USING A REFRACTOMETER TO TEST THE QUALITY OF FRUITS & VEGETABLES

by Rex Harrill



Reprinted by Perfect Blend, LLC as a service for our customers and friends who have requested an introduction to BRIX testing.

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You cannot buy---nor grow---good food until you can first identify good Food...

With special thanks to Dave Pelly, a consultant who truly cares about quality and who provided the Pelly Chart, proofreading, technical support, and encouragement. & With special thanks to Larry Strite, the Flora-Stim representative who tirelessly struggles to help his clients achieve higher Brix levels. Larry spent many hours helping me forge the finer nuances of **Brix=Quality.**

FOR THOSE INTERESTED IN NUTRITION

**ARE THESE VEGGIES JUNK,
SO-SO, OR SUPER??
THAT TRULY IS THE QUESTION**



“Perhaps you should eat more fresh fruits and vegetables,” said the doctor...
…and the dentist...
…and the osteopath...
…and the chiropractor...
…and the surgeon...
…and the nutritionist...
…and the herbalist...
…and the acupuncturist...
...and the ophthalmologist...
…and whoever...

“But they don’t taste good,” say the children...
…and your spouse...
…and your friends...
…and YOU!

Well, that’s because the food isn’t that good. Everyone is certainly telling you the truth. So, what could the answer be? The answer is to identify and purchase the higher quality food your body is craving---it tastes better. If you’re a grower, the answer is to GROW better food---for you, your spouse, your children, your animals, and not least---your customers.

This book is meant to help you see right through the ocean of misinformation put out by food manufacturers and the sellers of debased agriculture. Another purpose is to empower you with the ability to make wise choices about the very substances of life.

Food---real food---is grown on rich and fertile soil. Removing crop after crop, year after year, rapidly depletes the soil. Simplistic replacement of the NPK (nitrogen, phosphorous, potassium) does NOT replenish the soil and only leads to the sad insipid excuses so commonly stacked high on supermarket shelves. On the other hand, balancing the soil---fully mineralizing it to an ideal state---allows the production of fruits and vegetables of superb flavor and taste---fit for royalty: YOUR family.

There are farmers out there who know how to do the job right. Demanding the very best helps them. A refractometer can help lead you to the topnotch growers already doing the job. On the other hand, 5 countless consumers armed with a measuring tool and saying, “I don’t want your sad fare” will wake up the supermarkets. The produce managers will then wake up that majority of farmers who are still sleeping.

Quality: this, indeed, is the needed revolution in Agriculture.



FOREWORD

In 1970 the author "inherited" a large garden that had belonged to a long time J. I. Rodale devotee. As spring rolled around, the next door neighbor, Mike Lasko, came over and said, "Do you want some help tilling." I did, and a great friendship was born.

Not too long after the first transplants went out, Mike dropped over and asked if I had a sprayer. Hearing that I did not, he said, "Well, you've got to get one---or borrow mine. You'll be needing Malathion soon enough." Being a reader of Organic Gardening, I declined---with the thought that I would instead try the much-touted OG 'bug juice' insect control if that became necessary.

Each time that summer that Mike sprayed he would yell over, "Are you ready to spray?" I kept declining because the bugs never came. What did come were hungry friends who couldn't seem to get over the great taste of that garden's bounty. "What variety is that carrot?" they would say. I was several times accused of playing with the truth when I responded that the 'variety' was simply a 5-cent pack of seeds I had bought at the drug store on sale.

Another thing that came were customer raves when my wife started taking the veggie overflow to the office building where she worked. Soon each office was begging her to see them first. Finally, the customers started looking out the windows to see when my wife arrived so they could run down the stairs to buy ALL the produce before she could get in the building.

Yes, that 50' x 150' patch, whose soil had been built up so lovingly by a previous owner, brought us many spare-time dollars even as it provided abundant bounty for our table.

In 1987 I bought 16 acres that had been chemically farmed. The very first vegetables were tasteless. The crop the following year was again tasteless and the insects were again having a field day---spittle bugs, caterpillars, every pest known to man seemed to be after those almost bitter turnips, radishes, and other plants. It was time to do some serious research.

Dr. Arden Andersen's treatise on ecological agriculture suggested obtaining a refractometer to test one's output. I did, and small-scale farming has never been the same for me since. The mystery of that earlier bug-proof garden with its scrumptious fruits was soon revealed. It's so simple: when the Brix is low, the taste is poor, and the insects come. When the Brix is high, the taste is superb and the insects seem to busy themselves elsewhere. The farmer's job is simply to re-mineralize and fertilize in such a way that the plants, properly fed, can develop higher Brix.

I've studied much agriculture since then. Clearly, the conventional farmers should not use toxic chemicals to rescue crops that are obviously sick---and then sell them to you. However, they can't be blamed: so much of their education comes via the agriculture schools that are supported by chemical company grants. On the other hand, I'm often baffled by organic growers who simply substitute dangerous organic insect controls for the synthetic poisons. Very few people seem to understand what the word quality truly should mean.

"Can you believe that you can take pretty much identical-looking hay from neighboring fields, feed 50 pounds a day from one field to a cow and have her drop in milk production and get sick, and feed half as much from the other field and have the cow rise in production and be healthy? What is the difference between the two samples of hay? QUALITY!"

---Dr. Harold Willis "How To Grow Great Alfalfa"

Anyone who can't make a connection between the above quote and the importance of only putting high-quality fruits and vegetables into their body is reading the wrong book.

This book describes PAGE (Poor, Average, Good, Excellent) Testing of Fruits & Vegetables for True Quality by utilizing a simple tool, the hand refractometer.

The quality of fruits & vegetables served to themselves and, particularly, their children, concerns everyone. That concern naturally extends to the feedstuffs consumed by livestock when YOU and YOUR CHILDREN consume livestock production. It is unreasonable to expect top quality eggs, milk, cheese, and meat from animals fed on poor or average quality feed.

And, it is equally unreasonable to expect humans to be strong, healthy, and clear thinking if they are fed poor or average quality fruits and vegetables. Nor should we expect to take up extreme dietary regimens that fail to address quality without expecting negative, perhaps deadly, results somewhere down the road.

Many books, charts. and computer programs purport to show mineral & vitamin content of various foods. Libraries and bookstores have entire shelves of books reporting supposed food values. It may come as a shock to you to be told that information consists of average values collected by writers from sources such as the United States Department of Agriculture or the various universities.

Did you know that there are many animal feed testing laboratories across the US and throughout the world? Livestock farmers simply cannot work to "tables." There is little room for guessing. Their livelihood depends on knowing exactly what feed value is in the hay and other feedstuffs they produce, buy, or sell. Very few feedstuffs are sold where the actual makeup and inherent values are not actually tested and reported.

How strange it is that we base the nutrition for ourselves and our children on tables that many animal growers scorn.

The USDA performs some tests, but often uses results from approved private food laboratories across the USA. Sadly, the USDA is mainly concerned with size, color, and appearance grading standards. They must walk a political tight-rope for as surely as they would admit that some produce is of high quality they would be simultaneously confessing that most farm produce is of low quality.

The only agreement is that QUALITY varies tremendously. Some authors claim that the best quality fruits & vegetables have up to 1000 times (times, not percent) more vitamins & minerals than other fruits and vegetables that pass the same USDA size, color, and appearance standards.

Think about "average values." If YOU start testing your own food, YOU will soon dislike AVERAGE. It will have as bad a taste in your mouth as the average quality fruits & vegetables the grocer now sells you.

Children who give an average response to average food will give a GOOD response to GOOD food because IT TASTES SO GOOD. The response is even better to Excellent food. Excellent is the taste that you perhaps fondly remember from your own childhood when, say, your favorite uncle appeared with a delectable apple, peach, or melon.

YOU will start moving away from AVERAGE and gravitating to those growers or vendors who can deliver GOOD or EXCELLENT food.

Sure, you, the consumer, are free to send an item to a food laboratory. However, the report is not free and it only enlightens you about food consumed long, long, ago. A refractometer speaks to you about what you hold in your hand this very moment. The instant information it delivers allows you to buy more of what you really want and less of what you don't.

Questions, questions---people do ask questions. The questions tend to change from time to time and, hopefully, the answers will, too. For the BBrix concept is as modern a science as can be---and it is evolving day by day. Many people who read the words on these pages develop an uneasy feeling. They begin to understand that most of what they have been taught about fruit and vegetable quality is far from the truth. It is a small step from there to a wonderment as to whether the food they have bought (or grown) has really been the best available for themselves and their children. Perhaps you have a question, too. If so, send it to Rex Harrill, PO Box 6, Keedysville, MD 21756. Or just call 301-432-2979 Cellphone 301-992-2979



YES, THERE IS A BETTER WAY

There is a simple process where YOU can test quality at the point of sale. There is a way to test a small sample of any given produce and then make a fully informed decision. YOU decide if that produce is what YOU want to feed yourself or your family.

It's probable that the need for the concepts explained in this book has never been greater. The world is awash in a sea of misinformation about nutrition. For instance, any search of the Internet reveals never-ending comment and argument about "man's proper diet." I monitor many such discussions with amusement for it becomes immediately obvious that the participants, whether they be physicians, chiropractors, nutritionists, farmers, veterinarians, or laymen, know nothing of the quality of what they discuss.

