What follows are the beginnings of my critique and study of all the works I was able to gather generated by Carey Reams when exlaining his pioneering agricultural concepts and by his students when they attempted the same. My thought as I go into this project is that if I can critique, compare, and explore 250-500 of the most common terms used by Reams we should have a fair idea of what he wanted us to understand. If you are seeing these words and feel you have something positive to contribute please know that it will be welcomed. VERSION 0.5

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PREFACE

A great deal has been written about Carey Reams agriculture, both before and after he left this earth in 1985. The goal of this project is to track down as much direct Reams-related material as possible including books, audio files, and transcripts. The information can then be arranged in a meaningful array and in such a manner that his basic concepts and tenents show through clearly.

While it is possible, even ordinary, to teach or explain Reams' original agronomic thoughts by studying those materials or books and then writing a new book, that is not the intent here. Instead, this manual is designed from the start to simply extract short excerpts about hundreds of terms from almost two dozen RBTI-slanted source documents and hold them up to the light for comparison. Perhaps then we can determine which author, lecturer, or student "got it," which almost "got it," and which might not have gotton it at all.

"RBTI?" Anyone reviewing this manual should not go much further until they understand at least something about the Reams Biological Theory of Ionization. While the purpose here is not to boldly teach the theory, there is no harm in saying that at its core, Reams taught that in higher organisms cells are constructed, or ionized---ion by ion---into place with no acceptance of mainstream chatter that cells divide. As far as RBTI is concerned, the much-promulgated division process is left to single-celled organisms, if they are freely living and not connected to the nervous system, or if they are corpuscles of a higher organism. Ionization proceeds at a speed set by energy supply and also availablility of building materials, i.e., minerals.

Reams often opened his lectures by making a strong point that it all starts with energy, energy itself. He then explained that at an atomic level particles interacte in such a way that inherent energy is "lost" as those particles tend to reach a synchronization, or resting point. "Lost" is italicized here because there is no loss at all. Living organisms, plant or animal, stand at the ready to harvest that freed energy for their own purposes---to carry forth their life and anatomy to its full genetic potential. Many students still find the original Reams class handout that shows rotating and counter-rotating ions quite illuminating when exploring the idea of harvesting energy. For that reason the diagrams are reproduced on the back of this manual.

Reams' agricultural genius started showing when he perfected a way to assign energy availability to fertilizers and other elements at an ionic level. The computational tool he used was the Milhaus unit of energy, which gave respective value to the potential power of the parts of atoms, as determined by their

atomic weights. This assignation of the energy values of the various elements allowed easy calculation of fertilizer values and, therefore, the probable size and quality of a crop long before harvest. While there are those who scoff at the Milhaus theory, the fact remains that it offers a way to compute available energies in the soil and actual yield at the end of the growing season. This is something that all the Kings of Agriculture in all their ivy-covered towers have yet to do.

However, fully explaining the RBTI is far beyond the scope of this document, which is a simple critique and comparison of who said what, when they said it, and often why they said it, all when discussing the agricultural side of the RBTI. As stated above, the only purpose here is to excerpt what authors, including Reams, had to say about a limited number of terms or concepts. The hope is that when those excerpts are held up for review, a certain amount of fundamental truth may shine through.

Be warned that there are detractors from the RBTI. Some will tell you that the Brix concept is of no use. Some will tell you that it is impossible to grow crops that cannot rot. Others will deny that there is any difference in crop quality---that any fruit, vegetable, or grain can sustain life equally. The list does go on and this document is not meant for them. Let them go their way. Let them keep seeking the not-yet-developed poison to be sprayed for the pest or disease that they are sure will one day come over the horizon. I fully expect people who think that simplistic way to use the material you hold in your hands to discredit the RBTI and its promise of high yields of disease-free crops. Please feel free to ignore them and proceed.

SOURCES

ADVANCED AG: *Although obtaining a full transcript of Carey Reams' March 1981 Advanced Ag seminar was not possible, pulling out excerpts from the audio disks so as to critique and compare has not posed a problem.*
http://www.pikeagri.com/component/virtuemart/audio-seminars/new-dr-carey-reams-1981-march-advanced-ag-seminar-detail?Itemid=0

AG LECTURES: *One of Thomas Giannou's clients handed this 255 page transcript of a Reams seminar to him one day and requested it be shared with the world. The donor requested anonymity and Giannou has respected both requests. The full transcript can be downloaded for free from his website.*
http://www.tandjenterprises.com/reams-black-session1/Agriculture-Reams-year-unk.pdf

ANDERSEN: *Dr. Arden Andersen's "Science In Agriculture," covers much more than his take on Carey Reams' Biological Theory. Published in 1992, new copies are still sold in the ACRES USA bookstore.*

BEDDOE: *Dr. Alexander Beddoe first published his "Biologic Ionization In Farming & Soil Management" in 1985. Apparently, his intention from the beginning was that the farm book would serve as a companion to his highly-regarded "Biologic Ionization as Applied to Human Nutrition."*
http://www.advancedideals.org/

FOLIAR FEED 1981: *While a transcript is unavailable, the index combined with transcribing short excerpts from the audio disks allows for an easy critique and comparison of the rules in this work to be contrasted with other documents.*

The audio disks are available from Pike Agrilab.

FOLIAR SEMINAR 1983: *This edition was prepared with the aid of the track listing of the audio disks available from Pike Agrilab.*

FWTK: *Dr.Skow published the 23 page "The Farmer Wants To Know" booklet in the 1970s as an introduction to Reams-style agriculture. The lessons are timeless and copies are available for a small fee from IAL.*

FWTK-pH: *"The Farmer Wants to Know About pH & Energy" has an interesting history. Supposedly, Reams wrote it in the 1950s, possibly as a seminar handout. Sometime after Dan Skow became his top agricultural student in the 1970s, he turned it over to Skow and suggested it be republished under Skow's name. Skow did so and IAL still keeps the booklet in print. A side note is that a rumor persists that Skow's admitted "revision" mentioned in the opening page consisted of several changes in the manuscript to make the work more acceptable to mainline soil scientists. As both Reams and Skow are deceased, there is no way to either prove or disprove the story. An effort was made during preparation of this book to not include any section for critique that is not fully supportive of Reams' views in other documents. Obtain from IAL link above.*

FRANK: *Jon Frank of International Ag Lab is a confirmed senior Reams student. From time to time he releases transcripts of field interviews that are developed with his better fellow Reams students. The Frank references here include his "30 Emails in 30 Days," which he is planning to use as the core of a Reams Ag book.*
http://www.aglabs.com/carey-reams.html

GARDENING: *Is a 28 page transcript of a Reams audio lecture that was discovered in the Bob Kilian archives. The actual work was performed by Debbie Rich, a dedicated member of the BrixTalk newsgroup.*

JOHNSON: *In the late 1980s or early 1990s, Dwight Johnson edited and published a 186 page transcript of a Dan Skow seminar on foliar feeding deeply rooted in what Reams had laboriously taught Skow over the years.*
http://www.amazon.com/FEEDING-Printed-Transcript-Research-Development/dp/B003M6RWXM/ref=pd_rhf_se_p_dnr_6

PLANT FEEDING: *Carey Reams conducted a 5 day plant feeding seminar in 1976. This 257 page transcript of the audio record appears to "cover it all" as far as Reams Biological Theory of Ionization applies to farming.*

PLANT FEEDING AUDIOS: *Pike Agri-Lab worked with the old audiotapes of the same 1976 "Plant Feeding" and produced a 185 item series of audio clips covering the more important points.*

REAMS/SKOW COOKING: *Is a 104 page transcript of a cooking class rich in RBTI theory that was conducted by Reams in 1982 at Dan Skow's offices..*

SAIT: *In 1998, Nutri-Tect's Graeme Sait recorded and published an 8 page interview with Dr. Arden Andersen, who is both a Reams-oriented agronomist and an osteopathic doctor.*

SKOW: *Although Charles Walters, Jr., editor of ACRES USA actually wrote the book, Dr. Skow's "Mainline Farming For Century 21" is considered to be Skow's faithful testament to the biological theories he was taught by Carey Reams.*
http://www.amazon.com/Mainline-Farming-Century-Dan-Skow/dp/0911311270

SUCROSE: *Reams' "Sucrose Yield" technical paper has been difficult to date. The phone number and address on the front of this 10 page report easily lead one to suspect 1950s or even before. You can downlaod a free copy from this link.*
http://www.wideturn.com/

WHEELER: *Dr. Phil Wheeler is a partner in Crop Services International, of Grand Rapids, Michigan. He and Ronald Ward published the 236 page "Non-Toxic Farming Handbook" in 1998, which leans heavily on Carey Reams science.*
http://www.amazon.com/Non-Toxic-Farming-Handbook-Philip-Wheeler/dp/0911311564

PLEASE CLICK THE ITEM YOU WISH TO REVIEW
(clicking [HOME] returns you here)

ACID, HUMIC

ANDERSEN: As with the application of sulfuric acid and gypsum, some people [foolishly] reason that if a little [humic acid] is good, more must be better...

ANDERSEN: In negligibly small concentrations (0.001% and 0.0001%) they **[humic acids]** enhanced growth and increased the yield of wheat, oats, barley, sugar beet, tomatoes and other plants. The action of humic fertilizers was tested by the author in different soils. In all cases the effect was positive.

ANDERSEN: This [burning out the soil] is why anhydrous ammonia should not be used directly on the soil. Instead, it should be mixed with water to form aqua ammonia and a carbohydrate like sugar or molasses to help retain it in the soil, and some humic acid to help chelate it for better use rather than reducing further the soil's already **depleted humic acids**.

ANDERSEN: An interesting additional note about **alkaline extracted humic acid** products is that once they are applied to the soil and they are exposed to a pH less than 7, the humic acid precipitates and has little or no activity or benefit. The acid soluble fulvic acid component of the humate is the only component that remains active to give

soil/crop benefit.
SAIT: Graeme: We have had tremendous results with **humates and humic acid**, and I'm aware that it is possible to use too much of a good thing with these materials. What are the negatives associated with overuse? Andersen: There are two problems here. I agree that humates can provide an invaluable boost to fertility, but, if overused, they are capable of tying up valuable nutrients. Humates have the capacity of binding pesticides and toxic chemicals in the soil.
SAIT: Graeme: Yes, it's much the same with compost production. Your compost will only be as good as the ingredients it contains. The home gardener's lawn clipping compost is a prime example. If they were to add rock phosphate, **humic acid**, animal manure and molasses to the clippings, their end compost would be far more productive.
SKOW: The **need for humic acids** in a soil is very small. Too much is worse than no application at all. When humic acids are applied in liquid form on, say, the worst sands in Arizona or New Mexico, a gallon would be too much. Most of the time a pint to a quart per acre would be indicated.
SKOW: All plant root systems have a base exchange, and as the old rootlets drops off and new ones establish they supply nutrient for the bacteria introduced at planting time. This rootlet residue is rapidly **converted to humus and humic acids** which are powerful chelating agents and help the plant acquire plant foods more readily.
WHEELER: When nutrients are low on a CEC test they usually need to be added. When the calcium percentage shows less than 60 percent, many (most?) microbial products, including **humic acid**, don't work that well. Microbes need calcium to live. \ [HOME]

ACID, SULFURIC

ADVANCED AG: Spray **sulfuric acid** to fix magnesium problems.
ADVANCED AG: Use commercial grade [battery] **sulfuric acid**.
ADVANCED AG: Reams: You need 2 gallons sulfuric acid per 100 gallons of spray. Skow: The other way to do it is hydrogen peroxide. Student: There is no sulfur in hydrogen peroxide. Reams: Anyway, **sulfuric acid is cheaper** than hydrogen peroxide.
ADVANCED AG: Make sure 0-20-0 is made with **sulfuric acid**.
AG LECTURES: Reams: Sulfuric acid is an electrolyte. In certain alkaline soils, we **use some sulfuric acid,** but suppose we didn't have an alkaline soil. What would we use? Student: Aluminum? Reams: No, use super phosphate about 100 lbs. to the acre and that releases a lot more energy.
ANDERSEN: This sheds some light on why there appears to be an opening of the soil after gypsum or **sulfuric acid** is applied. The SO4-- anions cause dispersion of the clay colloids in a thinning action.
ANDERSEN: As with the application of **sulfuric acid** and gypsum, some people reason that if a little [humic acid] is good, more must be better...
BEDDOE: Acids (cations) coming into contact with bases (anions) are heat and energy producing because of the resistance between the anions and cations. Whatever organic or inorganic substance there happens to be in the soil also takes part in this chemical action and can be affected by it. These types of reactions, if too strong, can cause calcium and phosphate as well as carbon to be oxidized to the point of leaving a very low plant food bank account of soluble nutrient. You can experience this heat loss by placing a small amount of **strong acid like sulfuric** in water. The water will immediately get warm. It is this type of reaction heat from anion-cation encounters that causes burning and dehydration of the roots. The result can be seen as a sudden die back in the leaves because of reversing the normal osmotic flow. So the water in the plant is drawn right out through the roots. Only abundant water will compensate for this problem until the reaction weakens.
BEDDOE: Ammonium Sulfate is made by reacting anhydrous ammonia with sulfuric acid.
BEDDOE: Sulfur is a very active material, because when it contacts the soil moisture and bacteria it has the **effect of sulfuric acid**. This means it creates a lot of resistance as well as heat. The ideal time to use flowers of sulfur is when the soil is in a very wet condition and the weather has been cool.
FRANK: I'm going to clarify what Inferno [the product] is--it's a **sulfuric acid based fish** with extra acidity, extra sulfuric acid, just a little bit to drop the pH a little lower.
JOHNSON: Student: How come most of the [trace element] minerals have sulfate added to them? Skow: OK, the sulfate is mainly a mineral salt, and that is the only way they are water soluble. In other words, they have been treated with sulfuric acid. See, if it was in oxide form, it wouldn't go into solution so what they do is they take it with **sulfuric acid** and then they dry it to make it soluble in water.
PLANT FEEDING: For instance, if you added 1 ton of superphosphate per year you would have 1,000 lbs. of **sulfuric acid added to that acre**. Do you realize that? You take hard rock phosphate, 1,000 lbs. of it and 1,000 lbs. of the top quality highest hard rock phosphate and you will come up with the 20% phosphate- water soluble, and the rest

will be sulfuric acid and sodium filler . Then you will have approximately a thousand pounds of sulfuric acid absorbed and soaked into that material. It is highly acid forming and you won't grow an/thing on that acre from 3-5 years.
WHEELER: Sulfur could be applied as **dilute sulfuric acid**, thiosul or ammonium sulfate. \[HOME]

ALCOHOL

AG LECTURES: Reams: The higher the sugar content, the higher the mineral content and the higher the sugar and mineral content, the less bugs you have. Why? Student: The **alcohol kills them**? Reams: Yes, the alcohol kills them, but there's another reason too. There's one more reason I haven't told you about. It increases the oil content and it gives him a physic. That's right, that is exactly what happens. In other words he gets diarrhea.
ANDERSEN: Some nutritionists advocate feeding cattle alcohol as a quick energy source. That it is, but it has very detrimental effects. **Alcohol suppresses rumen bacteria**. It also causes calcium to precipitate and thus become unavailable. When the alcohol enters the blood, it also precipitates blood calcium (resulting in plaque build-up or hardening of the arteries); alcohol further stresses the liver, precipitating calcium and causing cirrhosis of the liver. Animals that **are fed alcohol** are certain to need more mineral supplementation which is convenient if you are selling both.
FWTK: Most laboratories use carbon disulfide, **alcohol** and strong acids to dissolve the elements in the soil. This type of test may show a forty-year supply of calcium, phosphate or potash, and yet these may not be available to the plant at all.
FWTK: Damage-produced from chewing insects [in high Brix plants] is also reduced because of the oxidation of the sugar in the sap of the plant into alcohol. The **alcohol intoxicates the insects**, killing them or making them sick in the process. This can only happen if the plant contains a high sugar content.
FWTK pH: All soil solvent testing reagents that are foreign to what is available in the soil should not be used. They are unreliable for the same reason that the flame photometer is unreliable. **Where could plants go to get alcohol** or carbon disulfide to dissolve the oxidized plant food?
FWTK pH: The higher the sucrose content of the fruit or vegetable crop, the lower the freezing point. When fruit freezes and the **sucrose turns to alcohol**, the fruit is headed for skid row rather than th farmers market.
GARDENING: The moth knows by instinct that where she stings the plant leaf and lays her eggs a small drop of sap will come out of the plant. And these little worms will eat on that sap until they get big enough to eat the leaf. But suppose that little drop of sap that comes out is very high in sugar content. When that sugar content then strikes the oxygen content of the air, **it's going to ferment and turn to alcohol**. And those little worms are going to get drunk and roll off of that leaf into the ground and the bacteria are going to eat them and you'll have a garden without any worms in it.
PLANT FEEDING: If you have a lot of sugar in the plant and the bug bites it or the moth lays its eggs there or punctures it in the least, this sugary sap will leak out in a day or so when the worms hatch. By that time the sugar has turned to alcohol and that bug gets drunk and falls off on the ground when tne sun hits him. Just rolls up and rolls off. Do you know what happens to him? The bacteria In good soil eats him up before the day is ovar and that is the end of him.
SAIT: We [Andersen speaking of overusing molasses] start getting decreased biology and even fermentation, and the **associated production of alcohols**, which are not good. We start precipitating calcium when we get alcohol and we can start the process of sterilization.
SKOW: An unbalanced equilibrium of calcium and magnesium **permits organic residues to decay into alcohol**, a sterilant to bacteria; and into formaldehyde, a preservative of cell tissue.
SKOW: In a field that has high energy and a high sugar content in the crop, **alcohol is produced**. A human being can consume alcohol with moderation. An excess can cause diarrhea, but diarrhea in a human being is nothing compared to the same malaise in an insect.
WHEELER: To moldboard plow residue 8 to 10 inches deep in this soil condition is to almost guarantee that there will be little decay system and no new humus formed. The aerobic bacteria will be buried below the oxygen level while the anaerobic bacteria will be left on top exposed to the air. The residue will ferment**, producing an alcohol** or aldehyde.
WHEELER: [Higher Brix plants] will **produce more alcohol** from fermented sugars and be more resistant to insects, resulting in a decreased insecticide usage. \[HOME]

ALFALFA

ADVANCED AG: **Alfalfa** takes more mineral from the air and requires less potassium from the soil.
ADVANCED AG: Some types of **alfalfa**, corn, or soybeans require less water than others. Experiment and discover

them.
ADVANCED AG: If you have no pith at all in pasture grasses **or alfalfa**, you have boron deficiency.
ADVANCED AG: Calcium nitrate can greatly increase brix and yield of **alfalfa**.
AG LECTURES: Remember, **alfalfa has the ability** to take practically all its potash from the air.
AG LECTURES: Did you ever take a leaf of alfalfa, sugar cane or corn and examine it closely and see little black dots in it? Have you noticed that or on the stem? **Have you seen little black dots appear on the stem of alfalfa?** Did you really look that close? That's too much potassium in the soil. How many have seen those little black dots? Have you noticed it on peach leaves, orange leaves, any crop?
AG LECTURES: Student: You said a 4 to 1 P and K for grasses, **do you consider alfalfa a grass**? Reams: Yes, sugar cane too is a grass. Corn is not a grass.
AG LECTURES: You would not **ever want to use a chelate on alfalfa**. Why? Student: Anionic instead of cationic? Reams: That's not the reason, but it's a true statement. Why? If, say you were growing out in Colorado, California, Arizona, Idaho, Nevada, you would not use chelates there. Why? Student: Well, the calcium is high out there. Reams: The calcium is high. That's exactly the right answer. Calcium is high. So what happens when you use a chelate in a high calcium soil? It loses its leaves, all the leaves fall off. Why? Because it thins the protoplasm that holds the leaf onto the stalk. Nothing to hold it on. The leaf is held onto the stalk by protoplasm. Did you ever break a leaf off and look at it about 3 minutes later under a glass and you saw a little jelly-like substance form in there? It's that little jelly-like substance that holds that leaf on the plant. And what happens when you use a chelate on a carbonate soil, high calcium soil? It sheds the leaf off. Many times this happens naturally in your soil and you don't want it to. Therefore the **alfalfa leaf sheds off**, you start to mow and the leaves all fall off. This material has been chelated and you don't want this to happen in a high carbonate soil. We are going to learn more about that later when we study soils and how to prevent it. But do not use a chelate in a high carbonate soil.
ANDERSEN: If cellulose is nitrated it forms nitrocellulose, which is used in the manufacture of explosives, collodion, and lacquers. Add **excess potash to alfalfa, displacing calcium, and you will have "gunpowder hay**" by the formation of potassium nitrate and
nitrocellulose, which form when phosphate is insufficient to catalyze the proper formation of protein and other metabolites.
ANDERSEN: Alfalfa and small grains commonly have hollow stems. Farmers are told that this is a genetic trait. However, a few years of proper nutrition can fill in those stems, raising both the yield and nutrient content of the crop.
ANDERSEN: The nutrient ration that is suitable for ocean plants would be **deadly for freshwater plants or alfalfa**.
ANDERSEN: Using the Reams soil-testing method, this ratio should be 2 pounds of phosphate to 1 pound of potash for row crops and **4 pounds of phosphate to 1 pound of potash for alfalfa** and grass crops.
BEDDOE: Potassium is what determines the caliber of a corn stalk or the caliber of an **alfalfa stem**.
BEDDOE: Alfalfa can have this [black spots on leaves] happen and the condition is said to be a virus. The problem is actually a potassium excess which opens the way for the virus to set up housekeeping.
BEDDOE: A dairy cow which is **eating alfalfa** that has a 16 Brix sugar level will need only 10-l2 pounds of l2 Brix grain mix to produce 100 pounds of milk. But the same cow eating 7 Brix alfalfa will require 30 pounds of the same gain to produce 100 pounds of milk; besides that, the cow is very vulnerable to disease.
BEDDOE: Hollow stems on grasses and forage crops, such as alfalfa, are not normal. It is an expression of phosphate of boron deficiency.
BEDDOE: Remember, that "normal" in agriculture, as in medicine, basically means an average of a bunch of sick things. In other words, if production levels of a certain farm crop such as alfalfa is randomly sampled and averaged it would show that high
"normal" alfalfa production is around 6-7 tons per acre. However, what this statistic does not tell us is what was the soil condition of the fields that the production information was sampled from. If the farmer does not scrutinize this kind of "normal" information he will never realize what the real production potential could be for his particular crops. And **in alfalfa that should be at least 20 tons per acre** with a six month growing season.
FOLIAR FEED 1981: Be cautious of nitrogen toxicity in fresh cut **alfalfa**. It is best fed as hay.
FOLIAR FEED 1981: Student: When should we last foliar feed soybeans? Reams: About 5 week after blossoms are done. Student: How about corn? Reams: Until it is well past the milk stage. You **can cut alfalfa** when 50% of the blossoms are open. You can spray the day before cutting.
FWTK: Part of the commercial yields achieved with the Reams program are: **20 tons per acre of alfalfa** at 28% moisture; 200 bushels of corn per acre as a starting point; 100 bushels per acre of soybeans; two bales of cotton per acre; 90 bushels per acre of wheat; 4,500 lbs., per acre of peanuts; 40,000 lbs. per acre of watermelons at l2% sugar; 1.000 boxes of oranges per acre; 20.000 quarts of strawberries per acre at 10-12% sugar; 20 tons per acre of cabbages - the list goes on and on.

GARDENING: There are people growing alfalfa today, 4 or 5 tons per acre, who think they are pretty good because that's what the neighbors do. They ought to be ashamed if they cannot produce **20 tons of alfalfa** per acre in a six month growing season.
FRANK: In **alfalfa, we have seen yields triple** when K-Mag was applied to relieve poor xylem circulation. Another circulation problem impairing successful foliar feeding: The stems of alfalfa and small grains such as wheat or oats are often hollow, lacking adequate phloem tubes which carry nutrients from leaves to roots and other parts of the crop. With proper basic nutrition, you can create much larger phloem tube pathways, visible as pith in stalk cores. Look for solid stem alfalfa.
FRANK: Crops with an outside bark over xylem tubes such as trees, **alfalfa**, or sunflowers may have a copper deficiency which doesn't allow the bark to stretch, making foliar nutrition futile.
JOHNSON: Student: You said you were going to say something about Vitamin C yesterday. Skow: OK, vitamin C. This is one we have come up with and have found to be very successful in legume crops. That means peas, string beans, **alfalfa** and bell peppers.
PLANT FEEDING: Remember one more thing. **Alfalfa is a grass** and If the 1-5-.5 ratio between your P205 and your potash gets higher than that on alfalfa, you know what's going to happen? It'll go to blossom when it is waist high. [Reams then held out the possibility that alfalfa could grow 12 feet high]
PLANT FEEDING: The ratio between phosphoric acid and potassium is 2:1, two phosphate and one potash **except alfalfa** and grass with the ratio of 2.5 to .5 .
PLANT FEEDING: You should also **carry alfalfa over from year to year**. Don't dig it up and replant each time. Let it come up from its roots each time. It's lifetime this way is at least 100 years.
SKOW: I have seen **farmers grow alfalfa, then cut it and watch dehydration virtually make it evaporate**. I mention this to stress again why a farmer needs to understand how a cell is made. When you have a problem with watery crops, calcium is missing in that cell.
SKOW: A soil high in magnesium and low in calcium can test above 6.5, but will be entirely **inadequate for the growth of alfalfa...**
SKOW: The **alfalfa crop is literally annihilated when there is a phosphate shortfall**. Stems will be hollow, and the difference between a hollow stem and a solid stem is the difference between half a yield and a full yield.
WHEELER: When farmers remove every cutting of alfalfa or chop corn for the silo, they are returning little organic matter to the soil. The alfalfa farmer is returning nothing while the corn farmer is returning only the root mass developed during the year. This is poor organic matter practice, and it is why recent emphasis has been given to growing cover crops which will at least provide a green manure to return to the soil. A good suggestion would be to cut and **leave the last crop of an alfalfa field each fall** as an additional humus builder or apply manures.
WHEELER: Farmers have another option when potassium levels are high. Cropping of potassium-loving plants, such as **alfalfa, removes the K** in the harvested crop and it can be sold off the farm.
WHEELER: When farmers inquire [at the extension office] about methods of **raising better (more nutritious) alfalfa**, the conventional answer comes back with recommending 0-0-60, keep the pH up, cut by the blossom, herbicide the weeds, use 18 pounds of seed per acre, and all the other wrong or wrongly reasoned advice. The failure of standard forage fertility programs is appalling.\ [HOME]

ALKALINE

ADVANCED AG: Measure the calcium in the area of the baseline ERGS. If acidic, you add the baseline to the test value. **If alkaline**, you subtract the baseline.
AG LECTURES: Reams: Sulfuric acid is an electrolyte. In **certain alkaline soils**, we use some sulfuric acid**,** but suppose we didn't have an alkaline soil. What would we use? Student: Aluminum? Reams: No, use super phosphate about 100 lbs. to the acre and that releases a lot more energy.
ANDERSEN: An interesting additional note about **alkaline extracted humic acid** products is that once they are applied to the soil and they are exposed to a pH less than 7, the humic acid precipitates and has little or no activity or benefit. The acid soluble fulvic acid component of the humate is the only component that remains active to give soil/crop benefit.
ANDERSEN: Carey Reams, as an ag consultant, used pH in a different way. He looked at pH as a measurement of the resistance in the soil. He observed that the higher the pH, the greater the resistance there was and the more difficult it was to get energy to flow, **particularly if the pH was somewhat alkaline**, in the 8 or 9 range, resulting in nutrient imbalances. On the other hand, he observed that if the pH was moderately low, below 6, there was not enough resistance. This exchange allowed the energy to flow too readily, making it difficult to contain it [and for the plant roots to grab it], again resulting in apparent nutrient imbalances. This seems to be a practical and workable use of pH,

for it addresses the reality of how plants grow through energy exchange. In essence, pH is the result of the nutrient interaction, not the cause. When the nutrient ratios are balanced, the pH will stabilize automatically in the correct range.

ANDERSEN: Nutrients and compounds in the soil **that are considered alkaline** include calcium, magnesium, chlorine, sodium, potassium, salts, ashes, and aldehydes. Their alkalinity is "relative," however, meaning that if you add an item that is less alkaline than whatever else is present, the pH may be lowered even though you added an alkaline material. For example, adding calcium to a high-magnesium soil may actually lower the soil pH.

BEDDOE: Many soil chemists say that when the pH of the soil is wrong that the iron is less available. In other words, when the pH is on the acid side of the pH scale, the iron is much more available than when it is on the **alkaline side of the scale.** This
statement is actually only true if there is not enough available phosphate in ratio to the potassium in the soil chemistry. When there is adequate available phosphate, the pH of the soil makes little difference.

FRANK: Avoid ashes on **high calcium alkaline soils**. Ashes are wonderful fertilizers but you must use them judiciously and at the right time. I like both hardwood and softwood ashes.

FRANK: There may also be some benefit from the slight pH reduction in a spray solution containing CO2: Carbon dioxide reacts with water to form mild carbonic acid, reducing the pH slightly. Generally, an acidic spray solution is absorbed more effectively **than a neutral or alkaline solution**.

FWTK: Soil elements or compounds whose electrons rotate faster than those in water are now classified as an acid in soil nutrients. Those elements or compounds whose electrons rotate slower than those in pure water are said to be alkali. This is a contradiction in the purest scientific sense, but this definition relates to what is considered to be acid or alkali regardless of intricate scientific implications. Consequently, a false impression results in relation to what constitutes sweet and sour, or acid **and alkaline**, soils.

JOHNSON: Some other things to watch out for when foliar feeding; If the pH of the water is extremely high **or extremely alkaline**, it probably is not going to be nearly as effective as far as being taken in by the leaf. Basically what you are looking for is something that is equivalent to fog that you can condense into water. That would be your ideal. The temperature of the water should be very close to the air temperature.

PLANT FEEDING: The liver manufactures the substance called bile **which is alkaline**, which is anionic. When cationic foods touch the anionic bile from the liver, energy is given off because of resistance. That's what we live on. That's what we're studying today. How to produce the most food with the highest nutrient value (TDN - total daily nutrient) required to maintain a plant or animal.

SAIT: Andersen: In plant growth there is the Yin (female) or acid energy, and there is also the **Yang (male) or alkaline energy.** Do you want to set fruit or do you want to get growth? If we want fruit and we have established a good calcium base, either locally or regionally, then I can apply an acid-based foliar and I can set fruit with that. There is a common problem with orchards and grapes, where we have one good year followed by a poor year. This is a nutritional problem.

SKOW: Phosphorus compounds in soils are slowly released to plants during the growing season and their availability is difficult to determine by chemical tests. Both acid and **alkaline soils** fix phosphorus in unavailable forms and annual fertilization may often be required.

SKOW: Let's consider a soil with anaerobic bacteria quite high. Aluminum could flip- flop in such a situation, but probably remain low. The soil would be sour and **highly alkaline** — with lots of calcium unable to release its energy due to a lack of air flow, carbon and water circulation.

SKOW: The age old problem of acid and alkaline requires steady scrutiny, with full appreciation of what pH means and what it does not mean. If a soil is tight and permits no circulation of air, it will probably be **both acid and alkaline**. If you were to run a water soluble test on this, more than likely you would find no calcium, but this would suggest a fair amount of calcium but no energy. There is a requirement for carbon and air circulation.

WHEELER: Although pH is usually thought of as a measurement of acid **or alkaline properties**, it can also be thought of as a measurement of energy flow. This "energy" flow definition is helpful in understanding pH for farming applications.

WHEELER: It is generally held that a clear, distinct line separating the blue and white fields indicates a more acid condition while a fuzzy line indicates better calcium levels and a **more alkaline condition**. \[HOME]

ALUMINUM

AG LECTURES: Reams: Sulfuric acid is an electrolyte. In certain alkaline soils, we use some sulfuric acid, but suppose we didn't have an alkaline soil. What would we use? Student: **Aluminum?** Reams: No, use super phosphate about 100 lbs. to the acre and that releases a lot more energy.

