Nutrient Dense Soil

Transcript – Module 1

Hey Tom Bartels from GrowFoodWell.com. Welcome to the soil certification program. This is how to grow super nutrient dense food in living soils and we'll be getting into all the details about that throughout these modules, but in this first module I'll not only be talking about what the basic components of soil are, but also why paying attention to the quality and health of your soil is so important for the ultimate nutritional content in the food that you grow in that soil. You'll learn about Brix testing and what that's all about as well as all the different components and how to test your own soils to find out what kind of soils do you have and how to improve those soils to grow nutrient dense food. But first a definition. What is soil exactly? Soil is the dynamic interface between geology and biology. It's the bridge between the nonliving world of rock and the dynamic yet thin layer of active life on the surface of the planet and through history, civilizations have grown and collapsed based on their ability to care for their soil.

So, the knowledge and ability to improve soils is very important culturally, but it's also important for anyone immersed in the horticultural arts who wants to grow nutritious food at home. It's really important to remember that when you deplete the health of your soil, all the food grown in that depleted soil is less nutritious as well. Several academic studies over the past decades have shown that over the past 50 years in the United States, we've consistently depleted our soil health in most of the industrial agricultural land, so much so that a carrot or potato or lettuce that's grown in that soil today does not have the nutritional density of the same carrot, potato or lettuce that was grown there 50 years ago. This has implications not only on the national level, in our diminished capacity to grow nutritionally dense food, but also on the personal level for those of you who are trying to stay healthier through the food that you choose to grow and eat. The key common denominator is the health of the soil that leads directly to the nutritional health of your food.

Here's a chart showing a rough demonstration of the loss of mineral content in food over time and proportional growth in illness in the general populace. It tracks the general progression of mechanized farming and increased use of fossil fuel-based fertilizers and synthetic chemicals in agriculture. Many studies show similar loss of key minerals and vitamins in our agricultural produce. So how do you know which vegetables have the highest density? Now the first step there is to know which vegetables naturally hold higher nutrient density than other vegetables. For instance, kale has higher levels of minerals and vitamins than iceberg lettuce. So, if you're looking to get the highest nutrient density in your garden, you want to choose those vegetables that naturally occurring, have the highest density in them as they're grown. And one test that a lot of people use to find the nutrient density of various foods is called the Brix test.

So, we're going to talk about that for a minute. This is a refractometer and what it does is takes the juice from various, typically fruits is where it started in orchards and vineyards to find out the sugar content in any particular food at any particular time. It takes the juice from various foods, fruits, vegetables, and puts it on the screen that then refracts light through it and shows the sucrose or sugar content in that juice. What you do is you just put the drop on the refractometer, look through it into all directly into a light and there will be a delineation between the colors in the chart and it will give you an actual numeric percentage. And that's the percentage of solids in this juice. And that refers to the sucrose or the sugar content. This grape that I just put in the refractometer is at 18 Brix or 18% Brix.

Then you can take those numbers, depending on what you're testing with the Brix refractometer, and compare them to a chart of baseline Brix tests for really healthy vegetables in that category and really low scoring vegetables in that same category. So, for instance, I might take some cabbage here and sometimes that's a little difficult to get the juice out, but

if you shred it, and this is mostly for fresh vegetables straight out of the garden, and that looks like about a 13. This is some older cabbage that's been in the fridge for a while, but that 13 on the Brix scale would be a number that I would go and compare to the Brix testing scale to see how it rates, how this particular cabbage rates. Now a quick note about Brix ratings. This is specifically measuring sugar content in the juice of that fruit or vegetable, which is why it started in vineyards and fruit orchards so that they can track the sugar content throughout the season and know when to pick it at peak ripeness or just before or whatever their particular priority was.

But when you're testing it on vegetables and greens and peppers and whatever it is, you're growing just remember you're testing sugar content. It's not actually registering the nutrient density or the vitamins or mineral content of these vegetables. It's strictly measuring sugar content. Now the thinking goes that if the sugar content is high and compares to a high Brix percentage on the standardized chart, that means that it's a healthy plant and that if it can produce all these extra sugars, it's most likely producing a strong set of minerals and vitamins to the capacity of whatever that variety can produce. So, keep that in mind. It's not measuring any kind of specific mineral or vitamin in the food. It's just measuring sugar, but it's the easiest correlative to find out if a plant is really healthy in general, if it can produce all those sugars.

