

Gardening for Nutrition

The Big Question of Why

I remember my first speaking engagement where I spoke to several hundred people. I asked the audience to participate in an informal survey by a show of hands.

My question was: "How many of you would like to contribute to America's GDP by reaching the end of your lives on a dozen prescription medications, then have a couple surgeries, and finally succumb to illness after a protracted hospital stay"?

As you can imagine no one raised their hands. I then pointed out that statistically this was their fate UNLESS...

As you know, there is a major problem with our nation's health, and it's getting worse fast. Wherever people have moved away from wholesome traditional foods to eating industrialized food, health problems are sure to follow. Today we see:

- Medical Drug Prescriptions On A Meteoric Rise*
- Healthcare Costs Threatening The Entire Economy*
- Mental And Physical Illness Everywhere*
- Societal Degeneration*

Sadly most of the food sold in the market today is junk. It does not confer health but rather detracts. In reality it is Fraudulent Food. By its appearance it promises nutrition, but in action it is minerally deficient and toxic.

Industrial Foods Are Toxic

Most foods today are grown in a toxic environment. Let me illustrate with 2 common foods: wheat and potatoes.

Did you know that it is common practice to spray wheat with a weed killer just prior to harvest? This insures an evenly dead wheat crop for easy harvest. Did you know that this weed killer is systemic? That means it circulates throughout the entire plant, including the kernels of wheat. And we wonder why so many people can't tolerate wheat.

Fresh eating potatoes are routinely sprayed every week with a fungicide cocktail. One fungicide is systemic to circulate throughout the entire plant and the other is to remain on the leaf as a contact fungicide. Fungicides assist the plant in resisting fungal infection and are used more and more on nearly all crops. Farmers have been taught to spray fungicides according to crop stage as a

preventative against crop disease. This costs farmers a lot of money, and consumers pay for it with their health.

Organics to the Rescue?

In response to industrialized agriculture organic farmers denounced the use of pesticides and genetic modification. A growing alternative to conventional food is now available as organic. Organic foods should be free from toxic pesticides. Hats off to the early pioneers who took a principled stand. Unfortunately... there is a downside to organic food.

About 10 years ago the USDA hijacked the organic food movement and took direct control by taking on the exclusive role of certifying the certifiers. Prior to this the organic food movement did not establish any standard for food quality. Instead, organics focused on the process. This same lack of standards is now institutionalized by the USDA. What this really means is that a crappy apple can be sold as organic, right alongside an organic apple of the highest nutritional quality and the market shows no discrimination between the two. So what is the solution?

Fraudulent Foods vs. Nutrient Dense Foods

The human body has a need for a well-balanced diet containing an adequate supply of minerals. Most foods in the grocery store, organic or conventional, only contain 30-50% of optimum nutrient composition. I am not talking about refined foods with empty calories. I am talking about "healthy foods" like carrots, spinach, and strawberries. They have become Fraudulent Foods - they only contain an empty shell - not the full mineral composition they should.

This is why I strongly advocate you grow your own nutrition in a small garden. Here's the really exciting news - it only takes a small amount of high quality food in your diet to start making a difference you can feel. The simple act of gardening for nutrition can create:

- Dramatic Improvement in Day to Day Energy
- Outstanding Flavor
- Healthier Pregnancies and Children
- Better Nourishment for our Minds

I saved the best part of this email till now so please read carefully. I have a secret that most people don't know and it is some really good news. Before I share this I need to give you some background about myself. People that know me will tell you that I am a humble guy who is passionate about soil, food, rock powders, and gardens. What follows is not meant to brag but only to put the good news I am about to share in perspective.

I own a soil testing lab and have worked in this field every day for the last 13 years. I have

consulted with thousands of gardeners and made fertility recommendations for many of them. Here is the good news.

Growing Nutrient Dense Food is Not Hard!

All you have to do is meet nature's requirements. This means you need to craft a soil that is adequately mineralized and energized to grow very healthy plants. Nature has been doing this for a long, long time. We just need to copy nature and speed up the process.

What Is a Garden?

It was the funniest thing I ever read. I was visiting a family and was given a tour of their home. In one of the bedrooms was a book of quotes. I flipped it open and this is what I read:

Whilst Adam slept Eve arose, strange how his first sleep should be his last repose.

I laughed out loud and have continued to chuckle for the past 20 years. My wife, however, finds it considerably less funny than I do.

As I write this email our garden is in full winter repose but soon it will arise in all its beauty. Winter is a great time to write and contemplate. Today's topic is very important but rarely asked, so let's dive in and ask; what is a garden?

1) A garden is the place where we recreate the ideal of nature, our very own Garden of Eden. The rules and principles that nature operates under are well worth studying. When we let nature teach us her secrets we can succeed far beyond our imagination. Yet in most circumstances nature is thwarted from reaching her ideal. Why is that? Because man was created to steward the earth on behalf of the Creator. Mankind is an integral part of nature and has a critical role to play, not as an enemy of nature, but rather as an enabler.

For an outstanding example of a person who has demonstrated stewardship of nature on a farm scale read Mark Shepard's book [Restoration Agriculture](#).

2) A garden is a place where nutrition is fabricated in food form. With the global expansion of industrialized food and the resulting decline in human health a new class of foods emerged - super foods. The rise of super foods has been nothing short of phenomenal. From noni to mangosteen, from goji berries to spirulina and chlorella, super foods are a marketer's dream. Many of these products are valuable and each offers its own contribution. But... do we really need such high

priced super foods shipped from half a planet away?

Why not raise our own super foods like super food green beans or super food beets and so on. If we pursue highest quality, the foods we raise in our garden will be super foods.

3) A garden is a joint collaboration. The collaboration is between your stewardship and nature's bounty*. Nature's bounty can really be grouped into two subsets. The first I would term Blessings From Above. This includes sunlight, rainfall, the atmosphere, and the soil you start with. The 2nd group is also part of nature's bounty but requires your active stewardship. In this group we find resources from forestry and geology. In other words, the foundation of a healthy agriculture rests on the twin pillars of forestry and geology. This concept will be fleshed out in much more detail in later emails.

*It is my belief that the Provider of nature's bounty is the one who created the universe, earth, and mankind to steward it, i.e. the God of the Bible.

4) A garden is a classroom for the next generation. Many a life lesson is learned in the garden. Multiple generations working together find ample teachable moments. It is fun to rejoice with our children as they exult in their contribution to the family's food supply.

5) A garden is the best model for entrepreneurship. It is a microcosm of how wealth is created. Inputs + energy + time = new goods that can be sold for a profit. I believe as a parent that one of the most important lessons I can teach my children is entrepreneurship, not how to prepare for a job working for the system, but rather how to create value in society and to capture that value in a family business. A garden is a first step in teaching this life skill to children.

To summarize:

1. A garden is the place where we recreate the ideal of nature.
2. A garden is the place where nutrition is fabricated.
3. A garden is a joint collaboration between a steward and nature's bounty.
4. A garden is a classroom for the next generation.
5. A garden is the best model for entrepreneurship.

In my previous email I covered the important question of "why" garden for nutrition. With this email and the next 3, we will be covering several aspects of "what". The balance of the sequence will focus on "how". Why, what, and how should be addressed in that order. The question of why is by far the most strategic. To augment what I wrote in yesterday's email I would like to offer you an additional report I wrote called: *Grow Your Own Nutrition - How to Opt Out of Toxic Agriculture*. It is available in both pdf and mp3 formats. Here is the link: www.jonsfreereport.com.

What Is Soil?

Such a simple question. Does it really even need an article? Any 6 year old can answer that question. "It's what I am not supposed to get on my clothes."

In our quest for highest quality food we must have an optimized soil. Unlike sunlight or rain which we cannot control, soil is 100% in our control. It is the key factor we must manage if we are to produce nutrient dense foods.

1) Soil is a storehouse of minerals. *This includes carbon and the organic portions of soil. In many soils the cupboards are bare and it is an empty storehouse. **The starting point to restore soil always begins with minerals.** Why? Because the presence and proportion of various minerals create the environment for soil biology. Minerals and carbon in the soil can be looked at through the lens of **chemistry.***

2) Soil is a teeming metropolis of microbial life. *Life in the soil ranges from the microscopic all the way up to centipedes and everything in between. A healthy soil is teeming with microbes and has a broad diversity of species. Success in this arena is predicated on creating the environment for biology and less on the application of live biology. In other words we must give microbes what they need to proliferate: air, water, and food.*

Let's take an example. All biology requires calcium to build their protoplasm. Many soils are critically short on calcium and consequently biology is hindered. Adding compost tea to inoculate the soil will achieve little. Adding calcium is what the situation requires. The levels and ratios of available minerals builds the housing complex for soil biology.

*When minerals are abundant in the soil biology proliferates. Soil microbes have one important need that they can't get from the soil - sugars. This will be discussed in tomorrow's email. Life in the soil is looked at through the lens of **biology.***

3) Soil is a giant battery. *Like a battery soil is a storage site of potential energy. It can be a large battery or much smaller. It can be charged up or nearly discharged. To simplify Einstein, we can say that energy is present in 3 forms: physical matter, heat, and every frequency on the electromagnetic spectrum. To properly function, soil must have all 3 forms of energy present and working in the desired ranges.*

*The concept of soil as a storage of energy is one of the most important aspects of soil and the most difficult to explain. The goal of growing nutrient dense foods is to have the soils battery as big as it can, and be fully charged up ready to grow healthy plants. **To achieve a charged up battery***

in soil requires the mineral and biology aspects of soil to be fully operational.

Some of the readings on the soil test directly relate to soil energy. The first is electrical conductivity which measures the ability of soil to carry a current. The second reading is ORP or Oxygen Reduction Potential. This is a measure of the actual voltage in soil. It is measured in millivolts. These energetic aspects of soil come about from the interaction of applied minerals and soil biology. Soil energy and its function as a giant battery are looked at through the lens of physics.

A Word of Warning

Don't look at soil only through one lens. Most authors who write books on soil are specialists in one particular lens. They have great material but soil needs to be looked at through all three lens: chemistry, biology, and physics.

What Is a Plant?

In 2009 I visited the Democratic Republic of Congo. As part of the trip we toured the main marketplace in Gemena, the district headquarters. I looked for tomatoes from all the vegetable sellers. Only a couple of sellers had any, just a few cherry-type tomatoes in a bowl for a grand total of less than 5 lbs. in a city of 50,000. I asked our interpreter why no one was selling tomatoes. The answer; "Oh tomatoes don't grow very well in this area". Keep reading for the real reason...

The Life of a Plant

It all starts with a tiny seed--a small package of carbon, minerals, and phytonutrients combined with a set of instructions on how to grow. It can store for many years just waiting for the right time to sprout. Once the seed finds a suitable environment a small miracle occurs; germination. At germination the energy in the seed divides into two camps. Growth energy elements cause the seed to put out a shoot going up. At the same time reproductive energy elements cause the seed to send out a second shoot going down. This becomes the root system. When the seedling emerges from the soil germination is complete.

The next stage in the life of a plant is the growth phase. During this time the plant rapidly increases in size. Roots draw nutrients from the soil while leaves collect solar and atmospheric energy. This is a buildup phase that sets the plant up for its ultimate destiny; reproduction.

At the fruiting stage plants stop their rapid growth. Instead it begins to produce blossoms, flowers, and seed. This is a major shift in plant metabolism.

Plant provides us with usable food, fiber, and energy in accordance with its genetic instructions. Imagine a tomato seed. It is only the size of a pinhead or two, yet one single plant can potentially produce 20, 50, or even 100 lbs. of fruit.

Plants are Unique

With the exception of some species of bacteria, plants stand unique in the realm of biology. No other biological group stores up chemical energy in the form of sugars. Bacteria and other decomposers in the soil all rely on plants to supply their energy requirements. Likewise animals and humans cannot manufacture sugars and also rely on plants. Animal feeds all trace back to plants. Even in the ocean it all goes back to the energy produced by plankton.

This is an important concept to grasp because it helps us understand what plants really are. In their very essence plants are energy collectors. From a tiny tomato seed to 100 lbs. of tomatoes--that is a lot of collected energy. What do plants do with all this collected energy? They reformulate it into specific patterns according to their unique genetic instructions.

Do you remember the hypothesis taught in elementary science classes? **Energy is neither created nor destroyed--it is just transformed into a different form.**

Nothing does this better than plants! Plants have a special ability to combine heat energy, light/electrical energy, mineral energy from soils and foliar sprays, mineral particles from the air, and atmospheric sourced CO₂ into plant tissue and produce.

So what is the difference between a tomato plant that collects and reformulates energy into 2 lbs. of tomatoes versus another plant that produces 30 lbs. of tomatoes? What is the difference between a plant that produces the highest quality and another that produces poor quality? **Lack of energy!** The difference is the amount of collected and reformulated energy.