AG LECTURES: Student: What does **aluminum do for soil**? It's not a soil nutrient or plant food nutrient. What does it do for soil? Why is it important? Is it important? Is it a catalyst? Reams: No sir, but you're getting mighty warm. Student: Is it a conductor? Reams: Right---it is an electrolyte. It's like little transformers in there. Picks up the electrical charge and makes the soil carry an extra bit of current through the soil.
AG LECTURES: How could **aluminum lead you astray in the soil**? How could it fool you? Student: Make you think you have a nutrient when you really don't. Reams: How would that show on a soil analysis report? Student: Say there's more energy than there really is? Reams: That's right, you'd say there's more energy there. Now what makes energy? Student: Anions and cations. Reams: And how does that show on your chart? Student: As ERGS? Reams: No, not as ERGS, not as ERGS. Student: pH? Reams: pH, that's right. It's a measure of the resistance. It can make you think you've got more resistance than you have got there. It can lead you astray. pH is always a measure of resistance. It can fool you, it can lead you astray.
BEDDOE: Therefore, iron is **heavier than aluminum** and iron will also float on boiling lead. For this reason, heavier elements in the soil naturally go down and very often too far down out of the range of the plant roots.
BEDDOE: Metallic substances, such as iron, sulfur, and **aluminum are often the culprits** that give low pH readings in soil where there is already an over-supply of water soluble calcium.
FWTK pH: Metallic substances, such as iron, sulfur and **aluminum**, are often the culprits that give low pH readings in soil where there is already an over-supply of water-soluble calcium.
FWTK pH: Therefore, iron IS heavier than **aluminum**, manganese is heavier than magnesium, and iron will float on boiling lead.
JOHNSON: Skow: Common electrolytes are iron, **aluminum**, copper, and one of the other ones that you will see a lot written about is magnesium and they get a wonderful response. Now the only reason they get a response is that the plant is constipated. And if any of you have had that problem you know that if you can get it moving again, that you feel better. So there is a time and a place once in awhile, where it is beneficial, where a crop stunned or not doing well and looks like it isn't growing satisfactory, and this is particularly important if you have some herbicide damage and you want to flush it out.
SKOW: Let's consider a soil with anaerobic bacteria quite high. **Aluminum could flip- flop** in such a situation, but probably remain low.
SKOW: If you record an erg reading of 1,000 and a pH of 2, this situation could be caused by the sulfur **or aluminum in the soil**. The aluminum in bauxite is what affects the ergs in this way. It is a very common condition in the state of Georgia. If sulfur is the problem, the soil will dry out. Aluminum will not do this. If you have this situation, we would suspect one of these two imbalances, because the pH is down. This is one time when it is important to know the pH. In this case, the way to drop the ergs is to add lime.
SKOW: Aluminum is not required for plant growth but is associated with soil acidity and is harmful to acid-sensitive crops. Liming acid soils reduces aluminum toxicity.
SKOW: A **high aluminum uptake sets up all types of strange things.** It stunts plants, then shrivels them. Under aluminum assault, seeds may not even sprout. These anomalies may not be at once apparent, for which reason the mischief is deferred until animals are fed. A **high aluminum concentration will affect the central nervous system.** If recognized in time, calcium can be used to counteract the effect. There is a product put out by Eli Lilly of calcium gluconate with vitamin D that is excellent.
WHEELER: In the soil, some nutrients tend to rise while calcium and others tend to move downward. A soil left undisturbed will stabilize from the top down in the following layers: carbon, magnesium, phosphate, potash, sulfur, **aluminum**, manganese and calcium.\ [HOME]

AMMONIATION

PLANT FEEDING: Student: Would you use chicken manure on citrus? Reams: Yes, but never dig it in. Leave it on top of the ground. Why? Because the boron will **ammoniate** your trees. It will never hurt citrus if you leave it on top of the ground. Not only that, if you've got your calcium and phosphate, you'll never need to spray your grove. No bugs or insects in it . Spread it from tree trunk to tree trunk evenly.
FOLIAR FEED 1981: If the bark on the tree plant roots is **loose from ammoniation**, you must completely foliar feed the entire TDN.
JOHNSON: When you build a spray, you should always add calcium to it in some form if you are going to put boron in. That is to protect against **ammoniation**. Now, if you have plenty of calcium in the soil, you will be alright.
JOHNSON: But if the carbons are low and you have an excess of boron in relation to calcium or a high salt or sulfur content, you can essentially get **ammoniation** of the plant. Essentially what it does is, it simply kills them.
JOHNSON: When the calciums are too low and the nitrogens are too high, you can get an **ammoniation of the plant**

and wipe them out.
JOHNSON: Without carbon, **ammoniation can occur** which is fatal to aerobic life. Conditions under which ammoniation can occur when carbon is deficient are; excess boron in relationship to calcium and or high salt or sulfur content.
JOHNSON: When spraying boron always add calcium or it **may cause ammoniation**.

NOTE: *Reams' use of AMMONIATION hardly fits with the common definition of a process whereby ammonia is added to straw or other non-digestible fiber to cause a breakdown into at least some digestibility. Perhaps Reams wanted us to share a thought that too much freed ammonia in the soil could harm or "digest" the outer layer of plant roots.* \[HOME]

ANTS

AG LECTURES: Student: Aerobic bacteria also eat live nematodes, right? Reams: Yes, grasshoppers, **ants**, cockroaches, anything else they come across, worms.
AG LECTURES: **Ants** really love cottonseed meal. So if you must add cottonseed meal, you better add a little [harmless] fumigant with it. I would suggest snuff.
PLANT FEEDING: Everytime I've ever used cottonseed meal, I've used about 100 lbs. of tobacco dust per thousand pounds to keep the **ants** and parasites out or it. \[HOME]

ANY CROP

AG LECTURES: Have you noticed it [little black dots] on peach leaves, orange leaves, **any crop**? That's too much potassium in the soil.
AG LECTURES: But also remember this, you can produce many times more on 5 or 10 acres of certain crops, well taken care of, than you can on 40-50 acres, half done or trying to do it all yourself.
AG LECTURES: If you will evaluate your soil by what you've got left over after the crop, it will mean a lot more to you than trying to figure out what you've got before you plant your crop.
AG LECTURES: Student: This crop's taking so much material out of the soil. Suppose the crop takes out, say 50 lbs. of phosphorus out and your test showed 100 lbs. of phosphorus when you started. Does that automatically mean your next test would show you needed 50 lbs. of phosphorus? Reams: Generally speaking when testing soil, at your very best you'll only pick up 70-72%. That's all you'll be able to pick up.
AG LECTURES: Student: How can you measure how much nutrient it's going to take out of the soil when it gets some of the nutrients out of the air? Reams: You're not interested in how much it takes out of the air, care less about that. All you want to know about is how much you have to put back in the soil.
AG LECTURES: Citrus requires the least sprays of **any crop** providing you keep the carbon contents of your soil, your phosphates and calciums high enough in your soil. You'll never have to spray.
AG LECTURES: On corn, wheat and soybeans, there's one other ingredient you should use on **any crop that you're growing for the grain**. It's manganese. Manganese is the element of life and without manganese there's not any life.
AG LECTURES: The opportunity is **very, very great on what you can do with most any crop**. One thing I would advise you to do if you're going to do it commercially, is, do not diversify too widely.
ANDERSEN: I dare say that there is not one university agricultural department in this country **that can raise any crop consistently over 12 brix** at its weakest point or that has any clue as to the nutritional management necessary to do so. Yet there are farmers all across this country with little or no college education who routinely achieve such results.
BEDDOE: Since calcium is the foundation of bulk substance for every cell in all biologic systems, it determines the volume as well as test weight **for any crop with very few exceptions**. The plant uses more calcium by weight and volume than any other element.
FOLIAR SEMINAR 1983: Alfalfa needs more water soluble calcium than **any [other] crop**.
FOLIAR SEMINAR 1983: Hollow stems in **any crop** is a boron deficiency.
JOHNSON: Skow: Is there any question on the amounts of the use of manganese? Student: How long or how many times can you use it? Skow: This product you can use practically every time you spray. This is for seed crops only, Any crop that you want to harvest the seed. Now one crop that is very important to maintain the manganese level is pecans, walnuts, and almonds. Spray, spray, spray, and spray some more with manganese.
PLANT FEEDING: All plants can take all the magnesium they need out of the air. You **do not have to add magnesium to any crop that I have seen**, anywhere in the world. Unless the farmer had added so much nitrogen he had to add Epsom Salts in order to release the nitrogen to keep it from burning tho roots.
SKOW: Without an active organic matter system in the soil you **cannot grow any crop at all**, no matter how much N,

P and K you add. \[HOME]

APPLE

ADVANCED AG: **Apple trees** with high phosphate will stand cold better.
ADVANCED AG: Nitrate causes **apple to shed**, don't add nitrate to deciduous trees before fruit is off.
ADVANCED AG: **Apple** or citrus trees always bear because they have both male and female blossoms.
ANDERSEN: The branches of **apple trees will grow straight up**, with no fruit production, if there is too much vegetative growth energy. On the other hand, if there is too much fruiting energy the branches will grow straight out from the trunk, thus setting more fruit than the vegetative growth can support. Apple growers will tie or brace branches at a 45 degree angle to the main trunk in an attempt to achieve a balance between fruiting and growth. In doing so, however, they are handling only the symptoms, not the cause of the problem.
ANDERSEN: With apples, the opposite seems to occur. An **apple with apple scab fungus** will itself have a low refractometer reading (below 12); however, the leaves on the branch supporting the sick apple will have very high refractometer values (above 12 or even in the upper 20s). In any event, there is a mineral imbalance/deficiency in the crop.
ANDERSEN: Regardless of whether you follow an organic or a biological procedure, your success will be reflected in the refractometer reading of the commodity and its freedom from insects, diseases, and weeds. A **wormy organic apple is substandard**, pesticides or no pesticides.
BEDDOE: On those [crops] grown for fruit, seed, root, or blossom, such as com, wheat, tomatoes, **apples**, etc., you use both Nitrate and Ammonia Nitrogen at the proper times.
FWTK: On those [crops] grown for fruit, seed, root or blossoms (com, wheat, tomatoes, **apples**, etc.), both nitrate and ammonia is used.
GARDENING: Many times all the blossoms come on at the same time [peaches, pears or **apples**] and they get frozen off because the soil chemistry's out. Those blossoms should come on over a 6 week period. And the first ones that come on are way down the stem so if they get frozen off, then a few more will come out, if they get frozen off a few more will come out, and then a few more will come out, and you can still have a bountiful crop of fruit providing you keep your soil chemistry correct.
PLANT FEEDING: Tell me, how do you rotate a peach orchard? An orange grove? **Apple orchard**? A grape vineyard? Well, if you don't rotate those, why rotate anything else? You do not rotate crops - but put the nutrient back in the soil.
SKOW: Repeated sprays with fish and seaweed combinations in low amounts as a ten day program — especially in orchards — will gradually build up fruit-wood and root production for the following year. The consequences will be high quality produce. **Apples will be firm and without blemishes.** Moreover, they will exhibit good taste and flavor. Vitamin B-12 added to sprays on a regular basis not only improves flavor, it also presides over improved brix readings. In working with fruit groves, it is mandatory to start a year ahead of time.
WHEELER: Reams suggested you avoid dolomite for three reasons. The most impressive one has to do with nitrogen release. Magnesium is antagonistic to nitrogen as seen in the use of Epsom salts as a treatment for nitrate poisoning in cattle or an Epsom **salt spray on fruit trees to stop apple drop due to nitrate-weakened stems**. When the magnesium releases from dolomite, it can cause nitrogen to release as a gas. \[HOME]

ASPARAGUS

ADVANCED AG: Skow: **Asparagus** likes table salt [but not too much].
ADVANCED AG: Reams: I use 10% ocean water for **salt on asparagus**.
ADVANCED AG: Reams: When **growing asparagus**, increase count [plant density], use commercial calcium nitrate and harvest in morning.
AG LECTURES: Student: You said the reason for [nematodes] is too much salt in the soil? Reams: Yes. Student: Which particular kind is it, the chlorides? Reams: It can be a chloride, it can be ammonia salts, nitrogenous salts, calcium salts, iron chloride salts, yes, it can be many different kinds of salts. Student: **Will [nematodes] attack asparagus** after you put salt on it? Reams: You don't put salt on asparagus for nematode purposes. You do it for ionization and it increases the ionization enough and the nematode can't start. In other words, it tingles him and he doesn't like it.
PLANT FEEDING: In one day, **asparagus** comes up to the height you should cut it . You have to cut it before the sun shines because if it gets 2 hours of sunshine, it is woody and bitter. \[HOME]

ATOMIZED/HOMOGENIZED

AG LECTURES: Lets take an orange grove. The trees are 15-20 feet high, producing 1,000 boxes to the acre. You would need 30 gallons of spray to cover an acre, **homogenized**. That's a lot of space, that's a lot of leaves and that's a lot of trunk.

AG LECTURES: Student: What's the difference in a homogenized spray or homogenized substance and one that is not homogenized? Reams: It's broken down. **Homogenized material won't separate**. In other words, each molecule is somewhat equal. The substances are not separate. They are together. In other words, each little molecule becomes a little solar system within itself. Do you know, can anyone tell me how homogenization is done? How do you homogenize anything? Student: Pass it through a very fine orifice? Reams: Yes, then what? It isn't the passing through the orifice that makes it to be homogenized. What actually causes it to homogenize? Do you have any idea how homogenization is done? You pass a very, very fine stream through a nozzle or nozzles. It can be hundreds of them. But then it strikes this cold plate. I don't mean a hot plate, but one you've got to keep at about the temperature of the atmosphere around you, temporarily. What happens when this force strikes this plate then it mixes all the substances in that solution into one molecule and that's homogenized substances. Now, this is what should be done when you spray onto the leaf---homogenize this spray.

AG LECTURES: Whatever you do, try to get a homogenizer spraying machine that will **homogenize the spray** and don't use the big droplets, they're too expensive, too hard to get on. The finer the mist the better.

AG LECTURES: Do not spray too close to you. Spray at a distance, 20-30 feet. It forms a smoke, it rolls when it gets out that far. When it hits the ground it rolls in a fine form. The density of the particles keeps it all from going to the ground. Anytime the force is hitting, with very much force, over 2 lbs. of pressure, the same force that put it there is also taking it away. There **are machines that do homogenize the spray**, in fact the spraying that is done by airplanes homogenizes the spray.

BEDDOE: Homogenized foliar spray solutions have 10 times the effect of non-homogenized. Homogenization is when each molecule within the spray contains all the elements in exactly the same solar system relationship. The process of homogenization is one of adding a high degree of energy to the molecule of plant food spray. What actually happens involves the outer electrons in the molecule. They are forced into a higher speed without changing their positions. When homogenization is accomplished, the end result will give a solution that has a greater density, while the molecule enlarges and increases in porosity. It is this porosity that sets the stage for a shrinkage that locks the molecule on the antennae of the leaves at the time it contacts them.

BEDDOE: The smaller the spray particles, the more complete the molecule. This is **another way to express the affect of homogenization**. Various sprayers are able to accomplish variable degrees of homogenization by the use of micronizing spray heads which reduce the nutrient solution to very fine micron size particles.

BEDDOE: Sprays must be homogenized or micronized for the maximum benefit. The smaller the droplet, usually the more complete the homogenization.

FOLIAR SEMINAR 1983: There are two Reams ways to foliar feed, **homogenize** & **atomize**. Homogenize is better but both are beneficial. Economy comes from learning that less spray goes further.

FOLIAR FEED 1981: Add Calphos to **homogenized spray** to achieve sticker effect on waxy leaves like cabbage.

FRANK: An ordinary submerged sump pump in the tank, lying on its side, is an easy way to spin the solution. You're moving a liquid armature through the earth's magnetic field. The rotating mix accumulates electrons, building the magnetic charge in your spray solution. Recirculating the solution through the pump **also homogenizes nutrients** for a uniform blend.

FRANK: Most foliar sprays mixed with water will form droplets on leaves, even if the mist is **almost atomized**, because water retains its surface tension without a surfactant.

FWTK: One pound of an element sprayed on with a **homogenizing sprayer** is as effective as 20 lbs. applied to the soil.

FWTK: Reams recommends using a sprayer that **homogenizes the spray** and sprays a mist, which is then spread out with the air current. The purpose of misting is to get the particles to the size a plant can absorb, and to help it reach the bottom of the leaf. The sprayer he recommends using is called a Chiron Sprayer, which they make in West Germany. This type of sprayer is much more effective for foliar feeding than a boom sprayer. Reams did teach a course on foliar feeding in which he explains how to formulate and spray many different crops, from green houses to orchards.

JOHNSON: Skow: Reams talks about a **homogenizing sprayer** and I am at a loss to know about that completely. He says that is the principle that the Chiron sprayer works on. Theoretically, if something is truly homogenized, it shouldn't separate when put into a container. It should stay uniform throughout the solution. If we run it through a Chiron sprayer, it does separate back out again so I don't know for sure, his concept of that. All I do know, and I think he is trying to explain it in the best terms he knows how, is there is still something different in the way the Chiron

affects the spray than any other current machine on the market.
JOHNSON: Skow: The use of a homogenizing sprayer is preferred for the elements will stay intact in each droplet. Also the heavier specific gravity elements will move to the outer most orbit of each molecule, therefore they will show up first in the plant by visual signs like darker color.
PLANT FEEDING: I not to show you something about your row crop farming. It's a spray machine called a Chiron Sprayer. It's manufactured in Germany for about $5,000. It's the **only spray machine in the world. that homogenizes the spray** in big amounts, - really homogenizes it. If you should see that spray machine a half mile away on a farm, at work, you'd Just know it use on fire. It looks like smoke and it rolls along the ground on the side of the sprayer and covers everything like a fog.
PLANT FEEDING: Student: Is there a **homogenizing sprayer they make in a smaller size**? Reams: No, there is not, except that little paint sprayer — homogenizer that works by electricity for a backyard garden. But it's too small to get into farms and things of that nature. Student: What are these backyard sprayers? Reams: It is a paint sprayer that homogenizes paint — in Sears and Roebuck catalogs all over. It's for paint and it'll homogenize, but it only holds about a pint and it works by electricity and it's only good for a backyard garden.
WHEELER: When temperatures soar, the effectiveness of the spray drops considerably. When using a boom sprayer, use high pressure and purchase **atomizer nozzles** if possible. Tip standard nozzles back about 90 degrees so the spray will roll up under the leaves. Keep active ingredients on the dilute side, e.g., 1 to 2 quarts per acre for majors and a few ounces for traces. It may be possible to use as little as 2 cups of active ingredient per acre and still be effective, especially when using a mist blower. The use of a wetting agent will often assist the solution to **break down and homogenize**. \[HOME]

ATRIZINE/ATRAZINE

AG LECTURES: Student: I had farmer tell me one day he took and sprayed his corn when it was just coming up with Atrizine, at the rate of 1/3 pound per acre. And he said it didn't kill the weeds, but it just stunted them enough that the corn grew up away from the weeds. Then he would go cultivate and cover everything up. Reams: Yes, I wouldn't have used **Atrizine,** I would just cover them up to start with. Student: Yes, I don't advocate Atrizine either, but that's what he did. Reams: I don't advocate it at all, period. I have never seen a weed killer that didn't do harm in the long run. One of the greatest things it ties up is phosphates, terrifically. Every one of them does.
ANDERSEN: No Atrazine had been applied to the field since 1984 or thereabouts. As a result, it was assumed, backed by industry insistence, that there should be **no danger of Atrazine release stunting the oats**. Consequently, last year no compensation was made in this field's oat-fertility program for Atrazine. The result was a 37 bushel per acre yield [whereas 130-150 was normal]. A sample of these oats was sent to A & L Laboratories for evaluation. Atrazine was isolated and determined to be the cause of the stunting. So much for the propaganda that pesticides readily dissipate.
WHEELER: Overlooked, however, is the effect on countless livestock who also drink the [contaminated] water. Livestock suffer the same decreased performance syndrome as do people, except they can't complain. Their performance goes down with no identifiable cause. Conventional analysis measures the water for nitrates or coliform bacteria but not for Atrazine or other poisoning. Much production is lost with nothing to account for it. \[HOME]

BACTERIA, AEROBIC

ADVANCED AG: To prevent nematodes, create a soil environment promoting **aerobic bacteria**.
AG LECTURES: Organic fertilizer is rich in bacteria, **aerobic bacteria**.
AG LECTURES: Student: **Aerobic bacteria also eat live nematodes**, right? Reams: Yes, grasshoppers, ants, cockroaches, anything else they come across, worms.
AG LECTURES: **Aerobic bacteria** have something about them similar to what a fish does, they can take oxygen out of the water, out of the soil moisture.
ANDERSEN: The **aerobic zone** of the soil ranges from nothing to only a couple of inches.
ANDERSEN: Ideally, there should be a **majority of aerobic microbes** in relation to anaerobic microbes. The desirable microbes are ultimately responsible for the availability of all nutrients in the soil. As a result, every fertilizer material that is used must be compatible with these microbes if the desired result is to be realized. Also, because the microbes are ultimately responsible for nutrient availability, the real crop is the microbe; it is what really needs feeding.

BEDDOE: Fungi and bacteria have their part in bringing opposite forces into contact with each other to form plant food energy. The aerobes are small one-celled animals that take in plant food by adsorption and procreate themselves by division. They do not ordinarily die, but go into a dormant stage when soil conditions become unfavorable. Soil bacteria are also put together by the process of ionization; the same method that causes plants to grow. The process is similar to a metal electroplating. Conversely, the **aerobic bacteria is taken apart by the same method that is is formed**, except the method is in reverse.
BEDDOE: A soil with **excellent amounts of aerobic bacteria** will have plenty of available ammonia nitrogen being produced by the bacteria.
BEDDOE: The aerobes [**aerobic bacteria]** in the soil convert everything possible into protein molecules. This is because they absorb mineral energy and chelate (link) it into their bodies amino acid structure just like your body links mineral energy from your food into usable amino acid chelates.
BEDDOE: As the bacteria feed and function they leave both their excrement as well as their body remains when there life cycle is complete. These remains are referred to as spore protoplasm. This **aerobic bacterial spore protoplasm** is natures way of preventing plant food from leaching as well as holding it in a very easily usable form.
FWTK: Aerobic bacteria take nitrogen out of the air; they also yield some from the rain and snow.
FWTK: Aerobic bacteria need four basic things: water, air, food and heat. Sandy soils will respond faster to this program because the chlorine in the soil will leach out more quickly, and because of improved aeration. Thus, the bacteria will be working. The warmer areas of the country will get results sooner, because, as mentioned, bacteria cannot thrive in cold or frozen soils.
FWTK pH: This **aerobic bacterial spore** is nature's way of preventing plant food from leaching. This makes the soil quite gummy and also helps prevent erosion.
JOHNSON: AEROBIC Any organism that breaths oxygen. **These bacteria** convert unavailable nutrients to usable form. They include sulfa ammonis, nitrous ammonis, lactobacillus, and europa.
PLANT FEEDING: Student: Your aerobic bacteria in the soil makes nitrogen like a cow makes milk, right? Reams: That's true. Your aerobic bacteria converts nitrogen. And remember there is as much of a plant under the ground as there is above the ground. After you harvest the top, if your soil is not sterile, **your aerobic bacteria will convert** those roots into heavy, heavy amounts of organic nutrients. Nature is trying to help you if you will let it .
SUCROSE: Lack of enough kinds and amounts of **aerobic bacteria** present in the soil will cause a lesser yield. Bacteria does many things to increase yield, such as converting the soil elements into protein which preserves the elements in soil for later use and also serves as a natural means of biological control.
WHEELER: Through continued use of this soil "killer," [chlorine] the **desired aerobic microbial life** has been seriously depleted and/or changed in character.
WHEELER: To moldboard plow residue 8 to 10 inches deep in this soil condition is to almost guarantee that there will be little decay system and no new humus formed. The **aerobic bacteria will be buried below the oxygen level** while the anaerobic bacteria will be left on top exposed to the air. The residue will ferment, producing an alcohol or aldehyde. These substances kill off the aerobic bacteria and preserve the trash.
WHEELER: Through continued use of this soil "killer," [chlorine] the desired **aerobic microbial life** has been seriously depleted and/or changed in character. \[HOME]

BACTERIA, ANAEROBIC

ADVANCED AG: Add lime if your manure slurry pit is **anaerobic**.
ANDERSEN: Many sporiferous **bacteria (anaerobic)** have toxic or herbicidal properties on many plants, suppressing growth and lowering the percentage of germinating seeds.
ANDERSEN: The plugging [in a corn stalk] is caused by many things—chemical toxicity such as herbicides, putrefaction products of an **anaerobic soil**,
ANDERSEN: In many cases, the soil in which these plants are growing is spewing free ammonia into the atmosphere, either from ammonia fertilization or **anaerobic soil digestion**. This further pumps up the plant signal—turns the volume up, as one can do with modern hearing aids—notifying the quality-control inspectors to reject this production run due to inferior construction.
JOHNSON: Now if you get into an anaerobic condition, that is what you want to try to avoid. There are a lot of things that can happen on that one. What you want to watch on that is basically again where the ground crusts over, and then your aeration and normal biological system cannot work. One of the things, when you get into that situation, you will have a salt build up and basically **anaerobic bacteria produce toxic substances**.
SKOW: Let's consider a soil with **anaerobic bacteria** quite high. Aluminum could flip- flop in such a situation, but probably remain low. The soil would be sour and highly alkaline — with lots of calcium unable to release its energy

due to a lack of air flow, carbon and water circulation.
SKOW: Formaldehydes are an **anaerobic breakdown product**. In some cases aerobes work from the top down and dilute and break out the preserved biomass. But aerobes cannot survive in formaldehyde. The remedy, again, is carbon.
WHEELER: Through continued use of this soil "killer," [chlorine] the desired aerobic microbial life has been seriously depleted and/or changed in character. **Compaction has induced the anaerobic bacteria** supposedly found only in the lower levels of the soil to populate the majority of the soil bed.
WHEELER: To moldboard plow residue 8 to 10 inches deep in this soil condition is to almost guarantee that there will be little decay system and no new humus formed. The aerobic bacteria will be buried below the oxygen level while the **anaerobic bacteria will be left on top exposed to the air.** The residue will ferment, producing an alcohol or aldehyde. These substances kill off the aerobic bacteria and preserve the trash.
WHEELER: Compaction has induced the **anaerobic bacteri**a supposedly found only in the lower levels of the soil to populate the majority of the soil bed. Potassium chloride isn't the only culprit. Herbicides, pesticides, and other farm chemicals also contribute to the decrease of proper soil life. \[HOME]

BANANA

AG LECTURES: Reams: **Which is sweeter, a big banana or a little banana off the same stalk**? Student: Little one. Reams: Right, the smallest one is sweeter. The banana puts the same amount of everything in every banana, mineral wise. So does an orange tree.
GARDENING: The banana, when it grows those bananas, it puts the **same amount of nutrient in every banana** whether it's a big one or little one.
PLANT FEEDING: When that banana puts food in each of those fingers, it will put the same amount in every one - mineral content. So if you **buy small bananas you will get more mineral** than you will buying big bananas.\ [HOME]

BASIC SLAG

ADVANCED AG: Use of **basic slag** for calcium.
ADVANCED AG: Basic slag contains 20% iron oxide, however is slow release.
ADVANCED AG: Basic slag is economical in some areas (freight is a cost).
AG LECTURES: Just ask the person who is selling lime, he has an analysis on it. Tell him you want Agricultural lime---calcium carbonate, calcium oxide, or **basic slag**.
BEDDOE: Basic slag is a good liming material, unfortunately it is not as readily available as it used to be. It is a by-product of the steel making industry. If available it takes only 500 lbs. to equal the effects of 1 ton of high calcium lime.
BEDDOE: Iron sources include soft rock phosphate, **basic slag**, iron sulfate, molasses, and various chelated irons as can be used in foliar applications.
FWTK: There are five basic sources of calcium for agricultural purposes. The most common source is ground limestone. Then there is dolomite - which we do not use, gypsum (calcium sulfate), calcium oxide, aragonite and **basic slag**.
JOHNSON: Manganese Sulfate and **basic slag** are excellent materials for getting manganese into the soil on a long term basis.
PLANT FEEDING: Anytime you use **basic slag** 500 lbs. will go as far as a ton of agricultural lime per acre.
SKOW: Materials useful to making the proper anion-cation connection turn up in some unlikely places. **Basic slag** is a byproduct of the iron ore smelting industry. They use calcium in the smelting kettles to keep the molten metal from spitting out the top. In the process the lime picks up iron and trace metals. The recommended application rate is 500 pounds per year, which will put about 25 to 40 pounds of actual iron into the soil if that is needed.
WHEELER: This is why we suggest locating and using free or inexpensive, nearby natural minerals where possible. Lime or marl are part of the mineralization process and usually have to be purchased, but gravel or kiln dust may be available for the hauling. **Basic slag from industry is an underused possibility**.\ [HOME]

BEANS

AG LECTURES: Reams: What is the primary benefit of adding compost over manures whenever you disc them in or plow them under. Student: It is immediately available. Reams: That's one thing, but what is the something else I am trying to get across to you? It doesn't burn the plants. The raw manure creates a heat in the soil. If you have a dry year

what happens? It releases too much moisture and you're really suffering from a drought. But compost does just the opposite, it draws the moisture from the air and holds it in the ground. How does it do that? The carbon content, it's not going through a heat, actually it cools the soil. What form is the nitrogen in the compost? Ammoniacal nitrogen and what does it do to the soil? Not only warms, but cools. It controls the temperature. Student: How does it do that? Reams: By refrigeration. Yes, in other words when you heat ammonia it freezes, when you freeze it, it boils, it's a contrary substance. If it wasn't true you couldn't use it for a refrigerant, do you realize that? That alone is worth everything you are paying for all the courses, just to know that one factor if you use it. **We picked beans up to 2 weeks before Thanksgiving right here in the mountains** last year because we used that factor. And do you know where I had to go to get ammonium sulfate? Orlando, Florida.
AG LECTURES: What happens to young plants or onions or peppers, **beans**, tomatoes – row corps; whenever there's a copper deficiency? What happens to your young plants? They rot off at the ground.
AG LECTURES: You only use it [manganese] where you're growing a mature seed. **Would you use it on green beans**? You would, yes, if you don't you'll have skinny looking beans. Yes, you need it in the beans, because nature is trying to leave offspring there.
ANDERSEN: To notice that **one field of beans has a sheen** and the adjacent field does not indicates a difference in nutritional balance.
BEDDOE: In newly **germinating beans** a lack of phosphate of copper means that the cuticle of the plant will not stretch fast enough to keep up with the growth of the plant so the blue mold that causes the damping off disease will be allowed to exercise some destruction.
FRANK: Why not raise our own super foods like **super food green beans** or super food beets and so on. If we pursue highest quality, the foods we raise in our garden will be super foods.
FRANK: This **variation of nutrient density in green beans** applies to all produce. To get true nutrient dense foods you must first fix your soil.
FWTK: According to government standards, it takes 32 lbs. of green beans to make a bushel. A bushel of high quality beans will only till the bushel basket 3/4 full and still weigh 32 lbs. Poor quality beans with a low sugar content will require an extra six inches of beans on top to weigh 32 lbs. The **heavier beans are the most nutritious** since they contain the most minerals. /[HOME]

SOYBEANS

Student: Are there other crops you suggest not growing? Reams: **Soybeans is one**. Student: Is that because the farmer has no control over the price? Reams: Yes.
AG LECTURES: Student: If you're applying your chicken manure to your soil, would it make any difference in the amounts you put on for corn, peanuts or **soybeans**? Reams: No it doesn't. Just put down what you can afford. If you're using the litter, use about 4 tons to the acre, but if it's cage manure, one ton to the acre or ton and a half to the acre. I'm talking about the dry or comparatively dry that stacks up under the cages.
SKOW: Farmers have often noticed that corn or **soybeans** planted in east-west rows outperform the same crops planted in north-south rows. This has to do with the magnetic field. \[HOME]

BEETLE

ADVANCED AG: Reams: **Potato beetle** can eat half plant and not affect potato.
AG LECTURES: All [pest] worms are laid by some kind of a moth **or a beetle**.
AG LECTURES: Nematodes bear their own young and lay eggs. **Worms have to have a moth or beetle** or something on that order to propagate them. Like a butterfly in a cocoon.
ANDERSEN: Squeeze the juice from the stalk next to an ear and take a refractometer reading. If the brix level is 8 or above and maintains this reading for 24 hours a day, there will seldom be any noticeable damage to the ear silks by adult **rootworm beetles**. However, if this reading drops below 8, there will be progressively greater silk damage as the reading gets lower and lower. It is important to make sure that the reading is a "true" reading and not one in a dehydrated condition, which would give a false impression. This reading can be a valuable tool in management because, **regardless of the beetle population**, if the reading in the stalk next to the ear is 8 brix or above throughout the day and night, spraying an insecticide would be unnecessary and a waste of money.
FRANK: Headings:I said [to Skow], I've got **potato beetles** on my potatoes." He said, "Oh? Well, you don't have high brix potatoes." I said, "High brix, what do you mean?" He said, "Well, the sugars aren't high enough." And so, it kind of went from there and we started soil testing, and we started seeing phenomenal results right away.
FRANK: Headings: That fall, I can't say we didn't have any **potato beetles** that year because we had just a couple here

and there. I saw them. But, it didn't do any damage. Anyway, we harvested an average of 16 potatoes per hill.
FRANK: And so, we mixed up some soluble nutrients and we also used a foliar spray from International Ag Labs. And he called me 24 hours later, and he said, "Duane, you have to come see this. All those **potato beetles moved out into the weeds**." And I said, "I DO have to see this." I drove up there and his potato patch was clean. I could not find one beetle in that potato patch, and that IS unusual. I mean, usually, you'll find one or two, but I couldn't find ONE.
PLANT FEEDING: You put cottonseed meal out there and a ground mole will go from one and of the row to the other and plow up everything. But you put your tobacco dust in it and they won't. That's a secret. Put about 100 lbs. of tobacco dust to every 1,000 lbs. of cottonseed meal, mix it thoroughly and **the beetles** and bugs [or ants] won't get in it.\ [HOME]

