- FROST
- FROZEN/FREEZE
- FRUIT
- FUMIGATION
- FUNGI
- FUNGICIDE
- GAMBLING
- GENETIC
- GENOME
- GERMICIDE
- GERMINATION/SPROUT
- GLANDS
- GMO
- GRAIN
- GRAPEFRUIT
- GRAPES
- GRASS
- GRASSHOPPERS
- GRAZING
- HARDPAN
- HARVEST/MATURITY
- HAY
- HEALTH
- HERBICIDES
- HOGS/PIGS
- HORMONE
- HUMATES
- HUMIC ACID
- HUMIDITY
- HUMUS
- HYBRID
- HYDROGEN
- HYDROGEN PEROXIDE
- HYDROPONIC
- INOCULANTS
- INORGANIC
- INSECTICIDE/PESTICIDE
- INSECTS
- INSOLUBLE
- INSTRUMENTS
- IODINE
- IONIZATION
- IRON
- IRON SULFATE
- IRRIGATION
- ISOTOPE
- LACTIC ACID
- LEACHING
- LEAVES
- LEGUME
- LETTUCE
- LIME
- LIME, HIGH-CALCIUM
- LIME, QUICK
- LINE LEAST RESISTANCE
- LIVER
- LIVESTOCK/HERD
- LODGING
- MAGNESIUM
- MAGNESIUM OXIDE
- MAGNESIUM SULFATE
- MAGNETIC
- MANGANESE
- MANURE
- MANURE, GREEN
- MARKET
- MELLOW
- MELONS
- METABOLISM
- METAL
- METALS, HEAVY
- MICROBE/MICROBIAL
- MILHAUS UNITS
- MILK
- MINERAL
- MINERAL ENERGY
- MINERALS FROM AIR
- MIST
- MOISTURE
- MOLASSES
- MOLD/MILDEW
- MOLYBDENUM
- MOTH
- MOWING
- MYCORRHIZA
- NATURE
- NEMATODES
- NITRATE
- NITRITE
- NITROGEN
- NO-NO/DO NOT
- NOURISH
- NUTRIENT
- NUTRIENT DENSITY
- NUTRITION
- NUTS
- OATS
- OCEAN
- OIL
- ONIONS
- OPTIMUM
- ORANGES
- ORGANIC
- ORP
- OSMOSIS
- OXIDATION
- OXYGEN
- P2O5
- PARAMAGNETIC
- PASTURE
- PEACH
- PEANUT
- PEPPERS, BELL
- PEPPERS, HOT
- PESTS
- pH
- PHLOEM
- PHOSPHATE
- PHOSPHATE FORM
- PHOSPHATE POTASH RATIO
- PHOSPHATE, HARD ROCK
- PHOSPHATE, SOFT ROCK
- PHOSPHATE, SUPER
- PHOSPHATE, TRICALCIUM
- PHOSPHATE, WATER-SOLUBLE
- PHOSPHOROUS
- PHOTOSYNTHESIS
- PITH
- PLOW, MOLDBOARD/DISK
- POLLINATE/POLLEN
- PONS
- POROSITY
- POTASSIUM as compound
- POTASSIUM as element
- POTASSIUM as potash
- PROFIT
- PROTEIN
- PROTOPLASM
- PRUNING
- QUALITY
- RADIONICS
- RAIN
- RATIO
- REFRACTOMETER
- REPRODUCTIVE
- RESIDUE
- RIPEN
- ROOTS
- ROT
- ROTATION
- RUMEN
- SAFETY
- SALT
- SAME SIZE
- SAP
- SAWDUST
- SCALE
- SEASON EXTENSION
- SEAWATER/SEA SALT
- SEAWEED
- SEED
- SEEDLESS
- SELENIUM
- SHEEN/GLOSS/TINT
- SILAGE/HAYLAGE
- SMELL/ODOR
- SODIUM
- SOIL CONDITIONERS
- SOIL STRATA
- SOIL TESTING
- SOIL, STERILE

- SOLUBLE
- SPECIAL PROCESSES
- SPECIFIC GRAVITY
- SPINACH
- SPLITTING
- STALK
- STARCH
- STEM
- STICKINESS
- STIMULATE
- STOMA/STOMATA
- STORAGE
- STRAWBERRY
- STRESS
- STUMP
- SUCROSE
- SUGAR CANE
- SUGAR CONTENT
- SUL-PO-MAG
- SULFATE/SULFUR
- SUNFLOWERS
- SUSCEPTIBLE
- SWEET
- SYNCHRONIZE
- SYNTHETIC
- TASTE
- TDN
- TEAR GAS
- TEMPERATURE
- TEMPERATURE, SOIL
- TERMS DESCRIBED
- THIN/THICK
- TOBACCO
- TOMATO
- TOPSOIL
- TOXIC/TOXICITY
- TRANSLOCATE
- TUBERS
- UNAVAILABLE
- UREA
- VAN ALLEN BELT
- VASCULAR/PLUG
- VEGETABLES
- VINE/VINEYARD
- VINEGAR
- VIRUS
- VITAMIN
- WATER
- WATER-SOLUBLE
- WEATHER
- WEED CONTROL
- WEEDS, BROADLEAF
- WEEDS, GRASSY
- WHEAT
- WIND
- WINTER
- WOOD
- WORMS
- XYLEM
- YEAST
- Z INC
- z30 RULES OF REAMS AG
- zWHERE TO FROM HERE?

