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# The Quest for Nutrient-Dense Food

## High-Brix Farming and Gardening

### An Interview with Rex Harrill by Suze Fisher

Rex Harrill of Keedysville, Maryland has been farming and gardening for the better part of thirty years. Seventeen years ago he moved to a 16-acre farm and started a new garden.

In the first few years his crops were tasteless and ridden with spittle bugs, caterpillars and several other garden pests. Yet his previous garden had produced delicious, pest-resistant crops, although he didn't know why at the time. Only later did he realize he'd inherited a garden with exceptional soil fertility at his previous farm. But after two years of bitter turnips, radishes and other crops from his new garden, Rex set out to find answers. That's when he came across a book called *The Anatomy of Life & Energy in Agriculture* by Dr. Arden Andersen. He'd finally found what he'd been seeking—a program that developed fertile soil which in turn produced delicious nutrient-dense crops that were resistant to pests, weeds and disease, year after year. Rex also learned from Dr. Andersen that the brix level of the crop correlated with its nutrient-density—that brix was a valuable measurement in determining the nutritional value of the crop. Ever since then, Rex has followed a high-brix gardening approach, strongly influenced by the works of Dr. Andersen along with those of Dr. William Albrecht, Dr. Carey Reams and Dr. Dan Skow.

**Suze**: Rex, can you explain what Brix is? Most people I've spoken to about Brix insist that it's only a measure of a plant's sugar content. Is this true?

**Rex**: I've come across many ways to dispel that "only sugar" notion. A favorite is to sit a Doubting Thomas on my back porch and pour him a glass of ordinary store-bought orange juice. Once he has sipped a little, I add a spoonful of sugar to his glass. Most people quickly understand that sugar is not what makes orange juice taste good—most report that the added sugar just makes the orange juice taste yucky. And it certainly does. The point is that adding the sugar raises the apparent "Brix," but it does nothing for the taste. True Brix measures a combination of sugar, amino acids, oils, proteins, flavonoids, minerals and other goodies. Sugar is merely one of the components of Brix. This same scenario holds for any fresh juice you wish to name.

Interestingly, the above doesn't hold true for the artificial juices made mostly from chemicals, sugar, and water. Most of them do taste a little better if you add plain sugar.

**Suze**: By "fresh juice" do you mean the sap of any plant?

**Rex**: Fresh juice means liquid squeezed from a fruit. Be warned that much orange, apple, and other fruit juice is reconstituted from concentrate. Reconstituting can lead to false results. For instance, if you were to use 2 cans of water (instead of the recommended 3) when preparing frozen orange juice, you would get a terrific high "Brix" reading but not a true Brix reading. Many people are unaware of the fact that the juice they buy in a carton at the grocery store was once in a very concentrated state so that it could be cheaply

shipped from another country. If the company reconstituting the juice adds too much water, you get lower "Brix." If they don't add enough water, you get higher "Brix." Neither is true Brix. To be safe, I guess it is better to use the word "sap" for Brix test samples. Sap is the juice squeezed out of the leaves, stems, green fruit or roots of a live plant.

**Suze**: How is Brix measured?

**Rex**: The Brix test requires a refractometer. For a consumer to conduct a Brix test, they need a few drops of sap (juice) squeezed from the part of any plant that they wish to eat. In other words, they need to squeeze a small piece of lemon, orange, apple, etc., between their fingers and drop the juice onto their refractometer prism. Harder produce such as cabbage, lettuce, carrots and pears often requires a garlic press or similar tool. When the drops fall on the prism, you close the cover plate to spread it out and then look through the viewing end of the instrument where you will see an etched scale generally calibrated in 0-30 or 0-32 degrees Brix. Just as a pencil appears bent when placed in a beaker of water, the light passing through the plant juice droplet is bent so that a clear line is shown against the scaled background. The amount of bending is directly related to the richness of the plant juice (richer juice bends the light more).

Centuries of wine making and working with other fruits and vegetables have always shown a direct relationship between higher Brix numbers and higher quality. This higher quality is reflected in superior taste. The process is somewhat altered for the gardener or farmer in that they test the leaf of the growing plant much earlier and are therefore afforded the opportunity to correct soil deficiencies before the crop matures. The gardener or farmer also benefits in that they soon learn that any crop with 12 or better leaf Brix will not be bothered by insect pests.

**Suze**: According to your website (www.crossroads.ws/Brixbook/BBook.htm), it was Carey Reams who first developed the refractive index of crop juices—a chart that gives "poor," "average," "good" and "excellent" ratings for produce based on its Brix level. Who was Reams and what was his contribution to high-Brix farming?

**Rex**: Dr. Carey A. Reams was a Florida native who owned a rather large agricultural engineering firm and lab in the Orlando area from 1931 to 1968. When he "retired," he only did so to further his research and travel the country giving seminars and lectures. During his college years, Reams discovered that there were huge disparities in the mineral makeup of fruits and vegetables—depending on how and where they were grown. Reams developed a following of farmers because they found that his methods produced crops of far superior quality. For many years, citrus and grape growers had used the Brix measurement to evaluate the quality of their produce. Reams took that knowledge and formulated a Brix chart, which covers most of the common fruits, vegetables and forage crops. Sometime shortly after the founding of *Acres USA*, Reams noticed that while the paper's contributors and readers talked about higher quality farm production, no one had quantified the process. One day Reams walked into the editor's office and handed him a copy of his Brix chart. The reverberations have been felt from one end of agriculture to the other.

