Soil Health: The Foundation to High Quality Grass Fed Beef and Profitability

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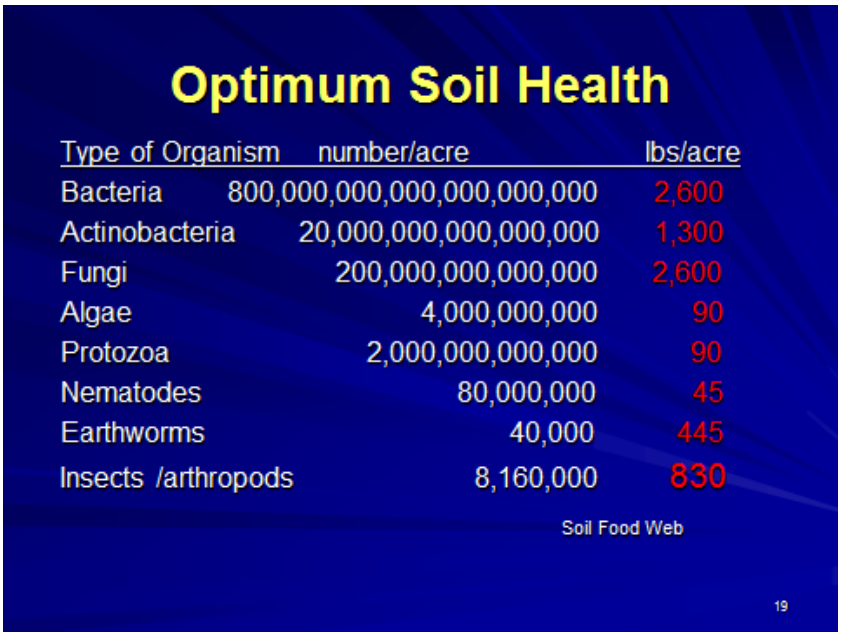
There are many challenges in the grass fed beef sector, but among those challenges is the ability to adequately finish cattle to a reasonable and uniform degree of finish on a consistent and profitable basis. In order to build a strong customer base and capture the price premiums necessary for reasonable profit margin, consistency of the end product is a must. This consistency not only refers to the actual degree of finish, but also to the flavor profile, live weight at harvest, and primal size and weight. After close to 20 years spent honing the art of finishing cattle to a high degree of finish on forages, the one thing I have learned is that it all starts with the soil. Without an excellent soil health profile, the job of finishing cattle on forages becomes much more difficult. So, let's examine what healthy soil should look like and what it can do for us.

First, a healthy soil should be literally teeming with life. This life exists below the soil surface, at the soil surface, and above the soil surface. If we take a look at a profile of healthy soil (Table 1), we find that an acre of soil should contain more than one ton each of active soil bacteria and fungi, more than 1,000 lbs of actinobacteria, the proper ratio of protozoa, nematodes, and algae, plus more than 400 lbs of earthworms, and 800 lbs of soil level insects or arthropods. The majority of the soil microbes live in the top six inches of the soil. So, within just the first few inches of a layer of topsoil, we should have more than three tons of microbes and other living organisms working for us. Unfortunately, in many situations today, we do not see this type of soil profile. Therefore, we have to implement practices that enable us to rebuild our soil life.

I call soil microbes my "livestock" below the ground. Just as we can use our cattle and other livestock to great benefit above the ground through hoof impact and manure and urine application, we can use the below ground livestock to great benefit as well. All of this soil level life is crucial to building and maintaining soil organic matter, improving soil aggregation and water infiltration, increasing the soil fertility and mineral profile, and putting "power" into the forages that we are growing. Improving soil organic matter and soil microbial populations can, over time, allow you to significantly reduce external fertilizer and herbicide inputs. Published studies show that the value of nutrients in every 1.0% soil organic matter exceeds $700 per acre. So the primary question is how can we effectively build soil health and improve grass fed beef production and profitability?

Table 1: Optimum Soil Health Profile



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The first step towards building your soil health is establishing a baseline for where you currently stand. This involves some basic tests that are relatively easy to perform and affordable. I suggest starting with a soil chemistry analysis that includes not only estimates of major and minor elements, but also of soil organic matter (OM), Cation Exchange Capacity (CEC), and Base Saturation. Secondly, a more expensive but very telling analysis is a Soil Health test or a PLFA test. PLFA stands for "Phospholipid Fatty Acid" and these PLFA's are a crucial component of the cell walls of all living organisms. This analysis provides you with a detailed breakdown of microbial functional group mass and diversity. The analysis includes Total Bacteria, Gram + and Gram – bacteria, Total Fungi and fungi by type, Protozoa, and undifferentiated microbes. In addition, the PLFA test provides a Fungi:Bacteria ratio, Predator:Prey ratio and a Gram+:Gram- Bacteria ratio, as well as a saturated to unsaturated fatty acid ratio.

Just as in your own diet and the diet of your livestock you must balance nutrients to be truly healthy, soil microbial life is similar. A good balance between all the classes of microbes and in the soil chemistry (major and minor elements) indicates a very healthy soil profile that will translate into greater productivity and healthier plants above the ground. Healthier plants translate to better animal performance.