In the case of tomatoes in Congo what specific energy was missing? Minerals and electrical conductivity **in the soil**. Unlike many other crops tomatoes take a lot of fertility in the soil to be productive. So if you lived in Gemena and wanted to earn a great living what would you do? That's right--raise tomatoes, provide plenty of mineral energy in the soil and keep mum.

Plants do not create energy. Plants can only collect and reformulate energy according to the amount of energy they have access to. It is up to you to provide the missing components.

Your job: Create the right energy environment for plants

Plant's job: collect and reformulate available energy

So what is a plant?

- 1. Plants are energy collectors*
- 2. Plants are energy reformulators*

The process of collecting and reformulating energy results in plant growth and reproduction. From an energetic perspective this process is very much like an atomic bomb in reverse at very low speed

What Is Food?

One of the tools large row crop farmers use more and more are GPS services that will drive the tractor while planting and doing other field work. This valuable tool takes a lot of "work" out of fieldwork. Farmers can now relax while the GPS controls their tractor. I wonder just how many farmers have caught a wink or two of sleep during a long pass over their field.

*Unfortunately in another area many farmers truly are asleep on the job. They rely on local fertilizer co-ops to test their soil, make fertility recommendations, and apply the fertilizers needed to grow their crops. While co-ops really do offer a great service to farmers, **the long term result is a great disservice.***

Here is what happens. Co-ops typically use the very worst fertilizers that compromise soil health; potassium chloride, DAP, and anhydrous ammonia are the worst offenders. The continued use of these products creates a soil that is unhealthy and incapable of growing healthy plants. With weakened plants there is now a need for crop protection products like fungicides, herbicides, and various other pesticides. These other products are also sold by the co-op for even greater profit at the farmers' expense. Many a farmer has fallen into this trap--they are sleepwalking when they should be careful stewards of their soil.

This same scenario plays out over and over in our nation's food supply. Foods, at their most ideal, are meant to be nature's medicine. And the best part--no prescriptions needed. Hippocrates, the father of modern day medicine, gave us this axiom:

"Let foods be your medicine and your medicine be foods."

Foods are a delivery mechanism that transports minerals and nutrition from your garden soil into your body. The better the soil and plant health, the better nutrition is delivered. Sadly, most foods in the marketplace don't have much of a nutritional payload. They are not endowed with

adequate nutrition.

Based on lab analysis we have conducted on food samples, I estimate that most foods only deliver 30-50% of the nutrients they should. What happens when this process occurs over a long period of time? The pharmaceutical industry has the answer; see your doctor, take your meds, and take even more meds.

This is just like the sleepwalking farmer who buys detrimental fertilizers and then needs crop protection. Consumers buy low quality food and then have to buy medical drugs.

The solution is to **WAKE UP** and start consuming real foods that truly convey the full complement of nutrition.

Time for a review. What are foods?

1. Foods are (should be) nature's medicine.
2. Foods are a delivery mechanism that transports nutrients from the soil to your body.

The great news is that you can grow this type of food...if you meet nature's requirements

Nature's Requirements -

A long time ago a young man worked with his father in a carpenter's shop. This shop was known for its agricultural implements. It was particularly noted for its fine craftsmanship in oxen yoke. According to tradition these yokes were custom made--specific to the shape and size of the oxen.

This young man later became quite famous. He is quoted in the New Testament with these words:

Come to me, all who are weary and heavy-laden, and I will give you rest. Take my yoke upon you and learn from me, for I am gentle and humble in heart, and you will find rest for your souls, for my yoke is easy and my burden is light.

The carpenter who previously crafted wooden yokes for oxen now preached about yokes that were easy and whose burden was light. These beautiful words could just as well been spoken about meeting nature's requirements to grow optimum nutrition.

- It is easy to properly mineralize soil.
- It is a light burden that gives a great reward.

- *It is so restful to refresh our souls and soils.*

Nature's Requirements are Not Burdensome

To grow nutrient dense foods you just have to create the right environment for soil biology and plant roots. Is this hard? No! It is an easy task. It is only hard if you don't know what to do. The simple job we must do is to use geological minerals to optimize soil toward ideal.

In truth, this is an ongoing work always in progress. As you will recall from a previous email, food is a transport mechanism taking nutrient out of the soil to your body. This continuous flow of nutrient out of the soil requires an annual checkup. This checkup starts with a soil test and concludes with a specifically tailored blend of soil amendments and fertilizers applied to your garden.

Why is this needed? Because raising crops invariably depletes soil of certain minerals. This depletion shifts the pattern of soil. Our goal as stewards of the land is to always keep pushing soil back to the optimum pattern. This pattern allows plants to easily produce an abundance of nutrient dense food--just like the carpenter said "My yoke is easy and my burden is light."

The simple requirement is to change the soil pattern so that it results in prolific roots and an optimum environment for soil biology.

This process starts with a soil test and culminates with a broadcast of minerals. This broadcast is custom formulated based on what nutrients are needed and those that are not. Here are 3 basic principles we follow when making custom formulated mineral blends for gardens.

1) Always optimize toward ideal. *The closer we get soil to ideal the better it performs with higher nutrient density, better yields, no insect or disease susceptibility, and a greater spectrum of trace minerals.*

Since this is a perpetual task we need to test and mineralize every year. This process is actually a crafting of the soil. By increasing or decreasing certain nutrients in soil, the pattern changes. The 3 main nutrients that determine a soil pattern are: calcium, phosphorous, and potassium.

2) Don't add what is already excessive. *This principle is extremely simple and self-evident. Yet it is frequently violated by those with the best of intentions. Many organic gardeners and avid readers of J.I. Rodale consistently overapply compost and/or manure.*

Compost and manure are actually potent suppliers of potassium to the soil. When compost is overapplied, potassium rises to become excessive. When potassium is excessive, calcium is hindered

and results in poor quality produce.

When potassium is excessive, do not apply compost or manure...period. Yes, I know composting kitchen scraps and yard wastes is sustainable, and gives a person those warm fuzzy feelings of doing good for the environment--but don't add it to the garden! Sprinkle it around some shade trees and forget about it.

3) What is deficient must be added. This is another self-evident principle but you would be surprised how often it is ignored. Most commonly, it is plant-available calcium that is short and not applied because soil pH is already 7.0 or higher. It is important to know what form of calcium to apply. The form that must be applied to raise available calcium is calcium carbonate, i.e. limestone.

Most soil educators strongly advise not to use calcium carbonate in higher pH soils. This one academic teaching has done incalculable harm to our nation's health. **This teaching of not using limestone when pH is high is false. It is a shackle to keep quality low in your garden.**

This principle also applies to other nutrients besides calcium. We must supply all minerals that are deficient including trace minerals and rare earth elements that are not even measured on the soil test. These minerals must be included in the yearly broadcast of minerals.

The Best Soils In The World

If you have been hanging around planet Aglabs for some time you may have read this article earlier. It bears repeating at this point in our Gardening for Nutrition sequence. -Jon

The Best Soils In The World Are...

1. Volcanic

Nothing beats volcanic soil. Period. From the grape growing region in Italy around Mt. Vesuvius to the fruit growing region of America's Pacific Northwest. Volcanic soils grow the best tasting coffee, tea, asparagus, fruit, the most fragrant flowers, and the best quality wheat.

What makes volcanic soil so special? Volcanoes are an awesome force of nature. They are also a foundational source of minerals to nourish and replenish worn out soils. They represent a bountiful supply of new minerals ready to assist you in growing better crops.

What is it about soils derived from volcanic ash and tephra (falling rock particles) that makes them

so productive? I believe it is the spectrum of minerals that range from the major minerals to the secondary minerals, to the trace minerals all the way to rare earth elements. They all play a role in stimulating soil biology and supporting the plant and animal kingdom.

Volcanic action is the base supply of earth minerals that make up soil. To enrich soil capable of growing high quality crops, we need to replenish the supply by adding volcanic rock powders.

2. Rich in Calcium

Calcium rich soils are highly productive. Unfortunately calcium is leached out of the root zone by percolating water. That means regions with higher rainfall, such as in the South and East, show low levels of available calcium. Poverty soils are low calcium while highly productive soils have more calcium.

Certain regions of the country are known for their high calcium levels. One of these areas is Southern Texas. Here is an experiment you might enjoy with your family. Buy some grapefruit from each of these states: Texas, Florida and California. Now squeeze the juice of each and do a taste test. If you have a refractometer, check the brix. I am pretty sure you will find remarkable differences in taste and quality. You might end up doing what I do--only buy grapefruit from Texas.

Why is calcium so important in soil? One reason that often gets overlooked is the impact of available calcium and the proliferation of plant roots. There is an almost linear relationship between available calcium and roots. When calcium is low, there are relatively few roots. As available calcium increases, so does the mass of roots. In addition to the main roots, there are now finer rootlets branching off the side of the main roots. When available calcium levels go beyond 1,900 lbs. on the Morgan test, something amazing happens with the roots--they now produce a profusion of fine root hairs. These fine root hairs are continuously growing and dying off.

What is so important about plant roots? The more roots, the more rhizosphere. The more rhizosphere, the more microbes are supported in the soil. And that leads us to our last type of soil. The best soils in the world are...

3. Teaming With Microbes

Microbes live off the sugars or plant residues produced by plants. They use this energy from plants to digest the rock minerals they need to proliferate. As they reproduce they also die and leave their minerals available for plant uptake.

Many growers make the mistake of only thinking "How can I grow a better crop of ____." Instead, they also need to be thinking, "How can I get my soil teaming with microbes?"

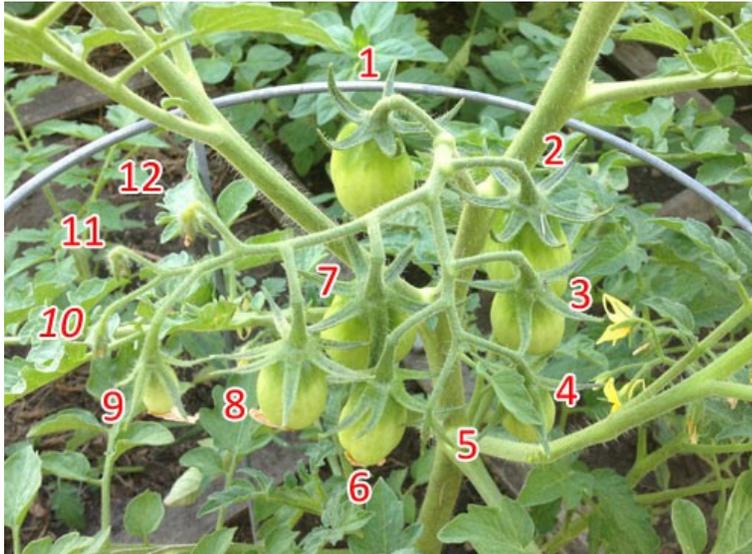
The answer is to create the right environment for soil biology by creating a volcanic soil well endowed with calcium. Supplying microbes is helpful, but it must be done in the context of adequate mineralization.

Most people have never seen a volcanic soil well endowed with calcium, broad spectrum trace minerals, and teaming with microbes.

Would you like to see this in action with your plants? Today you can!

After countless hours of study and experimentation, I am pleased to offer a product that can help transform your soil into a volcanic soil rich in calcium and microbial activity.

By using 1 tablespoon of Transplant Formula at planting, this tomato plant is showing a blossom cluster with 12 tomato blossoms. Many other clusters show 9, 10 and 11 tomatoes.



Transplant Formula contains:

- *3 different calcium powders supplying calcium sulfate, calcium silicate, calcium phosphate and calcium carbonate*
- *5 different volcanic rock powders supplying silicon and nearly a whole periodic table of elements*
- *4 microbial packages supplying live microbes to populate a growing rhizosphere around plant roots*
- *4 biostimulant carbon sources to push biology in high gear.*

As an extra punch, Transplant Formula also supplies quick acting enzymes to jumpstart the whole process.

For more information on Transplant Formula, including some articles and an analysis of the product, you can go to:

<http://mineralizedgardens.com/transplant-formula.html>

Transforming Soil to Produce Nutrient Dense Foods

The other day I had a unique opportunity to observe the transformation of soil. On a conference table I laid out soil test results and fertility recommendations I had made for the same garden for the past 7 years. Each year showed a new test and fertility recommendations that had been carefully followed. I also had the 8th consecutive soil test to make recommendations for the 2014 growing season.

What did I observe? **Soil can make a dramatic change in pattern.** What started out as a soil with quite high pH at 7.8 and very low available calcium now has 3 times the original calcium with a full point lower pH at 6.8. This occurred while limestone was added every year. In contrast the phosphorous and potassium were both 3 times higher than the desired level. They have dropped into the right range. This allows these nutrients to be available for the crop without interfering with calcium. It was interesting to note the ups and downs in nutrient availability and my less than optimum recommendations in the early years.