**Suze**: I understand that energetics was at the heart of Ream's biological farming approach. Can you explain what that is?

**Rex**: The genius of Reams-style farming is that he devised a way to calculate the energy released when various fertilizers worked their way down to equilibrium. For instance, Reams didn't suggest that his clients simply scatter so many pounds (or so many tons) of ammonium sulfate on an acre of land. Reams taught his students how to calculate the energy that would be given up by a single molecule of ammonium and then determine exactly how many pounds of that, or any other fertilizer, to apply. In conventional farming fertilizer excesses are generally wasted and ultimately go off the land into the ground water, while shortages create a limited crop yield. Reams-style farming not only creates superior output, it is also very economical because any

fertilizer applied is used by the plants, not lost. Dr. Dan Skow is probably the best known teacher currently explaining this desperately needed scientific aspect of agriculture to students around the country.

To me, Brix is a measure of energy. A high-Brix plant emits a far superior energetic electromagnetic spectrum than a low-Brix specimen. Insects "see" in this range and they "attack" plants with the weakest emanations. When the grower finally understands that all that talk about how healthy plants "resist" insects is really another way of saying that the strongest plants don't attract insects in the first place, they are on the road to understanding Reams agriculture. A refractometer is merely a way for us to see by proxy what insects see with their eyes.

**Suze**: How did you become involved in biologically friendly high-Brix farming?

**Rex**: For me it started with a turnip. I was raised on a farm and had always enjoyed sweet turnips, but I had no idea that there were poor, good and great turnips. In 1987 I had to move away from a delightful turnip-friendly garden of many years standing and start a new one at my current place. Those first turnips I grew tasted awful. Not only were they terrible in the mouth, but they were attacked by hordes of bugs, including bugs I had never seen before. This was before the Internet, but I started researching and came across a little book by Dr. Arden Andersen which gave a basic table of Brix values and what they meant to various crops. As measuring Brix called for a refractometer, I visited a winemaker friend and he told me how to get one.

I was quite excited the day the instrument came. I pulled one of those bug-eaten turnips and took it to the kitchen. The 3.5 Brix reading told me exactly what I needed to know. A few days later I made the rounds at the local farmer's market and bought samples from every one who sold turnips. It didn't take me too long back home to realize that the sweet turnips I liked so much had to measure about 8-9 Brix, or even higher. I haven't looked back since then. The ace is that when you finally get your soil good enough to grow higher-Brix turnips, the bugs don't seem interested.

**Suze**: Do you follow Reams' Biological farming approach?

**Rex**: I certainly do. Dr. Andersen is an open disciple of the Reams approach as am I. The Reams program leads to outstanding fruit and vegetable quality at the same time that it creates significantly increased yield. I simply cannot imagine trying to grow produce any other way. The Reams program, as furthered by Andersen, lays a well-marked path toward higher quantities of higher quality food and feedstuffs for both man and animal.

**Suze**: Can you explain what the Reams approach is? What does it entail?

**Rex**: Many years ago I approached Jay McCaman, a mid-west consultant with that same question. Today, people come to me for simplified explanations of the Reams approach to farming. As I've had to spend 15 years trying to master even a few of the fundamentals, I do feel sorely inadequate to provide a decent response to your question in "25 words or less." However, I will try as long as we can keep one Reams mandate in sight: higher Brix points to higher quality.

Although Reams viewed agriculture entirely as an energetic process, the basic Reams program requires that cropland have the following water-soluble *available* mineral elements per acre in place for a starting point. This is if you are truly looking for high quality (high Brix) and very high yield.

4000 pounds calcium
400 pounds magnesium
400 pounds phosphate
200 pounds potassium
40 pounds nitrate nitrogen
40 pounds ammonia nitrogen

The best system he found for many farmers involved putting down a copious supply of high-calcium lime, soft rock phosphate, and chicken manure. The reader must understand that although it has similar overtones, this "formula" is not the same as the quality improvement

methods suggested by Professor Albrecht, who merely wanted the calcium, magnesium, phosphate, potassium, etc. in a certain ratio of "cation exchange capacity" or CEC.

**Suze**: What makes the minerals available to the plant?

**Rex**: Many factors. First is the fineness of the mineral supplements added. A limestone boulder is unavailable whereas the same boulder pulverized is available. In the old days, local farmers built kilns to burn the boulders until they turned to dust. Today the job of pulverizing is done by machinery.

Another key factor that makes minerals available is micro-organisms in the soil. These are what make the minerals available to the plant. Plants can assimilate very few minerals directly. Plowed in cover crops, compost, molasses, other organic matter or even raw garbage dug in will all support microbial life in the soil. As Professor Albrecht said over and over, "The microbes feast first at the table." Dr. Reams suggested that you wait at least two weeks to plant seeds after plowing in food for the microbes.

The pH of the soil has a lot to do with mineral availability. Many minerals are available only in a narrow pH range, which for most plants is around 6.4.

The Brix of the plant is also important. Low-Brix plants can't develop the strong extraction fluids to pull minerals from the soil.