BEETS

AG LECTURES: There are certain crops that need a lower temperature than others, i.e. cabbage, lettuce, escarole, romaine, onions, English peas, garden peas, radishes, **beets**.
AG LECTURES: I'll tell you what you can **do with beets**. Take your beet and wash it really good, leave your top on it. Clean out that bud really good because there's more trash that can get in that bud than you ever thought of. Then freeze the whole thing, top and all. Then take it out, put it in the blender and into the juicer and you've got some of the finest beet juice you ever had in your life. You've got beet juice right out of this world. Beet juice is a wonderful physic. it's a laxative. It also builds red blood cells, vim, vigor, vitality. It gets you ready to go in the morning. That's the way you do beets, top quality. The health food stores, once they're shown how to do this, they can't supply enough beets, beet juice, fresh beet juice, frozen beet juice and it's really, really good providing the beets are top quality beets when you start. If they're low quality beets, etc., then the juice is low quality.
AG LECTURES: You've got 2-3 weeks to get your [matured] **beets** out of the ground.
ANDERSEN: In negligibly small concentrations (0.001% and 0.0001%) they [humic acids] enhanced growth and increased the yield of wheat, oats, barley, **sugar beet**, tomatoes and other plants. The action of humic fertilizers was tested by the author in different soils. In all cases the effect was positive.
ANDERSEN: Sugar-**beet lime**—fair [calcium source], depending on area of the county and the soil it is going on; inferior to CaCO3.
BEDDOE: Remember [when blending fertilizers to] use the best filler available and that may be just plain white sand. **Beet lime** or high calcium lime could be used also for the added benefit of the calcium.
BEDDOE: Beet lime is a high grade calcium carbonate limestone flour that has been used in the sugar beet processing during sugar making. After it has been used it is accumulated as a by product. It is available for agriculture and is usually very, very cheap. It has one other advantage; it has a higher level of phosphate than ordinary lime due to the process it went through.
GARDENING: Phosphate is what determines the amount of sugar that's in the leaf and in the carrot, in the potato, in the **beet** and everything else.
PLANT FEEDING: Sugar beets will vary in content according to the phosphate in the s o i l . They should run 12-15% in the juice as it comes out of the sugar beet.
REAMS/SKOW COOK: Red beets have something besides calciums, they are quite high in magnesium. So is watercress. Watercress has high magnesium in it, and so do some mangoes.\ [HOME]

BIOACTIVITY

ANDERSEN: Sources of phosphate are.: Mycorrhizae fungi—varies with **bioactivity**, good.\ [HOME]

BLUE MOLD

AG LECTURES: I've seen Tomato plants 6-8 inches rot off at the ground. It does something differently there. It doesn't make the bark stretch. What does it do? How does the copper work to keep the plants from rotting off at the ground? It's a germicide, it **kills the Blue Mold**.
AG LECTURES: The **Blue Mold** can't stand it. Copper is the greatest enemy Blue Mold ever had. Then it also makes the bark stretch in the plant and give you greater yields. It's a germicide.
BEDDOE: In newly germinating beans a lack of phosphate of copper means that the cuticle of the plant will not stretch fast enough to keep up with the growth of the plant so the **blue mold that causes the damping off** disease will be allowed to exercise some destruction.
FOLIAR FEED 1981: Add copper sulphate for [to prevent] **Blue Mold**.
PLANT FEEDING: There's only one reason why **Blue Mold** is present on a young plant. For lack of copper---a

deficiency in the plant.
PLANT FEED AUDIOS: Blue Mold and copper deficiency. [adequate copper] allows bark to stretch.\ [HOME]

BORON

ADVANCED AG: Proper boron prevents grain from molding and fruit from rotting.
ADVANCED AG: Excessive boron can be a problem for many years.
ADVANCED AG: Too high boron kills microbes.
ADVANCED AG: Excessive boron dehydrates the soil by killing microbes.
AG LECTURES: Student: What is the best way to get boron onto your fields? Reams: **Chicken manure is very rich in boron**. We're going to learn how to put it on via sprays a little later.
AG LECTURES: Reams: What would cause Black Heart in potatoes? Student: Boron deficiency? Reams: Boron deficiency causes Black Heart and it also causes them to split open in there. What causes the cabbage or lettuce when you cut it off at the ground to have a hole in the bottom? Student: Boron deficiency.? Reams: What is the best way to get boron onto your fields? Student: Chicken manure? Reams: Chicken manure is very rich in boron – yes.
AG LECTURES: Reams: Do you know one reason so many small grapes fall off the pod is because there is not enough manganese for all of them? Not enough manganese. Also, don't forget that I told you in the first course that grapes like a lot of boron, chicken manure. Pile it up, and they will really appreciate it. Student: Black heart is a lack of boron. Is it possible to get too much boron on potatoes and stuff like that? Reams: Not from chicken manure, no.
ANDERSEN: Boron is important for filling in hollow stems. It seems to have various functions, but there is little agreement among plant physiologists as to specifics. Boron can cause strawberries to taste woody. Boron deficiency causes black heart. Boron is best used where calcium also is being used. It is an effective biocide, but it must be used with caution.
BEDDOE: In a soil with 500 pounds per acre of chloride, chicken manure should not be used on the ground. The chicken manure is **high in boron** and with lack of plenty of water the stage would be set to convert ammonia nitrogen to nitrite nitrogen. If this were to happen it would severely burn the roots of any plants in the soil.
BEDDOE: Hollow stems on grasses and forage crops, such as alfalfa, are not normal. It is an expression of phosphate of **boron deficiency**.
BEDDOE: Excessive boron can be a problem. In too large amounts in the soil it works like a bactericide. it kills bacteria. In the strawberry excessive boron can make the berry develop a very woody center.
FOLIAR FEED 1981: Boron makes pith and is a germicide except in chicken manure because the calcium makes it non-toxic.
FWTK: Furthermore, healthy plants take a large part of the trace elements they need from the air. They supply magnesium, manganese, zinc. cobalt, copper, sulfur **and boron** in this way. Soil must contain proper mineral levels for this process to take place.
GARDENING: [Hydroponic situation] Now I said, "These bugs are sucking the sap out of these plants." He said, "What should I do about it." Well I said, "You **need a little boron**. You haven't got quite enough in, in order to kill them."
JOHNSON: But if the carbons are low and you have an **excess of boron** in relation to calcium or a high salt or sulfur content, you can essentially get ammoniation of the plant. Essentially what it does is, it simply kills them.
JOHNSON: When you build a spray, you should always add calcium to it in some form if you are going to put boron in. That is to protect against ammoniation. Now, if you have plenty of calcium in the soil, you will be alright.
PLANT FEEDING: Student: Would you use chicken manure on citrus? Reams: Yes, but never dig it in. Leave it on top of the ground. Why? Because the **boron will ammoniate** your trees. It will never hurt citrus if you leave it on top of the ground. Not only that, if you've got your calcium and phosphate, you'll never need to spray your grove. No bugs or insects in it . Spread it from tree trunk to tree trunk evenly.
REAMS/SKOW COOK: This grapefruit has a tight core in the middle. A lot of them are big enough that you can stick your thumb in the middle. What does that mean when it's got a hollow in the middle? Student: Too little mineral. Reams: Yes, but what mineral? Student: Boron? Reams: That's a **boron deficiency** whenever they have it. But this grapefruit is almost perfect in its boron content. I just wanted to show you that.
SKOW: Plants also have enzymes. These are small protein units that act as on-scene engineers in the cell building business. They take raw materials, such as earth minerals, and see to it that they reach the right stem, root, bud, flavor, or whatever. Indeed, how enzymes create hot spots to attract essential cell building materials — iron, nitrogen, **boron, for instance** — so that they can be linked to the right molecules in plant cells must be considered a miracle. Equally a miracle is the fact that most farm crops are 95% sunshine, air and water, and only 5% earth minerals.

SUCROSE: ...by first noting some things that will decrease yield: 15. an oversupply of nitrogen salts, potash s a l t s , magnesium salts, calcium, sulfur, **boron**, and others;
WHEELER: Calcium can also tie up or keep plants from taking up trace minerals such as boron. According to Hands-On Agronomy, excess calcium can hide magnesium. If Neal Kinsey is correct in this respect, too much calcium fools the reader by concluding that magnesium is in the correct range whereas it actually is in excess.
WHEELER: Boron functions as a regulator in the plant's metabolism of carbohydrates and hormones. Hollow hearts in vegetables have generally been associated with boron shortages. Alfalfa has been identified as particularly needing boron. Generally, boron is not available in high pH soil or soil low in organic matter. \[HOME]

BRIX

ADVANCED AG: Calcium nitrate can **greatly increase brix** and yield of alfalfa.
ADVANCED AG: Reams: **Any other Brix questions**? Student: What about grapefruit? Reams: It's the same as oranges. Should be in the top group, sometimes it isn't. The law says it's got to have brix of 9.25 in order to ship it (which is too tart).
ADVANCED AG: The **Brix reading should be the same throughout the plant**, unless the soil is low in TDN**.**
AG LECTURES: Reams: If you're cutting alfalfa [or other grasses], the best thing to do is is to start about 4 o'clock in the morning and cut them and then about 10 o'clock start putting them in your harvester. Student: One thing. Your nitrates would be too high. The sun hasn't shown on it at 4 o'clock in the morning and you may poison your cattle, right? Reams: No, **not if there's a high sugar content [Brix] you won't**. You'll poison the cattle because there's low sugar content in it. You will never poison the cattle with a high sugar content.
AG LECTURES: Cucumbers, squashes, green beans, bell peppers, hot peppers, rutabagas, turnips, onions should have **between 6 & 8 brix**.
ANDERSEN: Squeeze the juice from the stalk next to an ear and take a refractometer reading. **If the brix level is 8 or above** and maintains this reading for 24 hours a day, there will seldom be any noticeable damage to the ear silks by adult rootworm beetles. However, if this reading drops below 8, there will be progressively greater silk damage as the reading gets lower and lower. It is important to make sure that the reading is a "true" reading and not one in a dehydrated condition, which would give a false impression. This reading can be a valuable tool in management because, **regardless of the beetle population**, if the reading in the stalk next to the ear is 8 brix or above throughout the day and night, spraying an insecticide would be unnecessary and a waste of money.
ANDERSEN: An ear of corn at 24 brix with corn ear worms inevitably will have leaf or stalk refractometer readings below 12. Grapes at **18 brix with insect infestation inevitably will have cane or leaf refractometer readings below 12 brix**.
ANDERSEN: The **brix reading of these [high nitrogen, high potash] plants would be lower** and, therefore, these plants would be less desirable to animals and more susceptible to storage rot.
ANDERSEN: The belief that healthy soil grows weeds equally as well as the desired crop is based on the misconception that the soil in question is healthy. Evaluating the refractometer reading of the plants, both weeds and crops, growing in the soil tells the observer whether the soil is truly healthy. In this case, one will find that the refractometer readings of both the crop and the weeds are about the same, **probably in the 4 to 8 brix range**. Neither the crops nor the weeds are well balanced nutritionally at these brix levels, but the conventional soil test and nutrient standard may indicate that this is a "healthy" soil. In any event, It is not!
BEDDOE: A dairy cow which is eating alfalfa that has a **16 Brix sugar level** will need only 10-l2 pounds of l2 Brix grain mix to produce 100 pounds of milk. But the same cow eating 7 Brix alfalfa will require 30 pounds of the same grain to produce 100 pounds of milk; besides that, the cow is very vulnerable to disease.
FRANK: Headings:I said [to Skow], I've got potato beetles on my potatoes." He said, "Oh? Well, **you don't have high brix potatoes**." I said, "High brix, what do you mean?" He said, "Well, the sugars aren't high enough." And so, it kind of went from there and we started soil testing, and we started seeing phenomenal results right away.
FWTK: Alfalfa hay, which should measure twelve to 14% sugar content, is **often only six to 8 brix**.
FWTK: The average reading you will find in oranges is nine to 10 brix, but it **should be sixteen to 18 brix**.
PLANT FEEDING: Eight dollars a pint for green raw chlorophyll. You may have some trouble in learning how to do it. If you do decide to market, let me know and I'll help you, but you've got to have a sugar content in comfrey of about 5 1/2 or 6 [remember that Reams considered Brix to be half sugar] or it will spoil on you. Even 7 is not too high for comfrey.
SAIT: Andersen: The Reams test will reflect what kind of weed you will see in the field, what kind of soil compaction and tilth you will see, and **what kind of brix readings you will see** in the crop.
SAIT: Andersen: Let's take sweet com as an example. You may take a reading of the ear and you may have 24 brix,

yet the com borers are running rampant. What you will find with that sweet com is that, if you take a reading of the stem or the main roots, you **will have a brix reading of 4 or 5**. What's happening is that nature is moving all of the carbohydrates into the ear in an attempt to reproduce the species, so it's a fictitious level in the cob.
SKOW: Vitamin B-12 added to sprays on a regular basis not only improve flavor, it also presides over **improved brix readings**.
WHEELER: [**Higher Brix plants**] will produce more alcohol from fermented sugars and be more resistant to insects, resulting in a decreased insecticide usage.
WHEELER: However, although plants may grow at the higher ERGS levels, the bacterial populations may not function well enough to **result in high brix readings** along with the potentially higher production. \[HOME]

CALCIUM CARBONATE

ADVANCED AG: Some sources of carbon: sawdust, manure, **calcium carbonate**, sludge, compost, roots, green manure, etc.
ADVANCED AG: **Calcium carbonate** will not tie up potassium if applied with chicken manure because of the added bacterial content.
AG LECTURES: Just ask the person who is selling lime, he has an analysis on it. Tell him you want Agricultural lime---**calcium carbonate**, calcium oxide, or basic slag.
ANDERSEN: Adding high-calcium lime, one in which the **calcium carbonate** component is extremely dominant to a high-magnesium soil might actually lower the pH. This can also happen in high-sodium soils.
ANDERSEN: **Calcium carbonate (CaCO3)**, though not technically considered an organic chemical, is preferable to dehydrated lime (calcium oxide, CaO), hydrated lime (calcium hydroxide, Ca(OH)2), or even gypsum (calcium sulfate, CaSO4), if one is seeking the nutrient calcium.
ANDERSEN: Reams used **calcium carbonate**, never dolomite. He observed that sufficient magnesium would be available if he balanced the calcium, phosphate, and microorganisms and then applied fertilizer quantities of Sul-Po-Mag.
BEDDOE: Beet lime is a **high grade calcium carbonate** limestone flour that has been used in the sugar beet processing during sugar making. After it has been used it is accumulated as a by product. It is available for agriculture and is usually very, very cheap. It has one other advantage; it has a higher level of phosphate than ordinary lime due to the process it went through.
BEDDOE: **Carbonate molecules attached to the calcium** start a carbon dioxide bubbling reaction when worked on by water and bacterial action. This opens up the soil and will make it more granular so that it does not bake hard when dry.
BEDDOE: Making Sprays Anionic: 1. Use Calcium hydroxide (hydrated lime) or **carbonate forms of calcium**. The carbonate form of calcium has an advantage in that it contains the carbon complexes. These can help the plant get more water out of the air.
FRANK: Avoid using nutrient elements compounded as carbonates or oxides. Examples of carbonates: **calcium carbonate**, iron carbonate and copper carbonate. Examples of oxides: Manganese oxide, iron oxide and copper oxide.
FRANK: Roots also absorb CO2, and root uptake is just as important to yields as leaf absorption of CO2. When you apply **calcium carbonate** to the soil, organic acids excreted by microbes in the root zone react with it to release more CO2 for root uptake.
JOHNSON: Student: Is **calcium carbonate** (CaC03) biologically active carbon? Skow: Not by itself. It has to be worked on by bacteria. Very little of that will stand in suspension in water. Practically none unless you have a good ammonia level in the soil. It will become soluble because that is how they make calcium nitrate (CaN03).
SKOW: Carey Reams talked about calciums, plural. By calciums, plural, he meant that every kind of plant had calcium in it, but always in a different organic complex. Each affects a human being differently. Calcium sulfate has a different effect on Homo sapiens than **calcium carbonate**. Calcium from alfalfa and calcium from peppermint tea are each in a different complex. As a consequence, they affect the cells of the body differently. They have a different pH and a different energy potential. These
observations prompt a question over whether we should use different calcium forms on the soil. The answer is, Yes!
SKOW: The next calcium on our roster is **calcium carbonate** — generally known as ag lime. In this compound the carbonate and the oxide are bonded together. Spread on an acre of soil, calcium carbonate usually is applied at between 500 pounds and two or three tons per acre. Sometimes dry blends use 100 to 150 or 200 pounds per acre very effectively. A warning is in order — again! Always get a sample from the quarry, and be certain the delivered product is the same as the sample. Some lime materials are toxic.
SKOW: Calcium oxide and **calcium carbonate** also go together quite well. Generally speaking, lime from the pits

means ag lime.
WHEELER: Reams taught that the energy content of any given fertilizer or chemical could be calculated by using a mathematical formula. In using his calculations, one can determine that the energy of a single atom of calcium may range from a low of 540 Milhaus units to a high of 20,959 Milhaus units. Correspondingly, a **single molecule of calcium carbonate** (high-calcium lime) ranges from a low of 30,544 to a high of 82,895 Milhaus units. This range is obviously quite extensive. With this understanding, it is easy to see how a product from one supplier responds in the soil very differently from supposedly the same product obtained from another supplier. This fact has been confirmed by farmers on countless occasions.
WHEELER: The standard source of calcium for soil for centuries **has been calcium carbonate**. In the authors' experiences, application of high-calcium lime to a soil above 7.0 pH has sometimes actually lowered the pH due to the complex biological and chemical processes found in living soil. A non-toxic program calls for viewing soils as to their available calcium content, rather than using the pH concept. \[HOME]

CALCIUM HYDROXIDE

AG LECTURES: Then what would you do? The crop was rotting in the field. With all these numbers that I have told you and yet the crop was rotting just as it matured. Student: Put some sulfur on? Reams: Sulfur or copper? Student: Too much sulfur. Reams: Too much sulfur, that's right. So what would you do? Student: Put calcium on it? Reams: **Calcium hydroxide, the hot lime**. Just about 100 lbs. to the acre will knock that sulfur right out of existence as far as availability to the plant is concerned. And in 3 days you've stopped the rot. Calcium hydroxide is the hot lime.
AG LECTURES: So what you've got here is not a single anion, but you got a **triple anion in calcium hydroxide**. In other words you have [figuratively] dynamite! The other molecule you have, three instead of one. You have a triple anion there. A double is powerful, but a triple is very powerful. Now, it was no problem at all when I got my soil analysis to figure out how much it would take, two 50 lb. bags to an acre.
ANDERSEN: The term "hydrated lime" means that calcium oxide (CaO) has had water added to it to get Ca(OH)2. Its proper name is **calcium hydroxide**.
ANDERSEN: Sources of calcium are as follows: **Calcium hydroxide**—hydrated lime, quick lime; use with caution.
ANDERSEN: Calcium carbonate (CaCO3), though not technically considered an organic chemical, is preferable to dehydrated lime (calcium oxide, CaO), hydrated lime (**calcium hydroxide, Ca(OH)2**), or even gypsum (calcium sulfate, CaSO4), if one is seeking the nutrient calcium.
BEDDOE: Hydrated lime (also called slaked lime and **calcium hydroxide**): dry powder, 54% pure calcium, anionic. This is a "hotter" calcium source. It can make more soil heat because of the resistance it makes and it will then cause the soil to dry out. It is best used in the fall so that it can sit all winter long.
BEDDOE: Another interesting sidelight about calcium is that in some forms it can be very valuable to regulating soil temperatures. When the farmer encounters problems with cold weather, a substance called **calcium hydroxide** can be used to increase soil temperatures. It works this way because it creates a lot of resistance in the soil, therefore a lot of heat is produced. Using only a maximum of 200 pounds per acre can do wonders for warming the soil which will then increase the ERGS. This type of calcium is also good to counteract other problems that are becoming more prevalent today, such as excess acids from fertilizers, rain, and sulfur containing irrigation water.
FOLIAR FEED 1981: You should rarely use calcium in [foliar] spray unless **calcium hydroxide**.
FOLIAR FEED 1981: If the crop rots as it heads up, add **calcium hydroxide**.
FOLIAR FEED 1981: Add **calcium hydroxide** not calcium sulphate (gypsum).
FRANK: Limestone rock can be heated by fire. This drives off the carbon and leaves a very fine powder: calcium oxide. A certain amount of **water can be added to become calcium hydroxide**. Both of these forms of calcium are very hot chemically and aren't recommended very often. They are very strong on growth energy, but can burn plants and leaves. If you must use these forms, apply during dormancy and handle carefully.
JOHNSON: This was in sandy soil and there was no calcium in the root zone so what happened? There wasn't anything there to provide some resistance to cause the plant to grow. So what I had to instruct them to do is find some **calcium hydroxide** and dribble it down between the rows so that we could get our positive and negative current going again. We had all positive and no negative and that doesn't work too well.
JOHNSON: There is one other calcium source to consider and that is **calcium hydroxide**. Now how much? There are some things you need to know about calcium hydroxide. It is a very good product but you must first of all (it's a fine powder) put it into water (deionized or distilled) and stir it up and leave it set because it will get hot, too. You leave that for a couple of days in the container. Then take out a pint to two pints of that and put it in your 100 gallons of spray. This will be a saturated solution. Only a certain amount will stay in suspension and that is what you use.
SKOW: My formula follows: Put in water, a humate, **calcium hydroxide**, magnesium sulfate, Bo-Peep, a special

amine compound, castor oil, sodium carbonate and water — it has to be distilled water or good reverse osmosis water — and seaweed extract.
WHEELER: Soil pH will rise from adding a liming material like calcium carbonate, calcium oxide, or **calcium hydroxide**. But pH will also rise if any positive ion is added. The major positive ions that attach themselves to the negative clay colloids of your soil are calcium, magnesium, potassium and sodium. If you don't differentiate between ions and simply consider pH, you are falling into the pH trap and you may have imbalanced nutrients, particularly a shortage of calcium. Since the available calcium determines the total yield of your crop, you could be losing yield and test weight from being caught in the trap. So the first rule is: calcium is king and the second rule is: don't use pH to determine if you need to apply calcium. \[HOME]

CALCIUM OXIDE

ADVANCED AG: Use Aragonite on east coast for **calcium oxide**.
AG LECTURES: Just ask the person who is selling lime, he has an analysis on it. Tell him you want agricultural lime---calcium carbonate, **calcium oxide**, or basic slag.
ANDERSEN: The term "hydrated lime" means that **calcium oxide (CaO)** has had water added to it to get Ca(OH)2. Its proper name is calcium hydroxide. Dehydrated lime, burnt or calcined lime has had the water removed and is termed calcium oxide (CaO).
ANDERSEN: **Calcium oxide**, (burnt, dehydrated, or quick lime) CaO.
ANDERSEN: Calcium carbonate (CaCO3), though not technically considered an organic chemical, is preferable to dehydrated lime (**calcium oxide, CaO**), hydrated lime (calcium hydroxide, Ca(OH)2), or even gypsum (calcium sulfate, CaSO4), if one is seeking the nutrient calcium.
BEDDOE: **Calcium oxide**: (also called unslaked lime or quick lime) CaO, dry powder, 71% pure calcium, anionic. This is really hot lime. It can burn plants.
FWTK: **Calcium oxide**, Aragonite [calcium carbonate] and basic slag are not always available in different parts of the country, but they have the advantage of being quickly available to the plants [if you can source them].
PLANT FEEDING: Dolomite is a **calcium oxide** and magnesium oxide [mixture] containing approximately 35% magnesium oxide. One of the fastest ways in the world to go out of the business of farming is to add dolomite to your soil.
SKOW: **Calcium oxide** and calcium carbonate also go together quite well. Generally speaking, lime from the pits means ag lime.
WHEELER: Quick lime, CaO (46°/o Ca) — **Also called calcium oxide**, this dry product is very fast acting, contains readily available calcium and is loaded with energy. Use with caution or you can burn crops.
WHEELER: Soil pH will rise from adding a liming material like calcium carbonate, **calcium oxide**, or calcium hydroxide. \[HOME]

CALCIUM SULFATE (GYPSUM)

ADVANCED AG: If adding **calcium sulfate** in an alkaline soil to improve the energy, limit it to 500 pounds per acre for any one application.
AG LECTURES: Reams: Suppose you were down in a place like Haiti where the pH is 14, solid lime rock. What is the first thing you'd do to make that soil possibly produce? Student: You have to put in what you don't have, put acid on it. Reams: That's right, You'd use sulfuric acid. Then what? If you apply the sulfuric acid to the lime rock, what would it do, what would you have? Student: Change it to a cation. Reams: Yes, but what is the name of the substance you'd have? Student: **Calcium sulfate, gypsum**.
ANDERSEN: Calcium carbonate (CaCO3), though not technically considered an organic chemical, is preferable to dehydrated lime (calcium oxide, CaO), hydrated lime (calcium hydroxide, Ca(OH)2), or even **gypsum (calcium sulfate, CaSO4)**, if one is seeking the nutrient calcium.
ANDERSEN: Finally, this [typical organic program] program adds an **excess of calcium sulfate** in an attempt to lower the soil pH which contributes, along with the excess nitrogen and salt, to the depression of the biosystem.
ANDERSEN: **Calcium sulfate (gypsum)**; use a maximum of 500 pounds/acre.
BEDDOE: **Calcium sulfate is not a preferred source** mainly because the sulfate (a double cation) can either release too much energy and/or contribute to sulfur excess. Usually no more than 500 lbs. at one application per season.
BEDDOE: Other fertilizer materials that can be used as catalysts in certain situations include: ammonium sulfate, ammonium thiosulfate, ammonium phosphate, **calcium sulfate**, calcium nitrate, potassium sulfate, and potassium nitrate.
FOLIAR FEED 1981: Add calcium hydroxide not **calcium sulphate** (gypsum).

FRANK: The Morgan soil test has concluded time and time again that **gypsum [calcium sulfate]** is not the tool of choice to raise a low calcium soil. It flat out doesn't work. Limestone works very consistently. This information doesn't show up when using a Mehlich 3 soil test.
FWTK: There are five basic sources of calcium for agricultural purposes. The most common source is ground limestone. Then there is dolomite - which we do not use, **gypsum (calcium sulfate)**, calcium oxide, Aragonite and basic slag.
SKOW: Carey Reams talked about calciums, plural. By calciums, plural, he meant that every kind of plant had calcium in it, but always in a different organic complex. Each affects a human being differently. **Calcium sulfate has a different effect** on Homo sapiens than calcium carbonate. Calcium from alfalfa and calcium from peppermint tea are each in a different complex. As a consequence, they affect the cells of the body differently. They have a different pH and a different energy potential. These
observations prompt a question over whether we should use different calcium forms on the soil. The answer is, Yes!
SKOW: Gypsum is calcium sulfate. It has a tendency to act like baking soda, to fluff and drive the particles of the soil apart. Calcium carbonate does not do that.
WHEELER: High-calcium lime can be applied at most any pH, but is usually reserved for a pH of 7 or below. When the pH is above 7, **gypsum (calcium sulfate)** is preferred. This assumes that the high pH is due to sodium, magnesium or potassium. If the soil really is calcitic (very high in calcium), then the additions of sulfur forms other than gypsum would be best.

NOTE: *Magnesium sulfate is highly soluble in water whereas **calcium sulfate (gypsum)** is only moderately soluble in water. It is important to remember this when listening to Reams talk about the necessity of liming dolomitic soils (i.e., high magnesium). He is trying to help the student understand how to let nature (via rain) remove some of the excess magnesium.* \[HOME]

CALCIUM(s)

NOTE: *There is much ado about the term "calcium" in Reams agriculture. Most of the ag world thinks of calcium as simply calcium and Reams wanted his students to understand there are many forms of calcium and they usually react differently in the soil, hence "calciums" plural. While you will learn more by studying each individual calcium form in turn, you should come back here from time to time to refresh the "calciums" concept.*
AG LECTURES: Citrus requires the least sprays of any crop providing you keep the carbon contents of your soil, your phosphates and **calciums high enough** in your soil. You'll never have to spray.
ANDERSEN: The term "hydrated lime" means that calcium oxide (CaO) has had water added to it to get Ca(OH)2. Its proper name is calcium hydroxide. Dehydrated lime, burnt or calcined lime has had the water removed and is termed calcium oxide (CaO).
ANDERSEN: CALCIUM IS THE KING of elements. It is needed more than any other element by weight and volume. **Calcium is the foundation** of all biological systems and is the component that gives the living cell its capacitor characteristic via its place in the cell membrane.
ANDERSEN: Avoid products made with calcium chloride. The **liquid calciums** other than Biomin calcium [J. H. Biotech] can go in with the liquid nitrogen and preemergent herbicide or can be sprayed on after planting or in the first watering, whichever is most feasible.
BEDDOE: And of course the bacteria proliferates through the availability of the proper levels and ratios of phosphates, potassiums, **and calciums**, along with the humic carbon compounds.
BEDDOE: Calcium nitrate **helps other calciums become available** because of its nitric acid.
BEDDOE: Tillage practices directly affect the way carbons and colloids work to the surface to pick up the **precipitating calciums** and other minerals.
GARDENING: The **calciums in your soil** can increase the milk yield by as much as 200% and also if your pasture soils have enough minerals and calcium in it, whenever you put the feed in the trough to milk the cows, they won't even eat it. They'll just stand there waiting to be milked, because the grass will have so much more nutrient.
JOHNSON: When I use purified water in making a spray, it is far more effective than if I just used my well water which contains a **lot of calciums**.
JOHNSON: Liquid fish is a real nice thing to use from the stand point that it furnishes oil, amino acids, some nitrogen (N) , phosphorus (P), potassium (K) , a full array of trace minerals **and calciums**. This kind of formula can be used on practically any crop. Orchards, trees, grasses, grains, you name it.
JOHNSON: Don't use ammonium sulfate if the **calciums** are below 1800 lbs. per acre using the LaMotte method of testing
PLANT FEEDING: I advise putting chicken manure raw on the soil if your soil analysis shows your **calciums**,

phosphates, and potash are where they should be and won't go out of kilter.
PLANT FEEDING: Try to build your pasture grass **calciums** over a 2 year period. You should work on having 4500-4800 pounds of water soluble calciums.
REAMS/SKOW COOK: Red beets have something besides **calciums**, they are quite high in magnesium. So is watercress. Watercress has high magnesium in it, and so do some mangoes.
REAMS/SKOW COOK: There are more than a quarter million different types of **calciums**. They can be divided into seven classes
SKOW: Carey **Reams talked about calciums, plural**. By calciums, plural, he meant that every kind of plant had calcium in it, but always in a different organic complex. Each affects a human being differently. Calcium sulfate has a different effect on Homo sapiens than **calcium carbonate**. Calcium from alfalfa and calcium from peppermint tea are each in a different complex. As a consequence, they affect the cells of the body differently. They have a different pH and a different energy potential. These
observations prompt a question over whether we should use different calcium forms on the soil. The answer is, Yes!
SKOW: The basic source for all the **liquid calciums** that are sold in gallon jugs is calcium nitrate. \[HOME]

CARBON

ADVANCED AG: Some sources of **carbon**: sawdust, manure, calcium carbonate, sludge, compost, roots, green manure, etc.
ADVANCED AG: Add soft rock phosphate before lime to prevent moisture loss via **magnetism of carbon**.
AG LECTURES: And what happens when you use a chelate on a **carbonate soil**, high calcium soil? It sheds the leaf off. Many times this happens naturally in your soil and you don't want it to. Therefore the alfalfa leaf sheds off, you start to mow and the leaves all fall off. This material has been chelated and you don't want this to happen in a high carbonate soil. We are going to learn more about that later when we study soils and how to prevent it. But do not use a chelate in a high carbonate soil.
AG LECTURES: Just ask the person who is selling lime, he has an analysis on it. Tell him you want Agricultural lime---calcium **carbonate**, calcium oxide, or basic slag.
AG LECTURES: The raw manure creates a heat in the soil. If you have a dry year what happens? It releases too much moisture and you're really suffering from a drought. But compost does just the opposite, it draws the moisture from the air and holds it in the ground. How does it do that? **The carbon content**, it's not going through a heat, actually it cools the soil.
AG LECTURES: Carbon determines your chlorophyll.
AG LECTURES: Citrus requires the least sprays of any crop providing you keep the **carbon** contents of your soil, your phosphates and calciums high enough in your soil. You'll never have to spray.
AG LECTURES: When you see a crop that has no sheen on it or a grove or an orchard, that the leaves do not have a waxy sheen to, you're going to see a grove or orchard or crop that is **low in carbon**.
ANDERSEN: Reams used calcium **carbonate**, never dolomite.
BEDDOE: Acids (cations) coming into contact with bases (anions) are heat and energy producing because of the resistance between the anions and cations. Whatever organic or inorganic substance there happens to be in the soil also takes part in this chemical action and can be affected by it. These types of reactions, if too strong, can cause calcium and phosphate **as well as carbon** to be oxidized to the point of leaving a very low plant food bank account of soluble nutrient.
BEDDOE: Beet lime is a high grade calcium **carbonate** limestone flour that has been used in the sugar beet processing during sugar making.
FOLIAR FEED 1981: Don't use herbicides, cultivate your weeds out so that **they add carbon** to the soil.
FRANK: Roots also absorb CO2, and root uptake is just as important to yields as leaf absorption of CO2. When you apply calcium **carbonate** to the soil, organic acids excreted by microbes in the root zone react with it to release more CO2 for root uptake.
FRANK: Avoid using nutrient elements compounded as carbonates or oxides. **Examples of carbonates**: calcium carbonate, iron carbonate and copper carbonate.
JOHNSON: But if the **carbons are low** and you have an excess of boron in relation to calcium or a high salt or sulfur content, you can essentially get ammoniation of the plant. Essentially what it does is, it simply kills them.
JOHNSON: Student: How high is high enough [phosphate]? Skow: I wish I could give you an absolute answer but it is not possible because the phosphate in the soil has to be worked up in the soil in relation to the what? What key thing can you do to increase your TDN (total daily nutrient) more? What has to be there? **Carbon, there you go**.
PLANT FEEDING: Use the moldboard plow every year, because the **carbon keeps rising to the top**, making the

topsoil more narrow and more narrow.
SKOW: Let's consider a soil with anaerobic bacteria quite high. Aluminum could flip- flop in such a situation, but probably remain low. The soil would be sour and highly alkaline — with lots of calcium unable to release its energy due to a lack of air flow, **carbon** and water circulation.
SKOW: My formula follows: Put in water, a humate, calcium hydroxide, magnesium sulfate, Bo-Peep, a special amine compound, castor oil, sodium **carbonate** and water — it has to be distilled water or good reverse osmosis water — and seaweed extract.
SKOW: Calcium oxide and calcium **carbonate** also go together quite well. Generally speaking, lime from the pits means ag lime.
SKOW: Calcium sulfate has a different effect on Homo sapiens than calcium **carbonate**.
SUCROSE: Keep plenty of **water-soluble, ionized carbon** so the crop will not have to depend upon its entire supply of **carbon from the air**. Keep the carbon/nitrogen ratio equalized for greatest yield of sucrose.
WHEELER: In the soil, some nutrients tend to rise while calcium and others tend to move downward. A soil left undisturbed will stabilize from the top down in the following layers: **carbon**, magnesium, phosphate, potash, sulfur, aluminum, manganese and calcium.
WHEELER: Trash is often left lying on the soil surface with little effort given to incorporation into the soil. Residue left in this manner will actually rust, similarly to rusting equipment with the **beneficial carbon being lost** to the atmosphere. \[HOME]