Before looking more closely at patterns in the soil and its impact on the nutrient density of food, let's look at the various categories of minerals that are present or should be present in soil. All categories are significant and each element plays an important role.

Type	Minerals	Present In
Primary	Calcium/Silicon/Carbon	1,000's of lbs. per acre
Major	Phosphorous/Potassium/Magnesium	100's of lbs. per acre
Secondary	Nitrogen/Sulfur/Iron/Manganese	10's of lbs. per acre
Traces	Copper/Zinc/Cobalt	lbs. per acre

Rare Elements **Iodine/Selenium/Nickel and more** **<lbs. per acre**

It is the level and ratio of these minerals present/available in the soil that establishes the pattern of the soil. The pattern of the soil is significant because:

- *It Creates the Environment for Biology*
- *It Determines Yield and Production Capability*
- *It Determines if Soil Will Accumulate Carbon and Better Moisture Management or Not*
- *It Impacts the Potential for Quality*

The three most important nutrients to look at in determining a pattern in soil are Calcium, Phosphorous, and Potassium. As an example let's look at 2 common patterns; I call them Abused and Neglected.

Abused by too much compost

Neglected/abandoned soil

Phosphorous	3,100 lbs. / acre	Phosphorous	21 lbs. / acre
Potassium	2,600 lbs. / acre	Potassium	120 lbs. / acre
Calcium	1,600 lbs. / acre	Calcium	570 lbs. / acre
Zinc	24 ppm	Copper	0.4 ppm

Neither the Abused nor the Neglected patterns are anywhere close to producing nutrient dense food. The abused soil will be more productive but could have extreme pressure with insects or disease. Both are calcium deficient.

The role of a fertility consultant is to recognize what pattern a soil is in and to suggest a course of action in order to change the pattern. It is important to recognize that nutrient dense foods don't just happen. They are grown on soil with the right pattern/environment.

To expect either the Abused soil or the Neglected soil to grow nutrient dense food is like asking a 750 lb. guy confined to a wheelchair to build a house--it is physically impossible. Likewise you can't

ask a 4 year old to build a house either. Both soils have the potential but need time to improve, the first by cropping out excess nutrients and the other to build fertility.

Your role as steward of the soil is to create the right pattern in soil capable of producing nutrient dense foods. You do this by managing the minerals. What is excessive should not be applied; while what is deficient needs to be supplied.

This last point is simple to the extreme, but it is right here where so many organic and biodynamic gardeners/growers fail.

The pattern of the soil is set by minerals in all categories. When certain inputs are continuously applied, such as compost, they will move the soil toward the Abused pattern. Others focus excessively on compost tea with the goal of balancing fungal and bacterial ratios while neglecting minerals. Another approach is to supply cosmic energy in the form of biodynamic preps.

Unless minerals are applied, both the compost tea and the cosmic energy approaches run the risk of depleting minerals in the soil.

When minerals are taken out of the soil in the form of food or crops they must be returned. You can use this return of minerals as an opportunity to change the pattern in your soil. Here is the pattern on the Morgan soil test to shoot for if nutrient density is your goal:

Humus:	Ignore this--when the minerals are right this will automatically correct
Nitrogen:	Manage by crop needs and conductivity
P and K:	200-300 lbs. each, 1 to 1 ratio, Increase K slightly for potassium-loving crops
Calcium:	3,500-4,000 lbs. per acre, Calcium to Magnesium ratio from 7-15:1
Conductivity:	400-600 micre Siemens / centimeter, when low fertilize
Copper:	3-5 ppm
Iron:	40-60 ppm
Manganese:	20-30 ppm
Boron:	1.5-2.0 ppm
Rare Earth Elements:	Supply with broad spectrum rock powders

In conclusion I want to pay tribute to an early pioneer: Albert Carter Savage. He worked in

Nicholasville Kentucky. 70 years ago he wrote about how nutrient levels in food vary so much due to the soil it was grown on. He proved that the standard tables of minerals in various foods are useless because of the extreme variation. He concluded that the control of mineral uptake in food is dependent on the minerals present and available in the soil. **This led him to write about the need to standardize the level of mineralization in the soil as the best way to standardize nutrient density in food.**

I fully agree and am seeing this happen by comparing the same foods from our long term gardens

Energy Grows the Crop

The steward must provide energy to the plant while the plant accumulates this energy and reformulates it into food, feed, or fiber according to its genetic instructions.

Nature has been doing just fine without the stewardship of man since time began using forests and perennial crops. Yet nature does have its limitations, and I think mankind's stewardship plus forests and perennial crops is even better.

Annual crops definitely require man's stewardship or they will not grow. Most of what I am writing in this email sequence is directed toward annual crops in the context of a garden.

It is important to select plant genetics according to climate and region. As much as I would like to grow papaya in southern Minnesota it just isn't happening without indoor growing for at least a part of its life cycle. If you have selected the right genetics for your region and planted them in a timely manner, and if the produce is susceptible to insects or disease, or poor yielding, or low brix, or poor in flavor, then you have not provided enough energy to the growing crop. **The most important first step is to accept responsibility as steward to provide the energy plants need to grow a crop.**

Once we have this issue settled we can look at energy flow and where the bottlenecks are. Let's start with a review of the 3 forms of energy:

1. Heat Energy
2. Light/Electrical Energy
3. Matter

As an example of how all 3 forms need to be active at the same time, consider the human body. We are warm-blooded, so that demonstrates heat energy. Brain waves and vocal sounds demonstrate frequencies on the electromagnetic spectrum (electrical energy). And of course we

have a body that is an accumulation of matter.

Likewise, plants need all 3 forms of energy simultaneously within desired ranges. When one form is short, plant performance suffers tremendously. Think of what happens when a shade tree covers a tomato plant for 4 hours every day. You have reduced heat energy on the leaf and reduced light striking the leaf. Consequently the primary function of plant leaves--the making of sugars through the process of photosynthesis--is now significantly reduced. No amount of soil mineralization (energy present in the form of plant nutrients i.e. energy from matter) will fully make up for the loss of heat and electrical energy.

If you want to grow nutrient dense food or even just have outstanding yields, you must have all 3 forms of energy present, at the same time, in the desired ranges.

In tomorrow's email we look more closely at each form of energy and how it interacts with plants and the other forms of energy.

A Little Housekeeping

Every day between 1:00 and 2:00 am our software program sends out the next morning's email. A lot of people enjoy reading it early in the morning. I know because many have told me so. Unfortunately it looks like some emails take a wrong turn on the information super highway where they end their life in a horrible traffic accident. The missing email doesn't show up in your inbox because it is dead. ☹

The good news is that we have great power to raise it from the dead and send it again (imagine Handel's Hallelujah

Energy Grows the Crop - Part 2

In Part 1 of Energy Grows the Crop we concluded that all 3 forms of energy must be present simultaneously and in the desired ranges. A hindrance of 1 or more forms of energy will result in less accumulation of energy by the plant. This has the effect of poor yield, lower brix (a measure of food quality), insect and disease susceptibility, and poor taste. Ultimately the food will convey less nutrition to the consumer and it will not impact health like it should.

Let's start thinking about all 3 forms of energy as it relates to my garden in the winter and a garden in the Congo unable to raise tomatoes. Here are the questions to ask:

Jon's Winter Garden

Is heat energy excessive? No - especially not this year

Is heat energy deficient? Yes

Is heat energy out of range? Yes

Is light/electrical energy present? Yes

Is light/electrical energy in range? Yes

Is there adequate electrical energy in the soil? Yes

Is the electrical energy in soil excessive? No

Is the energy associated with matter present in the desired ranges? Yes to grow a crop, no to optimum quality since I do have a few high levels of nutrients.

So why can't I grow a crop now? One of the 3 forms of energy is out of range. In this case a lack of heat energy completely shuts down crop growth. Yes this is an obviously easy example but you need to see and understand the deductive reasoning behind these questions.

Now let's look at a harder example--tomatoes in the Congo. Before we begin we must ask if tomatoes can grow in the tropics. The answer is yes, but since they are not growing in the Congo there must be an obstruction to the flow of energy the crop needs. Once again here are our deductive questions and answers.

Tomatoes in the Congo

Is heat energy excessive? No - tomatoes can thrive in the tropics like many other plants.

Is heat energy deficient? Not at all

Is heat energy out of range? No - Many greenhouses have higher levels of heat and are quite productive

Is light/electrical energy present? Yes to light, but very inadequate to soil conductivity

Is light energy in range? Yes

Is there adequate electrical energy in the soil? No it is woefully short

Is the electrical energy in soil excessive? No

Is the energy associated with matter present in the desired ranges? No - Congo jungle soil is extremely nutrient deficient in the upper layers of the soil.

In this situation the energy associated with minerals in the soil is virtually absent. This was further proven by the extreme low reading of the conductivity meter indicating a lack of electrical energy. Heat energy alone will not grow a crop; it also takes energy from matter and the electromagnetic spectrum. Tomatoes are nutrient hogs--they must have an abundance of nutrients in the soil or they will not thrive. Calcium is especially important to achieving high yield.

When looking at various forms of energy needed to grow a crop it gets much more difficult to

discern the bottleneck when you are growing a crop that is underperforming. So much of the time it is an excess of various minerals at the expense of others that is the main hindrance.

Dr. Reams gave a very important rule that pertains to the third form of energy; matter.

Ream's Rule: Plants do not live off minerals--they live off the energy associated with those minerals.

This rule helps explain why a small dose of fertilizer used as a foliar spray can have such a big impact. It is the energy associated with the minerals in the foliar spray causing the effect--not the minerals themselves.

Don't Underestimate Heat Energy

"Come here Wendell, I want to show you something." Jeff grabbed a watermelon from the edge of his field and threw it hard against the ground.

"Feel the temperature inside this melon." Wendell obliged and noted a cool temperature.

"Now check this one out, just 8 feet away." Another melon smashed the ground. It was 20 degrees warmer, and had the same sunlight exposure.

"What is the difference between these fields?" asked Wendell.

"The hot watermelon is a seedless and the cool one is seeded. It happens every time. I can't stand to eat seedless watermelon."

"Why does that happen?" Wendell inquired.

"No, no, you tell me, you're the expert." came the reply.

"Well...I don't know...I'll see if I can find the answer."

That afternoon I get a call from Wendell relating the story and he asks me if I know the answer. I don't but promise to look into it. That evening I listened to an old cassette from Dr. Reams and here is what he said in paraphrase:

"You shouldn't eat a seedless watermelon because they are deficient in manganese. They are bred to block the entrance of manganese into the melon. This lack of manganese is what causes the melon to be seedless. Actually the roots do pick up manganese but there is a blockade that will not allow

the manganese to enter the plant. In order to get rid of the manganese, plants dissipate it into the melon as heat energy."

I called Wendell and he shared this information with Jeff the next day.

I have never heard anything like this from plant physiology books. But neither have I heard any other explanation of this phenomenon so until I have reason to doubt it; this is my story and I am sticking with it.

This true story about watermelons illustrates the vital role heat energy plays in the process of plant growth.

The leaf is an awesome creation. Here is how it works. The plant brings up 6 water molecules from the root. These are combined with 6 molecules of carbon dioxide. This reaction must occur in the presence of solar energy; i.e. a source of light. Water plus carbon dioxide plus energy equals sugar plus oxygen.

Here is the really amazing part; heat energy is a governor of the photosynthetic rate. In other words heat energy in the leaf (up to a certain point), increases the chemical reactions, increases the metabolic activities in the plant tissue, and ultimately controls the rate of photosynthesis.

This is powerful stuff. The question is can we find a way to govern the governor. It so happens we can, thanks again to the observations of Dr. Reams. The iron content in the leaf assists in making the leaf thicker. More iron means a thicker leaf **and a greater ability to absorb heat energy from sunlight.** If you leave iron in the sun it gets hot. Iron in the leaf does the same.

When iron is low in a leaf it will be thin and pale looking. By increasing iron in the leaf we increase the absorption of heat energy and thus increase the overall amount of energy accumulated by plants.

For commercial growers I suggest keeping Iron around 100 ppm or higher on a dry matter basis on a tissue analysis of the leaves. If it goes lower than this a foliar spray of Iron may be profitable. Since the question will be asked; yes we have an iron product called WayAhead Iron. It is a 3-15-0 with 5% Iron and it is used at the rate of 1 pint per acre.

High pH soils, western soils, and saline soils all seem to have tied up Iron and would greatly benefit from foliar application of iron.

Heat energy also impacts crop growth in the soil. An adequately warmed soil germinates seeds quicker than a cold soil. Like everything else there are specific temperature ranges soil must be in and extremes are not good for plants.