As a plant matures, it requires more and more soil energy to extract nutrients from the soil. Reams continually stressed the fact that while a baby seedling had minimal daily nutrient needs from the soil, a mature plant drawing down heavily was an entirely different story. He taught that for a plant to bear a full crop of high quality produce it must have adequate soil energy (called "ERGS" or Energy Released per Gram per Second) available to "set" the high-quality crop and then "bring it home." ERGS is merely a measurement of the ionic conductivity of the soil expressed as microSiemens and directly measured with an ordinary conductivity meter. The point is that only healthy soils with teeming bacterial life and full mineral availability can "keep up" when the plant roots are most demanding.

This is where foliar feeding comes in. Most farmers shifting to the Reams methods report for the first few years that they either cannot raise the Brix to the high quality levels needed or, if they do get there, they report it is tough to keep the Brix high. For most people, foliar feeding serves as a crutch until they get their soil in tip-top shape. A few, particularly those growing in such areas as Florida sand, must forever rely quite heavily on foliar feeding because their sandy soil simply cannot hold the full ration of minerals required. An important point here is the fact that foliar feeds are formulated as both general tonics for use by the novice and as very specialized mixtures for use by the expert who wishes to compensate for identified plant or soil deficiencies.

Reams insisted that his students had to master wet chemistry test methods so that they could run tests if, when, and as needed. For instance, he pointed out that if the farmer couldn't be sure they had the 40 pounds nitrate and 40 pounds ammonium at each moment required by the plant, the farmer stood a good chance of a severely limited harvest. He also reiterated thousands of times that the plant did not care whether the needed nitrogen or other substance came from "organic" sources or from a chemical such as calcium nitrate. His reasoning was simple: if the applied fertility agent raised Brix, it was what the plant needed. On the other hand, if the Brix stayed the same or fell, the material was either not needed, detrimental or in a form the plant could not use.

This system works and works well. Reams was always quick to calculate the future harvest, at whatever quality level desired, and he did this mostly by knowing how much available phosphate was in the soil.

Bob Pike, a Reams protégé, later developed a system that used high-grade electronic meters which was much faster than the original wet chemistry analysis. At its core, Pike's system first evaluates the Brix level of the growing plant and,

should that not be high enough, then measures the pH and conductivity of the plant sap. Then, by applying a chart developed by Bruce Tainio, a West Coast researcher and consultant, the farmer can program a foliar feed that will help the crop get back on track toward the highest Brix and the highest yield.

There is more to it of course. For instance, Pike found that he had to monitor the soil ERGS both before planting and during the growth phases. His method also requires that the soil pH be adjusted to the optimum 6.4 (acknowledged by almost all consultants as the best). Finally, Pike teaches that the old-farmer nemesis of hardpan will not occur if the farmer keeps his calcium and magnesium in his soil in the proper ratio. This can be readily determined at any season by probing with a soil penetrometer.

So, the Pike methods that I follow, and which I consider so true to the Reams call for high Brix along with good yield, are as follows:

Conduct an Albrecht-style soil evaluation in the fall and apply amendments as needed.

Couple this with a broad-spectrum trace element application.

Plant a thick winter cover crop, such as annual rye for pasture or compost on your home garden, to protect the soil and build organic matter.

Monitor and adjust the soil ERGS before planting and during crop growth.

Monitor and adjust the soil pH before planting and during crop growth.

Track the Brix, sap pH, and sap conductivity of the growing crop so as to apply just the right foliar feed if the Brix does not stay in the desired range.

One important point: I have learned by bitter experience that if I and 1000 other consultants calculate that the plant needs precisely thus as a foliar feed, *but* the Brix does not rise, then we were all wrong. Obviously, our calculations would not be for naught because we would at that point at least know one foliar combination that is wrong. There could not be a clearer case of "the proof is in the pudding" than the situation where one labors mightily to devise exactly the right foliar spray and the plant softly says, by way of not gaining Brix, "Sorry, but that is not the right mixture I need at this time." And, as in all of science, this is the point where art must take its turn. The experienced consultant starts reaching for a few tricks of his trade and finally makes the connection that shoots that Brix up where it should be.

**Suze**: Do you measure the nutritional quality of your crops with other tests besides their Brix value?

**Rex**: Once I mastered the Brix concept, I had little reason to be concerned with expensive chemical analysis. Although I suspect there are some valid chemical analyses performed here and there, the higher-Brix-equals-higher-quality concept renders most analysis redundant.

**Suze**: Can you tell us more about Dr. Andersen? Has Dr. Andersen modified the Reams approach along the way?

**Rex**: Arden Andersen earned a PhD in plant physiology. His intent, as was the intent of Dr. Reams, was to help revolutionize agriculture by showing farmers how to grow superior crops. When Dr. Andersen realized that the medical establishment, hooked as it is on drugs, did not believe that the food we eat must be of high quality for us to maintain good health, he returned to school and became a doctor of osteopathy. His thought was that perhaps his message would be better heard if he maintained both a practice of medicine and, simultaneously, a practice of farm consulting. Dr. Andersen closely adheres to the path first blazed by Dr. Reams.

I'm amused when I hear that this person or that person has "modified" the Reams approach. No one modifies the Reams approach, simply because the basic message that higher Brix equals higher quality is always central. However, it is fair to observe that although different practitioners use different methods, they all strive to achieve higher Brix. For instance, I follow the Pike method of using electronic meters for soil and plant evaluation instead of Andersen's preferred messy wet chemistry methods. The

goal, purpose, and result is always the same: higher Brix.