CHELATE

ADVANCED AG: Economics [circa 1981] are starting to look better for adding **chelates**.
ADVANCED AG: Albion labs achieved significant crop increase with **manganese chelate**.
AG LECTURES: The next thing I would add into that spray, in most areas of the U.S. would be some iron chelate. Let me give you **some warning about the use chelated materials**. There are times when you do not use them in the ratios that I give you, i.e. you would not ever want to use a chelate on alfalfa. Why? Student: Anionic instead of cationic? Reams: That's not the reason, but it's a true statement. Student: Why? Reams: Say you were growing out in Colorado, California, Arizona, Idaho, Nevada, you would not use chelates there. Why? Student: Well, the calcium is high out there. Reams: The calcium is high. That's exactly the right answer. Calcium is high. So what happens when you use a chelate in a high calcium soil? It loses its leaves, all the leaves fall off. Student: Why? Reams: Because it thins the protoplasm that holds the leaf onto the stalk.
ANDERSEN: This [burning out the soil] is why anhydrous ammonia should not be used directly on the soil. Instead, it should be mixed with water to form aqua ammonia and a carbohydrate like sugar or molasses to help retain it in the soil, and some humic acid **to help chelate it** for better use rather than reducing further the soil's already depleted humic acids.
ANDERSEN: EDTA chelate—not preferred; **many better chelates are available** [for most minors].
BEDDOE: Iron sources include soft rock phosphate, basic slag, iron sulfate, molasses, and **various chelated irons** as can be used in foliar applications.
BEDDOE: Chelate--A molecule with an extra electron riding along. This extra electron works like a claw, which is the meaning of the **Greek word chelate**. All matter is made up by interlocking of one chelated electron (claw) with another.
BEDDOE: The aerobes [aerobic bacteria] in the soil convert everything possible into protein molecules. This is because they absorb mineral energy and **chelate (link) it into their bodies amino acid structure** just like your body links mineral energy from your food into usable amino acid chelates.
FOLIAR FEED 1981: Also add **iron chelate** or iron sulphate [to soybean foliar formulas].
JOHNSON: Skow: OK, the **next one is chelate**. We have a number of them on the market. They have an extra electron on them. They have a slightly negative charge and the thing you have to watch out with them is this. Chelates are fine in low calcium soils. In other words, soils below 2000 1bs of available calcium If you have a high calcium soil and you start using such as an iron chelate, manganese chelate, copper chelate, watch out. You will completely defoliate the crop.
JOHNSON: Skow: What can you use in place of an **iron chelate**? You use iron sulfate solution. Just take your time and take the iron sulfate or manganese sulfate and mix them in water first. Then put them in you spray tank and you will be alright and it's pretty hard to do the harm I talked about using the chelates.
***REAMS PLANT FEED INDEX: 020 Chelate is atom with extra electron,. chelates interlock to make matter.
SKOW: A **chelate is an element that carries an extra electron**. Iron chelates are simply iron plus an amino acid. Normally iron has a strong positive charge, but when bonded to an amino acid, the resultant compound has a slightly

negative charge. This makes for easy transport into a plant. \[HOME]

CHIRON SPRAYER

FOLIAR FEED 1981: Skow: There is nothing like the Chiron.
FWTK: Reams recommends using a sprayer that homogenizes the spray and sprays a mist, which is then spread out with the air current. The purpose of misting is to get the particles to the size a plant can absorb, and to help it reach the bottom of the leaf. The sprayer he recommends using is called a **Chiron Sprayer**, which they make in West Germany. This type of sprayer is much more effective for foliar feeding than a boom sprayer.
JOHNSON: Skow: Reams talks about a homogenizing sprayer and I am at a loss to know about that completely. He says that is the principle that the Chiron sprayer works on. Theoretically, if something is truly homogenized, it shouldn't separate when put into a container. It should stay uniform throughout the solution. If we run it through a **Chiron sprayer**, it does separate back out again so I don't know for sure, his concept of that. All I do know, and I think he is trying to explain it in the best terms he knows how, is there is still something different in the way the Chiron affects the spray than any other current machine on the market.
PLANT FEEDING: I not to show you something about your row crop farming. It's a spray machine called a **Chiron Sprayer**. It's manufactured in Germany for about $5,000. It's the only spray machine in the world. that homogenizes the spray in big amounts, - really homogenizes it. \[HOME]

CHLORDANE

FOLIAR FEED 1981: 4 pounds of 5% **chlordane** per 100 gallons of water will destroy all sand flys, mites, fleas and ticks.
FOLIAR FEED 1981: Chlordane, Dieldrin, Black Leaf 40, or pyrethrin for grasshoppers. The last two are nutritional sprays.
FOLIAR FEED 1981: Use 2 pounds of 10% **chlordane** in 100 gallons for wire worm and grasshoppers.
GARDENING: There's a way to handle grasshoppers, raccoons, wild hogs, deer, rabbits, and many other pests that try to put you out of business. All you need to do is take one of those plastic jugs and cut the top out of it. Then get some 65-75% **chlordane**, pour it into the jug, get yourself some ordinary laths or sticks and half submerge them in the liquid chlordane. The next night, turn each of the sticks over and push them in the ground all around your garden. The odor of chlordane will keep all the animals out, all the moths out.

NOTE: *The National Pesticide Information center reports that in 1988, all chlordane uses, except its use for fire ant control in power transformers, were voluntarily canceled in the United States. This was 3 years after Reams' death. It should be obvious to all that Reams did not use chlordane for killing purposes in many cases, but only for its smell that drove away pests. If anyone is aware of a strong-smelling, but safe, alternative please let me know. Orthene, which is commonly available, has been mentioned as having a horrible smell and might do the job, but so far there is not enough evidence to fully recommend it.* \[HOME]

CHLORIDE & CHLORINE

ADVANCED AG: Chlorine is a gas and chloride is not.
ADVANCED AG: The reasons for nematodes include high nitrogen, high salts, low aerobic bacteria, **excess chlorine**, etc.
ADVANCED AG: Skow: Basically speaking, we would like to have **chlorides at zero**.
ADVANCED AG: Reams used to buy unsalable oranges and use them in lieu of fertilizer because it was cheaper than fertilizer and because the citric acid **would remove chloride** from groves.
AG LECTURES: Student: You said the reason for [nematodes] is too much salt in the soil? Reams: Yes. Student: Which particular kind is it, the chlorides? Reams: **It can be a chloride**, it can be ammonia salts, nitrogenous salts, calcium salts, iron chloride salts, yes, it can be many different kinds of salts.
ANDERSEN: Avoid products made with calcium **chloride**.
ANDERSEN: Nutrients and compounds in the soil that are considered alkaline include calcium, magnesium, **chlorine**, sodium, potassium, salts, ashes, and aldehydes.
ANDERSEN: When someone tells you that the chlorine from muriate of potash just evaporates into the air, you will know better because the molecular weight of chlorine gas (Cl2) is 70, compared to the lighter weights of H20 (18), C02 (44), N2 (28), and 02 (32), which are the major components of air. Thus, because **chlorine gas is heavier than air**, it will remain close to the ground.
ANDERSEN: Chlorine is a heavier-than-air, greenish-yellow gas that is highly toxic but rarely occurs freely in

nature. Chlorine is generally found in a chloride ion, or in salt. It is recognized as a trace element essential to plant growth, partially for the maintenance of a healthy immune system. Plant scientists generally contend that plants obtain sufficient chlorine either from the air or from rainfall. A & L Laboratories set 3 ppm or 6 pounds per acre as the desired level of chlorine on their soil test.
BEDDOE: In a soil with **500 pounds per acre of chloride**, chicken manure should not be used on the ground.
BEDDOE: Muriate of Potash is one fertilizer that ought to be completely out-lawed. It contains **40-50% chloride**. It is Potassium Chloride. The chloride ion interferes with bacteria proliferation and causes a replacement of sugar and oil in the chlorophyll. Chlorine is even worse, for in as little as .1 ppm it can kill soil bacteria.
FRANK: How much sodium/**chlorides** should be in soil? Not much. A few lbs. per acre is sufficient.
FRANK: How much growth energy does a few lbs. of **sodium chloride** provide? Very little.
FWTK: Fertilizers containing urea, potassium nitrate (**containing chlorides**) and anhydrous ammonia should be avoided. because of their effect on the soil.
FWTK: Muriate of potash is one fertilizer that ought to be completely outlawed, because it contains **forty to 50% chlorine.** It is actually potassium chloride. It takes only two parts per million of chlorine to kill all bacteria. More than 90% of the potash used in this country is muriate of potash.
GARDENING: Well I said, "You need a little boron. You haven't got quite enough in order to kill them. And the second thing is, you need a little chlorine in the water. **Chlorine is an essential plant food and essential food for people.** Clorox, but it has to be a lot more dilute.
PLANT FEEDING: Another way [to eliminate excess chlorine] is to add high amounts of lime - 8-9 tons of lime per acre and oxidize the chlorine. The number of pounds of **chlorine in your soil can be oxidized** by the correct number of pounds of ordinary agricultural lime, but. never use dolomite.
PLANT FEEDING: If you want to know why Texas carrots taste like dirty dish water, its because of the **natural high chlorine** content in the soil. That's why the Texas vegetables are so tasteless. It doesn't hurt wheat or corn, but it will go into leafy vegetables.
SKOW: Chlorides also account for cosmetic growth, which may or may not explain the enchantment many growers have with potassium chloride. It works, but works has to be interpreted loosely. The response is both obvious and temporary — and costly in the long run.
SKOW: Muriate of potash is one fertilizer that ought to be completely banned. It **contains 40 to 50% chlorine** and is actually potassium chloride. It takes only two parts per million of chloride in water to completely kill all bacteria. So 200 pounds per acre of muriate of potash is fifty times more chloride than it takes to kill all bacteria.
SKOW: Calcium chloride will pass a current because the compound has an electrolyte built in.
WHEELER: Through continued use of this soil "killer," **[chlorine]** the desired aerobic microbial life has been seriously depleted and/or changed in character.
WHEELER: Compaction has induced the anaerobic bacteria supposedly found only in the lower levels of the soil to populate the majority of the soil bed. **Potassium chloride** isn't the only culprit. Herbicides, pesticides, and other farm chemicals also contribute to the decrease of proper soil life. \[HOME]

CHLOROPHYLL

AG LECTURES: Carbon determines your **chlorophyll**.
AG LECTURES: Did you ever see corn that you had trouble getting the **chlorophyll green enough**? And you put on more nitrogen and it still looked pale? The more you put on, well it would make it grow, but it just didn't look waxy, a sheen.*[See SHEEN Entry]*
ANDERSEN: Iron draws energy to the leaf by absorbing heat from the sun; it makes the leaf darker, thus absorbing more energy. It will increase the waxy sheen of the crop. Iron is necessary for the **maintenance and synthesis of chlorophyll** and RNA metabolism in the chloroplasts.
BEDDOE: Muriate of Potash is one fertilizer that ought to be completely out-lawed. It contains 40-50% chloride. It is Potassium Chloride. The chloride ion interferes with bacteria proliferation and causes a **replacement of sugar and oil in the chlorophyll**. Chlorine is even worse, for in as little as .1 ppm it can kill soil bacteria.
BEDDOE: Many assume that it is necessary because **magnesium is used in the making of plant chlorophyll**, and many see a response when they add it to the soil. So it may be difficult for some to accept the fact that the problem with magnesium is usually that it is used in excessive amounts in soil applications.
BEDDOE: As the sun strikes the leaf several things begin to take place. First the chloroplasts, where the sugars are made, begin to expand as the anions of the sun's energy **hit the iron within the chlorophyll** and produce heat within the chloroplast.
PLANT FEEDING: Student: I've got 10 acres of comfrey I've been trying to get rid of. Reams: You ought to start

making c**omfrey chlorophyll** if you have ten acres of it. It retails for about 8 dollars a pint. Student: Is there a market for it? Reams: Yes, there is, if you prepare it correctly. Eight dollars a pint for green raw chlorophyll. You may have some trouble in learning how to do it. If you do decide to market, let me know and I'll help you, but you've got to have a sugar content in comfrey of about 5 1/2 or 6 [remember that Reams considered Brix to be half sugar] or it will spoil on you. Even 7 is not too high for comfrey.
SKOW: The other key to the success of this spray program is the use of magnesium sulfate which speeds up metabolic processes and helps make sure there is **enough magnesium for the chlorophyll molecule** to keep the process of photosynthesis rolling to produce simple sugars.
WHEELER: Lack of nitrogen, generally recognized through the light green coloration in plants, is thought to be associated with a **lack of chlorophyll** in the leaves.
WHEELER: Magnesium, like calcium, is now being considered as a primary nutrient. It is an **integral part of chlorophyll** making it essential for photosynthesis. \[HOME]

CITRUS

ADVANCED AG: Apple or **citrus trees always bear** because they have both male and female blossoms.
AG LECTURES: Reams: **Citrus trees that have a waxy sheen on them don't need to be sprayed**, why? Student: They are healthy? Reams: They're healthy, but what is it that makes a citrus tree not have to be sprayed if it has a waxy sheen on it? Kind of like a bald headed man. If a bug lights on it, it slides off. He has a job getting his feet to hold on there. But there's another reason besides that. I've seen a moth light 15 times on a leaf and finally get up and try another leaf and it does the same thing. Finally she flies out and goes somewhere else. Let me tell you something else about a citrus leaf. The citrus leaf has citric acid in it and it's hot stuff. If a bug bites a citrus leaf with citric acid in it he gets a hot foot and he doesn't like that at all. He's not even going to start there because it will burn him up. Citrus requires the least sprays of any crop providing you keep the carbon contents of your soil, your phosphates and calciums high enough in your soil. You'll never have to spray.
AG LECTURES: In 1939 I wrote an article about the salts that were accumulating in the fields and **in the citrus groves**. And I predicted that in 15 years the citrus industry would be in great difficulty. This was before WW II. I missed it by 2 years. In 13 years they were in great difficulty, because this salt was built up in the soil from their fertilizers, synthetic fertilizers.
BEDDOE: Citrus do not really require the help of Sul-Po-Mag.
BEDDOE: The **citrus farmers who survived** the massive freezes of the early 1960s were the ones who had been following Dr. Reams's recommendations.
FWTK: Citrus includes all members of their kind: for example grapefruit, lemons, oranges, tangerines and limes all have the frequency of .0009.
GARDENING: There are **citrus groves** in Florida that are 60-70 years old now that have never had a spraying machine in the grove.
JOHNSON: If **citrus leaves** tend to fall off if you touch them, that is a potassium availability problem.
PLANT FEEDING: Student: Would you use chicken manure **on citrus**? Reams: Yes, but never dig it in. Leave it on top of the ground. Why? Because the boron will ammoniate your trees. It will never hurt citrus if you leave it on top of the ground. Not only that, if you've got your calcium and phosphate, you'll never need to spray your grove. No bugs or insects in it . Spread it from tree trunk to tree trunk evenly.
PLANT FEEDING: In pecans the base exchange is about every 3 years. **Citrus is about 18 months** but a radish has no base exchange - none. Until it starts to go to seed. Most plants will not have a base exchange until it starts to blossom or fruit or both. In other words it maintains the same cells to perform the same duties that long.
PLANT FEEDING: Let me give you some **rules about citrus** and peaches and things of that nature. These are general rules but quite accurate. How marry citrus leaves does it take to furnish the normal amount of carbohydrate for one orange? How do you know when your grove is producing a maximum crop of citrus? What is the criteria for citrus, peaches, pears, grapes, apples - how do you know when the tree has produced its capacity load? So many leaves per fruit. Fifty leaves per fruit. \[HOME]

COMPACTION

AG LECTURES: Reams: What is it in the soil that **causes soil compaction**? I am not asking what breaks it, I am asking what causes it? Student: Is it nitrogen? Reams: No, something in nitrogen though. Sodium, it's sodium in the soil that causes soil
compaction. Now, how do you break this soil compaction? Have you ever seen a field plowed in great big clods? Turned over and it rains and rains and it's still in clods? That's high sodium content. Now how do you break this soil

compaction? What breaks it up? Student: Soft rock phosphate? Reams: Soft rock phosphate, that is correct. Not baking soda, but baking powder, crude baking powder or Calphos.
AG LECTURES: Reams: A lot of people get out there and cultivate, just to be cultivating when it doesn't even need it. Do you realize that? Does it make sense? Are they saving money? Student: They're tearing up the roots. Reams: They're tearing up the roots? How deep should you cultivate when you cultivate? I am talking about row crops now or truck crops. The answer is just as shallow as you can cultivate it actually. Very, very thin, very thin, unless you have a very high sodium content **[causing compaction]** and have to cultivate deeper.
AG LECTURES: Student: Where is the sodium on the strata? Reams: It's all through – it's equal, it's hard, it's what makes soil hard like a brick. It really makes it hard.
ANDERSEN: People **often blame compaction on heavy equipment and frequent traffic** across the soil. These things do cause compaction of soils with calcium-to-magnesium ratios of less than 7:1. They do not cause compaction of soils with calcium-to-magnesium ratios of 7:1 or more and less than 70 parts per million of sodium. Compaction is a phenomenon of physics (particle attraction/repulsion) and aeration.
ANDERSEN: Using the Reams soil test, we can predict accurately **whether soil compaction is present** in the field.
ANDERSEN: I would add a soil conditioner to the preemergent or first spray, or anywhere there is known **soil compaction**.
BEDDOE: Excess sodium levels can contribute to **soil compaction**.
BEDDOE: Sprinkler irrigation **may mean soil compaction**, but plant foods can be delivered to the soil nicely through many types of sprinkles.
FWTK: Sodium is the element in the soil that **causes soil compaction**. The use of soft rock phosphate will counteract this high sodium, and will pulverize the soil. Dr. Reams has seen hardpan, like the Mississippi Valley has (so hard that the soil is like a rock), on which soft rock phosphate has been used. The soft rock phosphate pulverized the soil and made it just as loose as a farmer could wish it to be.
FWTK: The use of herbicides is not recommended by Dr. Reams, herbicide ties up the phosphate of carbon in the soil, **causing more soil compaction**, and decreasing the depth of the topsoil.
PLANT FEEDING: So the thing that makes soil **compact tight** is sodium. Don't forget that. How do you break that sodium? You use the phosphate---the baking powder---the soft rock phosphate. Don't ever confuse the soft rock phosphate with your super phosphate or your triple super phosphate. It mist be soft rock phosphate, because hard rock phosphate will break down over many years while soft rock phosphate is baking powder, right now available.
SAIT: Andersen: The Reams test will reflect what kind of weed you will see in the field, **what kind of soil compaction** and tilth you will see, and what kind of brix readings you will see in the crop.
SKOW: Clay soils high in magnesium and low in calcium cement together tightly, are **subject to compaction** and clodding, crust over easily and prevent the insoak of water and the recovery of capillary water during the dry periods of the season.
WHEELER: Compaction has induced the **anaerobic bacteri**a supposedly found only in the lower levels of the soil to populate the majority of the soil bed. Potassium chloride isn't the only culprit. Herbicides, pesticides, and other farm chemicals also contribute to the decrease of proper soil life.
WHEELER: Potassium does not have the same electro-chemical properties as calcium and does not provide the same support to the clay structure. The excessive potassium can result in structural collapse of the soil which can affect the fertility and **increase compaction**.

NOTE: *Reams was adamant that soil compaction always traced back to excessive sodium. You can see that many of his students did not closely follow his thinking.*\ [HOME]

COPPER

ADVANCED AG: Sul-Po-Mag makes **copper available**.
AG LECTURES: But the copper makes the bark elastic. Just like a little boy that out grows his britches, they're too tight. It makes the bark elastic and lets the sap flow. Therefore gives you a greater yield. I've seen a 300% increase in yield just because **copper was added**.
AG LECTURES: Then what would you do? The crop was rotting in the field. With all these numbers that I have told you and yet the crop was rotting just as it matured. Student: Put some sulfur on? Reams: **Sulfur or copper**? Student: Too much sulfur. Reams: Too much sulfur, that's right. So what would you do? Student: Put calcium on it? Reams: Calcium hydroxide, the hot lime. Just about 100 lbs. to the acre will knock that sulfur right out of existence as far as availability to the plant is concerned. And in 3 days you've stopped the rot. Calcium hydroxide is the hot lime.
AG LECTURES: The Blue Mold can't stand it. **Copper is the greatest enemy Blue Mold ever had**. Then it also makes the bark stretch in the plant and give you greater yields. It's a germicide.

AG LECTURES: What happens to young plants or onions or peppers, beans, tomatoes – row corps; whenever there's a **copper deficiency**? What happens to your young plants? They rot off at the ground.
ANDERSEN: Ragweed, for example, is generally indicative of a phosphate/potash imbalance, but, more specifically, it indicates a **copper problem**.
ANDERSEN: Copper is the key to elasticity in the plant. It is an important constituent of many proteins like ascorbic acid oxidase, cytochrome oxidase, diamine oxidase, and polyphenol oxidase. Copper is an important nutrient for many microbes, such as Aspergillus niger. It controls molds and often alleviates perceived zinc deficiencies. Copper interacts with iron and manganese.
BEDDOE: The parts of the reserve soil TDN are calcium, phosphate, potassium (potash), nitrate nitrogen, ammonia nitrogen, iron, and **copper**.
BEDDOE: In excessive amounts **copper will prevent the soil bacteria** from developing and proliferating
BEDDOE: Citrus are very sensitive to having **too much copper uptake**. It will not bother the plant itself, but it will make the skin on the fruit split. Citrus do not really require the help of Sul-Po-Mag.
FOLIAR FEED 1981: Add **copper** for tight bark [to relieve].
FWTK: Furthermore, healthy plants take a large part of the trace elements they need from the air. They supply magnesium, manganese, zinc. cobalt, **copper**, sulfur and boron in this way. Soil must contain proper mineral levels for this process to take place
FWTK: It is recommended that elements such as manganese, zinc, **copper** and iron be applied by means of a foliar spray.
GARDENING: All plant food with the exception of nitrogen, must go into that tree or plant in phosphate form, phosphate of iron, phosphate of zinc, **phosphate of copper** and so forth.
FRANK: Examples of carbonates: calcium carbonate, iron carbonate and **copper carbonate**. Examples of oxides: Manganese oxide, iron oxide and **copper oxide**.
FRANK: Crops with an outside bark over xylem tubes such as trees, alfalfa, or sunflowers may have a **copper deficiency** which doesn't allow the bark to stretch, making foliar nutrition futile.
JOHNSON: Skow: Common electrolytes are iron, aluminum, **copper**, and one of the other ones that you will see a lot written about is magnesium and they get a wonderful response. Now the only reason they get a response is that the plant is constipated. And if any of you have had that problem you know that if you can get it moving again, that you feel better. So there is a time and a place once in awhile, where it is beneficial, where a crop stunned or not doing well and looks like it isn't growing satisfactory, and this is particularly important if you have some herbicide damage and you want to flush it out.
JOHNSON: If you have a high calcium soil and you start using such as an iron chelate, manganese chelate, **copper chelate**, watch out. You will completely defoliate the crop.
JOHNSON: Zinc is used to control many types of blight. It is also a minor catalyst for Sul-Po-Mag **and copper.** It helps to make the acedic acid in the root to keep it from rotting.
PLANT FEEDING: There's only one reason why Blue Mold is present on a young plant. **For lack of copper**---a deficiency in the plant.
PLANT FEED AUDIOS: Blue Mold and copper deficiency. [**adequate copper] allows bark to stretch**.
SKOW: The electrolyte is always a conductor of electricity — usually iron, **copper**, zinc, etc. The most important one is nitrogen because no crop will grow without it. Even if a cell needs iron, copper or zinc, it can't affect formation of the cell until nitrogen is present.
SKOW: Copper — or the lack thereof — is most frequently noted when fruit trees do not produce. They do not produce because the bark cannot stretch. When the bark cannot stretch, sap can't flow. This situation can be remedied at times by applying copper sulfate, but many times that device will not work. Again, a nitrogen or phosphate deficiency might be identified as the cause. In other words, there may be enough phosphate to accommodate the basic functions of the plant, but not enough to handle copper and iron needed from a standpoint of energy. There are a couple of products on the market that might be helpful. One is Sul-Po-Mag. It contains sulfur, potassium and magnesium, and **it makes copper available** to the plant.
WHEELER: Trace nutrients come premixed in fertilizers, can be requested as additions to custom mixes, and can be purchased in both dry and liquid forms. Most can be obtained in the sulfate form, **as found in copper sulfate** or iron sulfate, or in the oxide form as found in magnesium oxide. These are the most popular and least expensive forms. These forms, however, aren't of the highest energy nor are these the most biologically available forms. Other forms such as amino, citrate or humic acid types are more easily assimilated by the plant.
WHEELER: Copper is largely associated with plant enzymes. It regulates plant bark "stretchiness." It may be somewhat immobile in higher pH soils. Copper is known for its fungicidal qualities. Energy values will vary depending upon the source. \[HOME]

CORN

ADVANCED AG: Some types of alfalfa, **corn**, or soybeans require less water than others. Experiment and discover them.
ADVANCED AG: On **corn**, the dying off of main tap roots with maturity is normal.
ADVANCED AG: After corn reaches the milk stage**, its need for water lessens.**
AG LECTURES: Student: If you're applying your chicken manure to your soil, would it make any difference in the amounts you put on for **corn**, peanuts or soybeans? Reams: No it doesn't.
AG LECTURES: Did you ever take a leaf of alfalfa, sugar cane **or corn and examine it closely** and see little black dots in it? Have you noticed that or on the stem? Have you seen little black dots appear on the stem of alfalfa? Did you really look that close? That's too much potassium in the soil. How many have seen those little black dots? Have you noticed it on peach leaves, orange leaves, any crop?
AG LECTURES: Did you ever see **corn that you had trouble getting the chlorophyll green enough**? And you put on more nitrogen and it still looked pale? The more you put on, well it would make it grow, but it just didn't look waxy, a sheen.*[See SHEEN Entry]*
AG LECTURES: Student: You said a 4 to 1 P and K for grasses, do you consider alfalfa a grass? Reams: Yes, sugar cane too is a grass. **Corn is not a grass**.
AG LECTURES: Student: I had a farmer tell me he **sprayed his corn** when it was just coming up with Atrazine, at the rate of 1/3 pound per acre. And he said it didn't kill the weeds, but it just stunted them enough that the corn grew up away from the weeds.
AG LECTURES: On corn, wheat and soybeans, there's one other ingredient you should use on any crop that you're growing for the grain. It's manganese. Manganese is the element of life and without manganese there's not any life. Therefore the lack of manganese can cause a great loss of yield in the long run.
ANDERSEN: The **plugging [in a corn stalk]** is caused by many things—chemical toxicity such as herbicides, putrefaction products of an anaerobic soil,
ANDERSEN: An ear of corn at 24 brix with **corn ear worms** inevitably will have leaf or stalk refractometer readings below 12.
ANDERSEN: The corn plant just described is typical of those found throughout the United States today. Is this normal? Yes, if normal means commonplace. No, if normal means perfect health. Most **farmers have been taught that corn has brace roots to prevent the plant from falling over**. Actually, brace roots are the plant's emergency response in order to exchange nutrients and prevent starvation and death.
BEDDOE: Potassium is what determines the caliber of a **corn stalk** or the caliber of an alfalfa stem.
BEDDOE: Probably **corn has one of the highest demands for ammonia nitrogen**, so it is a good idea to work up to 200 lbs. per acre for its needs at 40-50 days from sprouting.
FWTK: Part of the commercial yields achieved with the Reams program are: 20 tons per acre of alfalfa at 28% moisture; **200 bushels of corn per acre** as a starting point...
FWTK: In **corn, for example**, the ERGS should be the highest from the time it tassels to the dying of the silk, in order to produce a maximum crop.
GARDENING: And the concept of high sugar turning to alcohol and disrupting worm cycles is **true on corn crops**, cane crops, anything. When corn silk comes out if it is high in carbon, hydrogen and oxygen which forms the sugar, it's going to be high in the corn itself and you should notice little teensy dots that looks like nectar on the silk. But if that silk is dry and you don't see those little drops of nectar on it, little teeny drops like a diamond that sparkle in the dew drop, then you are going to have worms in your corn.
GARDENING: There are farmers today, commercial farmers, producing 40-60 bushels of **corn per acre** and, and just think they're doing wonderful. They ought to be ashamed of their selves if they're not producing 200 bushels per acre.
JOHNSON: The oats that we had in here earlier had what I call a waxy sheen to the leaf. Those leaves get a waxy sheen like some house plants and **when you get a corn field** that looks like that or a bean field or an oats field, you have come a long way.
JOHNSON: Tomorrow we will be discussing the use of different sprays when the **corn is in silk stage**. There are specific sprays you can go in and spray corn at that stage especially with a mist blower on a highboy. It's theoretically possible if you can get the foliar spray on the silks of the corn early, you can increase your yield from 10 to 30 percent.
PLANT FEEDING: Plants are very much like animals in a barnyard. Lets consider a goose and a horse. You can feed them both on green grass alone and they'll live a long time. You can **feed. them both on corn** and oats and they'll live a good long time, but you put them both on hay, and the goose won't live. That's what you can do for plants---just don't give weeds the vital minerals they need and you'll get rid of the plants you don't want. Nothing difficult about that is

there? That's what you're here for---to learn how to keep from using poisonous sprays.
PLANT FEEDING: If you want to know why Texas carrots taste like dirty dish water, its because of the natural high chlorine content in the soil. That's why the Texas vegetables are so tasteless. It **doesn't hurt wheat or corn**, but it will go into leafy vegetables.
PLANT FEEDING: i advise you to put corn in 20" rows. It you actually have enough nutrients in the soil to support corn, in 20" rows, 8" apart in the row. Now, if you did that, look how much more you'll get. But let me tell you this - when you plant it that thick, you won't get ears 16-18" long---only about 6-12" long, but a lot more of them. This is the way to increase the yield. Something else about this: the com being so thick like that will shade out the grass. You won't have any grass problem.
SKOW: Let's assume we have **corn stover in the root bed**. This stalk has a magnetic charge. At one time this charge was superb because it accomplished the task of building a stalk. It was able to attract. Now the carbon in the soil has to pull it apart. That soil carbon has to be constructed by bacteria as amino acids. The sequence for action is at once simple and complicated in the extreme. Bacteria have a stronger magnetic force than the corn stover. As they break down the corn residue, they lose their electrical charge. In a weaker form the breakdown product becomes an amino acid first, finally carbon.
SKOW: One of these young investigators crossed over into this **cornfield** without permission. As a consequence he was asked promptly what he was doing. He said, "I'm out here getting a bug count for Monsanto, and your field is on my block." It had rained, and the com borers were all dead. He asked why they were dead, and then he looked down and saw a little water, "Oh, well," he said, "I guess they drowned." Three or four weeks later a new hatch was out and the insects were all dead again. The reason is that when you have insects in a field that has high energy and a high sugar content in the crop, alcohol is produced. A human being can consume alcohol with moderation. An excess can cause diarrhea, but diarrhea in a human being is nothing compared to the same malaise in an insect.
WHEELER: Try gently **pulling on a medium-size corn root** to see if the root bark will separate and slip off easily like a stocking. This would indicate weakness caused by excessive salts in relation to carbohydrates and humus and could provide a situation where nematodes could easily penetrate. \[HOME]

CULTIVATION/TILLAGE

AG LECTURES: Reams: A lot of people get out there and cultivate, **just to be cultivating** when it doesn't even need it. Do you realize that? Does it make sense? Are they saving money? Student: They're tearing up the roots. Reams: They're tearing up the roots? How deep should you cultivate when you cultivate? I am talking about row crops now or truck crops. The answer is just as shallow as you can cultivate it actually. Very, very thin, very thin, unless you have a very high sodium content [causing compaction] and have to cultivate deeper.
AG LECTURES: The closer you can plant your rows together, **the less cultivating you need**. That's a very important factor.
AG LECTURES: So as you begin to work with these soils and cultivation of soils, be sure you don't cultivate just because somebody else is. **Cultivate when you need it**. And it is this shadow that will stop more grass from ever getting started than anything in the world. So the closer you can put the crops together, the closer you can put the rows together, the less cultivating you are going to have to do. Student: Do you recommend any minimum width apart? Reams: Well corn, I like to plant 20 inch rows. Student: That's about as close as you want it? Reams: That's right, about 20 inch rows. You can work it out one time then. Student: Like beans or so, you can put a little closer? Reams: No. Beans are a little different crop. You need a little bit more room on beans than you do corn. **AG LECTURES:** The lower the quality, the less the quantity. And there's no exception to it. So watch your soil temperatures. It has **much to do with your cultivation program**. Don't be in too big a hurry to plant in the spring of the year, but get your soil ready. Get the problems out of the way. Do you know there won't be a weeks difference in the corn that you planted 3 weeks ago and the one you planted 3 weeks from now? Actually there won't be over 10 days difference in it if that much. And the yield will be that much greater.
AG LECTURES: Reams: There's one point I haven't discussed yet in planting your crops and that is, under cultivation and over cultivation. It's just as **important to cultivate at the right time** as it is not to cultivate at all. You can cultivate too early or you can cultivate too late. What is one of the primary factors on good timing of cultivation? Student: Water content of the soil? Reams: On some soils your gumbo soils, that would be true, yes. Or your soil was so wet you couldn't get in there---your muck soils, yes. That is one factor. But what is another one that is a primary factor on your cultivation? We have discussed it now I just want to know if you know what it is. Student: Breaking the crust is one of the things. Reams: The sodium content of your soil, that is correct. In other words, you must get your soil aerated. Now that is, when you first start this program, you're going to have a little problem with aeration. But the program moves along, and you'll have less and less trouble with aeration.