ACID, AMINO

`ACID, AMINO
ADVANCED AG: [Skow agrees with student that many feeds are protein-deficient and that added sulfur can increase amino acids leading to improved protein.]
ADVANCED AG: Sulfur increases protein by increasing amino acids.
ANATOMY: In other words, if there is a phosphate deficiency there will be a sugar deficiency, and thus, an amino acid deficiency.
ANATOMY: Also, the reduced nitrogen groups NI-I2 and NH3 combine with the carbon frameworks formed during the oxidation of sugars to form amino acids.
ANATOMY: Without nitrogen there is no life. It is a primary component of protein and amino acids.
ANDERSEN SCIENCE: The reduced nitrogen groups, NH2 and NH3, combine with the carbon frameworks formed during the oxidation of sugars (forming organic acids) to form amino acids.
ANDERSEN SCIENCE: ...microbes also increase the metabolism of amino acids in the roots by converting inorganic nitrogen to organic nitrogen compounds.
ANDERSEN SCIENCE: Nitrogen must be combined with carbon, hydrogen, and oxygen in order to form an amino acid. Amino acids are then combined, as discussed in the chapter on biology, to form proteins. This is rarely discussed in connection with fertilization.
ANDERSEN SCIENCE: By definition, nutrition must include vitamins, enzymes, amino acids, proteins, carbohydrates, and minerals.
BEDDOE BI: 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 BI: Amino Acid Core (AAC)—The center structure of an amino acid which contains the nitrogen.
BEDDOE BI: It [manganese] is an element that has a high specific gravity so it forms the center of attraction for the germ to be able to draw in amino acid ions to build plant cells to structure the beginning of the roots of the plant.
BEDDOE NOURISH: Calcium takes the lion's share of the work load in providing the anionic growth stimulation. The result of all the functions of calcium is the manufacture of amino acids for the making of plant protein and human food.
BEDDOE NOURISH: Yes, minerals can be carried into plants to a limited extent, in other forms, such as with nitrogen, but the result is that the plant does not form the sugar completely. It will be very watery an d the amino acids formed will be of a very inferior quality.
BEDDOE NOURISH: However, the protein content is high or low in just about the same proportion as the minerals. This is because just about all the minerals are used in the amino acid enzymes, which in turn ar e catalysts helping to make all the protein compounds.
BEDDOE OT: In plants, copper acts as an activator of several enzymes, converts amino acids, and may be involved in Vitamin A production.
ENERGY RESEARCH: Liquid fish is a real nice thing to use from the standpoint that it furnishes oil, amino acids, some nitrogen, phosphorus, potassium, a full array of trace minerals and calciums.
ENERGY RESEARCH: To get enough sugars, they go down into the rootlets and combine with nitrogen and you get what we call amino acids or organic acids produced.
ENERGY RESEARCH: In other words, you have organic acids, vitamins, and in particular, amino acids, fatty acids and the base of all these is carbon, hydrogen and oxygen.
FRANK: Add hydrogen and oxygen (as water) to carbon, and you have the elements of sugars. Add nitrogen, and you have the makings of a rudimentary amino acid.
FRANK: Dry or liquid seaweed is great for trace minerals, amino acids, and naturally occurring plant growth regulators.
FRANK: Enthuse is a broad-spectrum trace mineral foliar spray that we've added quite a bit of trace minerals. It also includes some PGRs, some single amino acids, and I spike it with some of the things I know we need such as selenium and iodine in very dilute quantities to make sure we're bringing that up.
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.
SKOW: Sugars are produced in the leaf during the day and translocated to the roots and back up to the various parts of the plant during the night. Many are converted to amino acids in this process, as well as to hormones and vitamins.
SKOW: In order to make an amino acid, carbon, nitrogen, oxygen, and hydrogen are required. These amino acids are the workhorse labor force in any soil system.
SKOW: That soil carbon has to be constructed by bacteria as amino acids.

WHEELER: These *[chemical supply trace nutrient]* 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: Sulfur is needed in protein and amino acid formation, in the formation of nodules on legumes, and in many other plant processes.
NOTE: *Remarkably, a diligent search of all the ReamsAg literature failed to turn up a single instance of Reams himself using "amino." Any reader who can solve this conundrum is invited to contact the author.*

ACID, GIBBERELLIC

`ACID, GIBBERELLIC
ADVANCED AG: Gibberellic acid can be used to speed up osmosis.
BEDDOE BI: One substance that can be used to increase the osmotic reaction is gibberellic acid. It is best used in foliar sprays at very early stages of growth to stimulate anionic growth.
BEDDOE BI: The use of the growth hormone gibberellic acid, if timed properly, in some plants can highly enhance the early anionic growth to a real advantage. Gibberellins cause an increase in the movement of energy into a plant, so the cells increase in length and rate of growth.
BEDDOE BI: From the time the seed sprouts until the 40-50 day period has passed, keep plants anionic. Also, gibberellic acid can be used to increase osmosis and top growth rate. Use no more than 50 ppm.
FOLIAR FEED 1981: You can use gibberellic acid to hasten process of osmosis, but you should never us e more than 30 ppm.
FOLIAR SEMINAR 1983: When sourcing gibberellic acid, look for "blossum set" or similar.
FOLIAR SEMINAR 1983: Gibberellic acid can create problems if the crops outgrow capacity of soil to give up elements to meet demand.
FOLIAR SEMINAR 1983: Seaweed has gibberellins.
FOLIAR SEMINAR 1983: Gibberellic can cause a bi-annual to become an annual.
FOLIAR SEMINAR 1983: Gibberellic acid is anionic & only works on osmosis, not photosynthesis.
FWTK: Along with the N-P-K and trace elements, other products such as sea kelp *[seaweed]*, fish fertilizer, vinegar, and sometimes some gibberellic acid can be added to foliar sprays.
PLANT FEED 1978: Gibberellic acid will speed up osmosis, but it will not speed up photosynthesis.
PLANT FEED 1978: Gibberellic acid increases osmosis. Light and temperature affect photosynthesis.
SAIT: What is your opinion of the use of natural hormones to manipulate plant growth? Andersen: Yes. I did a research project on gibberellic acid and growth hormones in general at the University of Arizona. I find that, if I understand the energetics of nutrition, I can get the same out of nutrition as I can from hormones.

ACID, ORGANIC

`ACID, ORGANIC
ADVANCED AG: Skow: Only that plant food soluble in water or dilute organic acids and that will stand in suspension is available to the plant. NOTE: *Skow stated the first part and Reams muttered, "True." Sko w made a point that "water-soluble only" claims should be modified wherever found to include acids. Ream s then added, "So long as the plant food stands in suspension." This is one of the few places that Reams is not leading and a student is trying to move him closer to conventional ag thinking. S*ee *WATER-SOLUBLE*
ANDERSEN SCIENCE: 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.
ANDERSEN SCIENCE: The reduced nitrogen groups, NH2 and NH3, combine with the carbon frameworks formed during the oxidation of sugars (forming organic acids) to form amino acids.
ANDERSEN SCIENCE: Organic acids are important in dissolving and holding soil nutrients for subsequen t use by microorganisms and plants. Some organic acids, like ascorbic acid, are used directly. Organic acids are obtained directly from microorganism metabolism of sugars or from humus as humic acid. The latter, however, also depends on microorganisms for its manufacture.
ANDERSEN SCIENCE: To maximize fertilizer efficiency, some type of sugar or at least an organic acid should always be applied with nitrogen to provide energy to the microorganisms.
ANDERSEN SCIENCE: The Morgan extract (UES) is a weak organic acid solution that acts on soil particle s to dissolve nutrients that are likely to be made available by the exudate from plant rootlets. This test is often referred to as testing for water-soluble nutrients.
BEDDOE BI: Calcium is the main element to provide resistance against the organic acids in the soil, thereby creating the energy to grow a crop.
BEDDOE BI: The phrase "water-soluble" in reality means that the test is done with the weakest type of organic acid. This is a weak plant acid similar to what the plant roots produce to mobilize soluble mineral energy in the soil.