However, the author is neither a licensed physician nor nutritionist. The information conveyed in this book is just that---information. It represents my lifetime of research, study, discussion, reasoning, contemplation, and conclusions about the nature, and effects, of the fresh fruits and vegetables that go into the human body. I fully intend to comply with the laws of the singular, and the united, States in their attempts to prevent consumer fraud and scam through often draconian food and drug regulations. Those laws generally call for a disclaimer that recommends a reader should consult their licensed health professional prior to adopting any practice described herein. Therefore…

Please consult your licensed health care professional before doing anything this book suggests if you have any doubts whatsoever.

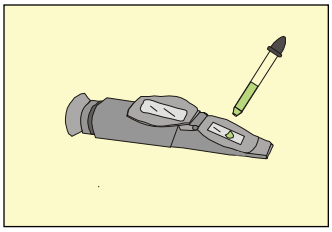
THE INS AND OUTS OF BRIX TESTING

Yes, the testing truly is as easy as child's play. Fruit & vegetable QUALITY correlates to the amount of dissolved solids in plant sap (fresh juice). All you need are the right tools and you can seldom be fooled again when buying produce.

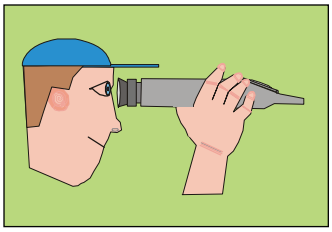
In this book are charts showing the relation of total soluble solids (TSS) to QUALITY. Your taste buds will prove the charts are TRUTHFUL.

REPEAT: YOUR TASTE BUDS WILL PROVE THE CHARTS ARE TRUTHFUL.

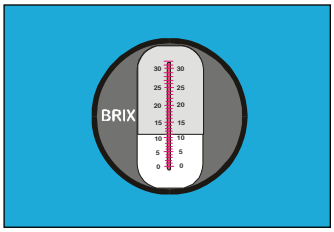
BRIX TESTING IS INCREDIBLY SIMPLE AND THE RESULT IS INSTANTANEOUS!



1. Squeeze a drop



2. Peek at the screen



3. Check the chart

THE ORIGIN OF THE WORD BRIX

Professor A. F. W. Brix was a 19th Century German chemist (b.1798, d.1890). He was the first to measure the density of plant juices by floating a hydrometer in them. The winemakers of Europe were concerned that they could not predict which of various grape juices would make the best wine. Being able to judge quality ahead of actual bottling was of immense importance in an industry where a bottle of the best wine might sell for hundreds of times more than a bottle of everyday wine. Professor Brix was greeted as a great hero when he emerged from his laboratory to claim his most generous prize. He was also honored by having the measuring process named after him.

- BRIX is a measure of the percent solids (TSS) in a given weight of plant juice---nothing more---and nothing less.
- BRIX is often expressed another way: BRIX equals the percentage of sucrose. However, if you study the contents of this book, you will soon enough understand that the "sucrose" can vary widely. For, indeed, the BRIX is actually a summation of the pounds of sucrose, fructose, vitamins, minerals, amino acids, proteins, hormones, and other solids in one hundred pounds of any particular plant juice.
- BRIX varies directly with plant QUALITY. For instance, a poor, sour tasting grape from worn out land can test 8 or less BRIX. On the other hand, a full flavored, delicious grape, grown on rich, fertile soil can test 24 or better BRIX.

I suggest that you remember that sugar is only one of the components of Brix. Also remember that many other substances can falsely indicate "Brix" readings (although those readings are valid in their own right). Try rubbing alcohol, whiskey, vinegar, or wine. Interestingly, cooking oil, molasses, syrup, and other thick liquids require a refractometer calibrated to read 30-90 Brix. Honey is checked with a refractometer calibrated to measure the water within it instead of the solids in the water.

HAND REFRACTOMETERS

Professor Brix's hydrometer worked, but it was cumbersome and required a tall graduate of juice to actually conduct the measure. This was OK for the vineyard wine cellar, but a nuisance to the grower in the field who wished to squeeze perhaps a single growing grape to judge its potential quality.

A refractometer is an optical device that takes advantage of the fact that light passing through a liquid bends or refracts. Thicker, i.e., more dense, liquids refract more. Solids dissolved in a liquid will cause it to exhibit a refractive index in direct relation to the amount of solids. A refractometer substitutes a calibrated prism and an etched screen for the liquid. Refraction is extremely exact and no modern chemist wishes to be without a refractometer.

Table model refraction measuring devices date back to the 1600's. Although lost to antiquity, it appears that some scientist, or perhaps artisan, developed a workable portable model sometime in the latter 1800's. By the 1920's, rather bulky "hand" models were in use in many vineyards.

Although complicated in construction, a modern hand refractometer is extremely easy to use.

Today's hand refractometer we are discussing looks almost like a small 5" or 6" long telescope, but it has a prism at the end opposite the viewfinder. A calibrated hand refractometer allows determination of a reading or degree Brix when you place a drop of juice on the prism and flatten it with the attached cover plate.

While widespread farming use (other than vineyards) traces back only some 20+ years, other (industrial & commercial) uses of hand refractometers are decades older. The devices are simple, accurate, durable, and easily carried. A refractometer's initial expense seems lessened as you use one and realize it will last as long as a pair of fine binoculars. It may even become a much-sought heirloom for family members.

Why do you both farm and tell the Brix story?

I really am driven by an absolute conviction that our culture (and nation) are in danger of degenerating and dying out. To survive, we must feed our kids higher quality foods and it will never happen until families can identify good food and distinguish it from chemically grown junk.

Here's an interesting diversion that may help you understand where I'm coming from. Visit your dentist and ask him how many mouths he looks in that have properly developed dental arches. Our children are being fed food so poor in minerals that the average kid's jaw cannot fully fill out. That is why wisdom teeth have to be removed. That is why so many kids are in braces. Take that knowledge and start studying the faces of the kids you see on the street. The mouth is only a window into the body. Those thin faces; with poorly formed mouth arches; with crowded teeth trying to push past one another; are accompanied by fragile, low-density, bones. Our race is in danger of dying out. High quality food is not important only because it tastes better...it is vital for us to survive.

Read Dr. Weston Price's Nutrition and Physical Degeneration. It is a timeless message that will shock you.

Contact Brixman@wideturn.com if you want a copy ($23 includes domestic mail)

ENTER DOCTORS NORTHERN AND REAMS

Carey A. Reams, D. Sc. (1904-1985), owned an agricultural consulting service in Orlando from the late 1920's to the late 1960's when he took up teaching full time. Although servicing mainly the citrus industry, the company provided high-level consulting to dozens of other crops. Reams was deeply influenced by the work of Dr. Charles Northern, an Alabama physician who stridently protested against the mineral poor food that clogged commercial channels and markets. Northern entered history when his powerful health-is-dependent-on-minerals research, as recorded by Rex Beach in an article in Cosmopolitan, was read into U. S. Senate testimony. Yes, this is the famous 1936 Senate Document No. 264 that is so widely quoted by hucksters selling liquid minerals. Sadly, those hucksters rarely bother to mention that humans are designed to get their minerals from food, not inorganic solutions. Perhaps we should revisit parts of the original article and see what wisdom we can glean.Rex Beach speaking…He [Northern] asked himself how foods could be used intelligently in the treatment of disease, when they differed so widely in content. The answer seemed to be that they could not be used intelligently. In establishing the fact that serious deficiencies existed and in searching out the reasons therefore, he made an extensive study of the soil. It was he who first voiced the surprising assertion that we must make soil building the basis of food building in order to accomplish human building.

"Bear in mind," says Dr. Northern, "that minerals are vital to human metabolism and health - and that no plant or animal can appropriate to itself any mineral which is not present in the soil upon which it feeds."

"When I first made this statement I was ridiculed, for up to that time people had paid little attention to food deficiencies and even less to soil deficiencies. Men eminent in medicine denied there was any such thing as vegetables and fruits that did not contain sufficient minerals for human needs. Eminent agricultural authorities insisted that all soil contained all necessary minerals. They reasoned that plants take what they need, and that it is the function of the human body to appropriate what it requires. Failure to do so, they said was a symptom of disorder."

"We know that vitamins are complex chemical substances which are indispensable to nutrition, and that each of them is of importance for the normal function of some special structure in the body. Disorder and disease result from any vitamin deficiency."

"It is not commonly realized, however, that vitamins control the body's appropriation of minerals, and in the absence of minerals they have no function to perform. Lacking vitamins, the system can make some use of minerals, but lacking minerals, vitamins are useless."

"Neither does the layman realize that there may be a pronounced difference in both foods and soils - to him one vegetable, one glass of milk, or one egg is about the same as another.

"Dirt is dirt, too, and our layman assumes that by adding a little fertilizer to it, a satisfactory vegetable or fruit can be grown."

"The truth is that our foods vary enormously in value, and some of them aren't worth eating, as food. For example, vegetation grown in one part of the country may assay 1,100 parts, per billion, of iodine, as against 20 in that grown elsewhere. Processed milk has run anywhere from 362 parts, per million, of iodine and 127 of iron, down to nothing. [Note: commercial milk tends to run about 10-11 Brix, whereas the very best milk can run up to 20 Brix]

"Some of our lands, even in a virgin state, never were well balanced in mineral content, and unhappily for us, we have been systematically robbing the poor soils and the good soils alike of the very substance most necessary to health, growth, long life, and resistance to disease. Up to the time I began experimenting, almost nothing had been done to make good the theft.