While non-farmers sometimes like to imagine that the best farmers have access to secret or esoteric knowledge, nothing could be further from the truth. Plants have needs such as proper pH, soil fertility and moisture, and the farmer who best meets those needs will find his plants doing well. The programs that Reams worked out over 60 years of agricultural engineering perform exceptionally well even though they are often treated with disdain by a chemical industry that cannot bear the thought of farmers producing abundant, high quality crops without the need for toxic rescue chemicals.

**Suze**: What characterizes low-Brix plants as opposed to high-Brix ones?

**Rex**: I find low-Brix plants and their produce to be watery, poor tasting, attractive to insect pests, and quick to mold or rot. But high-Brix produce not only has a robust taste, it also lasts remarkably well. In all sincerity I can tell you that the best produce simply will not rot. It will dehydrate, but it adamantly refuses to rot. Please understand that about 90-95 percent of the produce in ordinary commercial channels is fairly low Brix.

**Suze**: There seems to be a widely held notion that organic food is more nutrient-dense than non-organic food. Sometimes it's even advertised as such. However, I've seen you argue that this is not the case. Can you explain?

**Rex**: I've tested food from dozens of organic farms and rarely found Brix readings higher than the Brix readings of ordinary commercial produce at your favorite supermarket. Yes, organic food is somewhat safer in that it doesn't get exposed to pesticides . However, the only taste differences I've ever found were attributed to it being local and, of course, considerably fresher than supermarket fare. To me, that lack of superior taste marks the produce as lower nutrition.

There are exceptions. The most notable was back when the late Ward Sinclair, quite a name in organic circles, was growing produce in Pennsylvania. Ward perfected a technique of tilling alternating strips that in essence had him growing in fresh ground each year. That technique allowed him to grow absolutely delicious 9-9.5 Brix celery when all his organic competitors' celery was 4-5 Brix. I made many a trip to his farm to get a week's supply of his celery because I didn't grow celery and Ward's was the best. My grandkids loved to eat it like candy. I still miss Ward all these years later.

Ward's methods bring to mind the ancient technique of "slash and burn." Indigenous peoples found they could burn out a section of forest or grassland sward and grow superb, bug-free crops that would dehydrate in storage instead of rot—at least they could grow for a season or two. The minerals released by burning created an environment that crops love. Once the high-Brix characteristics went away and bugs invaded, the natives simply moved to a new area and started over. What Ward Sinclair did was use micro-organisms to "burn" organic material on the fresh land. Ward, blessed with plenty of land, "slashed" new strips each year with a tractor-mounted roto-tiller and grew superior crops while the old strips returned to grass and "healed." He also added standard organic supplements, but mostly to the healing strips, not the strips currently being harvested. If I had no other way to judge crops, I would always buy from a grower who planted in fresh strips each year.

**Suze**: How about biodynamic produce—is it generally high Brix? Please explain.

**Rex**: I love biodynamic growing and growers. I love all earth-friendly agriculture. However, all the biodynamic produce I've ever measured was the about the same as organic. If there is a difference in their produce, it is not measurable with Brix. What is there to explain? Something is either high-Brix or it isn't.

**Suze**: Do you believe that organic and biodynamic farming approaches can produce high Brix food? If so, how would organic and biodynamic farmers go about raising the Brix of their food? Is there anything in these farming approaches that you think is impeding them from producing high Brix crops?

**Rex**: As I said, I love all earth-friendly agriculture. Any organic or biodynamic farmer is free to raise the Brix of their crops with no penalty from their licensing organization.

**Suze**: Can you explain your theory about low-Brix, low-nutrient foods "robbing" the body of nutrients in a way similar to that of processed foods?

**Rex**: Every scientific sort I've ever talked to has agreed that it requires lots of energy to digest food. There is a huge expenditure of enzymes and other digestive fluids involved in breaking down even the most simple food.

There is an old farmer's saying: "You can starve a horse to death quicker by feeding him straw than by feeding him nothing at all." That saying only buttresses the idea that a horse trying to digest non-nutritive straw is going to come up short as he wastefully expends whatever digestive energy he had to start with. I think that poor quality fruits and vegetables create a similar situation in our bodies. It seems to me that when our systems expend minerals, energy and enzymes to break down "food" that doesn't even have enough value to replace what is expended, then we will lose the battle for life at some point.

**Suze**: The name William Albrecht resonates with many involved in the Weston A. Price Foundation as Albrecht wrote a chapter in Price's *Nutrition and Physical Degeneration* entitled "Food is Fabricated Soil Fertility." What influence has Albrecht had, if any, on your farming approach?

**Rex**: Professor Albrecht continues to have much influence on my work. For instance, even though I am retirement age and gradually "giving up" my small farm, the Pike methods that I follow call for an annual soil test to be sure the basic minerals are in place in the right proportions. If they are not, they need to be added before planting the winter cover crop so they have time to work their way into the soil life. For instance, crops grown on land with more sodium than potassium were not only sickly, but the animals raised in such lands or fed such crops were also sickly. The whole purpose is to achieve balance and enhance life, that is, to create healthier soil. And I suspect that you WAPFers deeply understand that healthier soil leads to healthier plants and, ultimately, healthier people.

Some people like to think that there is an either-or choice to be made between Albrecht and Reams. If such exists, I have been unable to find it. What I have found is that well-executed Albrecht methods produce good healthy crops and healthy animals. What I have also found is that the Reams approach can be applied independently or on top of the Albrecht methods to produce truly superior crops and yields. The Reams approach allows one to monitor the Brix and actually do something if deficiencies appear before the crop matures.

