Harvesting Solar Energy

By Jon C. Frank

Two Farmers

Imagine two farmers or ranchers from the same community meeting over breakfast at a local café. Over scrambled eggs and hash browns they compare notes on their farming operations. One is very efficient at harvesting solar energy and selling it at a profit. The other is not efficient at capturing solar energy and is slowly going broke. What is the difference? Both have access to the same amount of sunshine but with vastly different results.

After purchasing land or paying rent sunlight energy is free—no taxes, no patent infringement, and very dependable. And yet so many farmers and ranchers do not fully utilize this free gift. **It is the job of the farmer to use biology, moisture, and geological resources to transform solar energy into a sellable product. This is how wealth is created.** In other words the farmer sets up the environment that determines how much solar energy is captured.

So how do we increase efficiency in capturing solar energy?

Before answering that question we must first know how to measure the harvest of solar energy. Before doing this, however, it is important to step back and ask ourselves a simple, but often-overlooked, question: What is a plant? Plants have the unique function of combining minerals from the earth with atmospheric gases to form carbohydrates in the presence of sunlight and soil moisture. Plants are the original source of all proteins and carbohydrates. Ultimately plants are collectors of solar energy as shown by this zucchini plant hard at work.

So how do we measure the efficiency of plants? Simple—just look at the outcome of their primary function of photosynthesis. The more energy plants are capturing

from the sun the more carbohydrates and dissolved minerals produced. In grass and forages this adds up to greater palatability and increased nutrient density. When juice or sap is taken from a plant and placed on a refractometer light will bend or "refract" in proportion to the amount of total dissolved nutrients. This includes both carbohydrates and dissolved minerals. Whenever a plant makes sugars it always combines minerals with the sugars. Thus an increase in carbohydrates always signifies a corresponding increase in nutrient density.

The refractometer is both the judge and jury of quality. When calibrated in percent sucrose the following range is suggested as a guideline for grass and forages.

The numbers on the scale are referred to as the brix reading.

Animal performance is directly proportional to the brix readings of forages

I want to emphasize that animal performance is directly proportional to the brix readings of forages. Why? Because the brix reading reflects upon the amount of energy and minerals stored in the forage. I could tell many stories to illustrate the dramatic increase in animal performance when high brix forages are fed but will settle for just one.

A few years ago our family was milking a small herd of Nubian dairy goats. We had been feeding typical low-quality hay. To keep the goats milking we had to supplement their diet with grain because the hay did not have enough energy in it. Even with the grain the does were still losing flesh and showing their ribs. Still not enough energy in the diet. The milk being produced was about 12 brix, which is on the low side of being acceptable.

I was fortunate enough to buy some grassy alfalfa hay that measured 16 brix when it was cut. It was excellent hay. Within 2 weeks of changing to the new hay I stopped feeding grain. The goats quit losing flesh and were actually starting to cover their ribs back up. Milk production went up and best of all, the milk quality

rose to 16.3 brix. This was the best tasting goats' milk I had ever produced. All of this because somebody knew how to raise top-quality forage. The extra minerals and energy in the forages were passing through the goats into the milk. Needless to say I had some very satisfied milk customers who really weren't concerned how much they had to pay for a gallon of milk.

Back to our very first question / Simple Answer

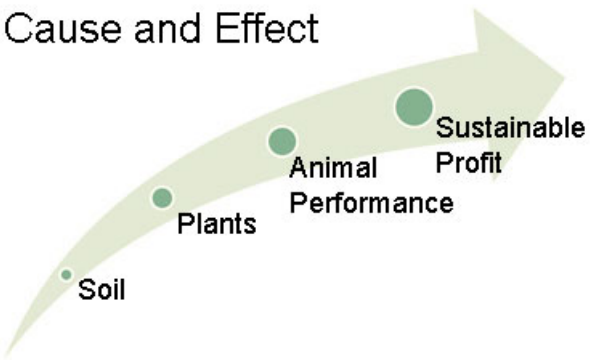
How do we increase a plant's efficiency in capturing solar energy? This also has a very simple answer. All we have to do is create an optimum environment in the soil. **It is the ratio and levels of plant-available nutrients that determine how efficiently plants can harvest solar energy.** If the plant does not have access to enough available nutrients the metabolic energy within the plant will be insufficient and carbohydrate production will decline even though the plant has plenty of solar energy. If you wish to confirm this check out the section on photosynthesis in any book on plant physiology.

Want to know what an optimum environment is for forages? I thought so.

On a soil test from International Ag Labs, www.aglabs.com, look for the following parameters*:

- Available Calcium at 5,000-6,000 lbs. per Acre
- Available Phosphorous at 200 to 300 lbs. per Acre
- Phosphorous to Potassium ratio at 2:1
- Calcium to Magnesium ratio between 7:1 and 20:1

*Please note that these parameters do not apply to any other laboratory or testing method.



These are the major parameters to start with. Other factors such as humus levels, CO2 release, trace minerals, and microbial activity also play an important role in creating an optimum environment. The starting point, however, is to get enough minerals available to the plant so they can utilize more solar energy.

It is important to see cause and effect as we look at the steps that culminate with sustainable profit. To understand the tremendous importance of getting nutrient availability in soil it is helpful to start with the end goal in mind. Most people can agree that they would like their ranching operation to make a sustainable profit. Stepping down 1 level it is easy to see that this will not likely happen without good animal performance.

What many farmers and ranchers miss is the importance of optimizing plant nutrient density, as measured on a refractometer, as the most significant way to ensure excellent animal performance. Even more do not recognize that the only way to increase the brix readings of plants is to provide the plants with optimum levels of available nutrients. In summary soil health governs the flow of Solar Dollars.

Meanwhile, back at the café...

The two farmers finally conclude that the reason for the hard times one is experiencing is due to a combination of bad weather patterns and a weak market. They leave the café hoping things will change for the better.