"The more I studied nutritional problems and the effects of mineral deficiencies upon disease, the more plainly I saw that here lay the most direct approach to better health, and the more important it became in my mind to find a method of restoring those missing minerals to our foods.

"The subject interested me so profoundly that I retired from active medical practice and for a good many years now I have devoted myself to it."

The results obtained by Dr. Northern are outstanding. By putting back into foods the stuff that foods are made of, he has proved himself to be a real miracle man of medicine, for he has opened up the shortest and most rational route to better health.

- He showed that it should be done, and then that it could be done.
- He doubled and redoubled the natural mineral content of fruits and vegetables.
- He improved the quality of milk by increasing the iron and the iodine in it.
- He caused hens to lay eggs richer in the vital elements.
- By scientific soil feeding, he raised better seed potatoes

in Maine, better grapes in California, better oranges in Florida, and better field crops in other states.

Before going further into the results he has obtained, let's see just what is involved in this matter of *"mineral deficiencies",* what it may mean to our health, and how it may affect the growth and development, both mental and physical, of our children.

We know that rats, guinea pigs, and other animals can be fed into a diseased condition and out again by controlling only the minerals in their food.

A 10-year test with rats proved that by withholding calcium they can be bred down to a third the size of those fed with an adequate amount of that mineral. Their intelligence, too, can be controlled by mineral feeding as readily as can their size, their bony structure, and their general health.

Place a number of these little animals inside a maze after starving some of them in a certain mineral element. The starved ones will be unable to find their way out, whereas the others will have little or no difficulty in getting out. Their dispositions can be altered by mineral feeding. They can be made quarrelsome and belligerent; they can even be turned into cannibals and be made to devour each other.

A cage full of normal rats will live in amity. Restrict their calcium, and they become irritable and draw apart from one another. Then they will begin to fight. Restore their calcium balance and they will grow more friendly; in time they will begin to sleep in a pile as before.

It is now agreed that at least 16 mineral elements are indispensable for normal nutrition, and several more are always found in small amounts in the body, although their precise physiological role has not been determined. Of the 11 indispensable salts, calcium, phosphorus, and iron are perhaps the most important.

Calcium is the dominant nerve controller; it powerfully affects the cell formation of all living things and regulates nerve action. It governs contractility of the muscles and the rhythmic beat of the heart. It also coordinates the other mineral elements and corrects disturbances made by them. It works only in sunlight. Vitamin D is its buddy.

Dr. Harold C. Sherman of Columbia University asserts that 50 percent of the American people are starving for calcium. A recent article in the Journal of the American Medical Association, stated that out of 4,000 cases in New York Hospital, only 2 were not suffering from a lack of calcium.

What does a deficiency mean? How would it affect your health or mine? So many morbid conditions and actual diseases may result that it is almost hopeless to catalog them. Included in the list are rickets, bony deformities, bad teeth, nervous disorders, reduced resistance to other diseases, fatigability, and behavior disturbances such as incorrigibility, an assaultive nature, and non-adaptability.

Here's one specific example: The soil around a certain Midwest city is poor in calcium. Three hundred children of this community were examined and nearly 90 percent had bad teeth, 69 percent showed affections of the nose and throat, swollen glands, enlarged or diseased tonsils. More than one-third had defective vision, round shoulders, bowlegs, and anemia.

Calcium and phosphorus appear to pull in double harness. A child requires as much per day as two grown men, but studies indicate a common deficiency of both in our food. Researcher on farm animals point to a deficiency of one or the other as the cause of serious losses to the farmers, and when the soil is poor in phosphorus these animals become bone-chewers. Dr. McCollum says that when there are enough phosphates in the blood there can be no dental decay.

Iron is an essential constituent of the oxygen-carrying pigment of the blood: iron starvation results in anemia, and yet iron cannot be assimilated unless some copper is contained in the diet. In Florida many cattle die from an obscure disease called "salt sickness." It has been found to arise from a lack of iron and copper in the soil and hence in the grass. A man may starve for want of these elements just as a beef critter starves.

If iodine is not present in our foods the function of the thyroid gland is disturbed and goiter afflicts us. The human body requires only fourteen-thousandths of a milligram daily, yet we have a distinct "goiter-belt" in the Great Lakes section, and in parts of the Northwest the soil is so poor in iodine that the disease is common.

So it goes, down through the list, each mineral element playing a definite role in nutrition. A characteristic set of symptoms, just as specific as any vitamin-deficiency disease, follows a deficiency in any one of them. It is alarming, therefore, to face the fact that we are starving for these precious, health-giving substances.

Very well, you say, if our foods are poor in the mineral salts they are supposed to contain, why not resort to dosing [supplements]?

That is precisely what is being done, or being attempted. However, those who should know assert that the human system cannot appropriate those elements to the best advantage in any but the food form. At best, only a part of them in the form of drugs can be utilized by the body, and certain dietitians go so far as to say it is a waste of effort to fool with them. Calcium, for instance, cannot be supplied in any form of medication with lasting effect.

But there is a more potent reason why the curing of diet deficiencies by drugging has not worked out so well. Consider those 16 indispensable elements and those others that presumably perform some obscure function as yet undetermined. Aside from calcium and phosphorus, they are needed only in infinitesimal quantities, and the

activity of one may be dependent upon the presence of another. To determine the precise requirements of each individual case and to attempt to weigh it out on a druggist's scales would appear hopeless.

It is a problem and a serious one. But here is the hopeful side of the picture: Nature can and will solve it if she is encouraged to do so.

It is merely a question of giving back to nature the materials with which she works.

We must rebuild our soils: Put back the minerals we have taken out. That sounds difficult but it isn't. Neither is it expensive.Therein lies the short cut to better health and longer life. When Dr. Northern first asserted that many foods were lacking in mineral content and that this deficiency was due solely to an absence of those elements in the soil, his findings were challenged and he was called a crank. But differences of opinion in the medical profession are not uncommon - it was only 60 years ago that the Medical Society of Boston passed a resolution condemning the use of bathtubs – and he persisted in his assertion that inasmuch as foods did not contain what they were supposed to contain, no physician could with certainty prescribe a diet to overcome physical ills.

He showed that the textbooks are not dependable because many of the analyses in them were made many years ago, perhaps from products raised in virgin soils, whereas our soils have been constantly depleted. Soil analyses, he pointed out, reflect only the content of samples. One analysis may be entirely different from another made 10 miles away.

"And so what?" came the query.

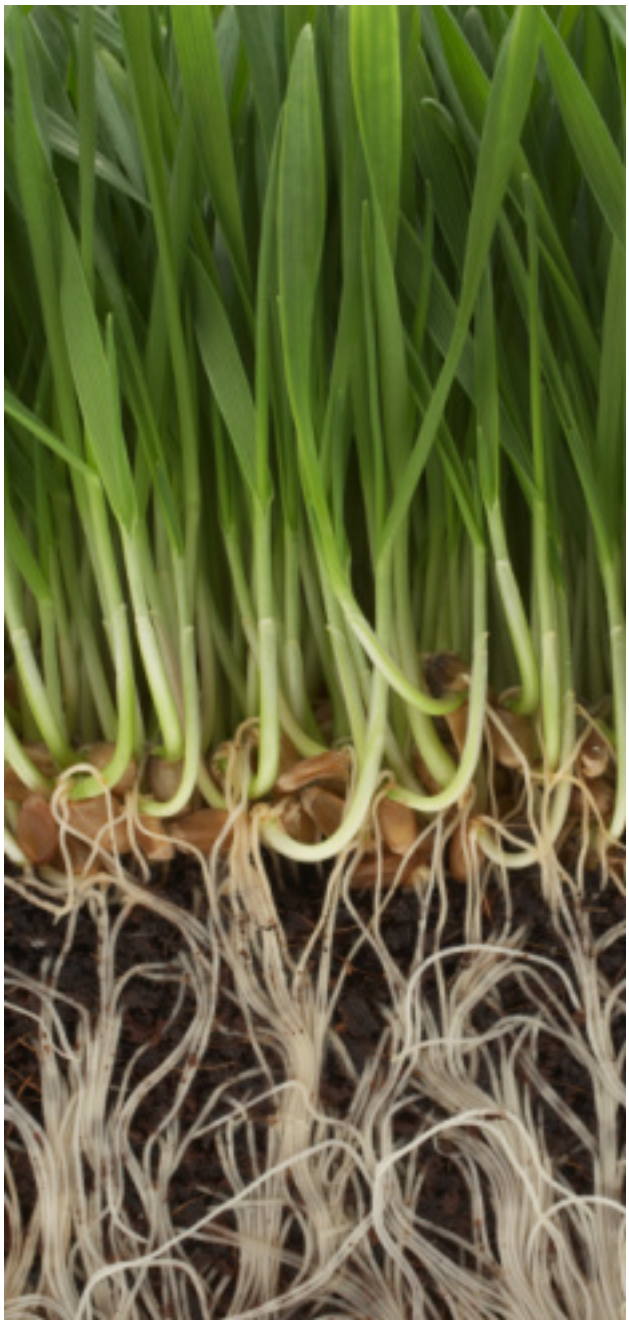
Dr. Northern undertook to demonstrate that something could be done about it. By reestablishing a proper soil balance he actually grew crops that contained an ample amount of the desired minerals.