Is there a way to control heat energy in soil? Indeed there is. The use of 5 lbs. per 1,000 square feet or 200 lbs. per acre of ammonium sulfate does wonders on soil temperature. In early spring it causes soil to warm up quicker, in mid summer's heat blast it keeps the soil noticeably cooler.

How does ammonium sulfate do this? Ammonia is a longtime commercial refrigerant. If you heat ammonia it cools and if you cool ammonia it heats. When ammonia is put into the soil in the form of ammonium sulfate it does the same thing. Truly amazing.

A Word to the Wise

Don't go over the amount recommended. If more nitrogen is needed for your crop, find a different form of nitrogen such as liquid fish or calcium nitrate.

Electrical Energy Powers Plant Growth - But I Can't Explain It

This was a once in a lifetime affair he had never seen before. Back and forth he went just to make sure it was real. In his field, the corn farmer saw no grasshoppers. Crossing the road he entered his neighbor's corn field. The whole field was jumping with grasshoppers. Many landed on him. Back he went to his own field. Sure enough it happened every time. As soon as he entered his field all the grasshoppers jumped off and flew back into the neighbor's field. They just couldn't stand being in his field.

After fertilizing his field for several years on the International Ag Labs program, he knew he was making progress. But this was proof he never expected to see. Yet it did happen. And that leads us to the all-important question: Why?

What was really going on? Why did his corn plants repel insects while his neighbor's plants attracted them? What does that say about plants, insects, and the impact of various fertility programs? More importantly what do grass hoppers have to do with electrical energy?

*The subject of electrical energy powering plant growth is fascinating, yet in this area we are still only peeping through the keyhole. Our vision and understanding is so **microscopic**. That is why you will find more questions than answers in this email.*

Here is another story to "whet" our appetite. It has been observed that drought stress causes corn leaves to curl up into pineapple-shaped leaves. This helps reduce the amount of moisture lost to the air. In the middle of the day a fierce electrical storm develops complete with many jabs of lightning. Alas it was a rainless storm--each plant got about 2 drops. Yet if you stop to look at

the corn leaves they are no longer pineapple leaves.

*The sun comes back out and shines on the corn for the rest of the day but there are no pineapple leaves. How can that be since the storm gave no rain? Then what did the storm give that helped the plants? **Was it a charged up electrical field in the atmosphere?** How does that help drought stressed corn?*

We all know that solar energy is the ultimate source of energy to grow a crop. Yet there seems to be many other sources of energy.

Consider the giant vegetables grown in Alaska. Some of these are monstrous in size. It appears they are prehistoric in size. What makes these vegetables so large? The native soil in Alaska is not special in itself. Is it the converging magnetic lines of force as they speed their way to the North Pole?

Electrical energy is all around us. Are plants tuning into this cosmic energy much like a radio can pull music out of thin air? Are plants really a double pole antennae with one antennae above ground and the other antennae below ground, more commonly called roots? Are plants more than an antenna but also a frequency generator that grasshoppers tune in to? Do grasshoppers need food to be on a specific frequency? Does fertility influence the frequency generated by plants?

*I don't know the answers to my questions and even if I did, I couldn't prove much. I am merely an uncredentialed soil guy trying to help people grow nutrient dense foods. I am certain of only a few things. Here's one: **Faith and wisdom trumps knowledge and information. Most important of all is to keep getting memos from the head office. To do that we need to keep asking.***

*In summary I believe that man has the opportunity to influence plants' ability to utilize the mysterious world of electrical energy **by how we mineralize soil and feed the plants.** The process starts with minerals, energy in physical form, but it influences the plants in ways we do not comprehend.*

Moms Are Making a Difference

I want to zoom out to the 40,000 foot view and look at our society as a whole.

I am very concerned with the health of our children in society. I see children growing up with so many challenges.

- *The prevalence of junk food and supporting media*

- Toxic Food
- Inadequate delivery of nutrition
- Compromised immune systems
- And so much more

In this context I am so appreciative for the Moms who are rising up and saying "Something is wrong with our food supply - we have got to fix it." I applaud your determination and your courage.

The areas my wife and I are most concerned about include:

1. Genetically modified food
2. Vaccinations
3. The wide-spread use of glyphosate and other pesticides
4. Fluorides in water and toothpaste
5. A regular supply of low brix foods

The good news is that growing a garden for nutrition can mitigate most of these problems. As we increase the diet of our children with high quality fruits and vegetables toxins are flushed out and health improves.

I heard an interesting quote the other week; "The only way a man will change is if he is in pain." Mothers, on the other hand, are more willing to change if their children are threatened.

Thanks to all the Moms (and Dads) fighting for the next generation.

Five Steps to Victory

1. Take upon yourself the "yoke" of soil stewardship.
2. Recognize that plant growth is all about energy. You make sure it is provided, and the plant will accumulate it.
3. Energy comes in 3 forms: heat, all frequencies on the electromagnetic spectrum, and matter--but the greatest of these is matter, i.e. minerals.
4. When you control the minerals you automatically control food quality.
5. When you consume a majority of your diet in the form of Nutrient Dense Foods, i.e. raised on fully mineralized soil, your body has no choice but to respond with health and energy.

Manage Those Minerals

Matter is the third form of energy. It is energy in physical form. This is the primary area you focus on as the steward.

The composition of available minerals in soil is what makes up the pattern of the soil. Here is an example. If you had woodland in Vermont and you cleared the land and tested the soil here is the pattern you would discover: critically low soil conductivity, phosphorous, and calcium. Somewhat low potassium and most trace minerals. Iron is well supplied.

This soil cannot raise nutrient dense food in this state. Its pattern shows a very depleted soil. On the positive side this soil has great potential but needs a lot of improvement. It is fairly easy to fix but not cheap.

The underlying problem with this soil is that the East has high rainfall and this washes nutrients out of the root zone. This is no problem for trees because their roots are deep and they can find the nutrients they need. It is a problem for shallow rooted vegetables and berries. This soil, as it is now, doesn't work for vegetables and berries because they need nutrients in the top soil.

Another basic problem with this soil is the lack of phosphorous. It is just not in the soil. Can this soil be brought into productivity? Can it grow foods of the highest quality? Yes it can--but it will always be a work in progress. Let's demonstrate how to improve this soil. We will assume it is a small garden of only 1,000 square feet. Here is what the fertility program may look like based on 2 years of soil testing.

Year 1 Broadcast

*50 lbs. Soft Rock Phosphate
50 lbs. Carbonized Limestone
75 lbs. Compost or 3 lbs. Potassium Sulfate
12 lb. Gypsum
5 lbs. Ammonium Sulfate
5 lbs. Calcium Nitrate
5 lb. 11-52-0 MAP
2 lbs. Kelp Meal
¼ lb. Copper Sulfate
¼ lb. Zinc Sulfate
¼ lb. Borax*

Year 2 Broadcast

*50 lbs. Soft Rock Phosphate
50 lbs. Carbonized Limestone*

25 lbs. Compost or 1 lb. Potassium Sulfate
5 lbs. Ammonium Sulfate
5 lbs. Calcium Nitrate
5 lb. 11-52-0 MAP
4 lbs. Epsom salts
2 lbs. Kelp Meal
1 lb. Manganese Sulfate
¼ lb. Copper Sulfate

In addition I would also add a microbial inoculant to the broadcast, plus provide liquid nutrients every month as drenches and weekly foliar sprays. This fertility program raises a lot of questions. Here are a few things to consider.

*The natural inclination of most people is to load up this soil with a plentiful supply of compost or aged manure. In theory compost can supply a whole lot of minerals and it may be cheap, local, and available. **DON'T DO IT!** This is the shackle that imprisons soil to produce poor to mediocre quality. Only use compost to the extent of the soils need for potassium **and no more.***

Here is another principle. Build and maintain phosphorous levels with Soft Rock Phosphate--not poultry manure, not hard rock phosphate, not commercial fertilizers exclusively. Why?

Soft Rock Phosphate is a colloidal clay rich in trace minerals that gets really sticky when wet. It is very important that SRP be included because it helps hold the calcium in the root zone. This is one of the secrets of raising available calcium in rain depleted soils.

Some people will object to the commercial fertilizers by concluding that they are all bad for the planet and kills soil biology. This is not true. What some people don't understand about commercial fertilizers is that they are concentrated packages of energy. This is exactly what depleted soil needs as it is changing pattern from being critically depleted to becoming well mineralized.

The 11-52-0 does not stay in the program permanently. It is only used to supply available phosphorous for the current crop. Once the Soft Rock Phosphate kicks in the available phosphorous will build to a sufficient level and the 11-52-0 is taken out of the program.

*Please remember that this example is only one starting pattern. Your soil may start with a sharply different pattern. The end goal is very similar for all soils, but since the starting point is so different the path to the end goal will look very different than the broadcast shown in this example. This example of a depleted soil becoming mineralized illustrates an important principle. **If you control the minerals you automatically control food quality.***

Compost: A Double Edged Sword

I was asked to explain in more detail why compost shouldn't be used. I want to clarify that I am not at all against the use of compost. Rather I am **100% for growing nutrient dense foods.**

Therefore I am against anything that detracts from this goal. The problem for most people is that compost has been ingrained in us as the optimum environmental response to those nasty chemicals that kill the planet and our soils. Therefore use a lot of compost and you won't need to use the nasty chemicals.

The problem with this approach is that it doesn't square with nature/biology. When compost is used at heavy rates, especially over a sustained period of time, this is what you get:

- Imbalanced Soil...potassium goes sky high while calcium drops like a rock
- Poor quality food...potassium substitutes for calcium in the cell wall resulting in weak watery cells that quickly rot and taste terrible
- Meta studies that show organic food is not clearly superior in nutrition compared to conventional food...yes it is less toxic but generally not any superior in nutrition

Instead of me lecturing on and on, let's have the soil speak for itself with 2 garden soil tests from Texas. Both came from the same plot of land but with sharply different patterns. Soil testing was done at International Ag Labs using the original Morgan soil test as promoted by Dr. Reams. All nutrients except humus are listed in lbs. per acre.

Garden #1

Humus 2

Nitrates 10

Ammonia 4

Phosphorous 29

Potassium 212

Calcium 13,43

 4

pH 7.6

Trace Minerals are all very low

This pattern of soil I call **Calcium Through the Roof**. It lacks acidity, trace minerals, phosphorous,

and most importantly reproductive energy. You can find this same pattern in areas of Montana, Colorado, and some parts of northern Iowa and southern Minnesota. Certain areas of Europe such as Spain also show this pattern. Here is the next soil.

Garden #2

Humus 20

Nitrates 10

Ammonia 8

Phosphorous
s 69

Potassium 1,852

Calcium 2,149

pH 7.2

Trace Minerals are all very low except Iron.

I call this pattern of soil **Abused by Too Much Compost**. This soil has a very different pattern than the first garden. So what happened between the two? Garden #1 is the unamended soil just getting ready for its first year as a garden. This is a typical look at what native high calcium Texas soil looks like. Garden #2 has been gardened for a long time with a sustained use of compost or manure or possibly the components of compost applied as continuous mulch. My best guess is lots of horse manure over a long period of time. The manure or compost or mulch supplies organic acids, a whole lot of potassium, and very little else. Look at what it did to the calcium; from 13 thousand to 2 thousand lbs. What a loss. Magnesium also took it on the chin; from 145 lbs as native soil to just 45 lbs. after years of compost or manure or mulching.

Here is how it actually works. On the clay colloid is adhered a certain amount of calcium, some potassium, some magnesium, and some sodium. When compost is applied the potassium is released into the soil solution. It then pushes some of the calcium off the clay colloid into the soil solution. Calcium is then taken up by growing plants. **A continuous supply of potassium over time will imbalance the soil with respect to calcium.**

When compost is supplied at high rates or sustained over a long period of time the soil pattern changes to become low calcium. Imagine what the results would have been with all this compost applied to a low calcium soil? It would have been only 600-700 lbs. of calcium. Without enough available calcium the plants cannot grow to their optimum nutrition. Compost or aged manure is a potent supplier of potassium. Only use it when the soil test calls for more potassium and skip it when potassium is well supplied.

Organic Approach vs. Gardening for Nutrition

A typical organic approach is to keep using compost. Smarter operators will add some calcium but overall will have excessive potassium. Large farm-scale organic farmers usually do not have an excess of potassium and don't over apply compost because of cost. The Gardening for Nutrition approach recognizes that both these example patterns are currently incapable of producing really nutritious food. In this approach the most prudent thing to do is to change both soils to a more optimum pattern. Let's explore how that could be started by looking at the broadcast of minerals per 1,000 square feet.