ENERGY RESEARCH: In other words, you have organic acids, vitamins, and in particular, amino acids, fatty acids and the base of all these is carbon, hydrogen and oxygen.
ENERGY RESEARCH: To get enough sugars, they go down into the rootlets and combine with nitrogen and you get what we call amino acids or organic acids produced. Those organic acids will cause things like phosphate, calcium to dissolve into solution around the rootlet and as they dissolve, they draw to the plant and you can get a dramatic change in a crop particularly a small grain crop because you get all that acid released into the root zone.
ENERGY RESEARCH: The raw structure of organic acids is still carbon, hydrogen, and oxygen. Then different molecules add on to make different kinds of acids. For instance there is acetic acid which some of you are familiar with. There is vinegar, propionic acid, and deuteric acid. Deuteric acid usually has a bad smell (which is produced by anaerobic bacteria which you really don't want). You can get a tremendous release of an element in the soil if it is locked up by getting those organic acids produced which are secreted by the rootlets of the plant.
ENERGY RESEARCH: One of the primary functions of the root is to absorb calcium but the root must secrete organic acids. The more sugar that is produced in the leaf, the stronger the organic acids get at the rootlet level. The stronger they get, the more nutrient they can dissolve so the plant can take them up.
ENERGY RESEARCH: You will be here from now to eternity trying to make that [humate] take on water unless you put some kind of an organic acid with it. That kind of carbon doesn't do a whole lot of good for you until you get something to act upon it to hold water.
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.
SKOW: 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.
SKOW: When it *[foliar applied phosphate]* reaches the rootlet it forms an organic acid and solubilizes fertility elements for plant uptake. But once phosphate reaches a basic level in the soil, its need is greatly reduced.
NOTE: *Although I searched diligently through the literature, except for the one Advanced Ag quote above, I could not find where Reams thought of, explained, or talked in terms of "organic acids" dissolving plant food mineral. Reams apparently stayed very close to his "water-soluble." Perhaps phosphoric acid plays a part and perhaps Reams was more comfortable with more anions & cations talk, but less talk of acids.*

ACID, PHOSPHORIC

`ACID, PHOSPHORIC
NOTE: *P2O5 is diphosphorus pentoxide, even though it is called "phosphoric acid" countless times by ReamsAg people. True phosphoric acid is H3PO4.. Perhaps every ReamsAg person would benefit from increased clarity if everyone automatically changed all instances of "phosphoric acid" to "phosphate" unless the writer added "H3PO4" to his description. Sometimes "white" is a tipoff that the person truly means H3PO4.*
AG LECTURES: Student: Too much is what caused the root to split? Reams: That's right, too much nitrogen salt, yes. Student: What do you do to prevent this? Reams: Raise your phosphoric acid content. Your copper, you make the roots stretch. Raise your calcium content and copper ratio. In other words, your nitrogen is too great for the other elements
ANATOMY: These include spent acids such as phosphoric or sulfuric acid that are first used by industry and then used to make fertilizers such as ammonium sulfate, liquid sulfur, liquid monoammonium phosphate and various other liquid blends. Not all fertilizer companies do this, but many do.
ANDERSEN SCIENCE: However, a little common sense can go a long way toward regenerating the soil. Sometimes, all we have to do is dilute the fertilizer with water to make it safe; a good example is phosphoric acid diluted sufficiently in water.
ANDERSEN SCIENCE: Programs are only as good as the quality of their individual components. A component may perform well in one part of the country but poorly in another. As a rule of thumb, avoid industrial-waste acids like 10-34-0 made with waste phosphoric acid, which was used to clean metal.
ANDERSEN SCIENCE: You can get somewhat more sophisticated *[beyond "organic"]* and add to the vinegar and ammonia 1 to 4 pints of phosphoric acid, 1 pound of powdered fish, 2 to 6 ounces of seaweed, and 1 to 2 pounds of sugar and/or molasses mix.
ANDERSEN SCIENCE: If you used phosphoric acid, which is commonly used in liquid fertilizers and soft drinks, you would need 9.8 grams in 990.2 grams of distilled water to reach a pH of 1.
BEDDOE BI: One other somewhat complicating factor that can create some misunderstanding has to do