This was incredible. It was contrary to the books and it upset everything connected with diet practice. The scoffers began to pay attention to him. Recently the Southern Medical Association, realizing the hopelessness of trying to remedy nutritional deficiencies without positive factors to work with, recommended a careful study to determine the real mineral content of foodstuffs and the variations due to soil depletion in different locations. These progressive medical men are awake to the importance of prevention.

Dr. Northern went even further and proved that crops grown in a properly mineralized soil were bigger and better; that seeds germinated quicker, grew more rapidly and made larger plants; that trees were healthier and put on more fruit of better quality.

By increasing the mineral content of citrus fruit he likewise improved its texture, its appearance and its flavor.

He experimented with a variety of growing things, and in every case the story was the same. By mineralizing the feed at poultry farms, he got more and better eggs; by balancing pasture soils, he produced richer milk. Persistently he hammered home to farmers, to doctors, and to the general public the thought that life depends upon the minerals.



REENTER DR. CAREY REAMS

Reams verified that the "soft" rock phosphate, washed away as an "impurity" while cleaning "hard" phosphate rock during the manufacture of acidulated phosphoric fertilizers was, indeed, a prime resource for the biological farmer. Combined with poultry litter and high-calcium lime, and all under the watchful eye of Reams, the formerly disdained soft rock phosphate produced superb highly-mineralized citrus as well as other crops.

Reams was well aware that citrus crop quality was directly proportional to juice richness. His years of incessant laboratory experiments had proven, over and over, that the mineral content of a crop marched in lockstep to the "heaviness" of the juice it contained.

History does not record when Reams first realized that the concept applied to other crops than grapes and oranges. Nor does history record when he first picked up a refractometer and said, "I wonder?" Did someone else say, " Dr. Reams, take a look at this," or did it come to him as inspiration?

Whatever the answer to those questions, it is known that he created a bombshell in the early 1970's when he, refractometer in hand, walked into the office of ACRES USA and placed a simple chart on the editor's desk. That chart correlated Brix numbers with four general quality levels for most fruits and vegetables. Copied innumerous times, it has made its way around the world over and over.

TRY IT---YOU'LL LIKE IT

You can easily get a drop of juice from most soft fruits, but some vegetables require a sturdy garlic press. Extreme cases require crushing pliers---and rarely---a blender. Understandably, juicing enthusiasts find this the easiest step.

•YOU, not some scientist in a lab coat, can test the food you want to buy.

•YOU can determine QUALITY at the point of sale.

•YOU will gain back a little control over YOUR life.

Please take readings immediately after getting the juice drop. If the juice dries on the prism, it will give a false reading. You must also be wary when testing dehydrated produce. Drying of a drop, or an entire fruit, creates a false high reading.

However, only HIGH QUALITY produce dehydrates. HIGH BRIX produce ADAMANTLY RESISTS ROTTING IN STORAGE! Check this claim yourself by testing and storing HIGH-BRIX fruit or other produce.

The above statement always comes as a shock to a lecture audience. The typical consumer has been conditioned to expect fruits and vegetables to decompose. That is why I must repeat the above sentence: good food will NOT rot in storage. *Please, please, check this claim yourself by testing and then storing HIGH-BRIX fruit or other produce in your refrigerator, or even on a windowsill.*

Once you depart your current thinking and enter the poor-food-rots / good-food-doesn't paradigm, everything else in this book will make sense.

BRIX=QUALITY CHARTS

The basic Reams' chart that follows is still widely disseminated by Pike Agri-Lab in Maine. Dr. Reams' widow insists that before he died he spoke often of Mr. Pike's invaluable assistance in helping finalize Brix=Quality crop improvement methods.





Refractive Index of Crop Juices Calibrated in % Sucrose or Degree Brix

VEGETABLES				
Vegetables	**Poor**	**Average**	**Good**	**Excellent**
Asparagus	2	4	6	8
Beets	6	8	10	12
Bell Peppers	4	6	8	12
Broccoli	6	8	10	12
Cabbage	6	8	10	12
Carrots	4	6	12	18
Cauliflower	4	6	8	10
Celery	4	6	10	12
Corn Stalks	4	8	14	20
Corn (Young)	6	10	18	24
Cow Peas	4	6	10	12
Endive	4	6	8	10
English Peas	8	10	12	14
Escarole	4	6	8	10
Field Peas	4	6	10	12
Green Beans	4	6	8	10
Hot Peppers	4	6	8	10
Kohlrabi	6	8	10	12
Lettuce	4	6	8	10
Onions	4	6	8	10
Parsley	4	6	8	10
Peanuts	4	6	8	10
Potatoes, Irish	3	5	7	8
Potatoes, Red	3	5	7	8
Potatoes, Sweet	6	8	10	14
Romaine	4	6	8	10
Rutabagas	4	6	10	12
Squash	6	8	12	14
Sweet Corn	6	10	18	24
Turnips	4	6	8	10

Refractive Index of Crop Juices Calibrated in % Sucrose or Degree Brix

FRUITS - GRASSES				
Fruits	**Poor**	**Average**	**Good**	**Excellent**
Apple	6	10	14	18
Avocadoes	4	6	8	10
Bananas	8	10	12	14
Cantaloupe	8	12	14	16
Casaba	8	10	12	14
Cherries	6	8	14	16
Coconut	8	10	12	14
Grapes	8	12	14	20
Grapefruit	6	10	14	18
Honeydew	8	10	12	14
Kumquat	4	6	8	10
Lemons	4	6	8	12
Limes	4	6	10	12
Mangos	4	6	10	14
Oranges	6	10	16	20
Papayas	6	10	18	22
Peaches	6	10	14	18
Pears	6	10	12	14
Pineapple	12	14	20	22
Raisins	60	70	75	80
Rasberry	6	8	12	14
Strawberry	6	10	14	16
Tomato	4	6	8	12
Watermelon	4	6	8	12
Grasses				
Alfalfa	4	8	16	22
Grains	6	10	14	18
Sorghum	6	10	22	30

The Reams Composite Chart					
Vegetables/ Fruits	**Poor**	**Aver-age**	**Good**	**Excellent**	**Disease-FREE**
Apples	6	10	14	18	(16)
Asparagus	2	4	6	12	( )
Avocados	4	6	8	12	( )
Bananas	8	10	12	16	( )
Beets	6	8	10	12	( )
Blueberry	6	8	12	14	( )
Broccoli	6	8	10	12	( )
Cabbage	6	8	10	12	( )
Cantaloupe	8	12	14	16	(16)
Carrots	4	6	12	18	( )
Casaba	8	10	12	14	(16)
Cauliflower	4	6	8	12	( )
Celery	4	6	10	12	(15)
Cherry (Sour)					(14)
Cherry (Sweet)	6	8	14	16	(16)
Coconut	8	10	12	14	( )
Corn (Sweet)	6	10	18	24	(24)
Cucumber					(13)
Kumquat	4	6	8	12	( )
Eggplant					(12)
Endive	4	6	8	12	()
Escarole	4	6	8	12	( )
Garlic					( )
Grapefruit	6	10	14	18	( )
Grapes	8	10	14	18	( )
Green Beans	4	6	8	12	(14)
Honeydew	8	10	12	14	(16)
Kohlrabi	6	8	10	12	( )
Lemons	4	6	8	12	( )
Lettuce	4	6	8	12	(12)
Limes	4	6	10	12	( )

The Reams Composite Chart					
Vegetables/ Fruits	**Poor**	**Aver-age**	**Good**	**Excellent**	**Disease-FREE**
Mangos	4	6	10	14	( )
Onions	4	6	8	13	(13)
Oranges	6	10	16	20	( )
Papaya	6	10	18	22	( )
Parsley	4	6	8	12	( )
Pea (Buckeye)	4	6	10	12	( )
Pea (English)	8	10	12	14	(14)
Peaches	6	10	14	18	( )
Peanuts	4	6	8	12	( )
Pears	6	10	12	14	( )
Pepper (Hot)	4	6	8	12	(12)
Pineapple	12	14	20	22	( )
Potato (Irish)	3			13	(13)
Potato (Sweet)	6	8	10	14	( )
Pumpkin				(15)	( )
Raisins	60	70	75	90	( )
Raspberries	6	8	12	14	(15)
Romaine	4	6	8	12	( )
Rutabaga	4	6	10	12	( )
Squash	6	8	12	14	(15)
Strawberry	6	10	14	16	(16)
Tomato	4	6	8	12	(18)
Alfalfa	4	6	8	12	( )
Watermelon	8	12	14	16	( )
GROWERS					
Corn, Stalks	4	8	14	20	( )
Corn, Young	6	10	18	24	( )
Grains	6	10	14	18	( )
Roses				(15)	( )
Sorgham	6	10	22	30	( )