AG LECTURES: Reams: What are some of the factors that determine **whether we should cultivate or not**? Student: Weeds? Reams: Weeds are one. Student: To break that top crust? That's right. When that crust form, you want to break that crust on the top of the ground.
ANDERSEN: Timely **tillage** is very effective at oxygenating the soil.
ANDERSEN: A further alteration would be to apply the herbicide in a band over the row on the planter and then **cultivate the middles of the rows**. Eventually, all herbicides and insecticides will be eliminated from the program. They do as much as or more than anything else to inhibit the regeneration of the biological system in the soil.
BEDDOE: Cultivation practices can tell how deep a potential soil may be. Or how much of a drainage problem may be encountered. The moisture-holding quality of the soil can be effected by the way the soil is cultivated. Cultivation can also affect soil texture, in other words, the fineness or coarseness of the soil. It can give an indication of the calcium content also. The **more calcium present in some soils the easier it will be to cultivate** and the better the soil will crumble.
BEDDOE: The only exception to the use of the moldboard plow is in a tree crop situation as in mature orchards, groves, and vineyards. **In these cases do not cultivate at all**. Just apply the plant nutrients to the ground between the trees and vines. The reason for this non-cultivation is to not cause the loss of energy from the plants bleeding through roots that get cut by cultivation equipment.
FOLIAR FEED 1981: Don't use herbicides, **cultivate your weeds out** so that they add carbon to the soil.
FRANK: In the past farmers would cultivate grain crops in order to combat weeds. With increasing acreage, farmers found it easier to spray herbicides rather than **to cultivate**.
FWTK: A few weeds in a crop, on land that is properly fertilized, will not affect the yield, because there is enough plant food for both the weeds and the crop. Actually, a few weeds that are **easily cultivated under** can produce 20 to 50 lbs. of nitrogen per acre.
GARDENING: Gardeners practice wrong cultivation sometimes. You can get more crop quicker by planting your rows east and west than you can north and south. If you plant your rows north and south, the plants are feeding out from under each other. And if you plant them east and west, they're eating out of the middle between the two rows. And, and therefore they have more food, and they'll come in as much as two weeks earlier and just as good.
JOHNSON: One thing that can make the soil pH go up is just the lack of air. As that pH goes up nutrients become unavailable and the quickest way to solve that problem is to **go out and cultivate**. How many of you have noticed after you cultivate there seems to be a good spurt of growth?
WHEELER: Even in this day of chemical control, many farmers find they have better weed control with cultivation. The benefit of air introduced into the soil is often an unexpected plus. The air assists the development of root mass and supplies microbial life with needed oxygen.

NOTE: *There are two meanings for cultivation, stirring the soil and also husbandry practice.*

\[HOME]

DOLOMITE

AG LECTURES: Student: If you find the agricultural lime in the area is up to the **dolomite strain**, would you use the dolomite? Reams: Don't use it. Student: Where do you go from there? Reams: If you can not get it [non-dolomitic lime] from your area, you may have to have it shipped in from Florida or somewhere else. Just don't use dolomite.
AG LECTURES: In **dolomite** you have your magnesium and you have your calcium. Those 2 things are together, but they are separate. They're not bonded together. What nitrogen will do is destroy this combination. In other words it will X it out, turn it loose into your air, into bubbles. Then your calcium will slowly become available. About 18 months later, providing you've got enough very expensive nitrogen in your soil.
ANDERSEN: Reams used calcium carbonate, **never dolomite**. He observed that sufficient magnesium would be available if he balanced the calcium, phosphate, and microorganisms and then applied fertilizer quantities of Sul-Po-Mag.
ANDERSEN: Avoid using **dolomite** fertilizers or additives.
BEDDOE: Magnesium is the enemy of nitrogen. This is important to remember. Every pound of magnesium available in soil chemistry will release a pound of nitrogen. This is why **dolomite is not used as a soil amendment**. It is 35% Magnesium Carbonate. Sometimes Magnesium is used in certain forms for the purpose of reducing nitrogen content in and around certain plants. Otherwise if the soil is worked properly, the plant can get all the magnesium it needs on its own.
BEDDOE: The second **problem with dolomite** is that the calcium does not become available in the soil for at least 18 months.
FRANK: Limestone with a high magnesium content is called **dolomite. It is not normally recommended** because it

provides too much magnesium and imbalances the calcium-to-magnesium ratio.
FWTK: There are five basic sources of calcium for agricultural purposes. The most common source is ground limestone. Then **there is dolomite - which we do not use**, gypsum (calcium sulfate), calcium oxide, Aragonite and basic slag.
PLANT FEEDING: Dolomite is a calcium oxide and magnesium oxide [mixture] containing approximately 35% magnesium oxide. One of the fastest ways in the world to **go out of the business of farming is to add dolomite** to your soil.
PLANT FEEDING: The Experiment Stations say you should always use magnesium oxide as dolomite with lime. They get anywhere from $1 to $4 a ton for every one that is used. Three dollars is a good average. **You don't want dolomite, period**. The Experiment station will have to think up some other gimmick to get their operating funds.
PLANT FEEDING: Another way [to eliminate excess chlorine] is to add high amounts of lime - 8-9 tons of lime per acre and oxidize the chlorine. The number of pounds of chlorine in your soil can be oxidized by the correct number of pounds of ordinary agricultural lime, but. **never use dolomite**.
SKOW: The refractometer — in its subtle way — **warns against the use of dolomite** limestone. When purchasing limestone, no product should be used on the soil if it contains more than 5% magnesium. If the source says the information isn't available, then request a laboratory analysis or look elsewhere. I have in mind a bunch of Michigan farms on which the wrong limestone was spread at the rate of two tons per acre. Years later, those fields still won't grow a crop. That's why it is mandatory to check the analysis.
WHEELER: Reams suggested you **avoid dolomite for three reasons**. The most impressive one has to do with nitrogen release. Magnesium is antagonistic to nitrogen as seen in the use of Epsom salts as a treatment for nitrate poisoning in cattle or an Epsom salt spray on fruit trees to stop apple drop due to nitrate-weakened stems. When the magnesium releases from dolomite, it can cause nitrogen to release as a gas. \[HOME]

ENERGY

SUCROSE: Too much fertilizer applied at one time can result in a **quick release of energy without preserving this energy** in protein molecules. Most of the energy is lost unless harnessed by the protein molecules, which results in a decreased sucrose yield. \[HOME]

ERGS (Energy released per gram per second)

ADVANCED AG: Reams speaking about when someone calls for help: "The **ERGS** is the first thing I would want to know."
ADVANCED AG: Skow: The **ERGS can be tested** in the office if need be.
ADVANCED AG: Figure your **baseline ERGS** in the forest or outside your fenced in land where you have not fertilized. The baseline should NOT vary that much year around.
ADVANCED AG: Measure the calcium in the area of the **baseline ERGS**. If acidic, you add the baseline to the test value. If alkaline, you subtract the baseline.
AG LECTURES: Reams: Which uses the most **ERGS of energy**---little plants or big plants? Student: Big ones? Reams: Yes, when they are big---now, at what stage does your production increase the most rapidly? Student: Silk stage? Reams: From the tassel to the dying of the silk. That is when your ERGS should be highest and you may need to use some superphosphate to keep it high enough.
AG LECTURES: Reams: Suppose you have soil that had 600 **ERGS**, what would that mean? Student: It means it's jumping? Reams: It means you'd have an extremely great loss of energy. Plants can't take it in that fast. They cannot take it that fast. Where would this energy be going? Student: Into the air? Reams: Into the air, that's right, but some of this energy could be being picked up by the bottom of the leaf.
AG LECTURES: Student: What is the **maximum ERGS that a plant can utilize**? Reams: About 200. If you've got 200 ERGS per gram of soil over that whole acre and your crop is at the climax, it can use that much and maintain it. But if it's greater than that, you have a terrific loss. You don't think soil chemistry is important? It's just like burning money if you get your ERGS too high.
ANDERSEN: Reams tested calcium, phosphate, potash, nitrate and ammoniacal nitrogens, **ERGS (conductivity in micromhos or microsiemens)**, and various trace elements.
ANDERSEN: **ERGS (energy released per gram of soil)**, measured in micromhos or microsiemens, represents the amount of energy available to the growing crops and microorganisms. The reading must be interpreted in relationship to the inherent conductivity of the base soil due to salts and non-nutrient minerals. If the overall reading gets above 1,000, there is generally a salt problem, energy loss and waste, and increased potential for root burn and nematode proliferation. If the ERGS level drops below 200, little or no crop growth is occurring. Late-season crop finishing is

directly correlated to the ERGS level.
ANDERSEN: The calcium-humus-phosphate complex is the key to maintaining **stable soil ERGS** and crop quality. Without the humus component, the calcium and phosphate complex [together] to form [useless] tricalcium phosphate rendering both the calcium and the phosphate unavailable.
BEDDOE: ERGS---A measure of soil energy release equal to grams/sec. **ERGS are directly equal to conductivity units** on the conductivity meter, micromhos/cm/sec.
BEDDOE: While conductivity (**ERGS**) tells quantity, pH tells speed and magnetism.
BEDDOE: Check ERGS and nitrogen at planting time. This will give you one final check to see if the soil energy is shaping up as planned. **ERGS will tell you if there is enough energy** reaction going on in the soil to germinate and feed the seed properly.
FOLIAR FEED 1981: Reams suggested that diatomaceous earth with an ERGS reading less than 30 not good. He wanted to see **60 ERGS or more**.
FWTK: Testing soil without using a test for water soluble plant foods will lead a farmer to believe his soil has plenty of the elements in which it may be most deficient. The basic tests included are for nitrate nitrogen, ammoniacal nitrogen, phosphate, potash, calcium, pH **and ERGS**.
FWTK: ERGS is a reading of how much plant food is available per second, per gram of soil. About **forty ERGS is the minimum** there should be even to plant a seed. Then, as the plants grow, the ERGS should increase. When the crop reaches its climax, the ERGS should also be at their climax. At the latest stage of growth, when production increases most rapidly, the desired level of ERGS is between 100 and 200. However, it can reach as high as 400 for a few days at a time. In corn, for example, the ERGS should be the highest from the time it tassels to the dying of the silk, in order to produce a maximum crop.
GARDENING: ERGS mean the amount of energy available per second, per gram of soil. As the plant grows the **ERGS level needs to increase** and if the level increases too quickly, the plant is too little to take them in and you've got a great loss. It's like burning your money.
FRANK: If you go in there with a high nitrate, high potassium product, you will **probably push the ERGS up some**, but the health of the plant will simply go down very fast if you put on what is there in excess already.
FRANK: With this program, it seems that if you **keep the ERGS where it needs to be**, if you put in what needs to be put in, the ORP kind of takes care of itself.
FRANK: If you put out the right thing [fertility], you will **increase the ERGS** and you will increase plant performance.
FRANK: Headings:We checked the energy with a **meter [ERGS]**. You buy a conductivity meter and anybody can do this and it's great to have one to check the energy in the soil and to see if that is the problem or if it's another problem.Well, in this case it was the problem. The energy was low. And so, we mixed up some soluble nutrients and we also used a foliar spray from International Ag Labs. And he called me 24 hours later, and he said, "Duane, you have to come see this. All those potato beetles moved out into the weeds."
PLANT FEEDING: Student: Why don't you care about pH values? Reams: Why should I? I'll handle it in any soil. For example ,we are going to be **testing the ERGS** and whenever I know what my ERGS are I feel that is what the pH is.Student: So you can do it either way---in some things? Reams: No, ERGS is the only accurate way to do it.
PLANT FEEDING: Suppose you have corn, Irish potatoes, wheat and just. about the time it. got ready to mature and there came a terrific rain and you tested the soil after the rain and you found the ERGS down between 40 and 50 but you need 200 ERGS for that last 2-4 weeks. Because in that time you can double your yield in your row crops.
PLANT FEEDING: Student: Can you give a particular rate on ERGS for how much superphosphate to use? Reams: It's a variable according to your temperature. How much superphosphate you should use to raise your ergs? 2 lbs. per thousand square feet at any one time should be a. maximum at about 100 lbs. per acre. You are not using it for the phosphate - you are using it as a catalyst.
SKOW: The term ERGS designates a reading of how much plant food in terms of chemical energy is available per second per gram of soil. When planting, you should start out with around 40 ERGS; this is the minimum you should have to even plant a seed. Then, as these plants grow, the ergs should increase as well. At the latest stage of growth, when production increases most rapidly, the desired level of ERGS is between 100 and 200.
SKOW: If the ERGS in the soil are being created by elements that are not plant foods, they then are not counted in the ERGS calculations. For example, if you have very low, or 0-0-0 readings on your soil test, but show an ERGS level of 1,000, these are not plant food ERGS.
SKOW: ERGS of pure sand and water will be less than 10 microsiemens. The **ERGS of a good natural woods earth soil will be 100 to 200 microsiemens**. If a soil has its nutrients tied up or complexed, then the ERGS will be low*** 2 uS and plant growth reduced. Some crops such as corn may be pushed to greater yields by bringing the ERGS to 400 microsiemens. A baseline reading of ERGS may be established by gathering a soil sample in the early spring after the

fall and spring rains before the bio-life has been activated with rising temperatures. Salt residues and underutilized plant nutrients results in baseline ERGS of 25 to 600 microsiemens. If soil ERGS equals 1200 microsiemens most plants won't survive.
WHEELER: **ERGS** — [equals] conductivity reading [of the soil].
WHEELER: When **ERGS are high**, e.g. 800 or higher, check to see if sodium is a factor. High-sodium soils can be more difficult to grow on. Very low sodium soils can benefit from applications of sodium for flavor enhancement of produce and soil texture.
WHEELER: Users of the Reams technology are finding that although the base reading concept is still valid, the **ranges of ERGS one has to work with may be much higher than the 200-400 range**. Part of the reason may be that the plant hybridization process has developed plants needing to consume or grow in the presence of high amounts of nitrogen which can result in higher ion counts. However, although plants may grow at the higher ERGS levels, the bacterial populations may not function well enough to result in high brix readings along with the potentially higher production. Some of Dr. Wheeler's clients are running as high as 1,200-2,000 ERGS under plastic with drip irrigation and achieving excellent results.

NOTE: *It may take careful study, but the true student should gradually become aware that Reams considered excessive soil ERGS as a waste that would escape and only sometimes be captured by the undersides of the leaves. We should never forget that Reams seminars were generally directed toward how the farmer could be successful economically, not just grow abundant bins and bushels.* \[HOME]

FERTILIZER

ADVANCED AG: If you had an orange grove in south Florida you could use Napier grass because of the large amount of tonnage that you get off it. You get your mineral high enough for Napier grass and you **won't have to buy any fertilizer** or sprays for 20 years.**AG LECTURES:** **Organic fertilizer is rich in bacteria**, aerobic bacteria.
AG LECTURES: [In orchards or groves] **Do not disk in any of the fertilizer**. Leave it right on top of the ground.
AG LECTURES: In 1939 I wrote an article about the salts that were accumulating in the fields and in the citrus groves. And I predicted that in 15 years the citrus industry would be in great difficulty. This was before WW II. I missed it by 2 years. In 13 years they were in great difficulty, because this **salt was built up in the soil from their fertilizers, synthetic fertilizers**.
ANDERSEN: The action of **humic fertilizers** was tested by the author in different soils. In all cases the effect was positive.
ANDERSEN: Reams used calcium carbonate, never dolomite. He observed that sufficient magnesium would be available if he balanced the calcium, phosphate, and microorganisms and then applied **fertilizer quantities of Sul-Po-Mag**.
ANDERSEN: In any program, it is a good idea to **split the fertilizer applications** and consider foliar feeding if it is feasible to do so.
ANDERSEN: Timely tillage is very effective at oxygenating the soil. Hydrogen peroxide can add oxygen to the soil, as can fluffing of the soil using **appropriate fertilizer materials**.
BEDDOE: Remember [**when blending fertilizers** to] use the best filler available and that may be just plain white sand.
BEDDOE: This type of calcium [calcium hydroxide] is also good to counteract other problems that are becoming more prevalent today, such as **excess acids from fertilizers**, rain, and sulfur containing irrigation water.
BEDDOE: **Other fertilizer materials** that can be used as catalysts in certain situations include: ammonium sulfate, ammonium thiosulfate, ammonium phosphate, calcium sulfate, calcium nitrate, potassium sulfate, and potassium nitrate.
BEDDOE: Muriate of Potash is **one fertilizer that ought to be completely out-lawed**. It contains **40-50% chloride**.
FRANK: Avoid ashes on high calcium alkaline soils. **Ashes are wonderful fertilizers** but you must use them judiciously and at the right time. I like both hardwood and softwood ashes.
FWTK: The **best fertilizer for a crop** is the residues from that crop.
SUCROSE: Too **much fertilizer applied at one time** can result in a quick release of energy without preserving this energy in protein molecules. Most of the energy is lost unless harnessed by the protein molecules, which results in a decreased sucrose yield.
WHEELER: Trace nutrients **come premixed in fertilizers**, can be requested as additions to custom mixes, and can be purchased in both dry and liquid forms. \[HOME]

FLEA

FOLIAR FEED 1981: 4 pounds of 5% chlordane per 100 gallons of water will destroy all sand flys, mites, **fleas** and ticks.\ [HOME]

FOLIAR FEEDING

ADVANCED AG: **Foliar feeding wont help ordinary trees** because its only used when there is fruit.
AG LECTURES: Student: When corn is going from the tassel to the silk, is that a good time to **foliar feed**? Reams: Yes, that is an excellent time to use manganese. Student: How often? Reams: Well, once or twice anyway, but after the silk dies, it's too late.
ANDERSEN: In any program, it is a good idea to split the fertilizer applications and **consider foliar feeding** if it is feasible to do so.
ANDERSEN: Apply a **foliar spray where appropriate**, according to the refractometer test. Forget the guessing; select according to refractometer increases.
BEDDOE: Iron sources include soft rock phosphate, basic slag, iron sulfate, molasses, and various chelated irons as can be used in **foliar applications**.
BEDDOE: One of finest ways to add additional nitrogen to crops is through the leaves. **This is called foliar feeding**. Foliar feeding recognizes that a plant takes in up to 80% of its energy for growth out of the air through its leaves. Since nitrogen is the important electrolyte, it is important that it is present in all foliar sprays in a small amount if nitrogen is not needed in the plant, but in larger amounts if extra is needed by the plant.
FOLIAR FEEDING: You should rarely use calcium in **[foliar] spray** unless calcium hydroxide.
FOLIAR FEED 1981: Student: **When should we last foliar feed** soybeans? Reams: About 5 week after blossoms are done. Student: How about corn? Reams: Until it is well past the milk stage. You can cut alfalfa when 50% of the blossoms are open. You can foliar feed the day before cutting.
FOLIAR FEEDING: Also add iron chelate or iron sulphate [to **soybean foliar formulas**].
FRANK: Crops with an outside bark over xylem tubes such as trees, alfalfa, or sunflowers may have a copper deficiency which doesn't allow the bark to stretch, **making foliar nutrition futile**.
FRANK: In alfalfa, we have seen yields triple when K-Mag was applied to relieve poor xylem circulation. Another **circulation problem impairing successful foliar feeding**: The stems of alfalfa and small grains such as wheat or oats are often hollow, lacking adequate phloem tubes which carry nutrients from leaves to roots and other parts of the crop. With proper basic nutrition, you can create much larger phloem tube pathways, visible as pith in stalk cores. Look for solid stem alfalfa.
FRANK: And so, we mixed up some soluble nutrients and we also used a **foliar spray from International Ag Labs**. And he called me 24 hours later, and he said, "Duane, you have to come see this. All those potato beetles moved out into the weeds." And I said, "I DO have to see this." I drove up there and his potato patch was clean. I could not find one beetle in that potato patch, and that IS unusual. I mean, usually, you'll find one or two, but I couldn't find ONE.
FWTK: As mentioned earlier, plants have the ability to take in **nutrients through their leaves**. The ability of spray nutrients to be absorbed and utilized was proven by Dr. Reams when he sprayed uranium and plutonium on the leaf of a plant and traced them down through the roots and back up to where they became a part of the plant.
FWTK: It is recommended that elements such as manganese, zinc, copper and iron be **applied by means of a foliar spray**.
JOHNSON: Some other things to **watch out for when foliar feeding**; If the pH of the water is extremely high or extremely alkaline, it probably is not going to be nearly as effective as far as being taken in by the leaf. Basically what you are looking for is something that is equivalent to fog that you can condense into water. That would be your ideal. The temperature of the water should be very close to the air temperature.
JOHNSON: Tomorrow we will be discussing the use of different sprays when the corn is in silk stage. There are specific sprays you can go in and spray corn at that stage especially with a mist blower on a highboy. It's theoretically possible if you can get the **foliar spray on the silks of the corn** early, you can increase your yield from 10 to 30 percent.
PLANT FEEDING: One of the finest things you can plan to do on all of your crops, in order to get your nutrients and minors in, is to **spray it on with a homogenized sprayer** - under the leaf.
PLANT FEEDING: That **[foliar feeding]** is the cheapest way to supply your minor elements, in nutritional sprays. It saves you a lot of work in so i l analysis expense.
SAIT: Andersen: In plant growth there is the Yin (female) or acid energy, and there is also the Yang (male) or alkaline energy. Do you want to set fruit or do you want to get growth? If we want fruit and we have established a good calcium

base, either locally or regionally, then **I can apply an acid-based foliar** and I can set fruit with that. There is a common problem with orchards and grapes, where we have one good year followed by a poor year. This is a nutritional problem.
SKOW: Manganese is a prime requirement for getting a good seed fill. This is especially true for stone fruit, peaches and apricots, for instance. Housewives who purchase grocery store fruit often encounter rotted centers, always a sign of manganese deficiency. **Foliar application can prevent the problem**. Manganese sulfate will do, but the key is its mix with phosphoric acid. Application must be started a year ahead of time.
SKOW: In developing a foliar program, maximum attention must be given to the thickness of leaves, how well leaves stand up, the degree of wilt, and so on. A thin or weak leaf suggests a nutrient deficiency, or low TDN — total digestive nutrients. The caliber of the stalk and stem is extremely important, as is the development of the root system. Field observation will reveal an under-developed root system when herbicides are used. These **shortfalls can be repaired with foliar sprays** and fertilization through irrigation systems.
WHEELER: It is important to consider using a **foliar nutrient or feed** with any type of insecticide whether synthetic or natural. Any plant under attack by insects is mobilizing its defenses. This requires nutrient and energy utilization. Wouldn't it be wise to give some "chicken soup" to your crop along with anti-insect treatment to aid in its recovery?
WHEELER: Foliar sprays and side dressing, applied about 40-45 days after emergence on corn, give the added reproductive energies needed to develop full ears and increase the potential for filling out second or third ears.
\[HOME]

FUNGI

ANDERSEN: Sources of phosphate are.: mycorrhizae **fungi**—varies with bioactivity, good.\ [HOME]

GRAPEFRUIT

ADVANCED AG: Reams: Any other Brix questions? Student: **What about grapefruit**? Reams: It's the same as oranges. Should be in the top group, sometimes it isn't. The law says it's got to have brix of 9.25 in order to ship it (which is too tart).
BEDDOE: As Reams continued to work for Porter, he began to realize greater and greater benefits from the use of soft rock. He found that the sugar levels in fruit would reach its highest level when 2000 lbs. of soft rock was applied to one acre. Later he discovered that this level applied to most farm crops, except **grapefruit trees which required 4000 lbs.** per acre.
BEDDOE: With **grapefruit the needs for phosphate are higher** than any other fruit tree. So apply Soft Rock any time during the year in smaller quantities. The goal is get the phosphate up to a level of 800 pounds in combination with 400 pounds of potassium.
FWTK: Citrus includes all members of their kind: for example **grapefruit**, lemons, oranges, tangerines and limes all have the frequency of .0009.
GARDENING: Why does the grapefruit tree have a bigger leaf than an orange tree? That is because a **grapefruit is larger and needs more sunlight to make enough sugar to make the grapefruit sweet**, so God gave it a bigger leaf. Now, when an orange tree or grapefruit tree has one fruit to each 50 leaves it has its maximum crop.
PLANT FEEDING: Grapefruit should have about 800 lbs. per acre of water soluble phosphate.
REAMS/SKOW COOK: This grapefruit has a tight core in the middle. A lot of them are big enough that you can stick your thumb in the middle. What does that mean when it's got a hollow in the middle? Student: Too little mineral. Reams: Yes, but what mineral? Student: Boron? Reams: That's a boron deficiency whenever they have it. But **this grapefruit is almost perfect** in its boron content. I just wanted to show you that.
REAMS/SKOW COOK: [Reams was in a market in Hot Springs and for 50 cents each bought **two bushels of grapefruit** that he noticed had hard rinds] Top-quality fruit won't rot; they'll form a shell like wood around it. The friends I was staying with thought I was crazy, buying junk, trash---but when they tasted them, they said, "That's the best grapefruit I've ever eaten in my life." Sure they were the best, or I wouldn't have bought them. [HOME]

GRASS

ADVANCED AG: If you had an orange grove in south Florida you could use Napier grass because of the large amount of tonnage that you get off it. You get your mineral high enough for **Napier grass** and you won't have to buy any fertilizer or sprays for 20 years.
ADVANCED AG: Ratio of phosphate to potassium is 2-1 **except in grasses**. Ratio of phosphate to potassium in **grasses is 4-1**.

ADVANCED AG: Student: **Should you plant grass** in the vineyard rows. Reams: No, it will come on its own.
AG LECTURES: Student: You said a 4 to 1 P and K for grasses, **do you consider alfalfa a grass**? Reams: Yes, sugar cane too is a grass. Corn is not a grass.
AG LECTURES: Reams: Name 3 sources of getting carbon into the soil? Student: Sawdust? Reams: Sawdust is one, what is another one? Student: Grass roots? Reams: **Grass roots** is another, or crop roots.
AG LECTURES: Reams: One of the finest things you can grow in orchards is **Bermuda grass**. If you can't afford Bermuda grass, you can't afford the orchard. And then in the winter, sow rye in there. Student: How about Kentucky Fescue? Reams: It's very good too, but **Bermuda grass is far different, because it is a legume** and Kentucky Fescue isn't. Student: Is Bermuda an annual or a perennial? Reams: It's an annual.
AG LECTURES: Reams: Let me ask you a question, what is the **ratio for grasses and alfalfa between the P2O5 and K**? Student: You want 200 lbs. of potassium and 100 lbs of P2O5? Reams: No, that's not what we said in the last lecture, first course. What is the ratio for grasses? Sugar cane? 4 to 1, 4 parts phosphate to 1 potash is for grasses.
ANDERSEN: Using the Reams soil-testing method, this ratio should be 2 pounds of phosphate to 1 pound of potash for row crops and 4 pounds of phosphate to 1 pound of potash for alfalfa and **grass crops**.
ANDERSEN: Basically, as Carey Reams instructed, sour **grass** weeds like quackgrass are indicative of calcium deficiencies, at least qualitatively if not quantitatively.
ANDERSEN: Lawn and turf grasses require high calcium availability, in the range of 4,000 pounds per acre or more using the Reams soil test. Ideally, they also require a 4:1 phosphate to potash ratio using the Reams test. These levels of calcium, phosphate, and potash will maintain a **lush, vigorous grass growth** uninvaded by sour grass weeds like quack grass, or broadleaf weeds like dandelion and pigweed.
BEDDOE: On grasses you want a ratio of 4 parts phosphate and 1 part potassium. These **grass crops** have the ability to get practically all their potassium from the air.
BEDDOE: Hollow stems on grasses and forage crops, such as alfalfa, are not normal. It is an expression of phosphate of boron deficiency.
FOLIAR FEED 1981: When building a **spray for grasses** (not grain crops) you should not add manganese, potash, vinegar, or cationic nitrogen. You should add anionic nitrogen, phosphate, calcium.
FWTK: All grasses, such as the Bermudas and fescues, and even sugar cane, can take most of their potassium from the air.
FWTK: Alfalfa hay, which should measure twelve to 14% sugar content, is often only six to 8 brix.
GARDENING: The calciums in your soil can increase the milk yield by as much as 200% and also if your pasture soils have enough minerals and calcium in it, whenever you put the feed in the trough to milk the cows, they won't even eat it. They'll just stand there waiting to be milked, because **the grass will have so much more nutrient**.
JOHNSON: Skow: **About grasses**. Basically Reams' opinion is, no potash in the spray, no manganese in the spray, no cationic nitrogen or ammonia. Now he does use Bo-peep despite what he says there. He says no vinegar except on St. Augustine and Centipede grasses.
JOHNSON: The phosphate to potash ratio for all crops, **except grasses**, should be two parts phosphate to one part potash. Grasses need four parts phosphate to one part potash.
PLANT FEEDING: Remember one more thing. **Alfalfa is a grass** and If the 1-5-.5 ratio between your P205 and your potash gets higher than that on alfalfa, you know what's going to happen? It'll go to blossom when it is waist high. [Reams then held out the possibility that alfalfa could grow 12 feet high]
PLANT FEEDING: Something else about this: the com being so thick like that **will shade out the grass**. You won't have any grass problem.
SKOW: This means that for maximum yields a minimum of 400 pounds of phosphate and 200 pounds of potash is indicated. This ratio and level applies to all crops except grasses. **On grasses a ratio of four parts phosphate and one part potash** is correct. Alfalfa has the ability to take practically all its potash from the air. Therefore, it needs very little from the soil.
SKOW: When such soils have a high carbon content, the roots will travel through the soil rapidly. The best cover crop is oats or wheat. Sometimes red clover is indicated if poverty soil is to be reclaimed. **Rye grass allowed to grow over eight or nine inches tall in spring will actually do more harm** than good for the immediate crop year. The massive root system in the top two or three inches of soil is beyond belief unless seen. If this crop is turned in before it achieves eight or nine inches of growth, it adds nitrogen. Allowed to grow beyond that limit, the effect on the nitrogen supply will be negative. Decay will rob nitrogen from the planted crop. This is true even if the rye was planted in the fall.
SKOW: There are so many ways of testing soils and so many interpretations that the only thing we do know is that when you have a tendency to have higher phosphate and lower potassium, there seems to be quite an explosion in yield, **especially in grasses**. This also seems to be true in corn.
WHEELER: Grasses can be brought under control by raising biologically-active calcium levels. High-calcium

lime and liquid calcium are excellent ways of raising calcium levels.
WHEELER: One way to bring the calcium-phosphate balance into line [in animal rations] prior to feeding minerals is to discontinue the practice of sowing straight alfalfa. You would be better off if you sowed an alfalfa-grass mixture. The alfalfa contributes the higher calcium levels **while the grasses contribute the higher phosphorus levels**.
\[HOME]

GRASSHOPPERS

AG LECTURES: Student: Aerobic bacteria also eat live nematodes, right? Reams: Yes, **grasshoppers [if they get under the ground]**, ants, cockroaches, anything else they come across, worms.
FOLIAR FEED 1981: Chlordane, Dieldrin, Black Leaf 40, or pyrethrin for **grasshoppers**. The last two are nutritional sprays.
FOLIAR FEED 1981: Use 2 pounds of 10% chlordane in 100 gallons for wire worm and **grasshoppers**.
GARDENING: There's a **way to handle grasshoppers**, raccoons, wild hogs, deer, rabbits, and many other pests that try to put you out of business. All you need to do is take one of those plastic jugs and cut the top out of it. Then get some 65-75% chlordane, pour it into the jug, get yourself some ordinary laths or sticks and half submerge them in the liquid chlordane. The next night, turn each of the sticks over and push them in the ground all around your garden. The odor of chlordane will keep all the animals out, all the moths out.
WHEELER: Rare cases of plagues of locust or **grasshoppers** may still require some type of disease, predator or poison to stop the damage, yet perhaps even these have their purpose. \[HOME]

HARDPAN

WHEELER: Most tillage approaches can produce a plowpan or hardpan. The moldboard plow carries much weight on a very narrow edge of the plow share. In wet conditions, the soil below the plow share will smear. As it dries, it will seal stopping water and air movement. Disks, chisel plows, field cultivators, and subsoilers can **all contribute to hardpans even in sandy soils**. As the-soil is tilled, the small particles settle. When tillage is continued at the same depth, the particles settle just below the tilled level. These small particles keep filling the pore spaces until a hardpan is formed. This can be just as bad a hard pan as that caused by plowing when the soil is too wet. \[HOME]

HARVEST TIME

AG LECTURES: Do you know there won't be a weeks difference in the corn that you planted 3 weeks ago and the one you planted 3 weeks from now? Actually there won't be over 10 days difference in it if that much. And the yield will be that much greater. Do you know that oranges that come on the blossom over a 6-7 week period **will mature at the same time**? Do you know that? Do you know that peaches that blossom anywhere, we'll say over a 40 day period, will mature at the same time? Do you know that?\ [HOME]

HYDROGEN PEROXIDE

ADVANCED AG: Reams: You need 2 gallons sulfuric acid per 100 gallons of spray. Skow: The other way to do it is hydrogen peroxide. Student: There is no sulfur in hydrogen peroxide. Reams: Anyway, sulfuric acid is cheaper than **hydrogen peroxide.**
AG LECTURES: Student: Blueberries need more calcium so you put gypsum on them is that right? Reams: Yes, that's the best form to put it on. Student: Suppose you didn't have any gypsum and you wanted to make some. How would you do it? Reams:
Sulfuric acid and calcium. Yes, just **hydrogen peroxide**. Pour some on some lime. Quick and easy isn't it?
ANDERSEN: Some people also will add some **hydrogen peroxide** to their program; this may help oxygenate the soil.
ANDERSEN: Timely tillage is very effective at oxygenating the soil. **Hydrogen peroxide can add oxygen** to the soil, as can fluffing of the soil using appropriate fertilizer materials.
ANDERSEN: Lactobacillus microorganisms produce **hydrogen peroxide**, as well as lactic acid, B-vitamins, and other metabolites that are valuable to the nutrition of animals and soil, as well as to the inhibition of pathogenic proliferation.
FOLIAR FEED 1981: If you will wait several months so that interlaced pruning residue, small trimmed limbs, or other dead plant material has fully dried, you can spray them with a solution of 4% sulfuric acid in water. This mixture forms **hydrogen peroxide** and the trimmings will turn to dust.