Another tool I use for establishing baseline forage performance and for making improvement is a plant brix measurement. Brix is simply a measurement of dissolved plant solids in the sap of a plant. Included in these plant solids are sugars (sucrose and fructans), amino acids, proteins, minerals, lipids, and pectins. Therefore, a plant brix measurement is a good overall estimate of individual forage nutrient density and plant sugars. Moderate to high plant sugars are necessary

for adequate finishing of livestock on forage. Picture 1 shows the process of preparing plant samples and taking brix measurements. It is as simple as picking plant leaf or blade material, putting it into the well of a garlic press or other type of press, squeezing out the plant sap onto the stage of a portable refractometer, and taking your reading.

Picture 1: Preparing Plant sample for Brix Measurement.

Brix measurements are best taken in early to mid-afternoon and on a sunny day. To be consistent in your measurements and comparisons, compare each forage type separately, take samples from only the leaf material of legumes of forbs and from the top four inches of the blade of grasses. Take measurements at approximately the same time each day and take multiple measurements within each pasture.

Brix can vary widely within each forage species or type. My research has shown that higher brix tends to translate into better animal performance, specifically in animal gain and degree of finish. Our data show that soils higher in organic matter and with better soil microbial profiles tend to produce forages that are high brix. Table 2 shows the significant variation in brix that can exist within the same forage. Therefore managing for higher brix can greatly improve your livestock performance and enhance ultimate degree of finish. Years of forage finishing experience, coupled with actual carcass quality data, have indicated that plant brix measurements of 10.0 and above are desired for optimum forage finishing. Stage of maturity of the forage and even time of day that livestock are turned into a new paddock can influence plant brix and livestock utilization of higher brix. Figure 1 illustrates how the ratio between plant brix or sugars and other nutrients, specifically plant protein, changes as the plant matures. So, for optimum gains and performance, turn livestock into new paddocks when forages are at mid-stage of maturity and in the early afternoon when daily brix are at their peak.

Table 2. Brix Index Variation in Common Forages.

Brix Index of Common Forages

Forage	Poor	Avg	Good	Excellent
Alfalfa	4	8	16	22
Ryegrass	6	10	14	18
Sorghum	6	10	22	30
Fescue	2	4	7	12
Bermuda	2	4	6	8

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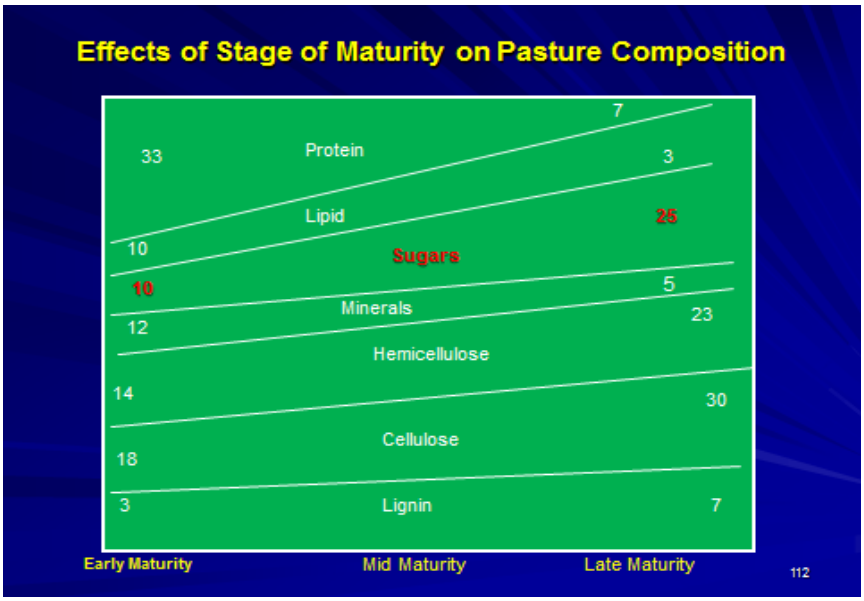
Figure 1. Ratio of Plant Sugars to Protein at Varying Stages of Maturity.



Your individual grazing practices will greatly influence ability to build soil organic matter and improve your soil microbial profile. I have found that high stock density grazing facilitates soil improvement and microbial profile improvement faster than any other grazing practice you can employ. This grazing practice requires frequent moves from paddock to paddock, coupled with adequate stock density necessary to achieve desired results. Animal performance in a finishing operation is critical, so I allow the cattle to consume no more than 40% of available forage dry matter in a specific grazing paddock before moving to the next paddock. If additional grazing impact is needed after the finishing phase cattle have moved through, then they can be followed

up by lighter weight stocker phase cattle or cows in a “leader-follower” type management practice.

Another practice that helps build soil organic matter and soil microbial populations includes either the planting of cocktail forage mixes or implementing grazing practices and rest periods that encourage the growth of “natural” cocktail mixes from the latent seed bank. The greater the variety of forages that are present in each paddock, the better the overall performance from both a forage and an animal perspective. I prefer a mix of grasses, legumes, and forbs in each paddock. This mix provides an array of nutritional choices for the cattle, along with varying root depth and root mass that soil microbes prefer.

Other practices that have shown benefit include incorporating winter bale grazing strategies for improvement of poor soils and the use of proven soil microbial products for a “quick start” in soil microbial profile improvement.

In summary, optimum forage finishing of grass fed cattle cannot be accomplished without good to excellent soil health. Even though animal phenotype and genotype are important, along with skilled forage and grazing management, the soil is your true foundation. To be able to repeatedly finish cattle to a consistently high degree of finish, and at a reasonable cost, building your soil organic matter and managing for an excellent soil microbial profile is crucial.