Plant	Poor	Average	Good	Excellent
Alfalfa	4	8	16	28+
Apples	6	13	14	18+
Apples (sweet)	10	14	18	22+
Apricots	6	12	16	20+
Asparagus	2	8	11	15+
Avocados	4	8	8	10+
Bananas	8	13	12	14+
Beets	6	8	10	14+
Bellpepers	4	8	8	12+
Blackberry	6	8	12	16+
Broccoli	6	8	10	12+
Cabbage	6	8	10	12+
Carrots	4	8	12	18+
Canalope	8	12	14	16+
Cauliflower	4	8	8	10+
Celery	4	8	10	12+
Cherry (sour)	6	8	14	16+
Cherry (sweet)	10	15	20	25+
Coconut	8	12	12	14+
Corn Stalks	4	13	18	20+
Corn Young	6	13	18	24+
Cow Peas	4	8	10	12+
Cucumbers	4	8	8	12+
Sweet Peas	8	12	12	14+
Grains	6	13	14	20+
Grapes	8	12	16	20+
Grapes (sweet)	8	15	20	16+
Grapefruit	3	13	14	18+
Green Beans	4	8	8	10+
Herbs (most)	4	8	8	12+
Honeydew	8	12	12	14+

Plant	Poor	Average	Good	Excellent
Hot Peppers	4	6	8	10+
Kiwi Fruit	8	12	11	18+
Kumquat	4	6	8	10+
Lemons	4	6	8	12+
Lettuce	4	6	8	10+
Limes	4	6	8	12+
Mangoes	4	6	10	14+
Nectarines	6	12	16	20+
Onions	4	6	8	12+
Onions (sweet)	6	8	10	16+
Onions (green)	6	12	16	20+
Oranges	6	12	16	20+
Papayas	6	10	18	22+
Parsley	4	0	5	10+
Peaches	6	12	16	20+
Peanuts	4	6	8	10+
Pears	6	12	16	20+
Pineapple	12	14	20	24+
Prunes	0	12	16	20+
Potatoes	4	6	10	12+
Raisins	60	70	75	30+
Raspberries	6	8	11	16+
Rutabaga	4	6	10	12+
Squash	6	8	12	16+
Strawberry	6	10	11	16+
Sweet Corn	6	8	18	24+
Sweet Potato	6	8	10	14+
Tomatoes	4	6	7	12+
Tomatoes (cherry)	10	14	16	22+
Turnip	4	6	8	10+
Watermelon	8	12	14	16+

GENERAL NOTES FOR ALL CHARTS

Any extended DISEASE FREE figures in parentheses are the plant Brix readings at (or above) NO DISEASE OR INSECT will infest the plant. Although they were unfamiliar with refractometers, this was the great secret that such men as Sir Albert Howard and J. I. Rodale inherently knew.

- It is possible to have values higher than excellent (as shown by various disease-free readings). More than likely, future practice will be to show "+" by the excellent values as it now seems that upper limits may never be known. For instance, Bob Pike once lectured about 28 Brix strawberries being grown in Virginia.
- As a GENERAL rule of thumb, 12, or better, Brix readings confer reasonable plant pest immunity. This is true of both fruit and leaf readings.
- Unknown (unmarked) values are still being researched.
- If you garden, or farm, care about QUALITY, and want POISON FREE food, you will find Brix values vital. Maintaining HIGH BRIX values frees you from spraying toxic substances.

You may sometimes find that you have to use a leaf (where the leaf is not the plant part you eat) to get your test drop. While this may help you determine the better of two plants, the majority of data in the quality charts refers to the eaten part.

In Nature, the plant has a single goal: to reproduce. However, it is obvious that the plant must survive to maturity if it is to achieve that goal. In a perfect world, the plant develops 12 or better Brix in its leaves. This resource, this goodness, this BRIX is transported to the roots and shared with the healthy bacteria growing in the root rhizosphere. The bacteria, using this gift of energy, "bloom" profusely and create many substances from soil minerals---substances critical for the plant to complete its life cycle.

Later, assuming the plant was successful in defending itself against pests and disease, it will start maturing the parts needed for that primary directive: reproduction. In other words, say, any apple tree will proceed to produce the very best apple that it can. The best tasting apple is the fruit most likely to be selected by an apple lover. Of course, the apple lover also takes the seed that is inside the apple---always with the possibility that those seeds may possibly be planted elsewhere.

Many scientific growers are adopting the Pike Agri-Lab Tissue Test methods where great attention is paid to maintaining leaf values at 12 or better, Brix. The sap translocation process is well understood and from long experience it is known that the ripened fruit which follows those high leaf Brix values can reach 20 or more Brix. Please remember that we are speaking of a dynamic process. Plants that are deficient in one or more of the minerals needed for optimum health can generate excessive Brix in their leaves that may be blocked from trans-locating to the roots and stem. For instance, 25+ Brix values in blueberry leaves have been recorded, but where the fruit ultimately only reached 12 Brix. Although these values are high, most readers will readily recognize that optimum conditions were not prevailing.

Sadly, some modern hybrid plants (sweet corn for instance) have been bred to excessively trans-locate sugar. They can give high ear readings even as the stalks and leaves are giving relatively low readings.

You will find pest problems persist until you achieve higher leaf and stalk readings. The target is always 12+. That knowledge becomes invaluable when gardeners or farmers need to monitor plant quality in early growth stages.

You may be a grower, consumer, or both. Although the selling grower's goals are sometimes at variance with those of the consumer, both benefit from any increase in Brix values. Hopefully, both will work in tandem to improve the quality of the food supply.

A GENTLE WARNING

A first natural inclination for many people is to test the fruits of their labor from their garden. Bruised feelings are common when their personal pride and joy indicates less than high quality. Be happy that YOU now have the knowledge needed to inspire you to grow higher quality fruits and vegetables. And you may rest assured that judging the quality of your neighbor's garden as anything less than "good" or "excellent" will cause difficulty. Another phenomenon I often encounter is where the new Brix convert starts rejecting produce that doesn't measure "excellent." The strange thing is that they will reject items that they would have eagerly bought back when they could not tell good from bad. Please let the refractometer guide you toward better food. For instance, if you have unknowingly used poor grade spinach to make salad in the past I would suggest you now look for average or good spinach with an eye toward pinpointing excellent spinach at some future time.

AND A FEW NOTES

•Spicy or pungent foods (such as onions or hot peppers) are tested for QUALITY the same as any other.

•The refractometer is not truly a ripeness tester, although it is used in that sense by many Departments of Agriculture. For instance, many Departments allow cantaloupe to be picked once it tests 9 Brix (this is what you normally find on salad bars). However, excellent cantaloupe is 16 Brix or better.

•Produce CANNOT gain minerals (increase in QUALITY) after detachment from the mother plant or the soil.

•Ignore vendor's comments about produce somehow ripening into better quality. Particularly ignore vendor's signs reading SWEET. YOU now have the means, using a refractometer of determining true quality. You'll never be fooled again by their cry of "Sweet!"

TASTE & FLAVOR

All creatures with a sense of taste use it to help them select nutritious food. You will rediscover that good tasting food is more satisfying than everyday fare. You will quickly learn that HIGH BRIX food actually tastes wonderful. Interestingly, once you rediscover the great taste of high Brix food, you may find the artificial flavorings you once tolerated objectionable. Certainly, you will find it difficult to eat poorer quality fruits & vegetables so easily as your taste sense is once again "recalibrated" to the great flavor of higher Brix produce.

The refractometer is a tool---no more---no less. It is used to help you select HIGHER QUALITY foods containing more vitamins and minerals. You will immediately notice the direct relation between flavor and Brix. You should find the refractometer quickly helping you regain your ability to select good food by taste alone. This re-developed skill can serve you well at both restaurant and supermarket.

However, you should remember that variety affects taste. That will not change the fact that a high Brix item of any produce is better tasting than a low Brix item of the same produce. For instance, some people prefer tart apples and some like sweet varieties. An excellent quality Winesap apple, while wonderful to some eaters, may be too tart for those who like, say, Red Delicious. In like manner the 42 Brix specialty wine grape often holds small attraction for the connoisseur of eating grapes, who may be ecstatic at finding a 24 Brix Ribier.

THE STAGES OF TESTING AS A CONSUMER

All Departments of Agriculture use refractometers. All food companies that process either liquid or paste foods use refractometers. All agricultural buyers are familiar with refractometers.

1. FIRST, CALIBRATE YOUR INSTRUMENT

•Place a drop of distilled water on the prism and flip the plate down (if you have a plate model). Flip the hinged prism shut if you have a double prism model.

•View through the instrument toward a light source (a clear sky is best).

•Adjust the focusing ring until you see a razor sharp image of the Brix scale. The demarcation line where the light and dark fields meet should CROSS at ZERO.

•ATC models (Automatic Temperature compensated) are calibrated with the adjustment screw to read ZERO. This adjustment is rarely needed. Standard (non-ATC) models may require temperature correction. Anyone needing the full version of the abbreviated sidebar chart should write or call.

Abbreviated International Temperature Correction Table for a Refractmeter Tested at 20 degrees C.

