effective way to determine soil pH and nutrient status.

Why and When to Soil Test

All soils have changing nutrient balance affected by continuous pasture imports (e.g., manure, synthetic fertilizer, rainfall, feed supplements) and exports (e.g., animal and plant products, soil leaching, runoff). The most effective way of determining nutrient levels is soil sampling (Photo). Periodic soil testing tracks seasonal and annual changes. Even a 'trained eye' cannot assess soil pH or needed nutrients.

Manure cycling is an additional factor in grazed pastures. Whether conventional or organic, consider a couple of factors. First, not all manure is 'created equal.' Composition varies with animal type (Table 1a). Regardless of type, nutrients in manure are not immediately available for plant uptake. Decomposition of the organic matter needs to occur for nutrients to be released (Table 1b). For example, only 30-50% of nitrogen is available from manure the first year.

Nutrients in manure are not perfectly balanced with how plants utilize them. Usually forage plants remove nitrogen (N) and potassium (K) in large amounts, and phosphorus (P) in very small amounts. They remove four times the amount of N and K compared to P, yet the proportion of manure nutrients is almost the same. If relying only on manure to meet N or K demands, you will likely be over applying P. Only soil testing can assess the amount of nutrients in the soil.

When and How to Sample

The timing of soil sample collection is critical. Soil nutrient levels vary with weather patterns and growing season. For example, freeze-thaw cycles, or wet and dry cycles tend to affect availability of some nutrients like K. Thus, soil sampling should be done at the same time of year to eliminate seasonal variability and to track changes in soil nutrient levels over time.

Fall or end of summer is an excellent time to soil sample pastures. Fall is a good time to apply soil correctives because there are several months before the next growing season, allowing amendments to react with soil.

All that is needed for soil testing is a clean plastic bucket (do not use metal cans or buckets), a soil probe (or hand shovel), and a sampling bag (Photo). Collect 10 cores representing sample area, mix together and place in sampling bag (previously labeled). The recommendation is to take one sample for every 5 acres, or one sample for each area representing a particular condition (e.g., uphill, bottoms, problem areas). Several extension publications further detail soil sampling and testing.

Table 1a. Average amount (lbs/ton; wet basis) of nutrients in manures.

	Dairy	Beef	Horse	Sheep	Swine	Poultry
	Fresh (lbs/ton)					
Nitrogen	10	14	12	25	10	25
Phosphorus	5	9	6	10	6	11
Potassium	8	11	12	20	9	10
Sulfur	1.5	1.7	2	3	2	2
Calcium	5	2.4	11	14	8	36
Magnesium	2	2	2	4	2	2

Table 1b. Manure nutrient estimated availability as a % of total.

	1 st Year	2 nd Year	3 rd Year
% of Total	% Nutrient Available		
Nitrogen	30 (Dairy) 25 (Beef) 25 (Horse) 25 (Sheep) 50 (Swine) 50 (Poultry)	10 (All Types)	5 (All Types)
Phosphorus	60 (All Types)	10 (All Types)	5 (All Types)
Potassium	80 (All Types)	10 (All Types)	5 (All Types)

Adapted from UW (Manure Nutrient Credits - Laboski; Guidelines for Applying Manure to Cropland and Pasture in Wisconsin - Kelling, Massie, and Good) & Soil Fertility Manual - International Plant Nutrition Institute.

Impact on Grazing and Your Wallet

A profitable operation relies on adequate herbage quality during the grazing season. It is fundamental to know soil nutrient status since stocking rate directly varies depending on herbage mass, and indirectly on soil fertility. A good soil fertility program allows for increased forage yield and quality, and both affect performance of your pastures and grazing animals.

Table 2 compares yield of fertilized and unfertilized pastures. There is an added value of over \$150 due to a fertilizer application alone, which does not include benefits of added gain or savings on weed control.

In addition to forage yield and quality, and animal performance, well-managed pastures have less cost associated with weed control. A well-fertilized pasture (organic or inorganic sources) will provide the best combination of minimal weed pressure and control.

Soil sampling and testing tell you what soil nutrients are available. A soil test is a small price (\$15/sample) to pay to save you from applying unneeded nutrients, leading you down the path of added pasture benefits and animal performance.



Table 2. Average forage yield for Upper Midwest.

Pasture	Limed & Fertilized	No Added Fertilizer	Yield Increase/ac	Value* Increase/ac
	---Yield (lbs DM/ac)---			
Red clover/grass	5500	2750	50%	\$178
Alfalfa/grass	5820	3000	48%	\$183

*Pricing pasture based on \$65/1000-lb hay bale.

Adapted from UW (*Pastures for Profit* - Undersander, Albert, Cosgrove, Johnson, and Peterson)