**Suze**: So what can consumers do to locate high-Brix, nutrient-dense foods for themselves and for their families?

**Rex**: The very first step is for them to buy, beg, or borrow a refractometer and educate themselves about what they are now eating. Once they learn to correlate their sense of taste to what they see in the refractometer screen, they will understand they have to locate better food. That is the easy part. The tough job is finding the food. As time goes on they will migrate toward better suppliers. They will learn to stockpile good food when they find it. When I say "stockpile," I'm trying to get across the point that they will buy a lot more of some higher-Brix food they find because people are willing to eat the same thing more days in a row when they know it is really good. A few seekers of higher quality will share what they have learned with a local grower friend and suggest that they will pay more for higher Brix. The family interested in better food will learn how to mail order, barter and—most importantly—grow some of their own. Locating better food is not something you do once and forget. It becomes important to continually learn which fruit stand has the best items and which farm or farmette is worth a little "drive in the country."

**Suze**: How can we use Brix to help determine the quality of animal products such as meat and milk?

**Rex**: I am sometimes accused of "holding back" when I say that Brix doesn't seem all that applicable to me when it comes to evaluating meat and milk. Certainly, I am the first to admit that 15, 16, 17, or 18 Brix milk tastes dramatically better than the ordinary 10-11 Brix milk sold in stores or even off ordinary farms. I'm also one of the first to say that I simply love high-Brix milk. 16 or better Brix milk is simply yummy. However, milk evaluation is a science in itself and a commonly overlooked factor by many consumers is the urea content of milk. MUN (Milk Urea Nitrogen) testing of milk is used to detect and control the overfeeding of protein to cows. This overfeeding can cause urea spillage into the milk. You can get a false Brix reading with too much urea, just as you can get a false Brix reading by adding sugar to orange juice.

If you know the farmer and know that he is not forcing protein into his cows, then the Brix reading is a valuable measure. Regular store-bought milk has a Brix reading of 10-11; 15-20 is good. In fact, 20 is the highest recorded for milk.

In a somewhat similar vein, I have had various people suggest that one could measure the "Brix" of blood and thereby determine the quality of the associated meat it came from. The big problem in my mind is that blood can be thick or thin (concentrated or not, dehydrated or not) and the refractometer would not be able to adjust for that. So, no, I don't think Brix is applicable to meat evaluation.

But wait! There is an answer to this problem. Simply measure the Brix of the pasture the animal is feeding on! The pasture with the highest Brix grass will produce both the better milk and the better meat.

**Suze**: I've heard it said many times that Brix is too simplistic to gauge something as complex as the nutrient-density of food. What is your response to this assertion?

**Rex**: The Brix concept is certainly too simplistic for industrialized agriculture. They would have you believe that all fruits and vegetables are the same. Right in step with industry are the Department of Agriculture standards which call for size and color evaluation and nothing else. So I can understand why they don't want consumers running around with an instrument in their hands that would give them all the information they need and the courage to reject lousy quality food. These are the same people who think that your sense of taste is too simplistic to measure the nutrient density of food.

Quite frankly, I don't trust any of those "experts," whoever they may be. I do trust my sense of taste. And I do trust children. So let me tell you a story.

Many years ago I made the rounds of the local farmers' market and bought a cantaloupe from every vendor. When I got home my daughter was there with her two daughters, ages 10 and 3. I took the cantaloupes out on the porch and cut them all in half. I had a couple of 9 Brix losers and they immediately went in the compost buckets (Brix measuring 7-9 is the tasteless melon you find on salad bars). I ended up with several 11's, several 13's, and a single 15. I called the girls out on the porch and gave them their first chance to use a refractometer to measure each of the fruits. Yes, little kids can use a refractometer and they have no trouble calling out the Brix number they see—if they know how to read numbers. Anyway, I suggested they taste samples as they went. I then found out that they did not have any cantaloupe at home.

"OK girls," I said, "I'm going to let you take one of these 11's home."

"That's not fair," they both shouted out.

"OK—you can have all the 11's and one of the 13's."

"Pops, you're being mean!" they shouted together.

"All right, already—you can have all the 11's, all the 13's and I'll keep just this one."

That, too, was a no-sale. I gave them spoons and they wolfed down the 15. They then helped me carry the 11's out to the big compost pile. I was left with one of the 13's, but I have to admit I secretly begrudged them that yummy 15.

So you have heard "experts" say that Brix is too simplistic? I say let them say whatever they want

to say. When they get through talking, start teaching them a little bit about nutrition.

**Suze**: I've also been told by some farmers involved in other eco-friendly farming approaches that Brix is too simplistic a measure of food quality. These are experienced farmers and consultants. How would you answer them, if any differently from the agro-chemical crowd?

**Rex**: I have answered such challenges many times with a question: "How complicated do you really wish to make things?" You need to understand that these challenges come from those who haven't quite figured out how to raise the Brix of their crops. Can you imagine such challengers deliberately discarding a higher-Brix sample of their particular proprietary crops and eating a lower-Brix sample grown the same way on the same farm? These challengers have the same taste buds as you and I do. They can tell the difference between 4 Brix lettuce and 10 Brix lettuce no matter how it is grown. They can watch the cows march across bitter low-Brix pasture and start grazing on sweet higher-Brix pasture.