Temp C	Temp F	Dry Substance Content in Percent				
		0	5	10	15	20
10	50	Subtract .50 Brix	Subtract .54 Brix	Subtract .58 Brix	Subtract .61 Brix	Subtract .64 Brix
15	59	Subtract .27 Brix	Subtract .29 Brix	Subtract .31 Brix	Subtract .33 Brix	Subtract .34 Brix
20	68	<none required @ 20c º / 68F degrees>				
25	77	Add .33 Brix	Add .35 Brix	Add .36 Brix	Add .37 Brix	Add .38 Brix
30	86	Add .72 Brix	Add .74 Brix	Add .77 Brix	Add .78 Brix	Add .79 Brix

Please understand that temperature compensation is simply not needed if you are only trying to select more nutritious food and the comparison tests are conducted at the same temperature. For instance, a glance at the chart shows that testing, say, a 15 Brix carrot on a hot day would require adding less than a single Brix to make full correction.

1.RUN A TEST

•Select a soft fruit from your refrigerator or fruit bowl and squeeze a drop from it onto the prism.

•Flatten the drop with the prism.

•Hold it to the light.

•THE READING IS EXACT! (many instruments read to 0.2 Brix)

3. REPROGRAM YOUR MIND TO THINK QUALITY

•Determine QUALITY by comparing the reading to either Brix CHART.

•Taste the fruit.

•Immediately begin to re-learn that taste is as important as all other senses.

•Rediscover that taste is far more important than simple appearance for selecting QUALITY produce.

•Test, then taste, your vegetables (a garlic press can be useful for squeezing a drop of juice).

•Resolve to buy QUALITY fruits & vegetables.

4.PROGRESS TO TESTING AT A PRODUCE STAND OR MARKET

•Try to obtain a sample of anything you wish to buy, but be warned that 90% of produce on retail stands will test POOR or AVERAGE.

•Of course, you should offer to pay for the sample. If you have rapport with the owner, you can ask if you can test the produce in their presence.

•You are a buyer. You should have the right to select your purchases by means other than simple appearance.

•Many consumers are conditioned to buy, whether they wish to or not, once they take a sample. Perhaps you should let the refractometer guide you to a "Thanks, but no thanks" when it indicates poor or average produce.
Of course, you may (and probably will) decide to buy a considerable amount of any produce that tests either GOOD or EXCELLENT.
However, you should never judge (nor "label") someone's produce as POOR or SO-SO. Simply tell the operator that you are looking for "higher sugar." Fruit stand operators have feelings, too. Remember that you are a consumer, not an arrogant inspector. And please remember that you have no desire to "punish" the stand operator for all the years of poor produce you have endured. You are trying to open channels so that you can get BETTER fruits & vegetables. Yes, you want this person interested in your special needs. Let the operator examine your instrument if they wish. Let them verify your readings. Ask how they select what they buy at the wholesale market. Ask if they can pick HIGH QUALITY produce out of a pile by its heft (a few experienced operators can). Many operators will be fascinated with your refractometer. Some may offer to buy it. They may quickly grasp how it could help them get better produce at the wholesale level where they buy. Don't be surprised if a stranger notices you testing and asks what Brix you are seeing as you peer. Discreet Brix testing may be going on all around you.

5.GO TO THE GROCERY STORE

•Ask for the produce manager.

•Tell him the information you want and what you wish to do.

•Offer to share the information you obtain.

•Grocery stores have a satisfaction guarantee. Suggest to them that you are trying to decide your satisfaction at the store instead of waiting until you get home.

•Do be discreet and not disturb other customers.

THE STAGES OF TESTING AS A GARDENER OR FARMER

1.IN THE FIELD

Start by testing your finished produce when it is ready for harvest. Recognize that HIGH QUALITY produce comes from HIGH QUALITY plants. Test the leaves of your plants that are not ready for harvest. If they continually test high as the days go by, the harvest will ultimately test high.
Start your testing earlier next season. You are no longer operating blindly. Adjust your fertilization to increase leaf Brix. The QUALITY of your produce will be far higher. An excellent step-by-step program using pH & electrical conductivity to adjust leaf Brix upwards has been developed by Bob Pike. This method removes much of the traditional guesswork that formerly dominated the "try this---try that" school of how to increase Brix.

2. OBSERVE THAT INSECTS, VIRUS, BACTERIA, AND FUNGUS ONLY ATTACK LOW BRIX PLANTS

Chemical control of plant pests is a multi-billion dollar industry. Each year, the chemical companies spend hundreds of millions of dollars advertising their products purportedly to control insects, viruses, bacteria, and fungus. The chemical companies spend more millions conducting and sponsoring field tests that attempt to prove the special worth of their particular products.

However, their tests assume that all pests voraciously attack all green plants. That premise brings forth the following questions:

What kept the pests from multiplying, and then devouring, everything green millions of years ago? Why is the Earth not a bare rock now?

Understandably, the chemical companies shy away from these questions. Most are well aware that pest problems occur in fields fertilized with NPK.

The true answer is that pests are extremely selective in what they eat. Selectivity is well known. For instance, a cabbageworm dropped in a cornfield starves to death in the midst of plenty. Similarly, corn-smut fungus spores landing in a cabbage patch quietly die.

HIGH-QUALITY organic growers have, for generations, calmly stated that pests leave their produce alone. They are telling the truth. However, the truth of their observations is often clouded by the pests that LOW-QUALITY organic growers battle with garlic sprays and other concoctions.

Simply stated, unhealthy plants attract pests. Parallels are well known in nature. Predators are drawn to the weakest, most unhealthy, animals in a herd.

Another thought is that the syrupy nature of high Brix plant juices is simply too difficult for sucking insects, such as aphids, to ingest. In all likelihood they depart in frustration to seek out the watery chemical grown produce of the neighbor's field.

Finally, some students of BRIX=QUALITY theorize that alcohol plays a major part in plant/pest interaction. Apparently, insects, unlike warm-blooded creatures have no mechanism in their blood to prevent sugar from rapidly fermenting to alcohol. Therefore, they reason an insect feeding on a HIGH BRIX plant would suffer toxic effects from sugar fermentation in their blood. They reason, further, that predators easily catch toxic (or tipsy) insects removing them from the gene pool.

Some alcohol theorists add yet another concept: namely that formed alcohol tends to dissolve the waxy seal exo-skeleton creatures employ to prevent fatal dehydration in hot fields.

Whatever---the reasoning goes on to suggest that insects feeding indiscriminately on HIGH BRIX plants fail to survive evolutionary pressures.

Although there is scant official research to validate any of these theories, there is wide agreement among non-toxic farmers the world around that healthy plants are immune to insect attack and disease.

3.OBSERVE THAT HIGH LEAF BRIX READINGS PROTECT AGAINST FROST

Pure water freezes at 32 degrees Fahrenheit. However, a 5 Brix water-sugar mixture freezes at 26 degrees; a 10 Brix mixture at 22 degrees; and a 15 Brix mixture won't freeze until it reaches 17 degrees. Plant frost damage (killing) occurs when ice crystals rupture plant cells. Many HIGH BRIX growers find their production season extended because the first few light frosts no longer harm their crop.

While a sugar-water mixture is not exactly the same as Brix, consumers would be wise to recognize that the last local field-grown produce is almost assuredly the highest Brix and therefore the highest quality. Such growers are worth seeking out.

Note: Some refractometer models are calibrated to directly show the temperatures needed to freeze certain liquids.

4.PRICE YOUR OUTPUT ACCORDINGLY

Once you understand that your produce is sweeter and more nutritious than average, you should be prepared to show your customers why it is worth more.

COMPANIES THAT USE REFRACTOMETERS

Refractometers are used extensively in commercial food manufacture. Individual instruments range from $100+ hand-held models to digital read-out laboratory types costing many thousands of dollars. Hundreds of major corporations routinely use refractometers to control processes, concentrations, and solutions. For instance, the soda dispensing machines so common in corner stores and gasoline stations are checked for accuracy with a hand refractometer.

Note: PINEKNOLL maintains lists of company names and will furnish Photostatted copies upon request. Please send a self-addressed stamped envelope (SASE) and $1 to cover copying costs & handling if you need this information.

TESTING FOR QUALITY WITHOUT A REFRACTOMETER

Of course YOU may wish to check your family's food QUALITY without buying an industrial grade device. Testers obtain identical results by floating an inexpensive hydrometer in a container filled with fresh made juice. You may have a friend who homebrews beer who has a Brix hydrometer (although many have shifted to refractometers). Actually, as earlier stated, the hydrometer was the tool first used by Professor Brix. One drawback, of course, is the inconvenience of requiring a pint or more of fresh juice. Another is that it is impossible (or very difficult) to gage the diffusion (of which more will be said later).

The same companies that sell refractometers often sell hydrometers.

REFRACTOMETER USE IN WINE MAKING

Wineries routinely determine the anticipated quality of wine during grape harvest with a refractometer. Those vintners who purchase grapes from independent growers base payment on Brix numbers. Vintners learned long ago that HIGH BRIX grapes are the raw material needed for HIGH QUALITY wine.

Consumers are rapidly learning that HIGH-BRIX equals HIGH QUALITY in all fruits and vegetables.

DEHYDRATION

A drop of plant juice starts drying immediately. Wind and sun speed the drying. If you suspect that your test drop dried enough to affect your result, clean your refractometer and start over. It only takes a moment Experts suggest that you re-check most tests when you first start using your own refractometer. The ability to duplicate your work by crosschecking is a powerful confidence builder.