with how the P and K are expressed. That is, they can be expressed as the pure element of phosphorus and potassium, or as the oxide form called phosphoric acid (P2O5) and potassium oxide (K2O). Most labels will have both, but a demonstrated tendency is to label on the elemental basis.
BEDDOE BI: Phosphoric acid: H3PO4 liquid. 50-80% phosphate depending on the strength and grade. Cationic. Used in soil sprays and foliar sprays.
BEDDOE BI: When mixing the spray, and too much foam develops after the first few ingredients are put in , then this is a sign that the ratio between nitrogen and phosphoric acid is not correct. Therefore, you should add more phosphoric acid until the excess foam is cut to the point of not being noticed. Be careful t o add only small amounts, about half a cup at a time.
ENERGY RESEARCH: The next thing we are going to put in in just about every instance when you are building a spray is the phosphate source. There may be exceptions but for this course our primary source o f phosphate is liquid phosphoric acid, 75% or better, white acid, food grade. I don't mean black or cut or brand X or cheap ones.
ENERGY RESEARCH: For all practical purposes now we have covered our nitrogens and potassiums. Our phosphate we are, basically, for this course, going to use the plain white phosphoric acid 85%.
FOLIAR FEED 1981: If the water in the tank is excessively hard, you should increase the phosphoric aci d (P2O5) to offset it.
FOLIAR SEMINAR 1983: You should start out with food grade phosphoric acid, but you can experimen t with cheaper ones.
FRANK: We use a 2-5-0.2 fish from Dramm that is acidified with phosphoric acid.
FRANK: Vinegar, phosphoric acid and certain types of non-petroleum based surfactants can help improve leaf absorption in warm, dry weather.
PLANT FEED 1976: 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 *[while this indicates 5:1, every other mention is 4:1]*.
PLANT FEED 1976: The first number on the fertilizer tag is nitrogen. The second is the phosphoric acid and the third is the potash, while four is the calcium.
PLANT FEED 1976: The next step to a ReamsAg soil after calcium is phosphoric acid, P2O5. We should have 400 pounds water-soluble *[phosphate]*.
PLANT FEED 1978: Reams: The first tomatoes are big and then get smaller and smaller. What can offset that until the end of season? Student: Manganese? Yes, a little, but Alaska fish and phosphoric acid will do better.
SKOW: To build a foliar spray, the above element [phosphoric acid] comes first and then water.
SKOW: Humid territory suggests a higher level of nutrients in solution. This translates to using half a pint to a pint of phosphoric acid per acre when humidity is high, and less than half a pint under dry conditions.
SKOW: Using a conventional sprayer, usually 20 gallons of water to the acre is correct. A mist blower---such as a Chiron sprayer---would work best with a pint of phosphoric acid in 100 gallons of water.
SKOW: Carey Reams once gave me a formula he used to achieve rapid dry-down of alfalfa hay. It involved sea salt, vinegar, molasses and phosphoric acid: 10 gallons of seawater. 5 gallons of black strap molasses. 1 quart of household ammonia. 5 pounds of Calphos [soft rock phosphate]. Add water to make 100 gallons of mix and use three gallons of mix per acre.
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 order to lower pH *[in foliar feeds]*, use acidifying substances diluted in water---vinegar (acetic acid), citric acid, ascorbic acid, phosphoric acid, sulfuric acid.
SKOW: The idea of a good strawberry is to have less seed on it. There is a case where you don't want to use very much fish on strawberries. You want to use mainly your phosphoric acid, ammonia, and calcium nitrate.
WHEELER: Phosphoric acid has a good energy reading unless it has been spent or used prior to wash down metal. Spent acid usually contains heavy metal contaminates.
NOTE: *The students of ReamsAg seem somewhat careless with "oxidation," which means to combine an element with oxygen. For instance, phosphoric acid, P2O5, so devoutly wished, is an oxide of phosphrous . It seems strange indeed to make such comments as "promotes oxidation of phosphate."*

ACID, SULFURIC

`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: 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.
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 superphosphate about 100 lbs. to the acre and that releases a lot more energy.
AG LECTURES: Student: Suppose you didn't have any gypsum and you wanted to make some. How would you do it? Reams: Sulfuric acid and calcium.
ANATOMY: The following is a list of phosphate sources: Super phosphate O-20-0 (rock phosphate reacted with sulfuric acid OK); Triple-super-phosphate 0-46-0 (super phosphate reacted with phosphate acid---avoid)
ANATOMY: Almost as detrimental is the use of industrial wastes. These include spent acids such as phosphoric or sulfuric acid that are first used by industry and then used to make fertilizers such as ammonium sulfate, liquid sulfur, liquid monoammonium phosphate and various other liquid blends.
ANDERSEN SCIENCE: 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.
ANDERSEN SCIENCE: 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 *[see note below]* in a thinning action.
ANDERSEN SCIENCE: 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 BI: 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 leave s 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 BI: Ammonium sulfate is made by reacting anhydrous ammonia with sulfuric acid.
BEDDOE BI: Sulfur is a very active material, because when it contacts the soil moisture and bacteria it ha s the effect of sulfuric acid. This means it creates a lot of resistance as well as heat. The ideal time to us e flowers of sulfur is when the soil is in a very wet condition and the weather has been cool.
ENERGY RESEARCH: 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.
ENERGY RESEARCH: Student: How come most of the *[trace element]* minerals have sulfate added to them? Skow: 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.
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.
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.
PLANT FEED 1976: 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 *[sulfuric acid?]*, 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 anything on that acre for 3-5 years. NOTE: *The transcript appears garbled, but it is clear that Reams felt superphosphate was full of sulfuric acid via its creation process and should*

only be used to create energy, not add phosphate.
PLANT FEED 1976: 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.
SKOW: In order to lower pH *[in foliar feeds]*, use acidifying substances diluted in water---vinegar (acetic acid), citric acid, ascorbic acid, phosphoric acid, sulfuric acid.
WHEELER: Sulfur could be applied as dilute sulfuric acid, thiosul [thiosulfate] or ammonium sulfate.
NOTE: *"Clay colloids" are not the "chemical compound colloids" of ReamsAg.*
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 there should make it clear that Reams felt he was on a strong chemical footing.*

ACIDS, MINOR

`ACIDS, MINOR
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: ...when the blossoms starts to shed off, what are you going to do to stop it? Student: Add acid? Reams: Well, what is the name of that acid you're going to add? Student: Superphosphate [sulfuric]? Reams: Superphosphate, yes, or you can use just plain *[acidic]* vinegar, if you've got a backyard garden.
AG LECTURES: 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.
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 nematodes who can't live in citrus soils or any other soil that are too dry.
ANATOMY: Initially there are 2 molecules of phosphoglyceric acid, which finally give rise to a single, 6—carbon sugar and eventually starch grains in chloroplasts.
ANATOMY: When this product [muriate of potash] comes in contact with acids or acidified fertilizers such as 0-46-0 (triple super phosphate---the most commonly used commercial phosphate fertilizer), the chlorine will form muriatic acid (commonly known as hydrochloric acid), which will destroy any bacteria it contacts and will acidify the soil, causing such minerals as calcium and iron to become less available in the soil solution should they contact the muriatic acid.
ANDERSEN SCIENCE: Lactobacillus microorganisms produce hydrogen peroxide, as well as lactic acid,
ANDERSEN SCIENCE: 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.
ANDERSEN SCIENCE: 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 SCIENCE: As a rule of thumb, avoid industrial waste acids like 10-34-0 made with waste phosphoric acid, which was used to clean metal.
BEDDOE BI: For example, in most plants there are acids produced similar to oxalic acid that is produced in spinach and asparagus. The calcium ties these acids up in the protoplasm to form calcium oxalate which is a crystalline substance that can actually be seen under high powered magnification. This combining with acids not only has a neutralizing effect, but also it effects permeability of the cell's membrane to other nutrients.
BEDDOE BI: It *[molybdenum]* has one primary benefit. It makes the grain kernel harder by making calcium more available. In animals it appears to make the bones denser. It is best used in the foliar sprays. Molybdic acid is used in the foliar formula in very, very small (milligram) amounts.
BEDDOE BI: Calcium nitrate helps other calciums become available because of its nitric acid.
BEDDOE BI: 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.
ENERGY RESEARCH: 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 acetic acid in the root to keep it from rotting.
ENERGY RESEARCH: In other words, you have organic acids, vitamins, and in particular, amino acids, fatty acids and the base of all these is carbon, hydrogen and oxygen.