Garden #1 - Calcium Through the Roof

50
lbs. Soft Rock Phosphate

25
lbs. Compost or 1 lb. Potassium Sulfate -
no more

20
lbs. Azomite

5 lbs. 11-52-0

5 lbs. Ammonium Sulfate

5 lbs. Epsom Salts

2 lbs. Kelp Meal

1/4
lb. Copper Sulfate

1 lb. Iron Sulfate

1/4
lb. Zinc Sulfate

1 lb. Manganese Sulfate

4 oz. Borax

Note: The remainder of the nitrogen would come through fish-based nutrient drenches designed to provide extra acidity.

Garden #2 - Abused by Too Much

Compost

50 lbs. Soft Rock Phosphate

30 lbs. Carbonized Limestone

20 lbs. Azomite

5 lbs. Calcium Nitrate

5 lbs. 11-52-0

5 lbs. Ammonium Sulfate

5 lbs. Epsom Salts

2 lbs. Kelp Meal

1/4 lb. Zinc Sulfate

1 lb. Manganese Sulfate

4 oz. Borax

Liquid drenches on both gardens would be highly acidified to work against the high pH.

If you want to see the full soil tests here are the links:

[Garden #1](#)

[Garden #2](#)

Here is the bottom line. Excess potassium creates a low calcium pattern in soil.

If your goal is to garden for nutrition, then never create an excessively high potassium soil because it will prevent plants from producing nutrient dense foods.

Because compost is a potent supplier of potassium, limit its use to documented needs for potassium.

Raised Bed Gardening

One of the exciting movements happening in gardening is the concept of raised beds. Many of these micro gardens are only 4' X 4' or 4' X 8' in size. In the last few years I converted my whole garden to 4' X 8' raised beds with the help of my oldest son Jethro. We currently have 22 beds and will add a few more this year.

Why did we do this? Several reasons; raised beds warm up earlier in the spring allowing early planting, they are easier to plant, weed, and water, and they don't get walked on so the soil stays softer. A major drawback to raised beds is their increased need for watering.

I was specifically asked if raised beds need to be closed at the bottom to prevent leaching of nutrients. The answer is no, this is not required. Just make sure to follow the guidelines from the rest of the email. Some people may find it useful to attach metal wiring at the bottom of the bed to stop shrews, moles, or gophers from feeding on plant roots. We don't do this because we haven't had any such problems.

The most important advice I can give is to start with real soil--not some compost blend or soilless mix. If your goal is to garden for nutrition here is an example of what you shouldn't do:

[Link to All Screwed Up Sample](#)

In this soil/compost/amendment mix we see nitrogen and phosphorous excessive while potassium and sodium are at toxic levels. Trace minerals and calcium are great. There is no way I can help this "soil" except to recommend leaching it with 12 inches of water to wash out some of the nitrogen, sodium, and potassium. Even then it will not grow high brix for a long time. This soil has to stabilize and truly become soil. It also has to crop out some many excess nutrients. **Don't do this.**

This soil is in a pattern I call All Screwed Up. It will be productive but the flavor and nutritional value will be very disappointing. **Compost is not soil, it is an organic fertilizer, and should be given the respect it deserves. Use it gently just like all fertilizers.**

Here are the 3 steps you need to take in order to get high brix foods from your raised beds.

1. Start with the right soil
2. Soil test
3. Apply minerals according to the soil test

I suggest repeating steps 2 and 3 every year. Here's why. The ultimate goal is your health and nutrition. That means we must produce high brix / nutrient dense foods. This is only possible when the soil is in the right pattern. Getting soil into and keeping it in the right pattern is always a work in progress because the garden will be quite productive. The more productive your garden is, the more nutrients it will draw from the soil. This drawing of nutrients from the soil must be accounted for by replenishing them in the annual broadcast of minerals.

Start With the Right Soil

The most important first step is to start with the right soil. You don't need ideal soil, don't worry about "perfect" soil, **all you need is real soil, top soil without any amendments.** When soil is wrongly amended it can be messed in just 1 minute but take years to correct. Wait for the soil test results before adding anything.

The best source of unamended soil is sifted topsoil from a hardwood forest. This is a lot of work

and may not be available in your area but is well worth the effort. Hardwood forest soils have impeccable structure and active microbial communities ready to be put to work.

My next suggestion is a lot closer to home. Just use the top soil from your yard. Don't worry about sifting it. If your soil is very clayey in texture, don't worry, it will get corrected by the soil amendments. Clay is good because it holds a lot of minerals. Soil amendments such as limestone, gypsum, and soft rock phosphate will loosen that clay and make it much easier to work.

My third suggestion is the least preferred. Simply buy unamended topsoil. This can be risky so you may want to get a sample and send it off for a soil test before purchasing it.

A Garden Tour

Today I am going to meander off the intellectual path and offer you a tour of my own garden and some garden experiments.

I have been asked for many years about a complete organic version of high brix gardens. Truthfully, I just wasn't pleased with what I saw in the organic gardens on our program. Because of that, I never promoted it and always encouraged people to go biological using some commercial fertilizers and foliar sprays because the results were so much quicker and better.

But with so many requests, and by drawing from a number of resources, I believe a combined system might work for growing organics with high nutrient density. My garden is an attempt to answer this request.

I live in southern Minnesota. Our soil was built by the tall grasses of the prairie interacting with wind-blown silt coming from melted glaciers. 150 years ago buffalo roamed these lands. My soil shows higher levels of phosphorous and potassium because a generation or 2 ago the land was an animal pasture. The soil is completely black. [Here is a link to the full analysis.](#) The pattern of this soil I call *On the Right Track*. As you can see my main weakness is available calcium.

Here is what I will be applying next spring per 1,000 square feet:

30 lbs. Carbonized Limestone

10 lbs. GeoCal - Calcium and trace minerals

20 lbs. ReMin - Trace minerals

20 lbs. TMB - Trace minerals

1 lb. Kelp Meal

½ lb. Eden

1/4 lb. Copper Sulfate
1 lb. Iron Sulfate
1 lb. Manganese Sulfate

*I didn't apply it last fall because winter moved in suddenly. **So have you noticed what is wrong with my fertility recommendations?** Keep looking.*

Last fall, after the soil test, I did apply 2 lbs. per bed of a blend of powdered charcoal and wood ashes. I observed something interesting about charcoal. If you have high heat charcoal and leave the charcoal in the rain and then blend it in a food processor the charcoal takes on a strong smell of ammonia. The charcoal going into the food processor had no smell. I am guessing charcoal has the property of grabbing hold of atmospheric nitrogen if moist and rapidly spun like in a food processor.

Speaking of nitrogen did you notice my fertility recommendations don't have nitrogen? There is a reason for that. My experiment this year is to intensively support soil biology and see if biology can utilize the nitrogen it needs from the interaction of moist soil and the atmosphere which is rich in nitrogen.

To support biology I am doing 4 important things:

1) Create a housing complex for bacteria. *This comes in the form of powdered charcoal. I intend to add a certain amount every year.*

2) Provide a plentiful supply of rock minerals in the soil. *The yearly soil test and broadcast makes sure the soil has an abundance of calcium and volcanic rock minerals. Bacteria can't proliferate well if they do not have the minerals needed to build their bodies. Calcium is especially important for the proliferation of soil biology.*

3) Provide live soil bacteria and fungal organisms in the soil. *I supply live bacteria and mycorrhizal fungi by using [Transplant Formula](#). Additional fungal species come from inoculating each bed 1 time with a shovel full of hardwood forest soil before applying the last ingredient. Hardwood forest soil provides a whole host of fungal decomposers, the white rot fungi, but they do not tolerate a high nitrogen environment.*

4) Feed the soil biology a source of energy. *This is one of my most exciting experiments. I have been using Ramial chips. These chips are hardwood twigs and branches less than 3 inches in diameter that have been chipped and shredded several times. The consistency is like fine sawdust but it isn't sawdust. Sawdust comes from the stem wood of trees and is not what I am suggesting.*

*After applying the shovel full of forest soil I then apply 2/3 inch of ramial chips. These are evenly worked into the top 4 inches of soil. **No nitrogen is applied.** This is best done ahead of dormancy in the fall but can be done in the growing season. If applied in the growing season I wait 2 months*

before planting a crop to avoid a nitrogen deficiency. It is important to keep the beds moist during this time. As ramial chips decompose they become a source of energy for biology just like plant sugars from roots are a food supply for biology. Only, in this situation, biology is not dependent on the roots.

These chips have not been composted. That means they have a lot more energy to feed soil biology. **Composting is a biological process where energy is dissipated and minerals are concentrated outside of the soil.**

Instead of losing this energy to composting, ramial chips keep this energy and release it directly to the biology in the soil. Energy transfers within trophic chains of soil biology. It is not in the form of soluble nutrients. Consequently it cannot be detected with a conductivity meter. What I am observing is that plants do get the energy from biology. I am looking to see if I get a crop failure by not applying nitrogen.

Please don't copy my approach--it is only one experiment based on the strong condemnation of using nitrogen by Julius Hensel and others.

The Case for Nutrient Dense Foods

In yesterday's email I showed you my soil test from one specific raised bed in our garden. Last year I grew Renegade green beans in that bed. In today's email you can see the nutrient density analysis we did on those green beans.

But first I want to tell you a little more about that bed. I had not previously applied ramial chips, so after the beans were up, I applied the ramial chips as mulch and left it on top. After we had a killing frost in the fall the chips were worked into the top 4 inches of soil. As a reference I have raised green beans that reached 8.9 brix after the soil had been treated with ramial chips.

Also note that the same green beans lasted though out the growing season. They were kept productive by the use of foliar sprays.

Nutrient Dense Foods

What are nutrient dense foods? This is the whole point of gardening for nutrition. These are foods that have less water content and more total dissolved solids. This means the dry matter will be higher. The quickest and easiest way to check produce is with a refractometer to measure brix. Then cross check your results with the brix chart. For more info see:

<http://www.highbrixgardens.com/what-is-brix.html>

What does a refractometer actually measure? It measures the bend of light as it passes through a liquid. Sugars and dissolved minerals cause light to bend. A refractometer reading strongly corresponds to taste. In other words a higher reading will taste better than a lower reading.

In order to measure food quality that looks closely at minerals, I developed a lab analysis that measures brix, dry matter, free nitrates, and nutrients in 100 grams of fresh produce. With these numbers we compute a Nutrient Density Score. The score is a single number that represents the overall nutrition of the food. Now comparable foods can be ranked based on the Nutrient Density Score.

Take a look at my green beans. [Green Beans #1](#). My beans had a nutrient density score of 114.3. I foliar sprayed a lot of calcium and trace minerals to overcome my modest level of calcium in the soil. Dry Matter was pretty good at 13.8%. Brix was only on the upper side of average. I can say that whenever my wife cooked these green beans we all enjoyed the flavor and taste. They were notably better than anything we could buy.

Here are the brix readings for green beans: Poor starts at 4, Average starts at 6, Good starts at 8, Excellent starts at 10. I think it is possible to get 12 brix and higher green beans at the upper end in quality.

In the next sample we see much lower nutrient density. [Green Beans #2](#). I purchased these at a local grocery store. The nutrient density score, brix, and dry matter are all lower. One exception to this trend is the level of manganese. 100 grams of these beans will give 20% Daily Value. This is important because it indicates that green beans are manganese accumulator plants. In other words if plenty of manganese is present, green beans will pick it up. The level in this sample is higher than my beans. Why? Look back at my soil test. I struggle with very low manganese in the soil.

As a reference I also computed the Nutrient Density Score on the USDA food data. [Green Beans - USDA](#). Wow--only a Nutrient Density Score of 52.3. This is very poor nutrition. What does this say overall about the USDA food data? **It reflects what is, not what should be.**

Lastly let's look at [Green Beans #3](#). This sample makes me both sad and angry. Imagine kids having to eat this. Their tongues rebel saying, "It tastes terrible." Meanwhile parents instruct saying, "Eat your green beans - they are healthy for you."

Notice the brix of these beans. They are off the chart on the wrong side. I had to create a new classification for beans less than 4 brix. I called them Deficient. With dry matter so low, what you are really getting is a lot of moisture that just look like a green bean but is mostly only water.

*If you take the dry matter of the poorest green beans and compare that to the dry matter from my green beans, you will find **the poorest beans only had 37% of the nutrients of my green beans.** And my green beans aren't the best.*

What kind of beans do you want to eat? What kind do you want your children and grandchildren eating?

This variation of nutrient density in green beans applies to all produce. To get true nutrient dense foods you must first fix your soil.

*Remember, **if you control the minerals--you control the nutrient density.** -Jon Frank Gardening Rule*

Little Hinges Swing a Big Door

Soil testing is the hinge that opens a door to the world beneath our feet. Soil testing lets us see what is happening from the perspective of plant roots. Are roots finding enough minerals? Are they present in the right ratios? Or is there trouble brewing with inadequate minerals?