Be alert for fading of the demarcation line in the viewing screen. Fading means the sample is drying on the prism. Do not confuse this with fuzziness (blurring---see below) f the demarcation line. You may want to gain experience at spotting fading with your refractometer. Place the smallest drop on the prism that will give a demarcation line. Then examine the screen for a minute or so. Fading should occur fairly soon as the moisture evaporates.

Dehydration is necessary when preparing certain foods. For instance, you must remove many gallons of water from maple sap to make a gallon of maple syrup. A refractometer user could determine in advance exactly how many gallons to evaporate by checking the Brix of the fresh sap.

Some refractometer users also know raw sap with HIGH BRIX produces far better, tastier, and more abundant syrup.

Stored fruit & vegetables either rot or dehydrate. Rotting in storage is an unmistakable sign of poor quality. Dehydration is an absolute sign of HIGH QUALITY. The purveyors of low-quality fruits and vegetables seem willing to resist this fact until the end of time. Many consumers are terribly confused on this point because they have been conditioned to cut off rotting portions of a fruit or vegetable and eat the remainder.

Please understand that testing the juice from a dehydrated item of produce can be misleading. Your refractometer will indicate a higher than true Brix. While seldom a problem when selecting foods, checking leave tissues in a field of heat-stressed plants can result in erroneous readings. You should avoid using a refractometer to check any plant with any possibility of lack of turgor i.e., droopy leaves. Even when drought is not apparent, it is best to check leaves as early in the morning as possible.

ADVANCED USE (blurry line)

•A less-than-sharp demarcation line (blurry/fuzzy/diffused) on the screen is an indication of varied atom distribution i.e., an excellent mixture of minerals. For instance, many veteran refractometer users grow forages for animals and also have access to standard lab tests (so as to make possible direct comparisons of Brix vis-à-vis other lab tests). They are adamant in insisting a sharp demarcation is an indication of increased simple sugar and therefore lesser high-quality protein (and other life-enhancing substances) at any given Brix level.

Conversely, they suggest a blurry/fuzzy line predicts more, and better quality, proteins (*). Interestingly, the fuzzy line concept appears to be supported by the ability of astronomers to use refracted light to determine the elemental makeup of distant stars. Starlight, properly refracted, is spread out so that the lines left by various elements can be identified. It is suggested that you think of your readings as, say, 12S (sharp) or perhaps 14D (diffuse). In almost all cases, blurry tastes better.

•You will quickly, and easily, learn to judge the mid-point of any blurring. Your correct reading lies there.

•Blue intensity matters on those models that have a blue background field. When different items reveal the same Brix but one has a less intense blue, it will taste sweeter and be higher in calcium, which neutralizes acids. However, the blue background can be overcast by the deep green chlorophyll color of some leafy plants. Do not be discouraged if your field of view appears to "greenout." Simply rotate your body away from the light source and watch for the demarcation as the light intensity diminishes.

•Although your mouth readily tells the difference, the refractometer cannot easily distinguish starch from sugar. There is an additional chart in the book to convert starchy food readings to sugar equivalents.

Some produce resists efforts to get a drop of juice for testing:

- •Consider that it may be very high Brix and that the juice is really thick.
- •Try cutting a very thin slice (1/16" to lay on the prism--it really works!)
- •Crush a leaf and lay that on the prism, or
- •Grind the food in a processor and squeeze the chopped result.
- •Be wary of dehydrated produce.

Some foods are made to order for testing:

- •You can plunge the prism end of many refractometers into citrus fruits. Then pull the instrument back and flip the plate down to get the reading. (The plunge method works well on other very ripe fruits and any tomatoes).

(*) Protein quality is a subject of much interest to farmers. Should you ever visit a farm show devoted to biological growing, as opposed to chemical growing, you are almost sure to find a booth where they have common ear corn sealed in air-tight jars. As could be expected, corn grown with their products will be as good as the day it was picked. On the other hand, ears of corn identified as grown with ordinary N-P-K technology will be seriously decomposed. This "oddity," which is far more common than you may suspect, is generally attributed to "funny" protein. When pressed, the speaker will describe malformed proteins and how they appear when too much nitrogen in the form of N-P-K is applied to the growing crop. Much money is spent on "research" to discover ways of using yet more chemical additives to keep poor quality food from decomposing right on supermarket shelves. One must wonder if any of those funds found their way to explore this phenomenon whether we might learn much about good agriculture and good food.

CARE & CLEANING

Refractometers require little, if any, special care. Normal wind, rain, cold, or heat will not damage them. (However, you should remember that temperature extremes might require using the correction chart).

Clean off plant juices with a moist paper towel after use (avoid grit or sand).

You should not drop one, but accidents do happen. Check the calibration and continue using the instrument if there is no physical damage. Physical damage requires a return to the factory.

Note: you can purchase prepared standard calibration liquids if your work requires extreme accuracy. Perhaps you have contracted to pay a certain premium if a grower achieves a higher-level Brix and there is some question as to whether the specified mark was reached. A calibration solution can help referee.

OTHER REFRACTOMETER USES

As mentioned before, specially calibrated hand refractometers are available to test other than 0-32 Brix. For instance…

- •Freezing point of anti-freeze mixtures...
- •Saline concentration...
- •Urinalysis
- •Detecting illegal wrestler dehydration...
- •Blood protein testing...
- •Drug tampering...
- •Jelly & jam production...
- •Honey quality...
- •Aquarium setup...
- •Jet fuel quality and contamination...
- •Aquaculture...

With practice, a standard Brix refractometer can be used to accurately test or help duplicate many aqueous solutions.

Example: some farmers buy barrels of 35% hydrogen peroxide to spray on their crops to raise Brix levels. 35% H202, itself tests about 17 Brix when fresh. However H202 gradually breaks down to water in storage. A farmer can check with a refractometer and determine if he is getting what he is paying for.

Example: drug store 3% hydrogen peroxide tests 1.5 Brix when fresh. It is an easy matter to dilute 35% concentrate down to 3% by adding distilled water to reach an identical reading.

Example: Sorbet (frozen fruit mixtures) can be adjusted to obtain more consistent results.

FAMILIES OF FRUITS & VEGETABLES

BRIX=QUALITY charts are not 100% complete nor finished. New researchers will establish values for unlisted produce. New farmers will re-discover long lost methods to grow higher quality produce. New agronomists will debate among themselves over the merit of a single degree Brix.
In the interim, the home tester using a Brix chart must sometimes substitute the value of a closely related item of produce. **For instance:**

•KALE, COLLARDS, and BRUSSELS SPROUTS are not normally listed. However, all three belong to the family BRASSICA, along with CABBAGE, and KOHLRABI.

•BLACKBERRIES are not listed, but RASPBERRIES are. The two are similar. Most people testing a blackberry use the raspberry values

•TOMATOES, EGGPLANT, POTATOES, and PEPPERS are from the NIGHTSHADE family.

•EGGPLANT, another nightshade, seldom has a listed value, but its relatives such as peppers, tomatoes, and potatoes do. You can generally interpolate a needed value.

•Where is DURIAN? PERSIMMON? ASIAN PEAR? ETHNIC PRODUCE? SPINACH? and many little known fruits.

Those, and many other produce items, must await further research. For instance, the U.S. based author has read market reports from the Southern Hemisphere in which he could recognize but a fraction of the names of the listed items. Hopefully, researchers in areas such as Australia will forward Brix=Quality values for their unique fruits & vegetables that can be included in future editions. If you have a special fruit that is unlisted, please reach out to the author or to BrixTalk@yahoogroups.com and you may quickly find the answer you need.

FRESH VERSUS PASTEURIZED FRUIT JUICES

TV commercials and other advertising try to create a fresh=high quality mystique. Sorry, but poor quality juice is poor quality juice. Fresh HIGH QUALITY juice is HIGH QUALITY JUICE. A glib actor can spout for hours and not change that.
While processing can damage vitamins, it ordinarily neither removes nor adds minerals. Of course, many processed juices have sugar added in an attempt to enhance taste. The added sugar prevents accurate Brix quality testing even as it degrades the taste. Read the labels.
People often report that pasteurized HIGH QUALITY juice is only slightly less tasty than fresh juice. They insist it tastes far superior to fresh poor, or average, quality juice.

MISCELLANEOUS SIGNS OF HIGH QUALITY

•CITRUS: A thinner rind indicates HIGHER QUALITY

•CITRUS: Top quality citrus has five points at the calyx (stem end).

•PEARS: A boxy shape is better.

•STONE FRUITS: A split pit indicates poor quality and mineral insufficiency.

•GRAINS: Dry grain QUALITY is relative to unit weight, i.e., if you weighed bushels of 2 equally dry wheats, the heavier bushel is HIGHER QUALITY. For instance, top quality wheat from mineral-rich soil can be 70+ pounds per bushel. On the other hand, mineral poor wheat can be as little as 60 or less pounds per bushel. The grain elevators pay meaningful premiums when they can find higher quality wheat or other grains.

•JUICES: Have your restaurant juice served over ice. HIGH BRIX juice will not taste watery.

•VEGETABLES: A natural waxy coating is good. Packers, processors, and stores try to duplicate this effect by mechanically waxing poor quality vegetables.

•VEGETABLES: Any hollowness indicates a mineral deficiency (probably boron).

•POTATOES: Sunken eyes signify lower quality (probably short on manganese).