FOLIAR FEED 1981: Dutch Elm disease is caused by a shortage of phosphate. Spraying the tree with a 4% **hydrogen peroxide** solution can stop the infestation.
JOHNSON: Skow: Here is a little formula that Dr. Reams has used in the past of spraying a 4% sulfuric acid solution on vine crops, trees and shrubs to get rid of the dead wood. It is kind of a method of making **hydrogen peroxide** and spraying it on.
WHEELER: Don't add hydrogen peroxide to concentrated mixtures. Always **add hydrogen peroxide to the water first**.

NOTE: *From Wikipedia: Sulfuric acid can be produced in the laboratory by burning sulfur in air and dissolving the gas produced in a hydrogen peroxide solution. There are other websites that claim hydrogen peroxide can be produced from sulfuric acid and water. A review of the entries here should make it clear that Reams was not about to back away.* \[HOME]

IRON

ADVANCED AG: Basic slag contains **20% iron oxide**, however is slow release.
ADVANCED AG: Optimum iron is 40 pounds per acre.
AG LECTURES: You who can get basic slag from the **iron mills**, it is an excellent product, even though they may use dolomite.
AG LECTURES: Student: You said the reason for [nematodes] is too much salt in the soil? Reams: Yes. Student: Which particular kind is it, the chlorides? Reams: It can be a chloride, it can be ammonia salts, nitrogenous salts, calcium salts, **iron chloride salts**, yes, it can be many different kinds of salts.
ANDERSEN: Iron draws energy to the leaf by absorbing heat from the sun; it makes the leaf darker, thus absorbing more energy. It will increase the waxy sheen of the crop. Iron is necessary for the maintenance and synthesis of chlorophyll and RNA metabolism in the chloroplasts. It increases the thickness of the leaf, that will geometrically increase nutrient flow, resulting in a production increase geometrically. Forty pounds per acre is desired on the Reams test.
ANDERSEN: Molybdenum is a **catalyst for iron** in the bark or epidermis, is important in the integrity of bark or plant skin, and gives a transparent look to the sheen on the bark.
BEDDOE: The parts of the reserve soil TDN are calcium, phosphate, potassium (potash), nitrate nitrogen, ammonia nitrogen, **iron**, and copper.
BEDDOE: Therefore, iron is heavier than aluminum and **iron will also float on boiling lead**.
BEDDOE: Iron sources include soft rock phosphate, basic slag, iron sulfate, molasses, and various chelated irons as can be used in foliar applications.
BEDDOE: Metallic substances, **such as iron**, sulfur, and aluminum are often the culprits that give low pH readings in soil where there is already an over-supply of water soluble calcium.
FOLIAR FEED 1981: If your nearby trees have lichen or moss, your farm probably **needs iron.**
FRANK: Avoid using nutrient elements compounded as carbonates or oxides. Examples of carbonates: calcium carbonate, **iron carbonate** and copper carbonate. Examples of oxides: Manganese oxide, **iron oxide** and copper oxide.
FRANK: Nitrogen. sulfur, **iron**, manganese are secondary elements and should be present in 10's of lbs. per acre.
FRANK: When **iron is low in a leaf** it will be thin and pale looking. By increasing iron in the leaf we increase the absorption of heat energy and thus increase the overall amount of energy accumulated by plants.
FWTK-pH: Therefore, iron IS heavier than aluminum, manganese is heavier than magnesium, and **iron will float on boiling lead**.
GARDENING: All plant food with the exception of nitrogen, must go into that tree or plant in phosphate form, **phosphate of iron**, phosphate of zinc, phosphate of copper and so forth.
JOHNSON: Skow: Common electrolytes are **iron**, aluminum, copper, and one of the other ones that you will see a lot written about is magnesium and they get a wonderful response. Now the only reason they get a response is that the plant is constipated.
JOHNSON: Skow: What can you use in place of an **iron chelate**? You use **iron sulfate solution**. Just take your time and take the iron sulfate or manganese sulfate and mix them in water first.
SAIT: Andersen: If you have a **high iron content**, you should be careful of molasses because of its iron content.
SKOW: Indeed, how enzymes create hot spots to attract essential cell building materials — **iron**, nitrogen, boron, for instance — so that they can be linked to the right molecules in plant cells must be considered a miracle.
SKOW: Light green or pale green moss on a tree is **sometimes an indication of iron deficiency**. It could and it could not be iron deficiency. Remember, every nutrient enters a plant in a phosphate form. There simply may not have been

enough phosphate to usher in the iron. So the iron may be there, albeit stalled in the plant's own horse latitudes. This is the major shortfall of leaf analysis.
WHEELER: Most [trace elements] can be obtained in the sulfate form, as found in copper sulfate or **iron sulfate**, or in the oxide form as found in magnesium oxide. These are the most popular and least expensive forms.
WHEELER: Calcium, boron, **iron**, magnesium and molybdenum tend to remain in the leaf after they are absorbed and have little tendency to translocate. \[HOME]

LEAVES

ADVANCED AG: You want to grow watermelons, not big thick vines and you need **50 leaves per fruit**.
ADVANCED AG: **Leaves determine your yield**, 50 leaves per plant.. However, that is not true on tomatoes
ADVANCED AG: Skow: "Close mowing peas (legumes) in an orchard with dolomitic soil will put a glossy **sheen on the leaves** by releasing magnesium to the air."
AG LECTURES: How many have seen those little black dots [indicating excess potassium]? Have you noticed it on **peach leaves, orange leaves**, any crop?
AG LECTURES: So what happens when you use a chelate in a high calcium soil? It [alfalfa] loses its leaves, **all the leaves fall off**. Why? Because it thins the protoplasm that holds the leaf onto the stalk. Nothing to hold it on. The leaf is held onto the stalk by protoplasm. Did you ever break a leaf off and look at it about 3 minutes later under a glass and you saw a little jelly-like substance form in there? It's that little jelly-like substance that holds that leaf on the plant. And what happens when you use a chelate on a carbonate soil, high calcium soil? It sheds the leaf off.
AG LECTURES: When you see a crop that has no sheen on it or a grove or an orchard, that the leaves do not have a waxy sheen to, you're going to see a grove or orchard or crop that is low in carbon.
AG LECTURES: Lets take an orange grove. The trees are 15-20 feet high, producing 1,000 boxes to the acre. You would need 30 gallons of spray to cover an acre, homogenized. That's a lot of space, **that's a lot of leaves** and that's a lot of trunk.
ANDERSEN: With apples, the opposite seems to occur. An apple with apple scab fungus will itself have a low refractometer reading (below 12); however, the **leaves on the branch supporting the sick apple will have very high refractometer values** (above 12 or even in the upper 20s). In any event, there is a mineral imbalance/deficiency in the crop.
BEDDOE: It is this type of reaction heat from anion-cation encounters that causes burning and dehydration of the roots. The result can be seen as a sudden **die back in the leaves** because of reversing the normal osmotic flow.
BEDDOE: An excess [of manganese] will cause plants that are being grown for **leaves to bolt**.
BEDDOE: One of finest ways to add additional nitrogen to crops is **through the leaves**. This is called foliar feeding. Foliar feeding recognizes that a plant takes in up to 80% of its energy for growth out of the air through its leaves.
FRANK: The stems of alfalfa and small grains such as wheat or oats are often hollow, lacking adequate phloem tubes which **carry nutrients from leaves to roots** and other parts of the crop.
GARDENING: Why does the grapefruit tree have a bigger leaf than an orange tree? That is because a grapefruit is larger and needs more sunlight to make enough sugar to make the grapefruit sweet, so God gave it a bigger leaf. Now, when an orange tree or grapefruit tree has **one fruit to each 50 leaves it has its maximum crop**. If you want to know how many bushels of oranges you have, all you have to do is count the leaves, divide them by 50, and there's about 200 oranges to about, roughly about 100 oranges per bushel and you know how many bushels you're gonna have next year.
JOHNSON: If **citrus leaves** tend to fall off if you touch them, that is a potassium availability problem.
SKOW: In developing a foliar program, maximum attention must be given to the **thickness of leaves**, how well leaves stand up, the degree of wilt, and so on. A thin or weak leaf suggests a nutrient deficiency, or low TDN — total digestive nutrients.
WHEELER: Lack of nitrogen, generally recognized through the light green coloration in plants, is thought to be associated with a **lack of chlorophyll in the leaves**. \[HOME]

LEGUME

ADVANCED AG: Legumes are better in magnesium soils, however **don't add magnesium to legumes**.
ADVANCED AG: Skow: "**Close mowing peas (legumes)** in an orchard with dolomitic soil will put a glossy sheen on the leaves by releasing magnesium to the air."
AG LECTURES: Reams: One of the finest things you can grow in orchards is Bermuda grass. If you can't afford Bermuda grass, you can't afford the orchard. And then in the winter, sow rye in there. Student: How about Kentucky Fescue? Reams: It's very good too, but **Bermuda grass is far different, because it is a legume** and Kentucky Fescue

isn't. Student: Is Bermuda an annual or a perennial? Reams: It's an annual.
AG LECTURES: Okra i**s a legume**. Black-eye Peas are legume. Peanuts are a legume, Bermuda grass is a legume. Only a different kind, from the peas or peanuts.
AG LECTURES: Reams: One of the finest things you can grow in orchards is Bermuda grass. If you can't afford Bermuda grass, you can't afford the orchard. And then in the winter, sow rye in there. Student: How about Kentucky Fescue? Reams: It's very good too, but **Bermuda grass is far different, because it is a legume** and Kentucky Fescue isn't.
ANDERSEN: University personnel tell farmers that they **cannot generate much nitrogen bacteria activity without legumes**. However, research in 1942 revealed that "root-nodule bacteria of lucerne grew equally well under lucerne and under cotton. The sap of corn enhances the virulence of the root-nodule bacteria of peas. Perhaps this is due, in part, to the sugars found in corn sap. "Root-nodule bacteria of lucerne grow well under timothy grass, cotton, and rye grass."
ANDERSEN: Cobalt is necessary for nitrogen fixation, especially in **legumes**' root nodules.
BEDDOE: Excess magnesium can be reduced by liming to keep it in an oxide form so it is insoluble. Also **green manure legume crops**, such as peas, can be of help.
FOLIAR FEED 1981: You may need to **foliar spray some magnesium** on legumes if nitrogen too high. I have never seen a case where magnesium was needed to release excess nitrogen on alfalfa.
JOHNSON: Student: You said you were going to say something about Vitamin C yesterday. Skow: OK, vitamin C. This is one we have come up with and **have found to be very successful in legume crops**. That means peas, string beans, alfalfa and bell peppers.
PLANT FEEDING: [Reams explaining how chicken (cage) manure is OK, but chicken litter with sawdust is not] Has too much potash in it. Keep your potash **off your legumes** and grasses.
SKOW: Magnesium, pound for pound, can raise the pH up to 1.4 times higher than calcium. A soil high in magnesium and low in calcium can test above 6.5, but will be entirely **inadequate for the growth of alfalfa, for the growth of legume bacteria**, and above all, for maintenance of an environment necessary to decay organic crop residues into humus.
SKOW: This man [professor Albrecht] of classroom and laboratory, a born teacher, knew, too, that contrary to early admonitions that **legumes "left the soil better than they found it**," wasn't always true. Legumes, overdone, could — instead of leaving the soil with an abundance of stored nitrogen — leave it as impoverished as a share-cropper's land following a life-time of following a "one-crop system."
WHEELER: Sulfur is needed in protein and amino acid formation, in the **formation of nodules on legumes**, and in many other plant processes. It is also used, both in combination with a calcium product or by itself, to make calcium energies available to plants.
WHEELER: If the plant is **a legume, such as alfalfa**, clover, soybeans, peas, or dry beans, root examination should include nodule observation. \[HOME]

LIME

AG LECTURES: Just ask the person who is **selling lime**, he has an analysis on it. Tell him you want Agricultural lime –calcium carbonate or calcium oxide or basic slag.\ [HOME]

MAGNESIUM

ADVANCED AG: [**Excessive] magnesium** is the most expensive thing to fix.
ADVANCED AG: Spray sulfuric acid to fix **magnesium problems**.
ADVANCED AG: Legumes are better in magnesium soils, however **don't add magnesium to legumes**.
ADVANCED AG: Skow: "Close mowing peas (legumes) in an orchard with dolomitic soil will put a glossy sheen on the leaves by **releasing magnesium** to the air."
AG LECTURES: You who can get basic slag from the iron mills, it is an excellent product, even though they may use dolomite. It's perfectly alright to use it, because the heat of the red hot iron **burns the magnesium out of it**. Or you can buy burnt lime because anytime you burn lime you burn the magnesium out of it. So you have nothing to fear in that.
AG LECTURES: In dolomite **you have your magnesium** and you have your calcium. Those 2 things are together, but they are separate. They're not bonded together.
ANDERSEN: Reams used calcium carbonate, never dolomite. He observed that **sufficient magnesium would be**

available if he balanced the calcium, phosphate, and microorganisms and then applied fertilizer quantities of Sul-Po-Mag.
ANDERSEN: Adding high-calcium lime, one in which the calcium carbonate component in extremely dominant to a **high-magnesium soil** might actually lower the pH. This can also happen in high-sodium soils.
ANDERSEN: People often blame compaction on heavy equipment and frequent traffic across the soil. These things do cause compaction of soils with **calcium-to-magnesium ratios of less than 7:1**. They do not cause compaction of soils with calcium-to-magnesium ratios of 7:1 or more and less than 70 parts per million of sodium. Compaction is a phenomenon of physics (particle attraction/repulsion) and aeration.
BEDDOE: Yes, **magnesium is a necessary mineral** in the function of the plant, but the **plant can usually get all the magnesium it needs just from the atmosphere** when the TDN is at an adequate level.
BEDDOE: Many assume that it is necessary because **magnesium is used in the making of plant chlorophyll**, and many see a response when they add it to the soil. So it may be difficult for some to accept the fact that the problem with magnesium is usually that it is used in excessive amounts in soil applications. Yes, magnesium is a necessary mineral in the function of the plant, but the plant can usually get all the magnesium it needs just from the atmosphere when the TDN is at an adequate level.
FWTK: Furthermore, healthy plants take a large part of the trace elements they need from the air. **They supply magnesium**, manganese, zinc. cobalt, copper, sulfur and boron in this way. Soil must contain proper mineral levels for this process to take place.
FWTK pH: Therefore, iron IS heavier than aluminum, manganese IS **heavier than magnesium**, and iron will float on boiling lead.
PLANT FEEDING: Dolomite is a calcium oxide and **magnesium oxide** [mixture] containing approximately 35% magnesium oxide.
REAMS/SKOW COOK: Red beets have something besides calciums, they are **quite high in magnesium**. So is watercress. Watercress has high magnesium in it, and so do some mangoes.
SKOW: The other **key to the success of this spray program is the use of magnesium sulfate** which speeds up metabolic processes and helps make sure there is enough magnesium for the chlorophyll molecule to keep the process of photosynthesis rolling to produce simple sugars.
SKOW: An unbalanced equilibrium of calcium and **magnesium** permits organic residues to decay into alcohol, a sterilant to bacteria; and into formaldehyde, a preservative of cell tissue.
SKOW: A soil **high in magnesium** and low in calcium can test above 6.5, but will be entirely inadequate for the growth of alfalfa...
SKOW: My formula follows: Put in water, a humate, calcium hydroxide, **magnesium sulfate**, Bo-Peep, a special amine compound, castor oil, sodium carbonate and water — it has to be distilled water or good reverse osmosis water — and seaweed extract.
WHEELER: **Magnesium is antagonistic to nitrogen** as seen in the use of Epsom salts as a treatment for nitrate poisoning in cattle or an Epsom salt spray on fruit trees to stop apple drop due to nitrate-weakened stems. When the magnesium releases from dolomite, it can cause nitrogen to release as a gas.
WHEELER: A soil left undisturbed will stabilize from the top down in the following layers: carbon, **magnesium**, phosphate, potash, sulfur, aluminum, manganese and calcium.

NOTE: *Magnesium sulfate is highly soluble in water whereas calcium sulfate (gypsum) is only moderately soluble in water. It is important to remember this when listening to Reams talk about the necessity of liming dolomitic soils (i.e., high magnesium). He is trying to help the student understand how to let nature (via rain) remove some of the excess magnesium.* \[HOME]

MANGANESE

ADVANCED AG: Albion labs achieved significant crop increase with **manganese chelate**.
ADVANCED AG: **Manganese is the element of life** and raises electrical charge in the seed.
ADVANCED AG: **Manganese availability** can be dependent on adequate calcium.
AG LECTURES: You **only use it [manganese] where you're growing a mature seed.** Would you use it on green beans? You would, yes, if you don't you'll have skinny looking beans. Yes, you need it in the beans, because nature is trying to leave offspring there.
AG LECTURES: Reams: Do you know one reason so many small grapes fall off the pod is because there is not enough manganese for all of them? **Not enough manganese**.
AG LECTURES: On corn, wheat and soybeans, there's one other ingredient you should use on any crop that you're

growing for the grain. It's manganese. **Manganese is the element of life** and without manganese there's not any life. Therefore the lack of manganese can cause a great loss of yield in the long run. So it's a good idea to add manganese to your nutritional spray.
ANDERSEN: According to Reams' concept of energy, calcium is classified as the kingpin of growth (anionic) energy and **manganese is classified as the kingpin of fruit (cationic) energy**. People consequently assume that these materials must be separated and applied at distinctly different times. The point to remember is that every cell of every living organism requires both growth and fruiting energy. Every living cell needs both calcium and manganese. Consequently, manganese is needed to get healthy growth, and calcium is needed to get healthy fruit.
ANDERSEN: Carbon Strata No. 1, Magnesium Strata No. 2, Phosphate Strata No. 3, Potash Strata No. 4, Aluminum Strata No. 5, Zinc Strata No. 6, **Manganese Strata No. 7**, Iron Strata No. 8, Copper Strata No. 9, Calcium Strata No. 10. These rankings were given by Carey Reams in his short courses.
ANDERSEN: Manganese activates a number of enzymes, including some related to photosynthesis, and is an important component in chloroplasts. **Manganese brings the electrical charge into the seed**, creating the magnetic force to draw the other elements into the seed. Manganese seems to be closely correlated to iron and copper; it is very important for seed quality and germination.
BEDDOE: Without manganese there would be no reproduction in any of the species on this earth. This is because the germ's ability to function is absolutely dependent on whether or not a phosphate form of manganese has been made available during seed development. Any seedless fruit is seedless because of the lack of phosphate of manganese, either due to its lack in the soil or because of the unique genetic characteristics of the bud union preventing the passing of phosphate of manganese into the plant
BEDDOE: Amount [of manganese] per acre that should show in the soil test is approximately **2-3 lbs.per acre.**
BEDDOE: Manganese Deficiency: Split pit development in stone fruit, Sunken eyes in potatoes, Poor seed development. An excess will cause plants that are being grown for leaves to bolt.
FOLIAR FEED 1981: Bell peppers have a "placenta." This requires **manganese.**
FRANK: Avoid using nutrient elements compounded as carbonates or oxides. Examples of carbonates: calcium carbonate, iron carbonate and copper carbonate. Examples of oxides: **Manganese oxide**, iron oxide and copper oxide.
FRANK: That evening I listened to an old cassette from Dr. Reams and here is what he said in paraphrase: "**You shouldn't eat a seedless watermelon because they are deficient in manganese**. They are bred to block the entrance of manganese into the melon. This lack of manganese is what causes the melon to be seedless. Actually the roots do pick up manganese but there is a blockade that will not allow the manganese to enter the plant. In order to get rid of the manganese, plants dissipate it into the melon as heat energy."
FRANK: When considering the overall influence of growth vs. fruiting energy in soil, the primary reproductive energy comes from phosphorous. **Manganese gets honorable mention**, but phosphorous is the big one.
FWTK: In seedless watermelons or grapes, the stump of the plant **will not allow manganese** to go out into the fruit, because of its micronage. Because there is no manganese the fruit will not have seeds, as manganese is required to make them.
FWTK-pH: Therefore, iron is heavier than aluminum, **manganese is heavier than magnesium**, and iron will float on boiling lead.
JOHNSON: Manganese Sulfate and basic slag are excellent materials for getting **manganese into the soil on a long term basis**.
JOHNSON: Skow: What can you use in place of an iron chelate? You use iron sulfate solution. Just take your time and take the iron sulfate or **manganese sulfate** and mix them in water first. Then put them in you spray tank and you will be alright and it's pretty hard to do the harm I talked about using the chelates.
PLANT FEEDING: You want your good plants to reach its climax of nutrients at the stage you wish to eat it, i.e. cabbages grown correctly **should be low in manganese.** If manganese was too high in the cabbage or lettuce field, it will go to seed long before it heads up.
REAMS/SKOW COOK: Also eat bell peppers – rich, rich, rich source of vitamin A, very rich. Also keep the seed and add to soup for **manganese**. Excellent, excellent foods raw.
SKOW: If we have one pound of manganese per acre, it may take 500 pounds of calcium to serve up the energy needed to capture that manganese. A low test weight on a crop means that the soil was not working correctly to **capture the necessary manganese**.
SKOW: Manganese is a prime requirement for getting a good seed fill. This is especially true for stone fruit, peaches and apricots, for instance. Housewives who purchase grocery store fruit often encounter rotted centers, always a **sign of manganese deficiency**. Foliar application can prevent the problem. Manganese sulfate will do, but the key is its mix with phosphoric acid. Application must be started a year ahead of time.
SUCROSE: Unless the **manganese joins with phosphate**, growth cannot continue. Phosphate of manganese forms

the seed in all forms of life. When the conditions for reproduction cease, growth stops. The plant takes in manganese for seed only in the form of phosphate of manganese.
WHEELER: In the soil, some nutrients tend to rise while calcium and others tend to move downward. A soil left undisturbed will stabilize from the top down in the following layers: carbon, magnesium, phosphate, potash, sulfur, aluminum, **manganese** and calcium.
WHEELER: Seed **lacking in manganese will often rot** in the soil rather than sprout. \[HOME]

MINERALS

FRANK: Duane: If you want a full discussion of nutrient density, we're referencing foods with more nutrition, **higher both of the minerals**, the phytonutrients and even those essential sugars that science is discovering how significant the sugars are for cellular health.
IAL: Duane: You can add taste to the tomato by **putting out other rock minerals**.\ [HOME]

MINERALS FROM AIR

AG LECTURES: Remember, alfalfa has the ability to take practically **all its potash from the air**.
AG LECTURES: Just one cigarette did that because that plant [Defenbachia] cannot stand potassium. **It takes it from the air**. So whenever you see the tip point of the leaf dead and crisp and dry on the side or little black dots on the leaf, that's too much potassium for the amount of P2O5.
AG LECTURES: But compost does just the opposite, it **draws the moisture from the air** and holds it in the ground.
BEDDOE: And it is more than just nitrogen and oxygen that the **plant takes from the air**. A vast amount of trace elements exist in the atmosphere due to the cleansing action of the oceans of the world.
BEDDOE: For example, deciduous fruit trees do not need more than a total of 40 lbs. per acre total nitrogen because they can get **most of their nitrogen out of the air**.
BEDDOE: Air is probably the most important source of the colloids. These air-borne colloids come from the oceans of the world. If it were not for the ocean, life would not have been able to exist for as long as it has because of the lack of mineral distribution. Remember that **80% of plant foods come from the air** and colloids are an important part of that.
BEDDOE: One of finest ways to add additional nitrogen to crops is through the leaves. This is called foliar feeding. Foliar feeding recognizes that **a plant takes in up to 80% of its energy for growth out of the air** through its leaves. Since nitrogen is the important electrolyte, it is important that it is present in all foliar sprays in a small amount if nitrogen is not needed in the plant, but in larger amounts if extra is needed by the plant
FWTK: [Reams grew] one tomato plant in white sand. He carefully weighed everything that went into the growing process, every gram of plant food, water and soil. After growing the plant for twelve weeks in a glass dome, he removed it. and dehydrated it in a vacuum. An analysis of the soil and plant showed that he had supplied only 20% of the increase in the plant. Through research he found that many plants have the ability to take in **nutrients from the air**.
FWTK: Furthermore, healthy plants take a large part of the **trace elements they need from the air** They supply magnesium, manganese, zinc. cobalt, copper, sulfur and boron in this way. Soil must contain proper mineral levels for this process to take place.
PLANT FEEDING: Student: What about all the minor elements that are there? Reams: God will supply **most of those in the air** . Student: Why don't plants take more of them from the air now? Reams: They're not healthy enough. In other words, you know the sap of plants is similar to the gastric juice of people? Well, there are saps and gastric juices that are very weak. The weaker the gastric juice - the sicker the person becomes. The weaker the sap in the plant - the less minerals it **can take in from the air** . I believe farmers are the finest doctors in the world. If you grow good produce, people are less likely to become sick. You only have one cause of illness: mineral deficiency.
PLANT FEEDING: Student: Is there any mineral the plants **cannot get from the air**? Reams: Yes, calcium, potassium[?], phosphate, potash[?] - those are the main ones they can't get from the air.
SUCROSE: Keep plenty of water-soluble, ionized carbon so the crop will not have to depend upon its entire supply of **carbon from the air**. Keep the carbon/nitrogen ratio equalized for greatest yield of sucrose.

 **NOTE:** *Reams claims in various places that certain crops can get all the potassium they need from the air. It is therefore strange that in PLANT FEEDING, he denies they can. My guess is that this is one of his famous mis-speaks that a properly prepared student should have called him on so that he could say, as he frequently did, "Thank you for correcting me."* \[HOME]

MOTH

AG LECTURES: All [pest] worms are laid by **some kind of a moth** or a beetle.
AG LECTURES: Nematodes bear their own young and lay eggs. **Worms have to have a moth** or beetle or something on that order to propagate them. Like a butterfly in a cocoon. \[HOME]

MYCORRHIZA

ANDERSEN: One of the more important natural protectors and plant symbionts (companion organisms in which both plant and microbe benefit each other) is the **mycorrhiza group of fungi**.
ANDERSEN: The essence of the action of [mycorrhizal] fungi consists in supplying the plants with nitrogenous and carbonaceous elements of nutrition in some cases and, in others, in the supply of auxiliary nutrients or biotic substances, and more correctly with both. There is a great deal of data in the literature on the **significance of mycorrhizal fungi** in the nutrition of plants.
ANDERSEN: Sources of phosphate are.: **Mycorrhizae fungi**—varies with bioactivity, good.
FRANK: As phosphorous rises to the optimum level, commercial phosphate is taken out of the program. Here is what I don't suggest; apply low doses of phosphorous, use mycorrhizea, and hope for the best. This approach keeps the soil depleted for a long time and rarely yields nutrient dense produce. If you want nutrient dense foods you must get available phosphorous to around 175 lbs. as fast as you can. At this level of available phosphorous, **mycorrhizea go dormant** and aren't much use to roots. The best use of mycorrhizea is to use it on low fertility soils where remineralizing with phosphorous is not economical.

NOTE: *It is strange that Reams never mentioned mychorriza fungi and his student Arden Andersen suggested it for many uses. Perhaps the answer lies in Jon Frank's comment that phosphate should be rapidly added full well knowing it would cause the mychorriza to go dormant. Frank feels nutriend dense food requires phosphorous supplementation.* \[HOME]

NATURE

AG LECTURES: Nature is at work in plants forever and you're not supposed to try to make a plant do anything. What you are supposed to do is to co-operate with nature.\ [HOME]

NEMATODES

ADVANCED AG: The **reasons for nematodes** include high nitrogen, high salts, low aerobic bacteria, excess chlorine, etc.
ADVANCED AG: The reasons for cut worms and root worms are the same as for **nematodes**, Aerobic bacteria will eat them for lunch.
ADVANCED AG: If you want to **prevent nematodes**, you should create an environment promoting aerobic bacteria.
AG LECTURES: Another thing that doesn't work very well is earthworms, **which are nematodes**, in orange groves, because the citric acid in the roots is very difficult for the nematodeswho can't live in citrus soils or any other soil that's too dry.
AG LECTURES: Organic fertilizer is rich in bacteria, aerobic bacteria. You know what their favorite breakfast is? Nematode eggs. Boy, **they can eat up more nematode eggs than the nematodes can lay**. And make fertilizer out of it. Those little bugs can eat up more nematodes in 3 minutes than can be hatched out in 3 weeks. Isn't that a simple way to handle nematodes?
AG LECTURES: Student: Aerobic bacteria also **eat live nematodes**, right? Reams: Yes, grasshoppers, ants, cockroaches, anything else they come across, worms.
AG LECTURES: There's **one reason that nematodes attack plants and only one**. What is that? There's too much salt in the soil. No other reason, but too much salt in the soil. The nematode cannot attack the root until the salt weakens the root, until the bark will slide off and then he gets in. He cannot attack the root until this happens. Now, you apply too much nitrogen what happens to the roots? Student: The bark slides off. Reams: Yes, but something else happens to a lot of the roots, even before the bark slides off. What happens? If you get too much nitrogen on radishes, turnips, or sweet potatoes, what happens? Student: Break open. Reams: They split open, that's right, they split open and that root does the same thing. And then you've said to the nematode, I've built you a house, furnished you room and board. Won't you please, please move in? And he does.
AG LECTURES: **Nematodes bear their own young and lay eggs**. Worms have to have a moth or beetle or something on that order to propagate them. Like a butterfly in a cocoon.