A lot of people believe that a Brix rating of 12 or 15 or more on a plant from your garden is going to show that it's a strong plant, that's going to be able to create its own chemistry to ward off disease and insects, which is probably in a rough sense, pretty true. Any plant that's robust and growing quickly and is not having any limits put on its growth curve is going to be the best kind of plant you can have in your garden because it's going to be able to have its natural defenses at peak strength. So sometimes that Brix test can help you kind of track, is this plant surging? Is it producing a lot of sugars? So, keep that in mind when you're, uh, if you use a Brix test and if you choose to use that tool. Now from my standpoint, the first priority there is to know which varieties create the most nutrition for you, why broccoli is higher in nutrition then a very light leaf lettuce. So, knowing those categories first, if you're really looking for high nutrition in your food is a first step. Then when you're growing, you can compare the strength of your produce to that from the organic market or the grocery store or industrial ag and see those differences. Now we know that through time in industrial agricultural settings in the United States, that the nutritional content of comparable vegetables has definitely reduced over time to a shocking degree, so that those soils can no longer produce the original nutrition that those carrots and broccoli used to have, et cetera in those soils back 50 years ago. So, keep that in mind and that's why we're teaching about soil health and how to improve your soils and give the full set of available materials that plants use to create nutrition in the plant itself that then carries on to your personal nutrition and health.

Just know that you can replenish soils to produce incredibly rich growing conditions but understanding the baseline components is super important for any grower so they can know how their soil is changing over time. So, let's get into soil composition and work our way up. Roughly half of soil is made up of mineral content as well as 25% water and 25% air. The remaining material is made up of organic content. Soil is much more than just a medium to hold up your plants, and the more you know about it, the easier your work becomes and the more nutritious your homegrown food can become. You can separate soil materials into two general categories, mineral content and organic content, also known as humus, and depending on the types and mixture of those two solid materials, it can affect the amount of air and water that can be absorbed and processed through the soil profile.

Let's start with mineral content. The mineral part of the soil consists of different types of rocks that have been broken down over time by geologic activity, temperature, wind deposition, erosion, and fungi. That's the baseline material content in your soil and typically as you move down from the surface of the soil, organic matter decreases and mineral content increases until you get to whatever bedrock is below your land. The baseline makeup of your soil depends on what region you live in, but when you're trying to determine what kind of soil you have in your own backyard, we can generalize your soil type by measuring three basic components in that soil; sand, clay, and silt. We all have different percentages of all three of those components and depending on what those percentages are, determines what kind of

behavior you can expect of that soil. Let's put the organic part of soil aside for a moment and just focus on the mineral part.

We'll get into the magic of organic content later on. When you think about the baseline rock components of your soil, like an infrastructure for transporting food and water, it becomes more clear. For instance, it can be harder for water to move through a solid layer of clay than a layer of sand because of the different structures of the different soil particles. So, if you have sandy soil, you have great percolation speed because the structure of the sand particles allows for more space between them or water can flow more easily and that can have implications in regards to how well your food can grow there. So, let's look at some of the characteristics of different soil types for a second. So here I've got the three basic components of soil; the sand, silt and clay. And since most of us are going to have a combination of all three of these components, it's a matter of finding out how much percentage of each of the components your soil has in it and then what capacity that soil has to hold water and percolate and aerate with oxygen and water and how it holds organic matter, et cetera.

So, I'm going to ask each one of you to go out into your yard and get a yogurt container or so full of generalized garden soil wherever you're planning to grow or maybe from a garden you're already growing in. And go ahead and grab some of that soil and I want you to do the squeeze test. And what this does is gives you a tactical understanding of what's going on with your soil. So, what you do is grab a handful like this and just tightly squeeze it in your fist and you want it a little bit wet when you do this. So, if you can find soil that's been rained on a few days prior, you don't want a super muddy soil but some wetness in there that'll show you if it's got clumping capabilities. You'll notice this sandy soil clumps up and if I push on it, it just kind of slides apart and to non-indeterminant kind of smudges more than anything.

So, it just has very little structure to it and when you rub that together with your fingers, you can feel the grit. You can feel the sand in there and that if you've got a heavy, gritty soil, that's telling you that there's a fair amount of sand in there and you can actually feel that when you rub it between your fingers. If you can add a little water to it and you should be able to find that grit, it should feel a little bit like sandpaper. It's pretty obvious with sand and that's because these particles are very large. If you looked in a microscope, these would be comparatively, as we go down through the three of these, this would be about the size of a basketball. The silt is about the size of a golf ball and then the clay particles are like the head of a pin compared to the basketball over here on the sand.

And consequently, water goes around these basketballs really easily. The golf balls a little less so of the silt as far as the structure and the particle size. And then when you get to the clay, the really super small platelets that kind of layer on each other, which is why clay kind of provides a barrier for the migration of water or the percolation of water. So, if you have really heavy clay soils, that's going to be problematic for allowing that water to percolate through your soil profile. We'll talk about how to amend that later. And silt is kind of in between the two. It does have the capacity to drain well and hold some water. A lot of people have silt soil and you can grow great food in really, in any of these soils. We'll show you how to amend for them throughout the series.