•MATURING GRAIN FIELDS: Dr. Skow says that a golden color is much to be desired.

•ANY ITEM: Bright pure color, whether in cut flowers or cut watermelons suggests higher quality.

•ANY ITEM: Slime or mold can be washed off the surface, but it has grown throughout the item. Reject such food. Remember that high Brix produce will not rot in storage, therefore rotting in storage is a sign of poor quality.

EXPERIENCE

You will start using a refractometer timidly. You will think that identifying HIGH QUALITY food could not be so simple. Then, as you become experienced, you will learn that it really is so simple. For instance…

•You will put back the watery, tasteless, low Brix tomato.

•You will smile at the vendor's "pretty" string beans and ask when he expects to get good tasting beans.

•You will insist on a small sample of melon or pineapple... or forgo buying, because you are tired of taking low quality melons and pineapples home.

•You may sometimes buy marked-down items, or some of the 'canning' peaches because your test proved them HIGHER QUALITY than the 'picture pretty' produce. You will begin to expect HIGH QUALITY produce and you will start getting HIGH QUALITY produce.

•You will get HIGH QUALITY produce because you will be able to identify HIGH QUALITY

With practice you will casually get the test-drop and only quickly glance in the viewfinder. You will rarely be fooled. Some buyers actually have the vendor give them a drop of juice to test. You will teach your children---and their children---how to select proper food.
You will share, and help your children re-discover, the yummy taste of the HIGH QUALITY fruits & vegetables humans deserve.

No one will have to convince you that you are providing you and your children superior nutrition.
That is because you will convince yourself!

Indeed I am! We've endured commercial "food" that quickly rots in storage for so long that we now think produce is supposed to rapidly decompose. Years ago, when I first heard of this "won't rot in storage" concept, I decided to conduct some kitchen tests. I really didn't need to test low Brix food because I had already spent a lifetime learning that typical produce rotted quickly. Anyway, I started sitting items of high Brix food on the windowsill to see what would happen.
Wow! What a revelation. As the days went by potatoes, peppers, oranges, even lettuces simply shriveled up as they dried. I had been warned that tomatoes were an exception and I found the warning valid.
Perhaps some curious scientist will delve into this anomaly and report back. Currently, I think the "water activity" notes published by CSIRO in Australia may best describe the rationale behind the seemingly bizarre "high Brix food won't rot" concept.

SOME NOTES ON AGE AND TASTE ABILITY

Babies are born with the ability to detect four tastes (sweet, sour, salty, and bitter). Those four, along with the sense of smell, are provided to help guide our young toward the proper food needed to develop to maturity (and to remain healthy).

Sadly, many babies are sent on a lifetime journey of confusion. The child at the table is often told, "eat it, it's good for you." Young as he is, the child knows the food tastes bad (or has no taste), but must eat it to avoid starving. Oft times sympathetic (and loving) parents add butter, sugar, or salt to induce the child to eat what the child's senses clearly tell them isn't proper food.

Far too often the child will mature into an adult with a mangled sense of taste molded to such as sugar, salt, and artificial flavors. Frequently, unless intervention occurs, the now-grown child will, in turn, ignorantly distort the instinctive taste abilities of their own children.

Food manufacturers are driven by the profit motive. They will continue to seek cheaper ways to produce "food." This generally means they will use lower quality flavorless food and try to improve its non-flavor with those sad low-cost adulterants: sugar, salt, and artificial flavors. Older readers may well remember the WWII phrase ersatz food. The term referred to the attempts by German chemists to create "food" from industrial byproducts such as sawdust. These created products were destined for ordinary people in the occupied countries. Meanwhile, the higher quality farm output in those same countries was earmarked for Nazi consumption.

Medical texts claim that taste ability declines as people age. That may be true in an absolute sense, but almost all older people report that HIGH BRIX food tastes wonderful. Possibly, the reported loss of taste only applies to artificial flavors and other adulterants.

*My late wife was asked to participate in a number of studies conducted by the National Institutes of Health. Among the more interesting were a series of "scratch & sniff" evaluations, some at Bethesda MD and some via mail at home. When I interviewed the doctors, they made a convincing case that they could evaluate one's health *or* non-health by how well they could smell. They were particularly interested when my wife couldn't smell something that she was sure she once could smell. I sometimes think back to her problems when I'm holding and smelling a particularly delectable peach. Obviously, the thrill that runs through my body is not triggered similarly by those sad 10 Brix imitation peaches in the store.*

SAVING MONEY

How can buying HIGH QUALITY fruits and vegetables save you money? An almost instinctive thought is that it must be the other way around.

An ancient proverb insists that the pleasure of purchasing QUALITY persists long after any difference in initial cost is forgotten. Can you not remember that, say, scrumptious peach or pear that accidentally found its way to your plate? What you are remembering is, say, 18 Brix instead of the 10 or 11 Brix fruit on most stands. If the purpose of buying food is to get the minerals needed to create bodies, then buying more Brix per dollar represents the wisest possible savings. Almost all doctors agree that eating more fruits & vegetables leads to far better heath along with less hospital and nursing care. At first thought you may worry that your family will consume far more of any better tasting, more highly mineralized (HIGHER QUALITY) fruits and veggies when you locate such. However, it doesn't work exactly that way. Indeed, once their bodies catch up on minerals and quit demanding endless empty calories, they will often surprise you by becoming sated much sooner and on smaller quantities. Livestock owners are quite familiar with this phenomenon and know the true economy of feeding quality forage. One producer of soil remineralization products uses the 6 bales = 9 bales concept to illustrate the value of his product when feeding hay. He points out that the feed value of hay produced with his product tends to run 50% higher than that produced by others.

Progressive dentists know that the higher mineral content of higher quality fruits & vegetables leads to healthier teeth and gums. That wonderful classic, "NUTRITION & PHYSICAL DEGENERATION" by Dr. Weston Price (available from Price-Pottenger Nutrition Foundation 800-366-3748 or the author) makes a strong case that highly mineralized food prevents ANY tooth or gum problems.

Saving money by first identifying, then buying and eating HIGH QUALITY food only follows:

•It's possible you will spend less for intensive doctor care...

•You may avoid a nursing home...

•Your dental checkups could become checkups only...

•You could avoid buying poor quality food that you later throw out...

•Your meals may shift away from high-priced manufactured food to more wholesome basic fruits & vegetables...

•You may even purchase and eat less total food because your body's hidden hunger for missing vitamins and minerals will lessen as you obtain HIGHER QUALITY food...

•Finally, you more than likely will free yourself from purchasing bottles upon bottles of vitamins and other food supplements because you will be getting more generous amounts of higher quality vitamins and essential body elements exactly as your body is designed to get them: from your food...
And the truth shall set you free...

E-MAIL SUPPORT FOR THE COMPUTER USER

The author moderates an e-mail list dedicated to food quality.
Simply send e-mail to BrixTalk@yahoogroups.com and follow the directions. Please also feel free to report any Brix results from either food you buy or food you grow. If it is something you bought, identify it as best you can as other readers may want to go buy some of that particular brand. If it is something you grow for sale, say so and include ordering information.

ACCESS TO TOOLS

Refractometers and charts are available from:

•Pike Agri-Lab Supplies Inc. RR2, Box 710, Strong, ME 04983 (207-684-5131).

•Most biologically-oriented farm & garden suppliers now carry and endorse refractometers.

•Various wine supply houses stock Brix refractometers and hydrometers.

•Online auction houses, such as eBay, always have refractometers listed.

•The author, Rex Harrill, PO Box 6 Keedysville, MD 21756 301-432-2979 will assist anyone who cannot obtain an instrument.

REFERENCES

•The Anatomy of Life & Energy in Agriculture, Dr. Arden Andersen. Acres USA, P.O. Box 91299 Austin, Texas 78709 USA

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•Mainline Farming for Century 21, Dr. Dan Skow, Acres USA

•Nourishment, Home Grown, Dr. A. F. Beddoe, S & J Unlimited, P0 Box N, Oroville, WA 98844
•How to Grow Great Alfalfa, Dr. Harold Willis
•Numerous articles in ACRES USA, P.O. Box 91299 Austin, Texas 78709 USA (800-355-5313)
•Taped interviews and transcribed seminar notes attributed to the late Dr. Carey A. Reams

WHERE DO WE GO FROM HERE?

While the above procedures work well for many, increasing numbers of large-scale growers are paying close attention to the full range of in-field tissue tests being highlighted by companies such as Pike Agri-Lab in the US and Australia's Nutri-Tech.
These methods, which employ not only the refractometer, but also pH and conductivity tests (of soil and plant), are gaining a worldwide reputation for putting profitability back into farming. High quality food production is no longer a hit or miss situation. Perhaps of even greater interest, the Brix/pH/conductivity parameters are making it possible for large-scale growers to farm at vastly decreased toxicity levels because they are growing crops that are far healthier.
Many consumers are quick to condemn farmers for using so many toxic sprays. Few stop to think about how unhappy the farmer is that no one has shown him ways to grow abundant crops, poison free. After all, in most cases the farmer is the one getting the brunt of those toxins.
The Pike Tissue Test methods are fully detailed on Worldsite Crossroads
No matter how or where you may have obtained an instrument, questions can always be directed to Brixman@wideturn.com for prompt and courteous response.

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