AG LECTURES: All [pest] worms are laid by some kind of a moth or a beetle. However, there are **nematodes that bear young** and there are **nematodes that lay eggs**.
AG LECTURES: Student: How **long did you say the nematodes get**? Reams: I've seen them 6 feet long. Student: What's the diameter? Reams: O, big around as an earthworm. Earthworm is a nematode too, did you know that? Snake is a type of a nematode also. It's all in the reptile family.
ANDERSEN: If the soil does not include enough desirable microbes like mycolytic bacteria, which kill fusarium, verticillium, and rhizoctonia fungi, or hyphomycetes fungi, **which kill undesirable nematodes**, or perhaps actinomycetes, which digest fodder and synthesize vitamin B12 for plant uptake, the soil is not regenerating or producing to its potential.
ANDERSEN: If the farmer chooses to create a soil environment that is most conducive to pathogenic microbes such as fusarium, verticillium, **parasitic nematodes**, and mosaic viruses, he need only reduce the soil oxygen level, degrade the humus, destroy the soil structure, and maintain a continuous toxicity level...
ANDERSEN: If the overall ERGS reading gets above 1,000, there is generally a salt problem, energy loss and waste, and increased potential for root burn and **nematode proliferation**.
FWTK: The presence of nematodes in the soil, shows that there is a sick crop. The nematodes would not be there if the crop was fit for animal or human use. **Nematodes attack plants for one reason**, and that is that there is too much salt in the soil. Once the soil dehydrates the root, the bark will slide off it, allowing the nematode to enter the plant. It cannot attack the root until this happens.
FWTK: A level of 400 lbs. of phosphate and 200 lbs. of potash will keep the **nematodes** from living in the soil.
GARDENING: Reams: I inspected 80 acres where a third of the onions were dying. When I inspected one and found **teeming nematodes**, the university people present said they did not know that nematodes would eat onions. I pointed out that the quality was so low that the nematodes would indeed eat onion. What I am trying to tell you is that worms, bugs, nematodes, etc. only strike at the poorest of poor produce.
SKOW: Root rot, **nematodes**, maggots and root worms, all are problems that noticeably subside once the [aerobic] bacteria culture is established. It is unique in that all of the nutrients that are necessary to establish the specialized bacteria are included in the product. This is a common problem with many bacteria products on the market today. Many times very good bacterial products are applied to the soil only to find a very hostile environment, such as lack of nutrient, air or water, which makes it practically impossible for them to establish.
WHEELER: Try gently pulling on a medium-size corn root to see if the root bark will separate and slip off easily like a stocking. This would indicate weakness caused by excessive salts in relation to carbohydrates and humus and could provide a situation where **nematodes could easly penetrate**. \[HOME]

NITRATE

AG LECTURES: Reams: If you're cutting alfalfa [or other grasses], the best thing to do is is to start about 4 o'clock in the morning and cut them and then about 10 o'clock start putting them in your harvester. Student: One thing. **Your nitrates would be too high**. The sun hasn't shown on it at 4 o'clock in the morning and you may poison your cattle, right? Reams: No, not if there's a high sugar content [Brix] you won't. You'll poison the cattle because there's low sugar content in it. You will never poison the cattle with a high sugar content.
FRANK: If you go in there with a **high nitrate**, high potassium product, you will probably push the ERGS up some, but the health of the plant will simply go down very fast if you put on what is there in excess already. \[HOME]

NITROGEN

PLANT FEEDING: If your crop is still not growing as fast as it could or if it has a blue color---anytime you see the crop begin to have a bluish tint to it---you get a soil analysis even if you had one a week ago because it means the **nitrogen is too low.**\ [HOME]

NUTRIENT

GARDENING: The banana, when it grows those bananas, it puts the **same amount of nutrient** in every banana whether it's a big one or little one.
FRANK: Duane: And they don't have energy enough to be picking up enough minerals to build strong enough cell walls to resist the insect attacks, which is--it's not just about the strong cell walls. But, **if a plant has enough nutrients**, the insects don't attack it.
PLANT FEEDING: You want your good plants to reach its **climax of nutrients** at the stage you wish to eat it , i.e. cabbages grown correctly should be low in manganese. If manganese was too high in the cabbage or lettuce field,

it will go to seed long before it heads up. \[HOME]

NUTRIENT DENSITY

FRANK: Frank: If you want **a full discussion of nutrient density**, we're referencing foods with more nutrition, higher both of the minerals, the phytonutrients and even those essential sugars that science is discovering how significant are for cellular health.\ [HOME]

OIL

AG LECTURES: There's one more thing I haven't told you about soils that I should tell you. And that is, if you can get oil, old motor oil, real cheaply, and you get a bunch of sawdust and begin to mix this old motor oil up with sawdust, you apply 2 or 3 hundred pounds of this old motor oil and sawdust to the acre, you need to do that after you harvest the crop, or it won't hurt to put 500 lbs. to the acre, if you want to, but I'm going to tell you, it'll really do miracles. One of the great things in soil today, it looses it's oil capacity because of the synthetic fertilizers used by yourself and your neighbors. What your neighbors use affects your farm too. So I would use old oil, 3-500 pounds of sawdust, something like that per acre, with the old oil in it. Did you ever see an old poor piece of ground, so poor that it couldn't do anything but make a used car lot out of it? In about 3 years there were weeds 20 feet high, couldn't hardly find the cars for the weeds. What happened? It was the old oil, rust and iron it got out of it, out of those old automobiles. Student: How much oil for the 2-3 hundred pounds? Reams: I'd saturate it, make it like it would be a good floor moping material. It does wonderful things for your soil. \[HOME]

ORANGE

ADVANCED AG: If you had an **orange grove** in south Florida you could use Napier grass because of the large amount of tonnage that you get off it. You get your mineral high enough for Napier grass and you won't have to buy any fertilizer or sprays for 20 years. All you've got to do is mow, mow, and mow. But I will tell you something, you'll have to mow every 10 days. Because you mow it off when it's a foot high and in 10 days it's waist deep. If you go 20 days you'll have trouble finding the trees even if they're 20 feet high. I am telling you, wet, rain or shine, you've got to keep that machine going in there. *[See Entry COVER CROP]*
ADVANCED AG: Reams used to buy **unsalable oranges** and use them in lieu of fertilizer because it was cheaper than fertilizer and because the citric acid would remove chloride from groves.
AG LECTURES: Did you ever take a leaf of alfalfa, sugar cane or corn and examine it closely and see little black dots in it? Have you noticed that or on the stem? Have you seen little black dots appear on the stem of alfalfa? Did you really look that close? That's too much potassium in the soil. How many have seen those little black dots? **Have you noticed it on** peach leaves, **orange leaves**, any crop?
AG LECTURES: Reams: Which is sweeter, a big banana or a little banana off the same stalk? Student: Little one. Reams: Right, the smallest one is sweeter. The banana puts the same amount of everything in every banana, mineral wise. **So does an orange tree**.
AG LECTURES: Lets take an **orange grove**. The trees are 15-20 feet high, producing 1,000 boxes to the acre. You would need 30 gallons of spray to cover an acre, homogenized. That's a lot of space, that's a lot of leaves and that's a lot of trunk.
AG LECTURES: Carbon determines the color, that's right. Did you ever see **oranges after the fruit matures they start turning green again**? Did you ever see that? You know oranges turn a golden yellow in the winter time then in the summer turn green again? Why did it turn green in the summer time again after it had been a golden yellow orange color in the winter? Student: Lack of carbon? Reams: That's right. If you have have plenty of carbon in your soil, those oranges will stay their golden color all summer long. Not only that, peaches will have a better color, alive, glossy, just a mouth watering color to them. Because the carbons are controlled in the soil.
FWTK: Citrus includes all members of their kind: for example grapefruit, lemons, **oranges**, tangerines and limes all have the frequency of .0009.
FWTK: Part of the commercial yields achieved with the Reams program are: **1.000 boxes or oranges per acre.**
FWTK: The average reading you will find in **oranges** is nine to 10 brix, but it should be sixteen to 18 brix.
GARDENING: Why does the grapefruit tree have a **bigger leaf than an orange tree**? That is because a grapefruit is larger and needs more sunlight to make enough sugar to make the grapefruit sweet, so God gave it a bigger leaf. Now, when an orange tree or grapefruit tree has one fruit to each 50 leaves it has its maximum crop.
PLANT FEEDING: How many citrus leaves does it take to furnish the **normal amount of carbohydrate for one orange**? How do you know when your grove is producing a maximum crop of citrus? What is the criteria for citrus,

peaches, pears, grapes, apples - how do you know when the tree has produced its capacity load? So many leaves per fruit. Fifty leaves per fruit.
PLANT FEEDING: Tell me, how do you rotate a peach orchard? **An orange grove**? Apple orchard? A grape vineyard? Well, if you don't rotate those, why rotate anything else? You do not rotate crops - but put the nutrient back in the soil.
PLANT FEEDING: When you see Peach, **orange**, apple or other trees with the bark leaking out sap and crystallizing, that means there is a phosphate deficiency first. Second, a copper deficiency. Or phosphate of copper.
PLANT FEEDING: I supervised for Minute Maid, a 40 acre field of alfalfa which they said would not grow, **and a young orange grove** that was about 3 1/2 years old, the trees up to my ears. They planted the alfalfa and in 7 weeks it was 17 feet high. You couldn't see the orange trees! People from all over the world flew in by the hundreds to see that alfalfa. It was difficult to even get the alfalfa down - let alone harvested. They said no more alfalfa for us.
PLANT FEEDING: If you've got enough sugar in the juice of the fruit all the way to the **top of the orange**, it can freeze solid and thaw out and still be good on the tree. If there's a lot of water and a lack of sugar, the expansion is so great it tears up the
tissue of the fruit and It will dehydrate and be ruined forever. Since 1938 I have not had any citrus groves to be damaged by cold whatsoever* In 1962-63, the coldest winters of the century — in which about 45% of all the groves in Florida were permanently destroyed, the groves I serviced never lost — most of them never lost the leaves. They never had to be pruned and they harvested 98% of their fruit. The others were bulldozed out right up to the rows I serviced.
SKOW: That **sugar content of an orange** or a lemon or a watermelon can be measured by its shelf life is nothing but confirmation of brix values. A high brix orange will simply dehydrate, keeping a hard shell. One with a low brix value will decay. \[HOME]

ORP (Oxidation Reduction Potential)

FRANK: With this program, it seems that if you keep the ERGS where it needs to be, if you put in what needs to be put in, the **ORP kind of takes care of itself**.
WHEELER: ORP readings are obtained using the ORP meter and calculating the result
based upon the soil's pH. **ORP readings indicate whether your soil is oxidizing (aerobic decomposition) or reducing** (composting).
WHEELER: Six portable instruments deserve mention for farmer use: refractometer, pH, ERGS, sodium, and **ORP meters**, and the new magnetic susceptibility meter developed by Dr. Philip Callahan. \[HOME]

PARAMAGNETIC

WHEELER: Six portable instruments deserve mention for farmer use: refractometer, pH, ERGS, sodium, and ORP meters, and the new **magnetic susceptibility meter** developed by Dr. Philip Callahan.\ [HOME]

PEACH

AG LECTURES: Did you ever take a leaf of alfalfa, sugar cane or corn and examine it closely and see little black dots in it? Have you noticed that or on the stem? Have you seen little black dots appear on the stem of alfalfa? Did you really look that close? **That's too much potassium in the soil.** How many have seen those little black dots? **Have you noticed it on peach leaves**, orange leaves, any crop?
AG LECTURES: One thing that makes **peaches** and apricots so excellent whenever they're dehydrated naturally is that the vitamins are still in there with natural dehydration. \[HOME]

PEPPERS, BELL

ADVANCED AG: **Bell peppers** may be a tough market to break into because the existing growers have it saturated.
AG LECTURES: I want to tell you something about growing **bell peppers**. You can grow bell peppers under this standard and I mean they are big ones. They're very large. And you can stuff these bell peppers with your favorite stuffing and bake it and it looks just like you picked it off the vine. It doesn't shrink, it doesn't wilt, it doesn't fold up. It's absolutely beautiful. I mean it still looks just like you plucked it off the vine even though it is baked. The most beautiful peppers you've ever seen. And it doesn't take very many of them to fill a bushel.
AG LECTURES: Student: Why is it that you can't plant **bell peppers** and tomatoes close together? Reams: Because they hate each other. The frequency is too far apart. Or hot peppers either. Don't plant them close to tomatoes. The frequency is too far apart.

AG LECTURES: What happens to young plants or onions or **peppers**, beans, tomatoes – row corps; whenever there's a copper deficiency? What happens to your young plants? They rot off at the ground.
AG LECTURES: Cucumbers, squashes, green beans, **bell peppers**, hot peppers, rutabagas, turnips, onions should have between 6 & 8 brix.
GARDENING: There are some plants that really appear to hate each other. One case is a tomato plant and a **pepper plant**. Don't plant those together.
FOLIAR FEED 1981: Bell peppers have a "placenta." This requires manganese**.**
JOHNSON: Student: You said you were going to say something about Vitamin C yesterday. Skow: OK, vitamin C. This is one we have come up with and have found to be very successful in legume crops. That means peas, string beans, alfalfa and **bell peppers**.
PLANT FEEDING: [Reams telling story of long ago personal farming] My **bell peppers** were 15 cents each and my competitor's were 3 for 5 cents. His were a little smaller than mine, but the weight of his 3 would equal more than one of mine. His were 3 for a nickle and mine 15 cents each, but in 5 days his would be wilted and in 2 weeks mine were still laying up beautiful. They'd stay that long.
REAMS/SKOW COOK: Also eat **bell peppers** – rich, rich, rich source of vitamin A, very rich. Also keep the seed and add to soup for manganese. Excellent, excellent foods raw.
REAMS/SKOW COOK: If you grow **bell peppers** in your garden, I"ve got a secret for you. Let them get red. The red bell peppers are better-flavored than the green ones. If you would grow a highly organic – no, not organic, highly mineralized pepper, and then you stuff it, it"ll look just like you picked it off of the bush after it"s stuffed. It will not wrinkle or shrink up and look like an accident waiting for a place to happen. \[HOME]

PEPPERS, HOT

AG LECTURES: Student: Why is it that you can't plant bell peppers and tomatoes close together? Reams: Because they hate each other. The frequency is too far apart. **Or hot peppers either**. Don't plant them close to tomatoes. The frequency is too far apart.
AG LECTURES: Every year I grow about 25 hills of **hot peppers**, about 25 hills of bell peppers and 25 hills of the yellow banana peppers. And we pick all these peppers about every 3 weeks. We get about a bushel of peppers.
AG LECTURES: Cucumbers, squashes, green beans, bell peppers, **hot peppers**, rutabagas, turnips, onions should have between 6 & 8 brix.
AG LECTURES: What happens to young plants or onions or **peppers**, beans, tomatoes – row corps; whenever there's a copper deficiency? What happens to your young plants? They rot off at the ground.
GARDENING: There are some plants that really appear to hate each other. One case is a tomato plant and a **pepper plant**. Don't plant those together.\ [HOME]

pH

ADVANCED AG: Reams: the **pH is not important** except to help understand the resistance in the soil.
SUCROSE: A **pH reading is not a quantitive reading**, and therefore is very unreliable when used as such.\
[HOME]

PHOSPHATE

ADVANCED AG: The **higher the phosphate** in the soil, the higher the sugar, the mineral, the specific gravity and healthier the animal.
ADVANCED AG: When **Phosphate Rule** doesn't work, look at other elements.
ADVANCED AG: All elements enter plant in **phosphate form** except nitrogen.
ADVANCED AG: Student: Can you add **hard rock phosphate** to compost? Reams: Yes, about 200 pounds to the ton.
AG LECTURES: Reams: What is the minimum amount of APA (available phosphate per acre) that soil should contain? Student: 400 lbs. per acre. Reams: Of what? Student: Phosphorus. Reams: Phosphate, not phosphorus, but phosphate. There is a difference in phosphorus and phosphate.
AG LECTURES: Reams: Let me ask you a question, what is the ratio for grasses and alfalfa between the P2O5 and K? Student: You want 200 lbs. of potassium and 100 lbs of P2O5? Reams: No, that's not what we said in the last lecture, first course. What is the ratio for grasses? Sugar cane? 4 to 1, 4 parts phosphate to 1 potash is for grasses. Did

you ever take a leaf of alfalfa, sugar cane or corn and examine it closely and see little black dots in it? Have you noticed that or on the stem? Have you seen little black dots appear on the stem of alfalfa? Did you really look that close? That's too much potassium in the soil.
AG LECTURES: Reams: Let me ask you a question, what is the ratio for grasses and alfalfa between the P2O5 and K? Student: You want 200 lbs. of potassium and 100 lbs of P2O5? Reams: No, that's not what we said in the last lecture, first course. What is the ratio for grasses? Sugar cane? 4 to 1, **4 parts phosphate to 1 potash** is for grasses.
AG LECTURES: Student: So you're taking land that's 0-0-0 trace 0 and you're putting this on, **first phosphate**, calcium, potash, chicken manure in that order, then you should plow it in right? Reams: Yes. That is for farm crops, but not on orchards or groves. Do not disc in any of the fertilizer in orchards or groves.
ANDERSEN: **Sources of phosphate** are.: Mycorrhizae fungi—varies with bioactivity, good.

NOTE: *Reams always speaks of phosphate and not phosphorous (as university people do}. You must keep these straight. Phosphate is determined by multiplying phosphorous by ***[AWAITING ADDITONAL RESEARCH]* [HOME]

PHOSPHATE, SOFT ROCK

ADVANCED AG: Add **soft rock phosphate** before lime to prevent moisture loss via magnetism of carbon.\
[HOME]

PHOSPHATE/POTASSIUM RATIO

ADVANCED AG: **Ratio of phosphate to potassium** is 2-1 except in grasses. **Ratio of phosphate to potassium** in grasses is 4-1.
ADVANCED AG: **Ratio** of phosphate to potash is 2:1.
ANDERSEN: Reams soil-testing method, this **ratio should be** 2 pounds of phosphate to 1 pound of potash for row crops and 4 pounds of phosphate to 1 pound of potash for alfalfa and grass crops. Succulent types of plants like pursilane are indicative of soils that are deficient in biologically active carbons.
BEDDOE: When the **phosphate and potassium ratio** is where it should be, you can remove a maximum of 50% of the available TDN (Total Daily Nutrient).
BEDDOE: The **ratio of phosphate to Potassium in the soil should be 2-1**, or two parts Phosphate to 1 part of Potassium or Potash. This means that for maximum yields you want a minimum of 400 lbs. of phosphate and 200 lbs. of potash. This ratio and level is for all crops except grasses. On grasses you want a **ratio of 4 parts phosphate and 1 part potassium**. These grass crops have the ability to get practically all their potassium from the air.
SKOW: The **ratio** of all crops (except grasses) for **phosphate and potassium** in the soil is two parts phosphate to one part potassium [2 P2O5 to 1 K.] The **ratio** for all grasses is four parts **phosphate to one part potassium**. [4 P2O5 to l K.]
ADVANCED AG: **Ratio Of Phosphate To Potassium** Is 2-1 Except In Grasses.
ADVANCED AG: **Ratio Of Phosphate To Potassium** In Grasses Is 4-1
AG LECTURES: Reams: What is the **ratio for grasses**? Sugar cane? 4 to 1, **4 parts phosphate to 1 potash** is for grasses.
PLANT FEEDING: The **ratio between potassium and phosphate** in the soil is this - don't forget it - two parts of phosphate to one part potassium.
PLANT FEEDING: The **ratio between phosphoric acid and potassium** is 2:1, two phosphate and one potash except alfalfa and grass with the ratio of 2.5 to .5 . What about sugar cane, what is your ratio for sugar cane? Did you know sugar cane is a special grass? So the ratio does not apply to sugar cane.
PLANT FEEDING: In this case where you've got too much potash, if you added more phosphate, that would tend to correct the imbalance if you added calcium proportionately to your phosphate. There's no ratio between calcium and phosphate in other words, it is a variable. Nature will make those corrections providing you have sufficient amount by volume.
SUCROSE: Keep the **ratio of phosphate and potash 2:1** from November to April, and it will join in sufficient amounts in the protein molecule to give tremendous yields (2 P:K).

NOTE: *The careful reader is sure to spot numerous variations of the "phosphate to potassium ratio" so staunchly pushed by Reams. Phosphate is P2O5, not phosphorous. Postash is K2O, not potassium.*\
[HOME]

PLOW, MOLDBOARD/DISK

ADVANCED AG: **Plow in the fall to stop erosion**. Plow roughly as possible so as to retain moisture.
ADVANCED AG: Skow: **Don't plow in the Spring**. Double disk instead.
AG LECTURES: Student: You're taking land that's 0-0-0 trace 0 and you're putting phosphate, calcium, potash, chicken manure in that order, then you should **plow it in** right? Reams: Yes. That is for farm crops, but not on orchards or groves. **Do not disk** in any of the fertilizer. Leave it right on top of the ground.
AG LECTURES: Reams: What is the primary benefit of adding compost over manures whenever you **disc them in or plow them under**. Student: It is immediately available. Reams: That's one thing, but what is the something else I am trying to get across to you? It doesn't burn the plants. The raw manure creates a heat in the soil. If you have a dry year
BEDDOE: Colloidal phosphate will prevent calcium from leaching down in the soil. Every ton of soft rock phosphate will pick up and hold in the top soil 6 tons of lime. Because of the upward movement of phosphate and carbon, it is **recommended to use a moldboard plow** to flip the soil so that the phosphates and carbons are taken down in the soil. When this is done, it will allow the phosphates along with the carbons to move toward the surface again picking up more mineral energy and moving to the top soil.
FWTK: An orchard or grove should **never be disced or plowed**. because the roots of the trees will bleed sap if they are cut.
PLANT FEEDING: Use the **moldboard plow every year**, because the carbon keeps rising to the top, making the topsoil more narrow and more narrow. The moldboard plow catches that soil, puts it down to the bottom and then it'll start. rising again up to the top. So use your moldboard plow. A good rotary disk plow is good on very hard soil. But. never try to get. by without your mold board or your disk alone. I prefer that every place you can use the moldboard p1ow, use it. But there are some soils so rocky you can not use the moldboard and you have to use the disk plow. So, you'll have to work out. those details according to how many rocks are in the soil.
PLANT FEEDING: Student: What about sandy soils? Won't the wind blow them away after **moldboard plowing**? Reams: Moldboard---put your plant food on like I told you and the wind will blow the dust off everybody's field but yours. Not a grain of sand will be blown off your field. It will be like your soil is magnetized and the wind will bring in soil from other places. I have seen 100-500 acres where this was done and not a grain was blown off. Yet all around it looked like a fire. It. may take a 1ittle while to reach its climax, but this sand blowing can be stopped. You have the power in your hands to stop it.
SKOW: Midwest prairie soils were running 10 to 12% in organic matter before the arrival of the **moldboard plow**. Today most of them have organic matter in the 2 to 3% range. Only a few well managed soils have a 5 to 6% index. Only rarely will 8% become an entry on a soil audit. Once intensified farming is started, most excellent soils have a tendency to back down to 5 or 6%.
WHEELER: To **moldboard plow** residue 8 to 10 inches deep in this soil condition [pre-existing 3-4 inches aerobic] is to almost guarantee that there will be little decay system and no new humus formed.
WHEELER: In spite of the negative aspects involving erosion and power requirements, the **moldboard plow can be beneficial**. In the soil, some nutrients tend to rise while calcium and others tend to move downward. A soil left undisturbed will stabilize from the top down in the following layers: carbon, magnesium, phosphate, potash, sulfur, aluminum, manganese and calcium. At times, it is very beneficial to invert this system with the moldboard plow. This inversion will bring the heavy nutrients to the top and move
the lighter nutrients down into the soil.

NOTE: *Plowing, the mechanical moving of soil, whether to plow or to not plow, has occupied the time and energy of countless farmers for perhaps countless years. Reams clearly instructed that permanent crops such as groves or orchards should never see a plow. On the other hand, he strongly suggested plowing to counteract or offset the tendency of certain minerals to move in the soil strata. He felt they should be brought back to the top. It is interesting to note that a general consensus among conventional farmers that plowing mostly harms soils has kept some of Reams' most loyal students from freely embracing him on this subject.* \[HOME]

POTASH

AG LECTURES: Remember, alfalfa has the ability to take practically all its **potash from the air**.\ [HOME]

POTASSIUM

AG LECTURES: Just one cigarette did that because that plant [Defenbachia] **cannot stand potassium. It takes it from the air**. So whenever you see the tip point of the leaf dead and crisp and dry on the side or little black dots on the

leaf, that's too much potassium for the amount of P2O5.\ [HOME]

PROTEIN

SUCROSE: Too much fertilizer applied at one time can result in a quick release of energy without preserving this energy in protein molecules. Most of the **energy is lost unless harnessed by the protein molecules**, which results in a decreased sucrose yield.\ [HOME]

REFRACTOMETER

WHEELER: Six portable instruments deserve mention for farmer use: **refractometer**, pH, ERGS, sodium, and ORP meters, and the new magnetic susceptibility meter developed by Dr. Philip Callahan.\ [HOME]

RESIDUE

ANDERSEN: To regenerate the microorganism populations rapidly, they must be fed. Then and only then can they **digest crop residues** and produce organic acids, humus, and nutrients. Very few crops have adequate sugar contents, as attested by their low refractometer values; hence, crop residues do not contain sufficient sugar for the microbes to use for optimum efficiency.
ANDERSEN: An area may have much organic matter but very little actual humus because humus formation requires plenty of oxygen and energy [sugar] for the correct microorganisms to work properly. If these conditions are not met, the **crop residue**, manure, and other organic materials are simply converted to ashes, alcohols, aldehydes, or other non humus compounds.
ANDERSEN: Reasons to **till the soil are to incorporate residue into the aerobic zone**, to prepare a seed bed, and to aerate the soil. Tilling too much, tilling too deeply, and tilling wet soil are three major contributors to soil degeneration.
BEDDOE: That is why this type of information would begin to reveal why growing crops of different frequency groups in rotation will set the stage for a poorer yield. **Crop residue will be of the frequency of the crop it came from**.
BEDDOE: Usually "soil sciences" only reason for measuring a conductance of a soil is to **calibrate the salt residue**.
BEDDOE: Some, I am sure, will wonder what the difference is between steer manure and cow-dairy manure. The cow-dairy manure is usually a better manure for two reasons. One is the way the cows are fed, and two, **this manure usually has much higher levels of urine residues** which cart carry higher levels of phosphate.
BEDDOE: ...it is even assumed that potassium is more important than phosphate. This conclusion is drawn from a fact that is almost always overlooked. That is that phosphate is a catalyst, and therefore is recycled in the plant, **leaving little in the plant residue** to be picked up by analysis.
FWTK: The best fertilizer for a crop is the **residues from that crop**.
SAIT: Andersen: In many of our conventional soil systems the **crop residues comprise an extremely high lignin fiber** and very low carbohydrate or free sugar. Lignin takes a lot of energy to break down, and the humus production is limited by this problem.
SKOW: An unbalanced equilibrium of calcium and magnesium **permits organic residues to decay into alcohol**, a sterilant to bacteria; and into formaldehyde, a preservative of cell tissue.
SKOW: All plant root systems have a base exchange, and as the old rootlets drops off and new ones establish they supply nutrient for the bacteria introduced at planting time. This **rootlet residue** is rapidly converted to humus and humic acids which are powerful chelating agents and help the plant acquire plant foods more readily.
SKOW: Salt residues and underutilized plant nutrients results in baseline ERGS of 25 to 600 microsiemens
SKOW: A soil high in magnesium and low in calcium can test above 6.5, but will be entirely inadequate for the growth of alfalfa, for the growth of legume bacteria, and above all, for maintenance of an environment necessary to **decay organic crop residues into humus**.
WHEELER: To moldboard plow residue 8 to 10 inches deep in this soil condition is to almost guarantee that there will be little decay system and no new humus formed. The aerobic bacteria will be buried below the oxygen level while the anaerobic bacteria will be left on top exposed to the air. **The residue will ferment,** producing an alcohol or aldehyde. These substances kill off the aerobic bacteria and preserve the trash.
WHEELER: Trash is often left lying on the soil surface with little effort given to incorporation into the soil. **Residue left in this manner will actually rust**, similarly to resting equipment with the beneficial carbon being lost to the atmosphere. Residue must be incorporated so that beneficial soil microorganisms can reduce it to humus. \[HOME]

ROOTS

ADVANCED AG: On corn, the dying off of main **tap roots** with maturity is normal.
ADVANCED AG: Reams felt 2 pounds per acre of zinc could keep **roots** from rotting.
ADVANCED AG: Some sources of carbon: sawdust, manure, calcium carbonate, sludge, compost, **roots**, green manure, etc.
ADVANCED AG: Phosphorous grows **roots.**
AG LECTURES: Reams: Name 3 sources of getting carbon into the soil? Student: Sawdust? Reams: Sawdust is one, what's another one? Student: Grass roots? Reams: **Grass roots** is another, **or crop roots**. What's the third one? Student: What about your carbonates? Your lime? Reams: Yes, but I was thinking of all of your carbonates, lime. It just goes in with the lime as carbonates. These are factors that you need to know and use and measure.
AG LECTURES: What about the top of the leaf? You know plants have bowel movement or urinate just like everything else. And this spray [we applied] goes through this leaf and [it] takes out the nutrients that it wants and **sends the rest down to the roots**, down through the stump and [the plant] mixes it with other substances and sends it back up. And then it becomes a part of the plant, [on] the frequency of the plant. But the water, the extra water that it gets in to keep that plant growing, sweats out through the top of the plant.
AG LECTURES: Reams: A lot of people get out there and cultivate, just to be cultivating when it doesn't even need it. Do you realize that? Does it make sense? Are they saving money? Student: They're tearing up the roots? Reams: They're **tearing up the roots**. How deep should you cultivate when you cultivate? I'm talking about row crops now or truck crops. Just as shallow as you can cultivate it, actually. Very, very thin, very thin, unless you have a very high sodium content and have to cultivate deeper.
AG LECTURES: There's one reason, that nematodes attack plants and only one. What is that? There's too much salt in the soil. No other reason, but too much salt in the soil. The nematode cannot attack the root until the salt weakens the root, until the bark will slide off and then he gets in. He **cannot attack the root** until this happens. Now, you apply too much nitrogen what happens to the roots? Student: The bark slides off. Reams: Yes, but something else happens to a lot of the roots, even before the bark slides off. What happens? If you get too much nitrogen on radishes, turnips, or sweet potatoes, what happens? Student: Break open? Reams: They split open, that's right, they split open and that root does the same thing. And then you've said to the nematode, I've built you a house, furnished your room and board. Won't you please, please move in? And he does.
ANDERSEN: The browning of the stalk interior is the result of congestion in the vascular system. The plant's plumbing is plugged, shutting off the movement of nutrients. The plant then sends out brace **adventitious roots** above the plugged area to make up for the reduction in flow from the primary roots. This is similar to a heart bypass operation. Each successive growth of brace roots indicates increased vascular plugging below. It is a rescue operation by nature. The plugging is caused by many things—chemical toxicity such as herbicides, putrefaction products of an anaerobic soil, excess nitrogen, and premature death of vascular tissue—all related to lack of nutritional integrity. Proper farming practices can eventually correct these problems, making brace roots unnecessary.
ANDERSEN: In addition, **plant roots** deposit certain materials into the soil and extract different materials from the soil.
ANDERSEN: During their life, plants excrete **through their roots** various organic and mineral substances which attract microorganisms.
ANDERSEN: The aerobic zone of the soil ranges from nothing to only a couple of inches. The depth of the aerobic zone determines the primary volume of the plant's rhizospheres. It takes oxygen to grow extensive third- and fourth-order roots and root hairs. **Primary and secondary roots may be growing outside** of the soil's aerobic zone, but their collective mass and volume are minor in comparison to the finer roots and root hairs that proliferate primarily in the aerobic zone.
BEDDOE: Therefore, iron is heavier than aluminum and iron will also float on boiling lead. For this reason, heavier elements in the soil naturally go down and very often too far down **out of the range of the plant root**s.
BEDDOE: Since nitrogen is an electrolyte, remember to not band it close to the plant. The electric fields need to be kept away from the plant, so that the magnetism is away from the plant. This will assure that the roots are drawn out into the middle of the rows. The **more top soil the roots are directed through, the better** the exposure to soil mineral energy.
BEDDOE: In a soil with 500 pounds per acre of chloride, chicken manure should not be used on the ground. The chicken manure is high in boron and with lack of plenty of water the stage would be set to convert ammonia nitrogen to nitrite nitrogen. If this were to happen it would **severely burn the roots** of any plants in the soil.
BEDDOE: Cover crops not only have good top growth for green manure for turning back in the soil, but also have large and prolific root systems that are rich in carbons. One of the cheapest forms of biologic carbon is from the

recycled roots of the plants.
BEDDOE: You can experience this heat loss by placing a small amount of strong acid like Sulfuric in water. The water will immediately get warm. It is this type of reaction heat from anion-cation encounters that causes **burning and dehydration of the roots**. The result can be seen as a sudden die back in the leaves because of reversing the normal osmotic flow. So the water in the plant is drawn right out through the roots. Only abundant water will compensate for this problem until the reaction weakens.
FWTK-pH: Therefore, iron is heavier than aluminum, manganese is heavier than magnesium, and iron will float on boiling lead. The heavier elements in the soil naturally go down, and they very often go too far down and **out of the range of plant roots**.
FWTK-pH: Heat created by acids coming into contact with bases is nature's way of growing crops. Whatever organic or inorganic substances there happen to be in the soil also take part in this chemical action. Too much heat at such a time **burns the roots**, releases too much nitrogen, promotes oxidation of calcium and phosphate, and will leave a very low plant food bank account.
FWTK: It is this charge that moves the needle of a compass, and it is the same force passing through the earth that attracts ionized plant food inside the seed. This plant food **enters the seed and roots** in two forms, anionic and cationic. There will be further discussion of this phenomenon later.
FWTK: Suppose you place a morning glory vine cutting in a glass of water and **watch the roots as they grow.** They will extend in a direct northerly line. They will grow in other directions, too, but the first roots will be on the north side.
FWTK: In a good soil, **most of the roots will grow to the north**. on perennial crops such as orchards, vineyards and groves. If the roots are reversed when trees or nursery stocks are transplanted, plant growth will be hindered because the root structure of these plants are polarized by the electrical fields of the earth.
FWTK: An orchard or grove should never be disced or plowed. because the **roots of the trees will bleed sap** if they are cut.
GARDENING: [Reams working with a failing hydroponics farmer] I said, "Now take this little pair of scissors I have in the edge of this scope/microscope case, you go over and **cut me some roots** off of these plants, these little plants, or just bring me a plant for that matter." He brought me a plant, we cut some roots off, and we put it under the microscope and you couldn't see the root for the bugs sucking on it. And I said, "Friend your trouble is not in the solution, it's in the bugs in the solution." He said, "There's nothing in the hydroponic book about that!" I said, "Well, if there was, you wouldn't have needed to call me over here." Now I said, "These bugs are sucking the sap out of these plants." He said, "What should I do about it." Well I said, "You need a little boron. You haven't got quite enough in order to kill them. And the second thing is, you need a little chlorine in the water. Chlorine is an essential plant food and essential food for people. Clorox, but it has to be a lot more dilute.
FRANK: When **roots and leaves sense a lack of moisture**, the potassium flow slows down, guard cells relax and stomates close.
FRANK: Roots also absorb CO2, and root uptake is just as important to yields as leaf absorption of CO2. When you apply calcium carbonate to the soil, organic acids excreted by microbes in the root zone react with it to release more CO2 for root uptake.
FRANK: With a drip tape underneath plastic, you can't do as much as you can with the broadcast, but you can change that little **micro climate right around the roots** and you can do a lot of good with that.
FRANK: Foliar feeding that you put on the plant goes down through the plant **and into the roots** and helps to build up the soil. But, it's not a good way to build up the soil because it's very slow, very difficult, very expensive.
JOHNSON: You can have all these things but the final and key thing here is the calcium that must come up **through the roots**.
JOHNSON: Student: You have the statement in here that the **synchronization of the nutrients takes place in the roots** and not in the soil. Is that right? Skow: Yes, that is correct.
PLANT FEEDING: You should also carry alfalfa over from year to year. Don't dig it up and replant each time. **Let it come up from its roots** each time. It's lifetime this way is at least 100 years.
PLANT FEEDING: Remember there is as much of a plant under the ground as there is above the ground. After you harvest the top, if your soil is not sterile, your **aerobic bacteria will convert those roots** into heavy, heavy amounts of organic nutrients. Nature is trying to help you if you will let it.
PLANT FEEDING: All plants can take all the magnesium they need out of the air. You do not have to add magnesium to any crop that I have seen, anywhere in the world. Unless the farmer had added so much nitrogen he had to add Epsom Salts in order to release the nitrogen to keep it from **burning tho roots.**
PLANT FEEDING: I want to give you a very simple rule to know whether your soil has too much nitrogen or not enough, without a soil test. Get **one of the little rootlets** the size of a small string and see if tho bark will slip off it and

if it does, there's too much nitrogen. That is, if tho rootlet is still looking alive.
SAIT: Andersen: Let's take sweet com as an example. You may take a reading of the ear and you may have 24 brix, yet the com borers are running rampant. What you will find with that sweet com is that, if you take a **reading of the stem or the main roots**, you will have a brix reading of 4 or 5. What's happening is that nature is moving all of the carbohydrates into the ear in an attempt to reproduce the species, so it's a fictitious level in the cob.
SKOW: Unlike nitrogen, oxygen, hydrogen and carbon , calcium does not come from the air. It has to come from the soil. Calcium in the soil is very insoluble. It has to be acted upon by organic acids which are **produced by plant roots,** bacteria, yeasts and fungi in the soil. Without this activity, calcium cannot be incorporated into the plant structure.
SKOW: If there is no manganese in the seed, it will swell up and rot. Manganese has a high atomic weight, 54.9380, meaning it has more power than nutrients in the surrounding soil. This puts into play the magnetism necessary to draw nutrients into the seed to **feed it and its emerging root system**. When there is a shortfall for manganese, the entire fertility program has to be adjusted to create enough energy to pull more manganese.
SKOW: In developing a foliar program, maximum attention must be given to the thickness of leaves, how well leaves stand up, the degree of wilt, and so on. A thin or weak leaf suggests a nutrient deficiency, or low TDN — total digestive nutrients. The caliber of the stalk and stem is extremely important, as is the development of the root system. Field observation will **reveal an under-developed root system when herbicides are used**. These shortfalls can be repaired with foliar sprays and fertilization through irrigation systems.
SUCROSE: Soils that are depleted of carbon will result in air that contains less carbon; however, it is not necessary for all the carbon to come from the air. Much of the **carbon can be taken in through the roots**, as this supply is mined out of the soil by the sugarcane; and its yield will decrease in direct ratio to the supply of the available carbon in the air and the soil.
WHEELER: When the pH is too low (acid) relative to the type of crop, the energy flows too rapidly. **Nutrients literally pass by plant roots too fast** to be properly attracted to and absorbed by the root.
WHEELER: The LaMotte procedure [used by Reams] uses solutions for nutrient extraction which, supposedly, are more similar to those **produced by the plant roots**.
WHEELER: Plant stress due to moisture, temperature or low pressure could trigger the plant to **move the sugars to the roots**. \[HOME]