ENERGY RESEARCH: The raw structure of organic acids is still carbon, hydrogen, and oxygen. Then different molecules add on to make different kinds of acids. For instance there is acetic acid which some of you are familiar with. There is vinegar, propionic acid, and deuteric acid. Deuteric acid usually has a bad smell (which is produced by anaerobic bacteria which you really don't want).
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.
FOLIAR FEED 1981: Aphids don't like high carbohydrate in leaves. They do not like the citric acid in citrus leaves.
GARDENING: If the citric acid is too low, you have a number of different kinds of scale *[disease]*, but if the citric acid is high, you won't have any scale. There are citrus groves in Florida that are 60-70 years old now that have never had a spraying machine in the grove.
SKOW: In order to lower pH *[in foliar feeds]*, use acidifying substances diluted in water---vinegar (acetic acid), citric acid, ascorbic acid, phosphoric acid, sulfuric acid.
WHEELER: It *[humus]* contains several factions of acids, such as humic, fulvic, and ulmic, as well as activ e carbon sources such as polysaccharides (soil sugar/glue). NOTE: *Wheeler's phrase "glue" may have connection to Reams' PROTOPLASM (see).*

ADDITIVE

`ADDITIVE
ANDERSEN SCIENCE: As a result, progressive agriculturalists have incorporated these materials [vitamins/enzymes] into their fertility programs, either as inherent components of blends or as separate mix additives.
ANDERSEN SCIENCE: Silicon seems to have some correlation to the carbon-calcium interaction in the plant and is generally used as a foliar additive.
ANDERSEN SCIENCE: Avoid using dolomite fertilizers or additives.
BEDDOE NOURISH: If you are adventurous and want to try other compost enhancers, then there are suc h things as bacterial additives, yeast, rock dust from rock crushers, decomposed granite, bat guano, citrus or beet pulp, black peat moss and kelp.
FOLIAR SEMINAR 1983: Be very cautious, motor oil [as a carbon source] sometimes has a lot of chemica l additives.
FRANK: If you start out with a soil that has 3,000 pounds of calcium, it will not take near as much additive, so to speak, or so much in the drip line to bring the ERGS up.
SAIT: In your experience, is it possible to substitute good human nutrition with bottles of multi-vitamins, minerals and high-tech antioxidants? Can you counteract the junk food with these additives or are you dreaming? Andersen: I think you are dreaming.
SAIT: Andersen: It [humic acid] can be a very productive additive, but it can be easily overdone.
SKOW: On the facing page are chemical additives approved by health officials, all of which affect and disturb the fine-tuned balance anion and cation computations call for.
SKOW: Parenthetically it may be noted that soft rock phosphate is the one soil additive most likely to affect Brix readings favorably.
WHEELER: This is done through the use of cultural practices and soil additives which can create condition s for the energy system to function efficiently.
WHEELER: There are many additives that can be used with herbicides to increase their effectiveness at lower rates. These include such products as soybean oil, nitrogen, liquid calciums, garlic, wetting agents, etc.
WHEELER: Free-choicing of minerals and additives is a controversial concept. It is said to be impossible b y some experts for an animal to choose, free-choice, what it needs. Why then, do animals chew bark, eat dirt, drink from corral urine pools, and crib? Why do they stop that activity when given specific supplements?
WHEELER: Dry solubles themselves usually consist of clean, high-energy sources of nitrogen, potassium, potash, calcium, manganese and sulfate sulfur. They may also contain trace minerals or other additives.

AERATE

`AERATE
AG LECTURES: What is the primary reason to cultivate? Student: To stir the soil to let the moisture down, aerate the soil.
AG LECTURES: The sodium content of your soil determines the need for cultivation. In other words, you must get your soil aerated. When you first start this program there will be a little problem with aeration. But as the program moves along you'll have less and less trouble with aeration.
ANATOMY: Organisms need oxygen to live and proliferate. Proper roto-tilling aerates the soil as well as

mixes the nutrients evenly.
ANDERSEN SCIENCE: Reasons to till the soil are to incorporate residue into the aerobic zone, to prepare a seed bed, and to aerate the soil.
ANDERSEN SCIENCE: Unfortunately, if you are checking a typical alfalfa field, you will be lucky to find an y rhizobium nodules; if you do, they will probably be brown or green inside rather than pink. This is due to the compacted, non-aerated, toxic conditions that often are found in conventional alfalfa fields.
ANDERSEN SCIENCE: Aeration will help raise the conductivity [ERGS] of wet soils by helping to dry the soil, which effectively increases the concentration of nutrients.
BEDDOE BI: Soft rock phosphate also does for the soil what yeast and baking powder does for bread dough. When the sun strikes the soil it makes it rise and aerates it. When the soil is thus aerated, it takes the bacteria down deeper and allows the oxygen to filter down in.
FWTK: Soft rock phosphate also does for the soil what baking powder does for dough. When the sun strike s the soil, it makes it rise and aerates it. When it aerates the soil, it takes the bacteria down deeper and allows the oxygen to filter down in, thus increasing the topsoil depth.
FWTK: More cultivation is recommended with this program, to aerate the soil, and to stimulate the aerobi c bacteria.
SKOW: If water is aerated as it plunges over a cataract or waterfall, it has a different effect than 9,002 unit water computed according to theory.
SKOW: Winter cover crops aerate the soil, but they leave very little humus after breakdown.
WHEELER: They [weed root feeder hairs] require soft, aerated soil and will not survive in hard, dry soil. Often weeds will benefit a corn or other crop by making water and minerals available which would not otherwise be accessible.
WHEELER: Besides preparing a seed bed, tillage can aerate, break soil crust, and control weed growth. In addition, it can improve the soil's magnetic flow and release energy. Excess tillage can destroy humus and soil structure by adding excessive air to the soil.