When I talk with such challengers, I never suggest they abandon their proprietary growing methods. I merely point out that they are free to improve their methods so that they are growing higher quality. If they are not interested in higher quality, that is their problem and I lump them right in with the chemical farmers who sell their own crops and buy crops from a better farmer to feed to their own livestock. As the old saying goes, to each his own. That is the beauty of using a refractometer. They can look and then decide whether they are willing to ignore what they see. It's their money and they can eat low-Brix food if they wish. God bless 'em.

**Suze**: On your BrixTalk list, you recently wrote: "Maybe a future researcher will be able to make his name by observing that two vineyards producing 31 Brix grapes had significantly contrasting Brix in the green stage grapes. But as I say often: while Brix is a dynamite tool, it is not the be-all, end-all of agriculture." This is an interesting comment coming from one so outspoken and passionate about using Brix to measure the nutritional quality of food. Can you explain what you meant by this?

**Rex**: First, you have to remember that sugar is a part of Brix, but Brix is not sugar. If you go back and study a few later BrixTalk posts, you may spot the place where I commented on the "insipid" label used in Florida to address overly ripe oranges that had stayed on the tree too long. Taste is far more than just sugar. There are acids, flavonoids, aminos, antioxidants, oils and who knows what else involved. If the tree is in poor soil and does not have adequate resources to create what I call "goodies," that does not mean the leaves will cease making sugar and if the fruit remains on the tree past proper harvest time that sugar will accumulate.

I think the wine makers can point to their own versions of the same phenomenon as witnessed by the recent observation that grapes left on the vine too long may build higher Brix, but that Brix is really just excess sugar accumulating.

My theory is that one should measure the Brix of the green-stage fruit to determine maximum potential quality. I have little evidence, but I remain convinced that, say, green grape A at 12 Brix will mature at 24 Brix into a far superior fruit than green grape B at 9 Brix hanging on the vine until it reaches an apparently identical 24 Brix. Just to be crystal clear here, the later grape should be picked when it properly matures at, say, 20 Brix. There is no circular logic here to say the 9-green/20-ripe grape B is lower quality.

This interview started with me pointing out that adding sugar to fresh orange juice doesn't do a thing for the taste nor the quality. There is no reason to think that letting a mother vine add excessive sugar to a grape will improve its quality as far as making great wine. Perhaps we have yet another way in which an ordinary refractometer can help both the farmer and consumer in what should be a joint striving toward quality.

Now that I reflect on it, maybe Brix really is the be-all, end-all of agriculture. That certainly seems to be the case when I cut up fruit for youngsters. They are a lot harder to fool than grown-ups who tend to think with their pocketbooks instead of

listening to their taste buds. A Brixmeter can help those adults get their priorities back in order.

**About the author**

Suze Fisher is a WAPF chapter leader in Mid-Coast Maine (along with Kate Mockus and Jane Greenleaf). She also administers the WAPF chapter leader email list, the WAPF practitioners list and the Beyond Price list.

# High-Brix Crops are Pest-Resistant

Rodney Heinen is a farmer and agricultural consultant in Wetmoe, Kansas, in the heart of alfalfa-growing country. As a farmer, he'd been interested in nutrient-dense agriculture for several years when he came across International Agrilabs, a company that promotes Reams' biological approach to farming. "Everything I'd been thinking about [in relation to growing nutrient dense crops] made sense when I talked to them," he reports. Thus, things began to fall into place for Rodney's growing program after he began implementing the Reams program under the tutelage of International Agrilabs. Rodney's been growing high-Brix crops of alfalfa, wheat, timothy and Bermuda grasses for dairy cattle and horses ever since.

Six years ago, when Rodney moved to his current farm, his next-door neighbor told him he'd regret it. The farm and soil were in bad shape. But things didn't quite work out as his neighbor predicted. Rodney recalls an incident in the summer of 2003 when his neighbor's conventionally-grown alfalfa crops were wiped out by grasshoppers. His neighbor used conventional fertilizers and sprayed both pesticides and herbicides on his crop. Rodney sprayed nothing on his crops—he just used Reams methods and fertilizers to grow high-Brix crops. One day his neighbor stood on the border of Rodney's alfalfa crops and his own. He then took three steps into his own field and was immediately swarmed by grasshoppers. He stepped back into Rodney's field and the grasshoppers hopped off him. He stepped back into his own field and was immediately covered with the insects once again. He repeated this five times with Rodney and several others witnessing. Each time the same thing happened. He was covered with grasshoppers when he stepped into his own field, but they hopped off him when he stepped back into Rodney's field.

Both fields contained the same variety of alfalfa. The major difference was the higher fertility of Rodney's soil. His alfalfa crops were on average 12-14 Brix (his highest Brixed at 19) while his neighbor's crop was on average 3-4 Brix. It was Rodney's best year for growing alfalfa, and his neighbor's worst.

# How I Grew High-Brix Turnips

Here's what I did to get the Brix number up in my turnips:

1. Balance soil pH: I found that my soil was too acidic, with a pH of 5.3. The ideal pH for almost all crops is 6.4. In this case, the right pH was achieved by adding the right amount of high-calcium lime.
2. Perform an Albrecht-type soil test and add the major nutrients, phosphorus, nitrogen and potassium, as needed.
3. Drench the soil with a seaweed mixture to supply adequate trace elements.
4. Once the turnips were up and growing, I Brixed the tiny leaves and foliar fed by trial and error until the leaf Brix consistently stayed above 12. Although there are hundreds of high-grade foliars on the market, I got good results with a 6/16/6 liquid foliar from a company in Florida (that has since gone out of business).
5. I did leaf Brix tests throughout the growing season, which indicated when it was necessary to add "a bit of tonic."
6. Harvest the world's finest turnips!