ROT

ADVANCED AG: Top quality produce **will not rot**, it will dehydrate, except with tomatoes.
ADVANCED AG: Boron prevents grain from molding and **fruit from rotting**.
ADVANCED AG: Celery and cabbage with **rotten core** has boron deficiency.
ADVANCED AG: If **everything starts to rot** its too much sulfur not enough lime.
AG LECTURES: There is no mineral in the sweet potato here, it's as light as a cork. Also, there's too much sulfur in this ground and when there's **too much sulfur it rots**. This is Black Rot and lack of calcium in the soil is what causes it and there's too much sulfur there.
AG LECTURES: But let's suppose that you had this same soil, same problem and that you found out that the crop was already on, its near maturity and ready to mature, but it was **rotting in the field**. Then what would you do? The crop was rotting in the field. With all these numbers that I have told you and yet the crop was rotting just as it matured. Student: Put some sulfur on? Reams: Sulfur or copper? Student: Too much sulfur. Reams: Too much sulfur, that's right. So what would you do? Student: Put calcium on it? Reams: Calcium hydroxide, the hot lime. Just about 100 lbs. to the acre will knock that sulfur right out of existence as far as availability to the plant is concerned. And in 3 days you've stopped the rot. Calcium hydroxide is the hot lime. This is the hot stuff they like to make plaster out of for inside of building.
AG LECTURES: Reams: At what percent moisture do you bale hay? Student: 20-25%. Reams: 25-30 is good. About 28% makes the best hay with the highest sugar content. **And it won't rot**, won't go thru a heat, not nearly so badly as the one with the low sugar content. The higher the sugar, the less trouble it is to go thru a heat? Why? What is protein? Student: Nitrogen. Reams: Nitrogen. Did you ever stick your hand into a bale of hay and it felt hot, warm?
Did you ever stick your hand in another bale of hay and it felt cold? Even on the same kind of temperature? I have and the one that was hot inside was rotting, decaying because it had a low sugar content. And one more thing too, it had a low protein content. The one that you put your hand in that felt cool to you, it had a high sugar content and a high ammoniacal nitrogen content and the heat cooled it. See what I mean? This is very important to know.
AG LECTURES: What happens to young plants or onions or peppers, beans, tomatoes – row corps; whenever there's a copper deficiency? What happens to your young plants? They **rot off at the ground**.
ANDERSEN: The brix reading of these [high nitrogen, high potash] plants would be lower and, therefore,

these plants would be less desirable to animals and **more susceptible to storage rot**.
ANDERSEN: Sulfate, the next item on the test, is not to be confused with elemental sulfur. Elemental **sulfur can cause rot at maturity of fruit** and can tie up or interfere with calcium.
ANDERSEN: Top-quality produce will dehydrate **rather than rot**.
BEDDOE: High nitrogen soils without enough calcium and phosphate make the produce very watery and low in sugar. Hence the produce will **deteriorate and rot**.
BEDDOE: When excessive sulfur is present in the soil where tree crops are grown, it will cause the fruit to ripen very unevenly and **rot before it ripens** completely.
FOLIAR FEED 1981: If crop **rots as it heads up**, add calcium hydroxide.
FWTK: High quality crops have a resistance to disease, will not be bothered by insects as much, and **will not rot** as easily.
GARDENING: Also, the higher the sugar content in produce, the longer it lasts and it won't rot. **Good produce won't rot.** I grew a crop of watermelons for a client and he gave me some of those watermelons and they sat on my desk for 3 years and didn't rot. I entered them into the fair 8 months after they were picked [and then] for 2 consecutive years. They did get lighter and dehydrate, but they did not rot.
JOHNSON: Zinc is used to control many types of blight. It is also a minor catylist for SulPoMag and copper. It helps to make the acedic acid in the root to **keep it from rotting**.
PLANT FEEDING: Do you know you can grow watermelons which can **sit on your desk for 3 years without rotting**? I've done tnat. I presented one in the county fair for 3 years consecutively. Yes, the same identical watermelon. It was marked - this was a demonstration of research. It was authenticated and sealed and under supervision and under no refrigeration. The higher the sugar content - foods will not rot.
SKOW: Top quality produce will not rot. It will simply dehydrate. There is a saying that all generalizations are false, including this one! The tomato resists identification with the above general rule. Even an excellent tomato will resist dehydration. Still, a top quality tomato will have longer shelf life before it starts to deteriorate.
WHEELER: The ideal ORP range is between 25 and 29. Soils with a reading lower than 20 can be said to be greatly lacking oxygen due to its use in the composting process. Such soils are characterized as poor growth mediums. **Seeds planted in these soils may tend to rot** as there will be an excess of moisture.
WHEELER: Seed lacking in manganese will often **rot in the soil** rather than sprout. \[HOME]

ROT, BLACK

AG LECTURES: There is no mineral in the sweet potato here, it's as light as a cork. Also, there's too much sulfur in this ground and when there's too much sulfur it rots. **This is Black Rot** and lack of calcium in the soil is what causes it and there's too much sulfur there.\ [HOME]

ROTATION

AG LECTURES: In small garden crops you don't have to fool with frequency, but when you get into specialized planting then you want to deal with frequency, because it matters much and then **you do not want to rotate crops**. You want to plant the same crop on the same soils every year. Never rotate, because you're just simply rotating yourself out of business.
ANDERSEN: Plants are a very strong ecological factor, selecting certain species of bacteria, fungi, actinomycetes and other inhabitants of soil. As a result of wrong agricultural practices and crop rotation, the soil becomes infested with harmful microbial forms [emphasis added]. **By use of suitable plants in the crop rotation, one may change the microflora** of soil in the desired direction, and eliminate harmful organisms, in other words— restore the health of soil.
ANDERSEN: The practice of intensive rotational grazing is regaining popularity and sophistication. With proper management of both the pasture nutrition and the **grazing rotation**, maximum production from both land and cattle can be obtained, as well as optimized animal health.
BEDDOE: That is why this type of information would begin to reveal why **growing crops of different frequency groups in rotation will set the stage for a poorer yield**. Crop residue will be of the frequency of the crop it came from. Planting another frequency crop in that ground means that the new crop will have less potential energy for growth until the bacteria and resistance process digest the previous plant material in time for the current crop. When it is the same crop being replanted or one of similar frequency group, the bacteria will also be of an arrangement unique

to that crop. This means the energy that can be recycled from the previous crop material will be readily available faster.
BEDDOE: Plant residue of a crop that is not in the same frequency group as the new crop being grown can interfere with production. This is why **crop rotation can work against good intentions**. Remember the rule: "like attracts like?" Well, a plant can only attract in plant food energy that is on its own basic frequency. Energy being released fiom decomposing plant material that is not of the frequency group of the plant being grown, means that the frequency mismatch does not as easily deliver food energy to the feeding plants.
FWTK: Another farming procedure that can ultimately **achieve maximum yields is continuous cropping, rather than rotating** crops. Dr. Reams recommends continuous cropping, once the fertility levels reach where they should be. The best fertilizer for a crop is the residues from that crop. By farming the same crop year after year, the soil is built on the frequency of that crop. This is a part of achieving maximum yields. Continuous cropping is a controversial subject, but is something that a farmer using this program will want to be doing.
JOHNSON: Skow: About the only known way to have some affect on this [high mag problem] is to basically have a compost and manure program and a very **effective rotation program** and just try to continue to row crop it.
PLANT FEEDING: How many have heard of **rotation of crops**? It's the worst thing that ever was done to American farmers. It was designed to put the farmer out of business on the installment plan. To rob the earth of the last little bit of nutrients in there. To keep the big farmer in business and let the little farmer go broke. Student: But we get bigger yields when we rotate. Reams: Yes---over a [short] period, but in a 10 year period, there's a decrease. But- you say - Doc - I don't believe that. However, I think you do, but you're so indoctrinated in what you've been taught in the last 30 years that you don't know what is true. Tell me, how do you rotate a peach orchard? An orange grove? Apple orchard? A grape vineyard? Well, i f you don't rotate those, why rotate anything else? You do not rotate crops - but put the nutrient back in the soil.
PLANT FEED AUDIOS: Crop rotation is the worst thing pulled over farmers eyes.
SKOW: Dr. Albrecht, as a director of all of the Sanborn Field research, had seen these same acres produce face-reddening facts. For instance, he knew that back when everyone was **talking and preaching crop rotations**, evidence from Sanborn Field had proved that such practices under certain conditions could be not beneficial but actually very harmful.
WHEELER: These cover crops, also known as "green manure" crops, are important in many ways other than just their nitrogen-fixing abilities. They play a crucial role in soil aeration, erosion control, and **crop rotation**, to name a few.
WHEELER: These [Wheeler listed Auburn University suggestions] can be considered as part of an IPM: Take advantage of **crop rotation benefits**.

NOTE: *Reams was adamant in his opposition to crop rotation. One does not have to seek deeply to see that some of his students failed to follow his lead.* \[HOME]

SHEEN/GLOSSY

ADVANCED AG: Dairy cows **without sheen** on hair have worms.
ADVANCED AG: Skow: "Close mowing peas (legumes) in an orchard with dolomitic soil will put a **glossy sheen** on the leaves by releasing magnesium to the air."
ADVANCED AG: You will have a **shiny leaf field [sheen]** when iron and phosphates are ideal.
AG LECTURES: Did you ever see corn that you had trouble getting the chlorophyll green enough? And you put on more nitrogen and it still looked pale? The more you put on, well it would make it grow, but it just **didn't look waxy, a sheen**. Let me tell you this, when you see a crop that has no sheen on it or a grove or an orchard, that the leaves do not have a waxy sheen to, you're going to see a grove or orchard or crop that is low in carbon.
AG LECTURES: What is it that makes a citrus tree not have to be sprayed if it has a **waxy sheen** on it? Kind of like a bald headed man. If a bug lights on it, it slides off. He has a job getting his feet to hold on there.
ANDERSEN: To notice that one field of beans **has a sheen** and the adjacent field does not indicates a difference in nutritional balance.
ANDERSEN: Iron draws energy to the leaf by absorbing heat from the sun; it makes the leaf darker, thus absorbing more energy. It will increase the **waxy sheen** of the crop.
ANDERSEN: Molybdenum is a catalyst for iron in the bark or epidermis, is important in the integrity of bark or plant skin, and gives a transparent look to the **sheen on the bark**.
FRANK: Don't worry about morning dew on leaves if you're applying foliar nutrients. A correctly designed spray will break the surface tension of those droplets. The mist you apply, plus dew, will **coat leaves with a glossy wet sheen**. The leaves will sponge up both dew and nutrients within a half-hour of sunrise, even with 70% humidity.

FWTK: The leaves of a healthy plant will have a **glossy sheen**, and egg-laying insects will not lay their eggs on a healthy leaf as readily as they will on a sick, dull leaf.
JOHNSON: The oats that we had in here earlier had what I call a **waxy sheen to the leaf**. Those leaves get a waxy sheen like some house plants and when you get a corn field that looks like that or a bean field or an oats field, you have come a long way.
SKOW: When a field has a **metallic sheen**, the crop will be healthy. On small grain, a golden color is something devoutly to be wished. It isn't seen very often, but when it shows up it brings real excitement. \[HOME]

SUCROSE

SUCROSE: Too much fertilizer applied at one time can result in a quick release of energy without preserving this energy in protein molecules. Most of the energy is lost unless harnessed by the protein molecules, which results in a **decreased sucrose yield**.\ [HOME]

SUGAR CANE

AG LECTURES: Did you ever take a leaf of alfalfa, **sugar cane** or corn and examine it closely and see little black dots in it? Have you noticed that or on the stem? Have you seen little black dots appear on the stem of alfalfa? Did you really look that close? That's too much potassium in the soil. How many have seen those little black dots? Have you noticed it on peach leaves, orange leaves, any crop?
AG LECTURES: Student: You said a 4 to 1 P and K for grasses, do you consider alfalfa a grass? Reams: Yes, **sugar cane too is a grass**. Corn is not a grass. \

SUGAR CONTENT

ADVANCED AG: Increasing growth without TDN will lower **sugar content**.
[See Entry BRIX]\ [HOME]

SULFATE

ANDERSEN: Sulfate, the next item on the test, is **not to be confused with elemental sulfur.** Elemental sulfur can cause rot at maturity of fruit and can tie up or interfere with calcium. Sulfate, on the other hand, can help enhance calcium availability, is needed in certain protein and enzyme complexes, and sometimes can aid in mellowing the soil. However, it is possible to apply too much sulfate, which seems to be happening in some areas where reductionists are attempting to "hammer down" soil pH with large amounts of gypsum and sulfuric acid. This practice causes additional salt problems, calcium demand, and microbial stress.\ [HOME]

SUPERPHOSPHATE

ADVANCED AG: 0-20-0 is **superphosphate** and needed for energy. Be careful as your fertilizer dealer may give you 0-46-0 mixed with something else.
ADVANCED AG: 0-20-0 On Reams program means **superphosphate** and no other product.
AG LECTURES: Too much calcium on Irish potatoes will cause them to have scales, look like scales on it. On potatoes you need to do 2 things. You need to have a certain amount of sulfates from **superphosphate** but you also need certain amount of calcium.
AG LECTURES: Anionic plant food makes growth, cationic plant food makes fruit. So now you're going to change it from anionic to cationic. You know when the blossoms start to shed off, regardless, there's a fine delicate point there in your soil chemistry that you're not going to be able to measure. It's too delicate, but when the blossoms starts to shed off, what are you going to do to stop it? Student: Add acid. Reams: Well, what's the name of that acid you're going to add? Student: Superphosphate. Reams: **Superphosphate, yes**, or you can use just plain vinegar, if you've got a backyard garden. It's a lot quicker and a lot cheaper and a lot handier. And it's in any store. Add one teacup full to two gallons. Just sprinkle it around the ground.
ANDERSEN: When Reams discussed applying a fertilizer or material such as vinegar, **superphosphate**, or thio-sul to set fruit, he stated that a cationic material should be added. In reality, more fruiting or condensing-energy (Yin) material was needed. If he discussed applying a fertilizer or material such as calcium or nitrate nitrogen (like in forage or leaf crops) to get mostly growth without fruit, he stated that an anionic material should be added. In reality, more growth or expanding-energy (Yang) material was needed.
ANDERSEN: Sources of phosphate are:

■ Soft rock phosphate, good.
■ Hard rock phosphate, good.
■ **Superphosphate**——0-20-0, specialty.
■ Triple super phosphate——0-46-0, no-no.
■ Diammonium phosphate—18-46-0, no-no
BEDDOE: Superphosphate is used to stimulate resistance in the soil to increase ERGS and to supply small amount of phosphate. BE AWARE that some companies have been guilty of taking double super and triple super phosphate and cutting it with a filler of some type to get the analysis on the bag to be 0-20-0 like single super phosphate. Even though the analysis is an 0-20-0 this does not make it the same as single super phosphate. It is still triple super in a diluted form and it acts like it in the soil. Single Super Phosphate will have about 12% sulfur content, so use this as a cross check. Remember to avoid the use of the double super and triple super phosphates.
BEDDOE: Super phosphates like (0-20-0) are highly acid, and if you were to use and try to apply enough to get 400 lbs. of available phosphate per acre, it would create so much acidity in the soil that the soil would be totally useless for upwards of 3 years.
BEDDOE: Increasing ERGS is done by the use of catalysts. The main catalyst is the fertilizer called Single **Super Phosphate** also known as O-20-0.
BEDDOE: Single **Super Phosphate** is also used in conjunction with Ammonia Nitrogen fertilizers to keep the Ammonia from following the line and least resistance and changing to Nitrate. As you will remember, Nitrogen is called an isotope. This means that as an element, nitrogen will follow the line of least resistance dictated by the other available minerals in the soil, especially calcium. Therefore, if you apply Ammonia Nitrogen on soil that is high in available calcium, then the Ammonia will switch to a Nitrate unless Single Super Phosphate is applied right along with it. So anytime there is a need for a cationic switch in a crop grown on high calcium soil and more Ammonia Nitrogen is needed in that crop, make sure Single Super Phosphate is also applied at the needed rate. \[HOME]

TDN (Total Daily Nutrient)

AG LECTURES: Student: And that's your **total of TDN of calcium**? How much have you got to apply? You recommended 8,000 didn't you? Reams: That's right, but you can't do it all the first year. You have to apply it in degrees. *****ADVANCED AG index:** 095 Need Chart For Fertilizer Recommendations And **TDN In Root Zone**
ADVANCED AG: The Brix reading should be the same throughout the plant, **unless the soil is low in TDN.**
ADVANCED AG: 80% of TDN from ground should be calcium
AG LECTURES: But one of the great mistakes in growing corps is that the **farmer does not regulate his TDN** or ERGS in the soil with the moisture content.
AG LECTURES: That pasture will be perpetual except for your calcium and phosphates. That juice [from sickle-bar mowed grass] will drop onto this ground and go back in and supply you with **enough TDN for 2 more crops**.
AG LECTURES: Reams: How much calcium do you have per acre? Student: 2,000 lbs. per acre. Reams: And that's your total of **TDN of calcium**? How much have you got to apply? Student: You recommended 8,000 didn't you? Reams: That's right, but you can't do it all the first year. You have to apply it in degrees. In other words I would get it to 4,000 the first year, 6-7,000 the next and 8-8,500 and even 9,000. If you will evaluate your soil by what you've got left over after the crop, it will mean a lot more to you than trying to figure out what you've got before you plant your crop. However, you've got to do both.
BEDDOE: It is interesting to note, that in a **high TDN and active soil** the bacteria have so thoroughly taken over that earth worms will seldom be found. Earthworms are natures way of trying to build the soil. When it is built to the maximum the bacteria take over the full load and the earthworms move on to where they are needed.
BEDDOE: When the phosphate and potassium ratio is where it should be, you can remove a maximum of **50% of the available TDN** (Total Daily Nutrient).
BEDDOE: Yes, magnesium is a necessary mineral in the function of the plant, but the plant can usually get all the magnesium it needs just from the atmosphere **when the TDN is at an adequate** level.
BEDDOE: There is a law in mathematics that says, "The whole is equal to the sum of the parts." Well **this law applies to the reserve soil TDN** also. The parts of the reserve soil TDN are Calcium, Phosphate, Potassium (potash), Nitrate Nitrogen, Ammonia Nitrogen, Iron, and Copper. When these are summed up they should equal 98% of soil reserve potential. If that potential equals 3000 lbs. per acre or more, than it is possible to start predicting yield potentials for a given crop. The higher the reserve potential, the more accurate the predictions.

FOLIAR FEED 1981: You will have to foliar feed more often in a wet year to control **TDN**
FOLIAR FEED 1981: If the bark on the tree plant roots is loose from ammoniation, you must completely foliar feed **the entire TDN.**
JOHNSON: Student: How high is high enough [phosphate]? Skow: I wish I could give you an absolute answer but it is not possible because the phosphate in the soil has to be worked up in the soil in relation to the what? What key thing can you do to **increase your TDN** (total daily nutrient) more? What has to be there? Carbon, there you go.
JOHNSON: TDN Abbreviation for **TOTAL DAILY NUTRIENT**. It is the sum of all the available nutrients that are available during any given day. One can calculate this by adding together the values obtained from the soil analysis for calcium, phosphate, potash, and nitrogens, primarily. The **minimum desirable TDN value is about 3000 pounds per acre**.
PLANT FEEDING: That's what we're studying today. How to produce the most food with the **highest nutrient value, (TDN - total daily nutrient)** which is what is required to maintain a plant or animal.
SKOW: The **goal is TDN, total digestive nutrients** — nitrogen, calcium, phosphorus, potassium. It is the function of carbon to keep these nutrients separated by enough space to confer on them the status of complexes. and keep them from becoming salts.
SKOW: A thin or weak leaf suggests **a nutrient deficiency, or low TDN** — total digestive nutrients. \[HOME]

TOMATO

AG LECTURES: Student: Why is it that you can't plant bell peppers and **tomatoes** close together? Reams: Because they hate each other. The frequency is too far apart. Or hot peppers either. Don't plant them close to tomatoes. The frequency is too far apart. \[HOME]

TOP QUALITY

REAMS/SKOW COOK: [Reams was in a market in Hot Springs and for 50 cents each bought two bushels of grapefruit that he noticed had hard rinds] **Top-quality fruit won‟t rot**; they‟ll form a shell like wood around it. The friends I was staying with thought I was crazy, buying junk, trash---but when they tasted them, they said, "That‟s the best grapefruit I‟ve ever eaten in my life." Sure they were the best, or I wouldn‟t have bought them.\ [HOME]

VITAMINS

AG LECTURES: One thing that makes peaches and apricots so excellent whenever they're dehydrated naturally is that the **vitamins are still in there** with natural dehydration.\ [HOME]

WEEDS

ADVANCED AG: Skow: A big reason for **excessive weeds** is from not managing the phosphate/potash ratio.Student: A proper cover crop can help.
AG LECTURES: Student: I had farmer tell me one day he took and sprayed his corn when it was just coming up with Atrizine, at the rate of 1/3 pound per acre. And he said it didn't kill the weeds, but it just stunted them enough that the corn grew up away from the weeds. Then he would go cultivate and cover everything up. Reams: Yes, I wouldn't have used Atrizine**,** I would just cover them up to start with. Student: Yes, I don't advocate Atrizine either, but that's what he did. Reams: I don't advocate it at all, period. **I have never seen a weed killer that didn't do harm in the long run**. One of the greatest things it ties up is phosphates, terrifically. Every one of them does.
AG LECTURES: Did you ever see an old poor piece of ground, so poor that it couldn't do anything but make a used car lot out of it? In about 3 years there were **weeds 20 feet high**, couldn't hardly find the cars for the weeds. What happened? It was the old oil, rust and iron it got out of it, out of those old automobiles.
AG LECTURES: Reams: What are some of the factors that determine whether we should cultivate or not? Student: Weeds? Reams: **Weeds are one**. Student: To break that top crust? That's right. When that crust form, you want to break that crust on the top of the ground.
ANDERSEN: The Reams soil test was developed to reflect, in the test values, the characteristics actually observed in the field. These characteristics include soil compaction and tilth, **weed and pest problems**, crop quality and yield, and overall stability of soil and plant nutrients. No other testing system can make such a claim.
ANDERSEN: The belief that healthy soil **grows weeds equally as well as the desired crop is based on the misconception** that the soil in question is healthy. Evaluating the refractometer reading of the plants, both weeds and crops, growing in the soil tells the observer whether the soil is truly healthy. In this case, one will find that the refractometer readings of both the crop and the weeds are about the same, probably in the 4 to 8 brix range. Neither the

crops nor the weeds are well balanced nutritionally at these brix levels, but the conventional soil test and nutrient standard may indicate that this is a "healthy" soil. In any event, It is not!
BEDDOE: Weed problems have their primary cause in the improper ratios of potassium to phosphate. Soil, no matter how virgin it is, will, as a rule, have excessive amounts of potassium while lacking on available phosphate. Hence the **primary approach to weed control** will be tied up with the over all soil chemistry changes.
FOLIAR FEED 1981: Don't use herbicides, **cultivate your weeds out** so that they add carbon to the soil.
FOLIAR SEMINAR 1983: Don't spray weeds because all herbicides destroy your carbon. Cut down your **first crop of weeds** to gain carbon and also ensure you have enough calcium to arrest chlorine.
FRANK: In the past farmers would cultivate grain crops in order to combat weeds. With increasing acreage, farmers found it easier to spray herbicides rather than **to cultivate**.
FWTK: A few weeds in a crop, on land that is properly fertilized, will not affect the yield, because there is enough plant food for both the weeds and the crop. Actually, a **few weeds that are easily cultivated under can produce 20 to 50 lbs. of nitrogen** per acre.
GARDENING: Is a rose bush in the middle of a potato field a weed? It is, it's out of place. A **weed is any plant that's out of place**. So you've got to keep each thing in its own place in order to produce.
JOHNSON: Student: How do you get the potassium down? Skow: Add lime. It is very strange how it will come into line. When the potassium goes down and the lime comes up a very interesting phenomenon happens. For some strange reason **the weed problems you've been having are no longer a problem**. Now you may get a new one but the ones you have like pigeon grass will essentially not be there. I have one farmer out here that I have been working with and I have not gotten his permission to visit his farm with a group, but there has been no herbicides used period and his field doesn't look any different than anybody else's.
PLANT FEEDING: Plants are very much like animals in a barnyard. Lets consider a goose and a horse. You can feed them both on green grass alone and they'll live a long time. You can feed. them both on corn and oats and they'll live a good long time, but you put them both on hay, and the goose won't live. That's what you can do for plants---just **don't give weeds the vital minerals they need and you'll get rid of the plants you don't want.** Nothing difficult about that is there? That's what you're here for---to learn how to keep from using poisonous sprays.
SAIT: Andersen: The fact is that, if we have problems with insecticides, diseases and **weeds, then we have an imbalance** in that soil, regardless of what the conventional soil test figures might be telling us. Carey Reams showed that insect and disease problems are related to the brix level of plants. He also showed that weeds are evidence of nutritional imbalance—often involving calcium and phosphate deficits or potassium excesses.
SAIT: I was wondering about your experience with weeds. **Weeds are often called a signpost** to nutritional deficiencies. Do you have concrete evidence of this nutritional link? Andersen: Absolutely and without question.
SKOW: The only readily available tool to discern the true situation is the refractometer. Most of the time sugars go down if there is a phosphate problem, and those same sugars **go up in the weeds**.
SKOW: When an ERGS test is made, it is necessary to flesh out the information gathering synopsis with a refractometer reading on the plant. **Weeds should also be checked** with a refractometer to see whether the crop plant or the weed has the highest reading.
WHEELER: When farmers inquire [at the extension office] about methods of raising better (more nutritious) alfalfa, the conventional answer comes back with recommending 0-0-60, keep the pH up, cut by the blossom, **herbicide the weeds**, use 18 pounds of seed per acre, and all the other wrong or wrongly reasoned advice. The failure of standard forage fertility programs is appalling. \[HOME]

WORMS

ADVANCED AG: As the TDN is greatly increased, the yields will increase but **earthworms will tend to disappear** because there is too much energy.
ADVANCED AG: The reasons for **cut worms and root worms** are the same as for nematodes, Aerobic bacteria will eat them for lunch.
AG LECTURES: Student: Aerobic bacteria also eat live nematodes, right? Reams: Yes, grasshoppers, ants, cockroaches, anything else they come across, **[including] worms**.
AG LECTURES: All [pest] **worms** are laid by some kind of a moth or a beetle. However, there are nematodes that bear young and there are nematodes that lay eggs.
AG LECTURES: Nematodes bear their own young and lay eggs. **Worms have to have a moth or beetle** or something on that order to propagate them. Like a butterfly in a cocoon.
AG LECTURES: Student: How long did you say the nematodes get? Reams: I've seen them 6 feet long. Student: What's the diameter? Reams: O, big around as an earthworm. **Earthworm is a nematode too, did you know that**?

Snake is a type of a nematode also. It's all in the reptile family.
AG LECTURES: Another thing that doesn't work very well is **earthworms**, which are nematodes, in orange groves, because the citric acid in the roots is very difficult for the nematodeswho can't live in citrus soils or any other soil that's too dry.
ANDERSEN: An ear of corn at 24 brix with **corn ear worms** inevitably will have leaf or stalk refractometer readings below 12. Grapes at 18 brix with insect infestation inevitably will have cane or leaf refractometer readings below 12 brix.
ANDERSEN: Obviously, earthworms are not people, but our digestive systems and that of the soil depend on microorganisms and enzymes. Earthworms are good surrogates for determining potential hostility to these important digestive microorganisms and enzymes. **Earthworms are not parasitic like pinworms, flat-worms, roundworms, or leeches**; rather, they are an integral intermediate part of the desired soil digestive cycle. Therefore, the response of earthworms to various environments accurately represents desired biological compatibility. Even chemical agriculturalists consider earthworms to be indicators of desirable soil conditions. There will come a time when soil fertility will evolve beyond the point where earthworms are a necessary part of the cycle. This might take some time, but it will occur when the **energy concentration of the soil is balanced beyond the need for earthworm intervention**.
ANDERSEN: Good compost has no identifiable organic-matter residue, ash, or sticky, putrefied pockets. It is **nontoxic to earthworms**, plants, animals, and soils.
BEDDOE: It is interesting to note, that in a high TDN and active soil the bacteria have so thoroughly taken over that **earthworms will seldom be found**. Earthworms are natures way of trying to build the soil. When it is built to the maximum the bacteria take over the full load and the worms move on to where they are needed.
FOLIAR FEED 1981: You can use Nemagon on nematodes and wire worms if you wish, but it **will kill your earthworms**.
GARDENING: The moth knows by instinct that where she stings the plant leaf and lays her eggs a small drop of sap will come out of the plant. And these **little worms will eat on that sap until they get big enough to eat the leaf**. But suppose that little drop of sap that comes out is very high in sugar content. When that sugar content then strikes the oxygen content of the air, it's going to ferment and turn to alcohol. And those little worms are going to get drunk and roll off of that leaf into the ground and the bacteria are going to eat them and you'll have a garden without any worms in it.
SKOW: Root rot, nematodes, maggots and **root worms**, all are problems that noticeably subside once the bacteria culture is established.
WHEELER: There is no means for mixing the crop residue into the soil for humus formation with [toxic] no-till. If the residue were cut and laid on the soil surface, the earthworms could carry some organic matter and minerals down into the soil. Herbicides on the crop residues, however, may **disperse the earthworms**. \[HOME]