AIR

`AIR
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: Alfalfa takes more mineral from the air and requires less potassium from the soil.
ADVANCED AG: Grass takes potassium right out of the air.
AG LECTURES: Student: How about aluminum? And zinc? Reams: Aluminum you don't need. Zinc it takes from the air.
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 moisture from the air and holds it in the ground.
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.
AG LECTURES: Remember, alfalfa has the ability to take practically all its potash from the air.
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: 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. 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: The carbons hold the moisture and take it out of the air.
AG LECTURES: The only difference between anionic air and cationic air is the temperature.
AG LECTURES: So your air drainage has much to do with your soil moisture. What can you do about it? Student: Plant windbreaks? Reams: Yes, windbreaks help. But what can hold that moisture in? Student: Protoplasm? Reams: Exactly right---protoplasm. So I am now asking how it does that. Student: It ties it up too well? Reams: Yes, but the real reason is that a crust is formed. The air can't get in and out so easily to dry.
ANATOMY: Two rules have already been mentioned: 80 percent of a plant comes from the air and 20 percent from the soil; plants grow on the energy released from the interaction of nutrients.
ANATOMY: In over sixty years of agricultural research, Dr. Carey Reams showed that plants accumulate more energy (mass) than can possibly be accounted for from fertilizer and water, thus his conclusion that

only about 20 percent of the energy is obtained from the soil, while about 80 percent is obtained from the air.
ANATOMY: God supplies the life force energy; everything is energy, whether it be thought, soil, air, water , or some chemical.
ANATOMY: The air is about 78 percent nitrogen. Soil bacteria and plants have the capability of extracting much of their nitrogen needs from the air if they are allowed to do so.
ANDERSEN SCIENCE: 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 H2O (18), CO2 (44), N2 (28), and O2 (32), which are the major components of air. Thus, because chlorine gas is heavier than air, it will remain close to the ground.
ANDERSEN SCIENCE: Carey Reams repeatedly asserted that plants absorb much nutrition from the air . But they can do this only if the plant is a good conductor and if the soil acts as a good electrical ground.
BEDDOE BI: 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.
BEDDOE BI: Air is probably the most important source of the colloids. These air-borne colloids come from the oceans of the world.
BEDDOE BI: 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.
BEDDOE BI: And it is more than just nitrogen and oxygen that the plant takes from the air. A vast amoun t of trace elements exist in the atmosphere due to the cleansing action of the oceans of the world.
BEDDOE BI: Plants receive their energy from two sources. First from the soil. And second from the atmosphere around it. 20% of mineral energy comes from the soil and 80% comes from the atmosphere. The more efficient the energy from the soil the more efficient the plant extracts mineral energy from the air.
BEDDOE BI: 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 BI: 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 BI: Foliar feeding recognizes that a plant takes in up to 80% of its energy for growth out of the air through its leaves.
ENERGY RESEARCH: One thing that can make the soil pH go up is just the lack of air. As that pH goes u p nutrients become unavailable and the quickest way to solve that problem is to go out and cultivate.
ENERGY RESEARCH: Everybody has the opinion that you have to put on herbicides and insecticides to get a toxic buildup in the soil. I am here to tell you that that is not true. You can get that by the ground crusting over and not getting air into it.
ENERGY RESEARCH: If you increase the electrical flow in the topsoil you have increased the magnetism. Then the plant can pick up more energy from the air.
ENERGY RESEARCH: The other major one that Dr. Reams talks about that comes from the air is zinc. He feels in all the work he has done that he has never had to add zinc.
ENERGY RESEARCH: They draw energy from the air and as the sap flows down the plant, it creates a vacuum there to draw nutrients in.
FOLIAR FEED 1981: The lower the humidity, the more gallons per acre are needed because of competitio n from the dry air.
FOLIAR SEMINAR 1983: Magnesium is a no-no because plants get all they need from the air and it is such an enemy of nitrogen.
FRANK: Plants have a special ability to combine heat energy, light/electrical energy, mineral energy from soils and foliar sprays, mineral particles from the air, and atmospheric sourced CO2 into plant tissue and produce.
FWTK: Aerobic bacteria take nitrogen out of the air; they also yield some from the rain and snow.
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: Aerobic bacteria need four basic things: water, air, food and heat.
FWTK: Warmer soil in the spring means earlier planting and better germination. In the fall it can mean an extension of the season, by preventing cold damage. The temperature of the soil also affects the evaporation of water from it into the air.
FWTK: All grasses, such as the Bermudas and fescues, and even sugar cane, can take most of their potassium from the air.
FWTK: Reams recommends using a sprayer that homogenizes the spray and sprays a mist, which is then

spread out with the air current.
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. NOTE: *An implication is made here that if plant sap is kept away from air, it will not ferment. The claim deserves investigation.*
PLANT FEED 1976: The weaker the sap in the plant - the less minerals it can take in from the air.
PLANT FEED 1976: Density definition: how far apart the particles are which make the energy in the soil for plant growth. It is the distance apart that matters. Suppose you have a strip of fog one mile wide, 10 feet deep and 30 miles long. I am talking about fog that is dense---100% vapor. How much water is in the fog visible to the eye would there be in gallons? I am using fog as a metaphor for density of plant food. If the fog was at saturation, there would be less than a bathtub full. There is more water in the air that you don't see than you do see. That little bit you do see is just a little steam blown up hundreds of times. This is density. The less the density of your soil nutrients, the less the yield. The greater the density, the greater the yield.
PLANT FEED 1976: Our foods have never been so safe from poison sprays as they are today. The sprays we use today are all gases that kill the pests. They evaporate off the vegetables and plants and don't remain on there like you read in the health books. It gets more into the air and messes up the air, doing more harm to the air you breathe, than it does to the food you eat.
PLANT FEED 1976: Reams: If you had grass that had a hollow stem *[no pith]* what kind of fertilizer would you use? Student: Chicken manure? Reams: That is right---chicken manure---why? Student: It has boron in it? Reams: Right. Chicken manure is the best---the rest of it can come from the air.
PLANT FEED 1976: 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 the roots.
PLANT FEED 1976: 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.
PLANT FEED 1976: It [pesticide/spray] gets more into the air and messes up the air, doing more harm to the air you breathe, than it does to the food you eat.
PLANT FEED 1976: Student: Yesterday you said that the plants breathed their magnesium from the air---which carries the most magnesium, hot air or cold air? Reams: It doesn't make a lot of difference. Maybe I can answer your question by asking one. Which air carries the greater electrical charge, hot or cold? The cold air does. Does that answer your question?
PLANT FEED 1976: Student: How long will it be before the cows will start eating the grass because of the ammonia where the chicken manure was spread? Reams: They don't mind. Spread the cage manure at 1 to 2 tons per acre. Most of the ammonia will go directly into the soil [air?] in 2-3 days.
PLANT FEED 1976: 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.
NOTE: *This is a puzzling claim as Reams also says ALFALFA [see] can obtain all its potassium from the air.*
SKOW: Alfalfa has the ability to take practically all its potash from the air. Therefore, it needs very little from the soil.
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.
SKOW: Carbon attracts moisture from the air, especially at night. If there is high humidity in the air and enough carbon in the soil, plants can get enough moisture from the air to fix a crop if there is at least 20 to 25% humidity.
SKOW: Keep in mind the fact that carbon has an important *[should we say critical?]* role in holding nutrients in a given area. It also has the potential for increasing the nutrient density during the growing season by extracting nutrients from ionized air.
SKOW: For every pound of water-soluble magnesium in the soil, one pound of nitrogen is released straight