And here I've got some really wet silt. I pulled it out of the river basin today and it happened to be really wet, so I didn't have time to dry it, but the difference is obvious. When I squeeze this, there's no structure to it whatsoever and if there was less water, I would get kind of a sticky glob that would create some structure in it, but then it would quickly kind of slide away as one piece. It doesn't break up into a crumble, it's a little bit more oily and gooey is a good word for it. So, you want to kind of get intimate with your soil to figure out the feel of your soil. And I'll show you another way to determine what these percentages are in a minute. Okay, now I'm gonna move to the clay soil. This is out of the garden and clay soil, I've got a clay loam, which is a mixture of all three and a fair amount of organic matter that I've been amending in that garden for, oh 18 years now. So, you're going to get a clump like this that is really easy to form into a bunch with your hand when you squeeze it. And then when you push it with your other hand, it breaks up into clumps. It breaks relatively easily, but it breaks into clumps and you can see it and that's just right. It shouldn't be super hard to break it up. You should be able to reform it. It clumps again and when you push into it, it forms some aggregate pieces of

different shapes that kind of fall apart like a chocolate cake. That's the kind of texture and structure you're looking for in your soil eventually so that it's not super sandy. It's not slick, muddy, silty. It's a mixture of organic material and I got lucky. I have a clay loam, which is a clay dominant combination of all three of these. And then when you add a lot of amended organic matter to that clay loam, it's incredibly rich, good garden soil because there's a lot of mineral holding in clay soils. It has the capacity to hold water for long periods of time, but you have to add a ton of organic matter to allow for percolation through that clay profile. Once you do and you amend soils that are clay heavy, they turn out to be your friend. They're really good gardening soil, so I got lucky. Southwest Colorado here has a lot of clay soils and that's what I'm working with. What's really the most fun is you don't have to get a degree in biology or geology to figure this out.

If you've got silty soil or sandy soil or clay soil, the great part is that you handle them the same way by adding organic matter in the form of mature organic compost and once you add compost to clay soils, it improves that percolation capacity. When you add it to silty soils, it adds the whole water holding capacity because of all that infused organic matter in the soil profile, and it also helps percolate as well and aerate that soil, same for sandy soil. Instead of percolating really fast, if you're adding organic matter to your sandy soil, it's going to help trap that moisture and hold it for longer periods of time. Organic compost improves all three of these basic components, so you don't have to get too deep into this. Once you figure out in general what percentage your soil is of sand, silt and clay, you're still gonna just add organic compost every year, use cover crops and all the basic organic techniques for good gardening skills, but that is going to help your soil tremendously. And all of these components and different physical attributes are all buffered by adding organic compost. Now another quick way to find out the percentages of sand, silt and clay in your soil is to take a sample of your garden soil. I've got one here from my garden. Just take a simple ball jar and take about half the jar or so. Go ahead and pour your soil in there like so. That's too much.

That's about right. So, it's about half full and I'm going to fill that with water until beyond the level of the soil itself. Just like so. Cap it and make sure that cap is on really strong, really tight, cause you're about to shake it vigorously. Okay? You're just going to shake that up and what you're doing is getting all the suspended particles, the soil components mixed up; the clay, the silt, the sand are all going to be settling out at different rates. So, what will be happening now is I'm going to set this aside and let it settle overnight and it will have distinct layers once it settles out. So, it's really important to make sure that everything is saturated in there. You've shaken it vigorously to make sure everything is in suspension, it's all floating up, up and down, that column in the jar. And once you have that and you feel like it's all integrated, then we're just gonna stop it, leave it on the table overnight and what'll happen is this will settle out. The heavy particles will drop to the bottom first. The medium particles will drop second, and the lighter particles will take a lot longer to settle out, but eventually you'll see it clear up. So, don't worry too much about those percentages in your particular soil because in future modules we're going to be showing you how to use amendments to help all the different types of soils and why that's important. It's just good to get the baseline first so that you understand as your soils improve and as you learn more about your soils, you can watch that soil improve and you'll know why it's improving and how that's helping build nutrient density in your garden. So if you haven't yet, right after this module, go outside, grab a big sample of your soil from the garden or the place you're planning on growing food and either do the squeeze test in your hand or go ahead and do this settling test in a ball jar; one of the two to get a feel for what kind of soil you have in your backyard.

There's a short quiz after this module, so don't miss that, and we'll see in module two. Hey, a quick note, for those of you interested in the Brix meter, you can support an awesome nonprofit at the same time as getting a good price on one It's the Bionutrient Food Association, and there's a link in the resources section after this module, so you can check it out there. They're also working on developing even more sophisticated tools to measure nutrient density. So, it's a really interesting group to check out. So, look in the resources section after this module for that link. Thanks. See ya.