The fundamental basis of soil stewardship is to apply the minerals that are deficient and to not apply the minerals that are excessive. The soil test tells us how to be good stewards.

*Since a garden is the place we grow nutrition, and since the quality of produce reflects the soil it was grown on, then **our stewardship of soil should not be haphazard. It should not be by guessing, and it should not be done by saying "This is what I have, so that is what the soil is going to get."***

Rather stewardship of soil should be according to the actual needs of the soil. If it needs copper, then copper should be applied. If potassium is well supplied, then more shouldn't be added. This is where soil testing becomes the little hinge; it is just an analysis. Yet it opens a big door: effective stewardship. If you supply effective stewardship and be diligent to grow a garden, then the soil will supply health-giving nutrition back to you.

So how is soil testing done? In principle it is a very simple procedure.

- 1. Mix soil with water and a chemical reagent*
- 2. Filter the solution*
- 3. Analyze the filtrate*

In soil testing a reagent is a chemical or group of chemicals used to extract nutrients out of the

soil into the water solution. Filtration then removes all the remaining soil particles. Laboratory equipment then analyzes the amount of nutrients present in the filtrate.

The big variable in this process are the reagents that are added to the soil and water. Soil test results differ dramatically according to the chemicals used. If no chemical is used then it is called a water extract.

The main difference in the various soil tests is the change in the chemical reagents. As you may imagine there are many different reagents used for soil testing. Common reagents or soil tests include; the Morgan test, the Modified Morgan test, the Ammonium Acetate test, the Bray 1 test, the Olsen test, the Mehlich 3 test, and many more.

International Ag Labs has always promoted the Original Morgan soil test. All of our fertility recommendations and writings are based off this specific test.

The purpose of a soil test is to make proper management decision for the soil and the crop being raised.

Dr. M.F. Morgan worked for the University of Connecticut as the Chief of the Soils Department. He developed the Morgan test in 1934. Morgan's soil test became the world's first widely accepted method for efficiently estimating soil fertility. His test was later promoted by Dr. Carey Reams while the reagents to run the test were manufactured by the LaMotte Chemical Company. Sometimes the Morgan test is called the Reams test or the LaMotte test, but the proper name is the Original Morgan test.

Here is what makes the Morgan test so beneficial to growers. Dr. Morgan studied plant roots and plant root exudates. He found plant roots give off a weak acid around the roots. This helps solubilize nutrients out of the soil and make them available for plant uptake.

Dr. Morgan used the weak acid of plant roots as the template to copy when he developed the reagents for his soil test. What weak acid did he use? It is very common, derived from plants, and probably in your cupboard, vinegar. More properly it is called acetic acid. He also added a sodium salt of acetic acid to control the pH. The pH of his solution was set at 4.8 which also emulated plant roots.

Of all the soil tests, the Morgan extract is the simplest in composition and yields the best results. All of the other soil tests commonly used today have been developed **after** the original Morgan test. Dr. Morgan died in WWII in 1945. After this his colleagues changed the Morgan test by adding in stronger chemicals. This was done because the world of science and chemistry was

progressing.

The new way of looking at chemical reagents in soil tests was to study **chemistry**. By looking at chemistry better reagents were developed to extract more nutrients out of the soil. This was accomplished by using stronger chemicals; typically a very strong acid was mixed with a very strong base. This resulted in many more nutrients showing up on the soil test. Consider the popular upstart in soil testing; the Mehlich 3. It was developed in 1984. Here is what is in this reagent:

- Glacial Acetic Acid
- Ammonium Nitrate
- Ammonium Fluoride
- Nitric Acid
- EDTA Chelating Agent

This powerful mix was designed to extract every nutrient in the soil except nitrogen. It is actually quite sophisticated chemistry and does a beautiful job at extracting nutrients out of the soil. It is also a dream for soil testing labs because it saves so much time and cost to analyze the soil.

There is really only one problem with this soil test: **Plants Don't Read Chemistry Books**. They can only produce weak acids.

From the Modified Morgan to the Mehlich 3, they all use good chemistry; **but only the Original Morgan was patterned after plant root exudates**. Does this make a difference? It makes all the difference in the world. The door into the realm of plant roots is now open and visible to us all!

Gardens Need Forestry

By their very nature gardens are very intensive. Annual crops and closer spacing of plants require intensive management. Without this management gardens would be overrun with weeds and soon it wouldn't even be a garden.

In a garden, nutrients flow from the soil to food. This flow of nutrients and the garden's need for energy requires intensive management. One way to assist a garden in this is to use products from forestry. Forests are really net accumulators of energy. Wood and leaves represent accumulated energy. When these decompose on the forest floor soil is created.

Unlike annual vegetables, trees have deep roots that allow them to access minerals and moisture from far below the top soil. Let's review some of Nature's Bounty from the forest.

Leaves - Leaves are an excellent source of quick release energy, carbons, and minerals. Nature has been building soil with the annual drop of leaves since time began. I prefer the use of leaves over a cover crop because leaves provide more carbons and dry mater in soil. If you want to add leaves to your garden I suggest working in about 4-6 inches in the fall or at the beginning of the dormant season. Before working them in, I suggest spraying leaves with live microbes, a food supply such as dissolved sugar or molasses, some liquid fish for extra nitrogen, and possibly a bio stimulant derived from humates. Here is what it may look like:

Spray on Leaves per 1,000 square feet:

1 quart of liquid fish - prefer higher nitrogen

1 cup of dissolved sugar

4 oz. Z-Hume or substitute another inoculant

2 oz. RL-37 or substitute another bio stimulant

Now till the leaves into the soil. I find this protocol especially useful for greenhouses where today's leaves are next year's supply of CO₂.

Ashes - Burning wood separates atmospheric elements from earth minerals. The ashes are the earth minerals previously taken up by plants. I am impressed by how many trace minerals are present in wood ashes--especially manganese. Wood ashes are useful in the garden but are chemically hot. This means they should be applied to the land as it is going into dormancy. Do not apply wood ashes just prior to planting. It will interfere with germination. Use up to 20 lbs. per 1,000 square feet. Avoid ashes on high calcium alkaline soils. Ashes are wonderful fertilizers but you must use them judiciously and at the right time. I like both hardwood and softwood ashes.

Charcoal - Charcoal is an excellent addition to soil because it holds onto minerals and nitrogen, it attracts transient carbons, and it houses whole microbial communities. The poorer the soil the more charcoal helps. Here is how I make my own charcoal. Use branches and wood larger than 3 inches in diameter. Burn a larger amount at one time then let it burn down into the coal stage. When in the coal state shovel out the gleaming coals and ashes into a metal barrel and cover them. Add more wood to the fire and repeat. This is a great time to add bones and eggshells to the fire. The high heat leaves them soft to crush, making calcium and phosphorous available for plants.

After a couple of days the coals have lost all their heat and are now charcoal. Sift out the ashes and you now have high heat charcoal. It should crush easily between your fingers.

Soil - Forests are great factories for brand new soil. The term for this is pedogenesis. This is some of the best soil to use when starting raised beds. Not only does it have great structure but it hasn't been sprayed with farm chemicals so the microbial life is optimum.

Twigs and Branches - I have covered the use of chopped twigs and branches (ramial chips) in a

previous email so I won't repeat that. I am convinced that ramial chips are pivotal to recreating the health and vitality of forest soil in our own gardens. Whenever I see twigs and small branches, I always think **wealth of the nations**. Put it to work in your own garden and you won't be disappointed.

Many municipalities have collection sites for tree leaves and wood waste from yards. This is an excellent source to find all your forestry needs.

Wood Chips - Wood chips are much courser than ramial chips and are mostly from stem wood or large branches. Wood chips are an excellent source of carbon and are the very best permanent mulch cover there is. The Back to Eden film popularized the use of wood chips as a permanent cover on the soil. If you haven't seen the video you should. It is very inspiring. Here is the link:

<http://www.backtoedenfilm.com>

In spite of my endorsement for the video that is not what I am actually doing because I find better results with ramial chips and soil mineralization.

Stem Wood - The use of large logs in gardening is new for me but it is becoming increasingly popular. Large logs or chunks of wood are buried under topsoil. Over time the wood begins to decompose. As it does the wood sucks up water like a sponge and becomes a large reservoir of moisture that is available to plants during times of drought. The term for this is hugelkultur and is promoted by teachers of permaculture.

Wow that is a big list of forest products that can benefit your garden. Isn't it amazing how forests don't need man's intervention to grow and maintain, yet they provide so many useful things to gardening and agriculture? If possible return the favor by spreading a little rock dust around your trees.

Why Calcium is King

Dr. William Albrecht was a preeminent soil scientist during the last century. He did a lot of field and animal studies. I am particularly intrigued by one experiment he performed on soybeans. He planted 2 groups of soybeans: 1 group in high calcium soil, and the other in calcium deficient soil. 10 days after germination, both set were gently uprooted and had all the soil washed off the roots. Then both groups were replanted back into calcium deficient soil. The seedlings that grew for 10 days in calcium rich soil looked better all through the growing season and they yielded significantly better.

Germination and growing in high calcium soil for only 10 days had a surprising impact on plant health. This is kind of like prenatal nutrition for people. It pays big dividends for years to come. This experiment highlights how important it is to achieve high calcium in your garden soil.

Calcium is critical for:

- *Volume of yield*
- *Healthy cell walls*
- *Prolific roots that support soil biology*
- *Crop quality*

The bottom line is that if you want to garden for nutrition you must have an abundance of available calcium.

*Let's look closer at **why** calcium is such a kingpin. All nutrients applied to soils or in soils have an effect on the soils ability to raise a crop. These nutrients are divided into 2 types of energy-- those that increase the growth of stalks, stems, and leaves, i.e. growth energy, and those that increase the growth of flowers, blossoms, and pods being set, i.e. reproductive energy.*

To get the best growth you need all nutrients at appropriate levels and close to the right ratios. It is especially important to have the right ratio of growth energy to reproductive energy.

*Consider the scenario where a tomato grows awesome vines all summer but doesn't put on any flowers or tomatoes. This does happen, and the cause is an insufficiency of reproductive energy. Consider another example. Compost (a reproductive fertilizer) is applied to lawns at a heavy rate. What do you observe? Lots of dandelions (a reproductive crop) and grass that is only 3 inches tall that pushes up seed heads. **The reproductive fertilizer shifted the physiology of the grass from growth into reproductive mode.***

Here are the growth energy nutrients and reproductive energy nutrients for quick comparison. Remember you want both sides roughly the same. It is very similar to running a teeter-totter. Both sides need to be close to equal weight.

Growth Energy

Sodium/Chlorides

Nitrates

Potassium

Calcium

Reproductive Energy

All Trace Minerals

Ammonial Nitrogen

Phosphates

Sulfates

Silicon

Magnesium

All Organics/Carbons

So let's ask a few important questions. How much sodium/chlorides should be in soil? Not much. A few lbs. per acre is sufficient. How much nitrates should be available per acre? Not too much. We list 40 lbs. per acre on our soil test. Call it 10's of lbs. per acre. How about potassium? Potassium is needed anywhere from 100 to 500 lbs. per acre depending on the crop. Normally it is needed somewhere around 200 lbs. per acre. Call potassium hundreds of lbs. per acre.

What is left on the growth energy side? Calcium! How much calcium is needed per acre? 1,000's of lbs. per acre. How much growth energy does a few lbs. of sodium chloride provide? Very little. How about the 10's of lbs. of nitrates? Only a small amount. What about the 100's of lbs. of potassium? Some. And lastly the 1,000's of lbs. of calcium? This is the vast majority by far. Here is the take away.

Calcium is the main growth energy element that all reproductive elements work against to create energy in soil. This is why Calcium is King!

Do you want trace minerals to work for you? Make sure you have plenty of calcium for that to happen. Do you want liquid fish or ammonium sulfate to work for you? It will happen when your soil is well endowed with calcium.

To garden for nutrition you must equip your soil with an adequate supply of calcium.

Building Available Calcium in Your Garden

A few weeks ago, I was on a Skype call with a gentleman in Mongolia. We were talking because he was looking to improve his soil and vegetable quality. The mountainous region he and his family are in has precious little top soil. To increase the topsoil, sheep manure is added regularly. After many years of doing this, insects and disease are becoming a menace. What is the problem? No return of calcium. The soil was becoming increasingly depleted of calcium.

In the tropical soil of the Democratic Republic of Congo, the situation is similar. The top soil is severely depleted in calcium because of high rainfall. Around the world, calcium is a limiting factor--and it is probably a factor in your garden as well. I would estimate that 90% of the soils struggle with low calcium. There are notable exceptions, and a few soils struggle with excessive calcium.