into the air.
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: 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.
SKOW: Plants, generally, become susceptible to molds because of stress. This stress might be nothing more than high humidity and a lack of air flow.
SKOW: Unlike nitrogen, oxygen, hydrogen and carbon, calcium does not come from the air.
SKOW: To build a foliar spray, the above element [phosphoric acid] comes first and then water. The amount of moisture in the atmosphere rates maximum attention. If the air is dry, the low end of the recommended amounts should be used to construct the spray.
SKOW: Equally a miracle is the fact that most farm crops are 95% sunshine, air and water, and only 5% earth minerals.
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 sugar cane; and its yield will decrease in direct ratio to the supply of the available carbon in the air and the soil.
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.
SUCROSE: The theorem that all carbon used in the manufacture of sucrose comes from the air and there is nothing we can do about it is only a half truth.
WHEELER: Excess tillage can destroy humus and soil structure by adding excessive air to the soil.
WHEELER: Most tillage approaches can produce a plowpan or hardpan. The moldboard plow carries much weight on a very narrow edge of the plowshare. In wet conditions, the soil below the plowshare will smear. As it dries, it will seal, stopping water and air movement.
WHEELER: To moldboard plow residue 8 to 10 inches deep in this soil condition is to almost guarantee tha t 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: The air *[introduced by cultivation]* assists the development of root mass and supplies microbial life with needed oxygen.

ALCOHOL

`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.
ANATOMY: It [higher Brix crop] will produce more alcohol from fermented sugars and be more resistant to insects, thus resulting in a decreased insecticide usage.
ANDERSEN SCIENCE: 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 buildup 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.
ANDERSEN SCIENCE: An area may have much organic matter but very little actual humus because humu s formation requires plenty of oxygen and energy 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.
BEDDOE BI: Most labs use a strong solvent such as carbon disulfide, alcohols, or acids to dissolve the soil sample. Analysis is then carried out via various types of atomic absorption spectrometry.
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 *[fermentation?]* 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. Whe n fruit freezes and the sucrose turns to alcohol, the fruit is headed for skid row rather than the 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.
GARDENING: And the concept of high sugar turning to alcohol and disrupting worm cycles is true on corn crops, cane crops, anything.
PLANT FEED 1976: Then they run another test, using alcohol to test for calcium. They will tell you there is enough calcium to last 10,000 years in your soil. And yet you've got only 50 lbs. per acre water-soluble.
PLANT FEED 1976: 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 tha t time the sugar has turned to alcohol and that bug gets drunk and falls off on the ground when the 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 over 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 huma n 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 tha t 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.

ALFALFA

`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: You don't dry 10 foot alfalfa in the sun. this is material that has to go into a Harvestore. This is a Harvestore for silage material. You don't dry that kind of material when you take that kind of tonnage off.
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 thos e little black dots? Have you noticed it on peach leaves, orange leaves, any crop?
AG LECTURES: Reams: If you're cutting alfalfa *[or other grasses]*, the best thing to do is to start about 4 o'clock in the morning to cut them and then about 10 o'clock start putting them in your Harvestore.
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: If you are feeding the cow a lot of alfalfa, you need to feed some wheat to offset the tendency of alfalfa to make the blood too thick.
AG LECTURES: Reams: If you're cutting alfalfa *[or other grasses]*, the best thing to do is to start about 4 o'clock in the morning to cut them and then about 10 o'clock start putting them in your Harvestore.
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.
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: Let me ask you a question, what is the ratio for grasses and alfalfa between the P2O5 and K2O? 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 phosphat e to 1 potash is for grasses.
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 yo u 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: Reams: How would you check the mineral content of 4 foot high growing alfalfa? Student: The refractometer? Reams: Suppose you didn't have your refractometer? Suppose you were in lespedeza or corn or any other field? Student: Could you do it by checking the pith? Reams: Exactly right. Cut it off and look to see if it is hollow in the middle. If the pith is solid and full. You have higher sugar content. Low sugar content gives you a hollow stem, a reed.
AG LECTURES: Student: Alfalfa must be good for us, if you grind it up and eat it or something? Reams: It thickens your blood. It is certainly a good thing for people who have blood [clotting] problems. It is rich in Vitamin K. Student: Then people who have low calcium can go on alfalfa? Reams: No, you could have low calcium and thick blood, too.
ANATOMY: [High Brix alfalfa] There are no black leafspots, no insect pests, no hollow stems, no nitrate problems, no mold problems, and there are yields in excess of ten tons, and they are profitable farmers.
ANATOMY: Alfalfa is a legume, which means it has rhizobium nodules on its roots for fixing nitrogen (taking nitrogen from the environment and supplying it to the plant).
ANATOMY: Boron is the key element for filling the center of stems and fruits. Hollow—stemmed grains an d alfalfa and hollow heart or black heart in potatoes is an indication of a boron deficiency.
ANATOMY: A sure indicator of potash excess is the occurrence of black spots on the leaves. This is a typical occurrence in alfalfa today, and the farmer is told it is a disease or insect problem and should be sprayed for.
ANATOMY: ...it [typical soil report] recommends top-dressing the second and third year alfalfa with 200 pounds per acre of potash and two pounds of boron. As a feed, alfalfa is a calcium supplier, yet potash is the nutrient perpetually recommended.
ANDERSEN SCIENCE: 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 SCIENCE: Much of the fiber in typical alfalfa is insoluble, and much of the protein is incomplete; many of the minerals are out of balance
ANDERSEN SCIENCE: The nutrient ration that is suitable for ocean plants would be deadly for freshwater plants or alfalfa.
ANDERSEN SCIENCE: An excellent plant to include in the pasture mix is comfrey in 6 x 6 grids, which adds nutrition and healing substances to the pasture. Protein levels of 25% to 30% are reasonable with good soil nutrition as well as a more balanced calcium-to-phosphorus ratio (2:1) than alfalfa has. NOTE : *Here Andersen is speaking of the ratio in the comfrey itself.*