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# Cows Eat Half the Amount of High-Brix Grass

Merlin Nussbaum from Lancaster Ag Products has been a farmer for 20 years, and is now an agricultural consultant in Bird-in-Hand, in the heart of Lancaster county, Pennsylvania. Like Rex Harrill, he uses a combination Reams-Albrecht farming approach. Nussbaum works with many greenhouse farmers in his area, as well as farms growing livestock feed. His experience with high-Brix crops mirrors that of Rodney Heinen in terms of pest-resistance. Nussbaum recalls a field of alfalfa a few years ago that Brixed at 14-16. (Generally, plants measuring 12 Brix and above are observed to be pest-resistant.) Nussbaum reports that leafhoppers congregated on the edge of that field, but just wouldn't go in.
According to Nussbaum, there are several other advantages to high-Brix crops, aside from the most important fact that they are nutritionally superior:

- His greenhouse clients can grow high Brix crops in the same soil, without rotational growing, year after year
- His asparagus, at 12-16 Brix, is so sweet it can be eaten right out of the field.
- He's observed that cows eat only half the amount of high Brix grass than when they eat low Brix grass. Nussbaum's pasture Brix is around 19, which includes timothy, Bermuda, rye and fescue grasses. However, his alfalfa Brix were between 24-28. 22 Brix is considered to be "excellent" quality alfalfa.
- Nussbaum has found that high Brix pasture increases milk production.
- The milk is yellower (likely due to increased carotene content in the high Brix grass) and his clients' vet bills have decreased substantially.
- His greenhouse clients can make a considerable amount of income a year with a 100 x 30 foot greenhouse.

# Brix Certification Programming in the Works

John Marler of Bellevue Washington, president of Reunion Process company, a company that designs and constructs facilities for processing organic materials into fertilizers, and vice president of Perfect Blend organic fertilizer, is developing a Brix certification program designed to enable farmers to receive high prices for their high Brix produce. It will be a cooperative, non-profit share-owned entity that Marler envisions will bootstrap the agricultural industry into growing high Brix crops. According to Marler, the USDA standards for produce quality measure size and color *only*, with no criteria for *nutritional* quality. The Brix certification program will be just the opposite with nutritional density being the primary criterion. Marler expects the certification program to get underway sometime in 2005. Marler's experience with high Brix produce mirrors that of others involved in high Brix farming—animals always choose high Brix feedstuffs over lower Brix, bugs don't like to enter fields of high Brix crops and the taste is remarkable. Marler explains that people are so often amazed at the taste when they try their first high Brix tomato, or other high Brix fruit or veggie. However, Marler estimates that only about 5-10 percent of U.S. produce is currently high Brix.

**FROM: http://crossroads.ws/CRActive/PikeAg.htm**

***Are there Brix detractors? But of course there are! What should you expect if something so simple came along and shook YOUR toxic chemical agriculture house of cards to its very foundation.***

***For instance, several years ago a California State University researcher conducted a "fair" evaluation of Brix in regards to grape leafhopper control. His conclusion: "no difference."***

***Interestingly, even a high-schooler could read his paper and notice that he conducted his "tests" at 9 Brix. He failed to mention that all Brix advocates insist you must maintain 12 Brix in the leaf to gain leaf sucking insect control.***

***University "research" programs have been bought, lock, stock, and barrel, by the toxic chemical industry. Would YOU pay for a report that could cost you billions of dollars in sales?***

# How to grow superb biological produce above & beyond ordinary chemical OR organic agriculture

OK, if you've read the Brix pages you're now aware of the true nature of ***quality*** in terms of fruits & vegetables. Typically, the next question is "How can I grow produce to better standards?"

My research found many ways. One of the most simple is to apply liberal amounts of top-quality compost to one's "patch." That, of course, implies one can produce "top-quality" compost. As you'll soon see, almost all compost has to be doctored to improve its inherent quality.

Why would not just any old compost be top-quality? A little thought reveals several answers. One is that if you're using compost made from ordinary low-quality plants and garden waste, the end product will be low-quality. Another thought is that if you're using low-quality manure then you can, at best, expect low-quality compost.

"Low-quality" manure? Yes! All manure is by its very nature low-quality. How could it be otherwise? If it came from an animal---any animal---then that animal's digestive system had to have mined out all, or most, of the elements needed to maintain the animal's health. The manure, then, is nothing but unusable waste. That is not to say that plants don't appear to thrive on ordinary manure. They ***will*** grow lush and green on manure. But the growth is low Brix and low Brix is low quality. That is what excess nitrogen does to plants. However, our goal is to grow higher quality plants, not just more of the low quality junk that so dominates modern agriculture.

Perhaps an old farmer saying can help here: "You can't put 10 Brix alfalfa in one end of a cow and expect to get 20 Brix milk out the other."

Over a hundred years ago, Julius Hensel, a German chemist, who also owned a grist mill, discovered that the dust from ground up stones had the ability to vastly improve the quality of plants. His book, ***Bread From Stones***, has been reprinted and is serving as a major inspiration for modern farmers who want to look beyond the simplistic nature of chemical agriculture, along with its attendant soil destruction.