As we discussed in yesterday's email, calcium is the main growth energy element to counteract reproductive nutrients. Here are a few more snippets of information about calcium.

- *Of all crops, vegetables require more calcium*

- Calcium has a natural tendency to go down in soil
- It takes microbial digestion to convert limestone to available calcium
- For most soils, building calcium is always a work in progress

In contrast to calcium, it is very simple to build potassium levels in soil. Just apply it in some form and it is almost immediately available to plants. Potassium is a very soluble nutrient and doesn't seem to have as much problems with leaching. If anything, potassium will climb in soils to the surface.

Here is the good news. **Calcium is one of the most abundant natural resources.** It is available primarily in the form of limestone. The truth is that limestone is everywhere. Guess where it's located? Mongolia has mountainous limestone deposits, while Congo has limestone in a river basin.

Isn't it interesting? **The nutrient most needed is also the nutrient most supplied the world over.** This is what I call Providence for Nutrient Dense. Let's examine the various forms of calcium and conclude with a few strategies to raise calcium levels in your garden.

Calcium Carbonate

This is the chemical name for limestone. Interestingly, this is the only form that contains carbon in its structure. By using limestone, both calcium and carbon is applied at the same time. Limestone is the main form of calcium to raise low levels of available calcium. One drawback is the need for microbial digestion. In other words, limestone does not equal available calcium. Limestone with a high magnesium content is called dolomite. It is not normally recommended because it provides too much magnesium and imbalances the calcium-to-magnesium ratio. For many years, IAL has recommended carbonized limestone for garden, greenhouse, and market garden recommendations. Carbonized limestone starts with finely ground, high calcium limestone. To that is added a small amount of powdered humates, some sugar, and some liquid humates. This enhances microbial digestion and helps hold calcium up in the root zone longer before sinking in the soil profile. If you're interested, here is an MP3 audio introduction to Carbonized Limestone I recorded awhile back:

[Introduction to Carbonized Limestone](#)

Calcium Oxide/Calcium Hydroxide

Limestone rock can be heated by fire. This drives off the carbon and leaves a very fine powder: calcium oxide. A certain amount of water can be added to become calcium hydroxide. Both of these forms of calcium are very hot chemically and aren't recommended very often. They are very strong on growth energy, but can burn plants and leaves. If you must use these forms, apply during dormancy and handle carefully.

Calcium Nitrate

Calcium nitrate is the king of available calcium sources. It is a double growth energy nutrient source. In other words, the calcium adds growth energy to the soil as do nitrates. Calcium nitrate is a very valuable tool, but must be used judiciously in order to avoid over applying nitrogen. Calcium nitrate cannot be used solely to build available calcium, but it is a great fertilizer to assist in building soil.

Normal rates are 5 lbs. per 1,000 square feet. Organic farmers cannot use this product because it is the result of a chemical reaction between limestone and nitric acid derived from the air, and is not a natural mineral deposit.

Calcium Phosphate

Calcium phosphate is the form of calcium in bones and teeth. It is available for field application by using rock phosphate. International Ag Labs strongly recommends the use of soft rock phosphate because it becomes available much quicker in the soil than does hard rock phosphate. Soft rock phosphate is useful for building calcium in the soil by a very unique feature.

Just to be clear, let's back up and clarify the differences between hard and soft rock phosphate. Hard rock is the rock phosphate in ground. Over a century ago mining companies realized that the clay "impurities" mixed in the hard rock could be washed off. The benefit was a higher analysis rock phosphate that was easier and more profitable to refine into commercial phosphate fertilizer.

This clay impurity was washed off into massive settling ponds the size of lakes. Eventually the lakes filled up and the surface dried. Soft rock phosphate is this colloidal clay impurity. What were the impurities? Clay and trace minerals. It has proven to be one of the best phosphate fertilizers for organic and biological growers. It still has a decent amount of phosphorous and calcium but it also has the benefit of clay colloids and many trace minerals.

When soft rock phosphate gets wet it becomes sticky--very sticky. This stickiness attracts calcium to the soft rock phosphate and holds onto the calcium in the soil.

Calcium Silicate

This form of calcium is present in some volcanic rock powders. Normally this form is also rich in trace minerals. Calcium silicate works great for low pH tropical soils that are struggling with aluminum toxicity in plant tissue.

Calcium Sulfate

This is commonly known as gypsum. Gypsum is the popular upstart seeking to displace limestone as the preeminent calcium supply. Gypsum is very useful in specific situations such as:

- Compacted soil
- Anaerobic soil
- Saline or salty soil
- Sulfur deficient organic soil

In these situations nothing beats gypsum. It is also useful to augment limestone in helping to raise available calcium.

The Morgan soil test has concluded time and time again that gypsum is not the tool of choice to raise a low calcium soil. It flat out doesn't work. Limestone works very consistently. This information doesn't show up when using a Mehlich 3 soil test.

So what are some strategies to raise available calcium in your garden?

- *Use multiple forms of calcium, with limestone as the base*
- *Use yearly applications but with more modest rates*
- *Carbonize limestone with sugar and bio stimulant humates so bacteria attack it in a feeding frenzy*
- *Use soft rock phosphate to hold calcium up in the root zone*
- *Use modest amounts of soluble calcium...this applies to dry calcium nitrate and drenches during the growing season*
- *Be persistent*

These are the same strategies we use when doing soil programs for the high brix gardens program at www.highbrixgardens.com

Phosphorous

*Have you ever baked a cake? If you want the cake to turn out well you need to have the right levels and ratios of ingredients. What would happen if you decided to modify the cake recipe and doubled the liquids while cutting the flour and dry ingredients in half? It would mix just fine in a bowl but when you take it out of the oven you would have some glop that nobody wants to eat and you wouldn't dare call it a cake. **Either you must understand the right proportions, or else you need to follow a recipe.***

In the same way you need to maintain the right levels and ratios of available nutrients in soil if you want your garden to produce nutrient dense foods. It is especially important to keep your eye on the big 3; calcium, phosphorous, and potassium. If you get these 3 right in your soil, everything else is a piece of cake.

The easiest problem to fix is low potassium. Just add it and your problem is over. Raising a low calcium level is a bit more challenging because it takes microbial digestion. Harder still is to build up low phosphorous in soil. Once phosphorous is built up it becomes much easier--all you have to do is maintain a consistent level.

*When considering the overall influence of growth vs. fruiting energy in soil, **the primary reproductive energy comes from phosphorous.** Manganese gets honorable mention, but phosphorous is the big one.*

When looking at phosphorous in soil, it is important to view this nutrient in ratio with other elements. For example the phosphorous to potassium ratio should be around 1:1 with a level of around 175 lbs. per acre of each. At this level these elements are well supplied, but are not interfering with calcium.

*Another ratio to keep an eye on is the calcium to phosphorous ratio. Look for an 18:1 ratio as ideal. When the ratio gets narrower than 12:1, phosphorous begins to interfere with the function of calcium. What does that mean? **Produce tastes like garbage.** I have seen many soils showing 2-3,000 lbs. of phosphorous and potassium with only 1,800 lbs. or less of calcium. Instead of 18:1 the ratio becomes 0.7:1. **This is just like that gloppy cake recipe. There is no way a soil like this can grow nutrient dense***

foods until the levels and ratios come in line.

As hard as it is to build phosphorous in soil, it is much harder to reduce an extreme level of phosphorous. It only comes down at a snail's pace. Many zealously amended soils will need 20 years to reduce all that phosphorous. Here is my best advice in such a situation; move your garden. Another option is to excavate the top 6 inches of soil and replace with unamended topsoil. A third option is to dilute existing soil with 6 inches of unamended topsoil. All 3 of these approaches are much quicker than trying to bring down phosphorous to the right level by cropping it out.

On the other hand many new gardens are critically deficient in phosphorous. They are so low that the plants are practically on life support. Phosphorous is the P in ATP. ATP is the prime mover in the energy cycle in plants. In other words a plant needs phosphorous to:

- Make Sugars
- Transport Minerals
- Transport Sugars

When phosphorous is undersupplied in a plant, everything suffers--especially quality.

Strategies to Raise Phosphorous in Depleted Soil

1. Use Soft Rock Phosphate as the base. About 50 lbs. per 1,000 square feet should do it. Repeat 1 more time if needed. Do not waste your time with hard rock phosphate.
2. Use 11-52-0, an acid phosphate, in conjunction with Soft Rock Phosphate. This will supply the plants' need for phosphorous right away and the acid assists in making Soft Rock Phosphate more available.
3. Use other acids in the fertility program. This again helps the Soft Rock Phosphate become available.
4. Use a liquid fish that has been stabilized with phosphoric acid as part of the nutrient drenches.

I have used this exact program on hundreds of gardens all across the pH spectrum and it works very well. Rarely does it take more than 2-3 years. What really slows this process down is trying to do it 100% organic. The other acids and the commercial phosphate are the key to getting Soft Rock Phosphate available. Do not use 18-46-0 or DAP. It is a useless, high pH fertilizer that just ties up with calcium.

The strategy I use in gardens to raise phosphorous is to get a big hammer and swing it as hard as I can. In many instances a low phosphorous reading of 20 lbs. per acre might move up to 70 or 80 lbs. in one year. I normally repeat the program from the first year and see phosphorous further rise to 150-180 by the beginning of the 3rd year on the program. Then it goes into a maintenance mode where small doses of Soft Rock Phosphate are added whenever the soil test shows phosphorous between 150-250 lbs. per acre. The maintenance dose is 12 lbs. per 1,000 square feet or 500 lbs. per acre.

As phosphorous rises to the optimum level, commercial phosphate is taken out of the program. Here is what I don't suggest; apply low doses of phosphorous, use mycorrhizea, and hope for the best. This approach keeps the soil depleted for a long time and rarely yields nutrient dense produce. **If you want**

nutrient dense foods you must get available phosphorous to around 175 lbs. as fast as you can. At this level of available Phosphorous, mycorrhizea go dormant and aren't much use to roots. The best use of mycorrhizea is to use it on low fertility soils where remineralizing with phosphorous is not economical. Phosphorous in soil is very similar to a dry sponge. If water is dribbling on a sponge, no runoff will occur until the sponge is saturated. First you have to saturate the sponge. The same principle applies to phosphorous. You have to apply quite a bit at first to saturate the sponge, then available phosphorous will show up all of a sudden.

On the Morgan soil test here is what I do for specific levels of available phosphorous:

1-120 lbs. per acre - Swing the big hammer, don't be timid, move past this insufficiency as fast as you can by using Soft Rock Phosphate, 11-52-0, other acids, and phos acid liquid fish.

120-150 lbs. per acre - Swing a smaller hammer but make sure to take action by using all the tools listed above.

150-250 lbs. per acre - Maintenance Mode, use Soft Rock Phosphate in maintenance doses and 1-2 lbs. of 11-52-0 if lower than 200 lbs. per acre.

Above 250 lbs. per acre - Leave it alone, this soil does not need any more phosphorous. Check it next year.

Last, but not least, phosphorous plays a big role in foliar sprays

Foliar Feeding

One of the exciting frontiers in the world of agriculture is the direct feeding of plants with nutritional solutions through their leaves. With properly made foliar sprays, plants can be fed major plant nutrients, supplemental calcium, trace minerals, and bio stimulants.

Foliar feeding provides nutrition to a plant without using microbial digestion in soil, root uptake, and xylem transport in plants. Instead the nutrients penetrate the plant and are transported by the plants phloem system directly to the growing regions of the plant and to the roots.

Foliar feeding is fast--very fast. How fast? How about showing an observable result in just 24 hours? When a reproductive spray is applied to green beans you can see a plethora of new blossoms the next day and a bunch of quarter inch long beans within 24 hours--all from one spraying.

*One of the great problems in society today is a deficiency of trace minerals in our food supply. Foliar feeding can help in this area dramatically. Foliar feeding is a very effective tool to deliver trace minerals to plants and into the foods we consume. **To be effective, foliar sprays must present nutrients to the plant in the form it can use.** This is an important rule for foliar feeding. If a nutrient is insoluble, the plant cannot use it. So the starting point of a good foliar spray is to make sure the nutrients are soluble in water.*

But it is not good enough to get nutrients on the leaves. For it to be effective foliar sprays need to penetrate the leaf and be mobile in the plant. This is not an easy task, especially since the basis function of a leaf is geared toward producing sugars and not taking in nutrients.

Yet with proper formulations, foliar sprays can deliver nutrients through the leaves and to the produce being raised. The big question that many will ask is why? Why foliar feed plants when that is not the basic function of the leaf? There are several reasons. Here are several:

- **Improved Yields**... This is the primary reason foliar feeding is done in production agriculture...it pays to do so.
- **Improved Quality**... When foliar calcium and trace minerals are delivered to the growing fruit and vegetables, quality is improved.
- **Foliar Sprays Feed Soil Biology**... A good foliar spray increases photosynthesis in leaves. This increases sugar production. Subsequently, a certain portion of these sugars are sent out of the roots as exudates that feed soil biology.

One objection to foliar feeding is to focus on feeding the soil and not the short-term view of feeding the plant. I fully agree that we must focus on soil building but why not also focus on increasing yield, quality, and ultimately more nutritious food by using foliar sprays. What is wrong with feeding the soil and feeding the plant? Nothing.

Another question gardeners have about foliar feeding is when it should be done. **Most anytime is better than not doing it at all**, but just to be careful I suggest avoiding extreme heat and high humidity. Foliar feeding plants in the mornings, afternoons, or early evening all work great.

Here are some basic guidelines on how to foliar spray your garden.

1. **Use Pure Water**. Distilled water, reverse osmosis water, or captured rain water are all ideal.
2. **Only use a very dilute amount of nutrients in your spray solution**.
3. **Add a surfactant**. This is fulfilled by the use of dextrose, a 6 carbon sugar--not sucrose, not molasses.
4. **Spray lightly with just a fine mist**. It only takes a small amount to make a significant difference.
5. **Spray Frequently**... about 1-2 times per week.

Here is an example of a foliar spray that will supply nitrogen, phosphorous, potassium, calcium, amino acids, trace minerals, and bio stimulants.

1. Start with 1 liter of Distilled Water
2. Dissolve into this 5 Tablespoons of Dextrose
3. Add in 10 Mills of Amaze
4. Add in 5 mills of PGR
5. Spray lightly with a fine mist.

This amount should cover around 200 square feet or about 6 - 4 X 8 raised beds. The whole process only takes 3 minutes to make and 5 minutes to spray out in your garden. The cost of this spray is negligible while the return is a noticeable increase in production.

For more specific information on Amaze and PGR see www.foliarsprays.com. To order small containers of foliar sprays including Amaze, PGR, and dextrose please contact Luke Lemmers at [952-239-2042](tel:952-239-2042) or luke@fixmysoil.com. For orders of 5 gallons or more call the office at [507-235-6909](tel:507-235-6909).

Most of the foliar sprays on the market are not organic. For organic growers here are a few ingredients you can use:

- 1. **Liquid Fish** - We use a 2-5-0-2 fish from Dramm that is acidified with phosphoric acid. It is a great foliar spray but it is also strongly reproductive so do not use on growth dominated crops such as cabbage, spinach, broccoli, or cauliflower.*
- 2. **Dry or Liquid Seaweed** - This is great for trace minerals, amino acids, and naturally occurring plant growth regulators.*
- 3. **Fulvic Acid** - Great for trace minerals and acidity.*

Wishing you a great garden and plenty of nutritious food,

Gardens Need Geology

*Nature has a plan and a complete cycle to remineralize the soils of the world, including your garden. Here is how it works; first nature gets out massive rock crushers and grinds an infinite amount of rock to dust. Then nature removes the rock crushers and distributes the rock powders around the globe. **Do you believe me?** It has happened before several times and the state I live in, Minnesota, and all its lakes, are proof. Okay I left a few details out of the story so let's back up.*

The study of ice ages is fascinating. According to scientists an ice age is divided into 2 phases. The first part is long and cold, while the second part is short (relatively) and warm. During the first phase, called glacials, it snows a lot. The snow packs into ice and glaciers form. As it snows more and more the weight of the ice pushes the glaciers out. This movement of ice is like a slow moving river. As the "ice river" flows it pushes massive quantities of rock. As rock rubs rock, dust is formed and is carried along with the ice.

Over time a massive change occurs as the glaciers build up in the northern and southern Polar Regions. So much water is stored as ice that the ocean level drops considerably. Glaciers start closer to the poles but over time push out towards the equator.

Finally, after a long time, scientists say ~90,000 years, the globe once again warms up. The warm phase after glaciers retreat to the north is called the inter-glacial period. As the glaciers melt they leave great quantities of dust behind. Massive wind storms pick up this dust and strew it all over the planet. Even soils in the equator benefit from this mineralization.

With new minerals, vegetation reappears on the land and plants once again cover the land that had been under glaciers. The deep pits dug out by ice now become new lakes. Masses of rock and sand too heavy for the wind to carry become today's gravel pits.

*It is nature's pattern to remineralize soil on a global scale. It has happened several times in the past and maybe it will happen again. The remineralized soil from wind-blown dust, can produce massive results. Europe once raised trees and forests of gigantic size. Today's specimens cannot compare. I attribute this to full mineralization of soil. **The good news is that this very process can occur in your garden and you don't have to wait for a glacier to come along.***

The truth is that this globe is full of minerals. There is no shortage of supply. Minerals may be short

in your garden or in your body, but the earth as a whole has no such shortage. What is lacking is stewardship that moves geological minerals from point A to point B--your garden.

Every time you see a volcano or volcanic ash, just remember nature is giving us land dwellers a gift of minerals and ultimately, good health.

The high brix garden program uses over 10 geological resources to help mineralize your soil. Let's look at the amazing resources geology provides:

Rock Powders... *These come in many different forms such as phosphate based, volcanic ash based, clay based, silicon based, and calcium based.*

Humates... *These are carbon based with plenty of trace minerals. Like all rock powders raw humates need microbial digestion before releasing their nutrients.*

Ocean Products... *According to some, oceans are the nutritional center of gravity. Products from the ocean include liquid fish, seaweed (kelp meal), liquefied seaweed, and sea minerals (mineral rich salt).*

Soil Amendments... *Limestone, gypsum, and Soft Rock Phosphate are foundational.*

*In summary: **The nutritional base of a garden comes from applying geological resources to your soil. In other words gardens need geology.***

Gardening For Nutrition

Do you take vitamin and mineral supplements? Studies reveal that most Americans do. If you take supplements let me ask you why. Why are you taking them? For most the simple answer would be-- they help.

How much more help would we receive if these minerals came to in the form of high quality food?

*That is what this whole sequence is about--growing and consuming more nutrition. **The enjoyable part is that we get to create the reality we seek by fixing our garden soil.** As you know, soil doesn't fix itself. Man's action or inaction can degrade soil. On the other hand man's specific actions can build up soil to produce nutrient dense foods. To do this here are the top 10 principles to keep in mind:*

- 1. Strive for higher available calcium*
- 2. Build phosphorous up to moderately high levels, but avoid extremes on the high and low side*
- 3. Use compost when soil needs potassium; avoid compost when potassium is excessive*
- 4. Calcium, phosphorus, and potassium levels and ratios set the pattern of soil*
- 5. Apply specific trace minerals if shown to be low; apply broad spectrum trace minerals with volcanic (full spectrum) rock powders*
- 6. Test and remineralize soil every year*
- 7. The better you steward the soil the more nutrition it returns back to you*
- 8. Feed and stimulate soil biology*
- 9. The foundational inputs for a garden comes from geology, while forestry lends a great assist*
- 10. You provide the energy for plants in all its forms, and plants will accumulate this energy and turn it into the food you consume*

If you follow these principles the food you raise will literally change in quality. Its taste, fragrance,

shelf life, nutrient content, and health impact will all be noticeably superior to what is currently available to purchase.

Growing a Garden is a Lot like Driving a Car

An internal combustion car is a marvel of modern engineering. It is a fascinating machine that uses stored up chemical energy and converts it into propulsion. This stored energy is so volatile that a single flame could blow the whole car into fragments--including the driver. Have you ever considered how much explosive power is in just 1 full tank of gas? Have you ever driven such a contraption? My guess is that you have. **Congratulations--you haven't blown up!** Okay, I am being a little facetious, but I have a point to make.

Most people learn how to operate their car. 99% of these drivers have decided they **don't** want to maintain the car by replacing the spark plugs, oil, and worn out starters when they need replacing. Instead they have someone else, a trained technician, do that for them. Yet there are a few that do their own car repairs. In contrast how many people do you know that designed their own car from the ground up? I would guess not 1 in 10 million. Here's the bottom line; most people operate a car, a few maintain their car, and almost no one designs their own car.

The question, as it relates to gardening for nutrition, is this:

1. Do you want to drive the car?
2. Do you want to drive and fix the car?
3. Do you want to drive, fix, and design the car?

To drive, fix, and design your garden means you want to make your own garden program, source local nutrients, and make your own fertilizers. If that is you then I suggest you get a book by Steve Solomon and Erica Reinheimer called ["The Intelligent Gardener"](#) to be used as a guide. You may also want purchase Dr. Beddoe's book called ["Nourishment Home Grown" available here](#). Both of these books will help you design your own garden program but take different approaches.

If your goal is to drive and fix your garden then you will most likely want the soil test with fertility recommendations. This will always make you a little hot under the collar because you prefer to find all nutrients locally and to do that you have to make substitutions for products you don't understand. If that is you here is my best advise--**don't stay in the middle ground**. Either take the plunge and engineer your own garden, or focus on gardening only, and let International Ag Labs take care of the fertility.

The largest group of gardeners we work with are those who just want to garden for nutrition without devoting years of study to becoming a soil expert. In this situation customers stay focused on all aspects of gardening while International Ag Labs provides the soil testing and fertility recommendations. Our garden dealers provide a custom blend of mixed nutrients tailored specifically to the needs of your garden. They supply all the dry and liquid products to help you grow nutrient dense foods. Our goal is one-stop shopping to make it easier for your garden to flourish.

This testing and custom mixing is the innovation that International Ag Labs brings to the marketplace,

but you get to decide--is it right for you?

If you are ready to start gardening for nutrition [here is how to get started](https://www.highbrixgardens.com/getting-started-highbrix-garden.html/?inf_contact_key=15429ec66f6afaeb00620e2f9e58d4525955ea07ffdc24e7b5f7650190f7ca53).

[https://www.highbrixgardens.com/getting-started-highbrix-garden.html/?](https://www.highbrixgardens.com/getting-started-highbrix-garden.html/?inf_contact_key=15429ec66f6afaeb00620e2f9e58d4525955ea07ffdc24e7b5f7650190f7ca53)

[inf_contact_key=15429ec66f6afaeb00620e2f9e58d4525955ea07ffdc24e7b5f7650190f7ca53](https://www.highbrixgardens.com/getting-started-highbrix-garden.html/?inf_contact_key=15429ec66f6afaeb00620e2f9e58d4525955ea07ffdc24e7b5f7650190f7ca53)

Giving From Your Garden

When I first started working with gardens I remember one older lady named Rose. She called wanting help with her flowers in her yard. In our initial conversation she told me that every year she plants several tomato plants for fresh eating and that she enjoys giving away tomatoes to friends and neighbors. We discussed what to do for her flowers and she told me she would apply the same nutrients to her tomatoes.

After the growing season we talked again. She told how the flowers had better aroma, lasted longer when cut, and had many more blossoms. I asked how the tomatoes tasted and she told me they were fabulous. I asked if her friends and neighbors noticed a difference in flavor. I was surprised by what she told me: "Oh - those tomatoes were just too good to give away. They were so tasty I ate them all myself." Over the years I chuckled a lot over that statement.

This email is not about how to grow a garden but rather about how to bless your garden and other people. One of the first scripture verses I ever memorized was Luke 6:38. It reads;

Give, and it will be given to you. A good measure, pressed down, shaken together and running over, will be poured into your lap. For with the measure you use, it will be measured to you.

What I come to realize is that this principle is actually a law of the universe. When you give to others you will be blessed in return. In fact nothing else can bring so much personal joy and satisfaction until something is given freely to someone else.

It is interesting to watch and read about famous and wealthy people who had no satisfaction in life until they found some way to give to others. Once they started doing that so many other things fell into place in their life.

An example of this is American Tennis player Andre Agassi. Growing up he was forced into tennis by his father, which caused him to hate the very sport he played so well. He was a child prodigy and eventually became world no. 1. He continued his love/hate relationship with tennis until he began giving. He found his peace by opening charter schools and offering high quality education to people who could not pay for it. His blessing of others in fact, blessed him. Now he had a reason to enjoy and play tennis. In fact he continued on till his mid-30's so he could support the schools he had founded.

But you don't have to be rich and famous to benefit from this law. With your knowledge of gardening for nutrition you could find out the economically and nutritionally needy in your community and bless them with real nutritious food. Here are a few groups that might greatly benefit from a donation of nutritious food:

- *Local food shelves*
- *Homeless shelters*
- *Local schools or nursing homes*
- *Hospitality to people in need*

If you do this in some measure, the law of the universe will bring a blessing on your garden that fertilizers never will. Your garden will bring blessings on your life beyond health and nutrition. And this is far better than keeping all the good tasting tomatoes for your own eating.

~ 30 days of Gardening for Nutrition by Jon Frank