Hensel's discovery was carried forward in the 1970s by John Hamaker, a retired engineer, who made healthy agriculture his second career. Hamaker's prescription for worn out, dry, failing soil is simple in the extreme: gravel dust will do the job. Hamaker's book, ***The Survival of Civilization*** carefully documents the astounding inprovements in quality AND quantity that are possible in fully remineralized agricultural soils.

Yes, although there are other methods, one answer for larger scale agricultural operations is to remineralize, i.e, to spread ground rock on the fields (or add it to their compost) so as to improve next year's crops. Given time, this is also the ideal way to improve the quality of garden output. However, time is not always available. Most people who first start using a refractometer to measure Brix are astounded---exasperated---to realize that what they thought was truly good produce is not so good after all. They want something done ***now!***

***Why get caught up in the plant disease "game"? You could spend a lifetime studying diagnosis, pathology, and other silliness only to know as little when you ended as when you started.***

***Why not accept that bacterial & fungal "attacks" are nothing more than nature sending her clean-up crews to remove malnourished tissues from the scene?***

***It's a lot easier to learn mineral balancing and appropriate fertilizing than to memorize endless lists of "diseases" and their associated toxic chemical "cures."***

***The kicker in the "kill the disease" scenario is that every time the public gets wise to toxic chemical failures, something yet more destructive must be brought out from the lab with much fanfare: "this time we really do have the answer---honest."***
***Honest???***

The answer for many farmers and gardeners is to simply experiment by feeding the growing plant with various sprayed-on fertility elements. For instance, the concerned gardener may try a dilute solution of fish or seaweed (or both). If, indeed, the plant gains Brix they know they have hit on something. If the Brix remains the same---or drops---they know they must keep searching. And the search may not be as difficult

as they think: manufacturers around the world are constantly developing soil & foliar applied products that can raise Brix---often dramatically.

However, let nothing said here make you think that you can take, say, a tomato plant loaded with green tomatoes and magically move them from 6 Brix to 16 Brix immediately before ripening. Your efforts will be most rewarded when you acknowledge the needs of that baby tomato seedling---and continue to do so at each of its stages. This is exactly why "Doctor" Pike (as I now teasingly call him) devotes so much effort to perfecting the tissue test methods detailed on these pages.

Dr. Carey Reams, who is given full credit for developing the Brix=Quality concept, spoke on his deathbed of the help he had received from the mentioned Bob Pike, of Pike Agri-Lab in Strong, Maine. Reams' widow even today speaks glowingly of how Reams said that his scientific testing mantle should be passed to Pike.

Several years back I decided to get to know Pike better and it proved a fruitful experience. In the years since Reams passed (1985), embedded computers have allowed the development of test instruments that now equip the informed crop consultant to literally carry in his pocket what once required a rather good sized laboratory.

Pike has not been idle for those years---far from it. As you will see in the pages that follow, he has refined and further developed Reams' concepts to the point that an equipped consultant can deliver ***real-time*** answers to vexing agricultural problems. However, even though the procedures are rapidly spreading among in-the-know crop consultants, Pike's modesty prevents him from claiming this is the ultimate answer. Instead, if you'll read carefully, you can almost hear him saying, ***"These procedures can help guide you to what you must do to create higher quality crops."*** By the way, if any Australian readers are here, they may want to review the Nutri-Tech webpages to see how the Reams/Pike methods are being utilized "down under." Nutri-Tech currently has over 7,000 farmers following their programs.

As you read, try to keep a thought in mind: these procedures are neither "organic" nor are they "chemical"---they are ***plant*** oriented. In other words, if the plant indicates (via a Brix gain) that it has benefited from a substance (whether that substance be "organic" or "chemical"), then that substance is what the plant needs to thrive better. There will be many times that one or more of the elements of ordinary N-P-K chemical fertilizer are ***exactly*** what the plant indicates it needs, but that in no way invalidates the need for **COMPLETE** fertilization.

***American researcher, Bruce Tainio, has discovered that plant sap pH is a simple and accurate guideline for the following:***

***1) Enzymatic breakdown of carbohydrates (sugars) for plant growth and vitality.***
***2) Risk potential for insect damage.***
***3) Risk potential for foliar disease appearance (fungi, bacteria and viruses).***
***4) Nutritional balance in the growing crop.***
***5) Quality of fruit and vegetables.***
***6) Shelf-life of fruit and vegetables.***

***The desired sap pH-level for optimal plant growth and production is pH 6.4. If sap pH exceeds 6.4, then the most likely cause will be a shortage of the anions nitrogen, phosphate or sulfur. At pH 8 the likelihood of insect trouble is 100%.***

***Conversely, if sap pH is lower than 6.4, then there is a cation problem, with possible deficiencies of calcium, magnesium, potassium and/or sodium. Low sap pH suggests a far greater potential for foliar disease. For example, at pH 4.5 the probability for fungal appearance is 100%.***

***---as reported by Graeme Sait of Nutri-Tech***

The former fact dooms many well-meaning "organic" growers (who may ignore the plant's true needs so as to follow philosophical rules) to hopelessly flounder with low-quality crops (along with the insects & disease that such quality engenders). The

latter thought, just as harmful, keeps many a mainline farmer from producing a high quality output. They'll both flounder until they learn to listen to their crops.

Rex Harrill 7/22/00