ANDERSEN SCIENCE: Unfortunately, if you are checking a typical alfalfa field, you will be lucky to find any rhizobium nodules; if you do, they will probably be brown or green inside rather than pink. This is due to the compacted, non-aerated, toxic conditions that often are found in conventional alfalfa fields.
ANDERSEN SCIENCE: 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 SCIENCE: The nutrient ration that is suitable for ocean plants would be deadly for freshwater plants or alfalfa.
ANDERSEN SCIENCE: 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 BI: Potassium is what determines the caliber of a corn stalk or the caliber of an alfalfa stem.
BEDDOE BI: 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 BI: A dairy cow which is eating alfalfa that has a 16 Brix sugar level will need only 10-12 pounds of 12 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.
BEDDOE BI: The basic goal that any farmer ought to set is to produce 45,000 lbs. of produce at the highest Brix reading per acre of land whether it is alfalfa, watermelon, or apples.
BEDDOE BI: ...hollow stems on grasses and forage crops, such as alfalfa, are not normal. It is an expression of phosphate of boron deficiency.
BEDDOE BI: Alfalfa has the ability to take practically all its required potash from the air, and so needs little from the soil.
BEDDOE BI: 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.
BEDDOE NOURISH: What is not realized is that hollow stems in grasses and forage crops such as alfalfa are not normal. It is an expression of phosphate of boron deficiency.
BEDDOE NOURISH: Quality alfalfa only starts to be quality when the sugar content begins approaching the range of 8 to 20 Brix. It should be more than that, like over 24 Brix, but few farmers have understood the proper way.
BEDDOE OT: An example of some of the commercial yields that are achieved under this program: 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, 2 to 3 bales of cotton per acre, 90 bushels per acre of wheat, 4,500 lbs. peanuts per acre, 40,000 lbs. per acre of watermelons at 12% sugar, 1,000 boxes of oranges per acre, 20,000 quarts of strawberries per acre at 10 to 20% sugar, 20 tons per acre of cabbages -the list goes on and on. Not only has he obtained this type of yield, but the quality is greatly improved.
ENERGY RESEARCH: There are people in Wisconsin getting over 20 tons per acre of alfalfa from 4 cuttings.
ENERGY RESEARCH: 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.
ENERGY RESEARCH: Do not apply potash to the soil for grasses (alfalfa included). There are times when a little potash in a foliar spray will benefit, but as a general rule this is not the case.
ENERGY RESEARCH: Now that *[additional growth]* is great if you are producing alfalfa but if you want to produce wheat or barley or oats you don't want more growth after a certain point. Somewhere along the line you want some seed production.
ENERGY RESEARCH: The interesting thing about that aspect [dying cows] was when we examined the alfalfa crop the leaves on the alfalfa and the stems were covered solid almost with little black dots. This is an indication of an excess of potassium nitrate...
FOLIAR FEED 1981: In cold weather a little molybdenum chelate added to the complete spray can hold back damage in fruit trees, vines, and grains. It forms a protective film over the bark. If used on alfalfa, hold back the manganese.
FOLIAR FEED 1981: Be cautious of nitrogen toxicity in fresh cut alfalfa. It is best fed as hay.

FOLIAR FEED 1981: You can cut alfalfa when 50% of the blossoms are open. You can foliar feed the day before cutting.
FOLIAR FEED 1981: Student: When should we last foliar feed soybeans? Reams: About 5 weeks 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.
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.
FOLIAR SEMINAR 1983: Alfalfa needs more water-soluble calcium than any *[other]* crop.
FRANK: In alfalfa, we have seen yields triple when K-Mag *[proprietary?]* 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.
FWTK: Alfalfa hay, which should measure twelve to 14% sugar content, is often only six to 8 Brix.
NOTE: *Be wary of wrong comparison because in various places Reams says that a Brix reading is 1/2 sugar.*
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 acr e of watermelons at 12% sugar; 1.000 boxes of oranges per acre; 20.000 quarts of strawberries per acre a t 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 alfalf a per acre in a six month growing season.
PLANT FEED 1976: Alfalfa is a grass and if the 1.5-.5 ratio between your P2O5 and your potash gets higher than that on alfalfa, you know what's going to happen? It will go to blossom when it is waist high.
NOTE: *In other places it is clear that Reams meant that the phosphate:potash ratio should not narrow to less than 4:1. In this document Reams then held out the possibility that alfalfa should grow 12 feet high.*
PLANT FEED 1976: 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 [while this indicates 5:1, every other mention is 4:1].
PLANT FEED 1976: 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 FEED 1976: 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.
PLANT FEED 1976: Alfalfa is extremely high in protein, a legume, it is also high in calcium. In order to produce 20 tons of alfalfa, a minimum of 8-10 tons of water-soluble calcium per acre is required.
PLANT FEED 1976: 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.
NOTE: *This is a puzzling claim as Reams also says ALFALFA can obtain all its potassium from the air.*
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: I have seen severe frost damage in alfalfa fields, and yet neighboring fields that had been foliar sprayed remained nice and green. This capacity for leap-frogging over a cold snap allows a farmer to lengthen his growing season.
SKOW: Alfalfa has the ability to take practically all its potash from the air. Therefore, it needs very little from the soil.
SKOW: Hollow stem is the favorite indicator *[of boron deficiency]*, not only for alfalfa, but also for cauliflower and broccoli.
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.
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.

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: 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.
SKOW: Those who serve farmers as advisors have lost track of the fact that alfalfa, for instance, is supposed to be solid stemmed. Obviously, solid stemmed alfalfa will stand up. It may sway in the wind and rain, but it won't lay down.
SKOW: Calcium from alfalfa and calcium from peppermint tea are each in a different complex.
SKOW: Crops that need a lot of calcium are alfalfa---unless you're going to harvest the crop for seeds---lettuce, cabbage, broccoli, Brussels sprouts and spinach.
SKOW: If you finally get a soil in true balance for seed crops, you will want two parts phosphate to one par t potassium. For leaf crops and forage---spinach, lettuce, alfalfa---the ratio of potassium should be four to one.
SKOW: Hollow stem is the favorite indicator *[of boron deficiency]*, not only for alfalfa, but also for cauliflower and broccoli. This may or may not be the case, there being so many other possible deficiencies, any one of which can affect the color.
SKOW: Carey Reams once gave me a formula he used to achieve rapid dry-down of alfalfa hay. It involve d sea salt, vinegar, molasses and phosphoric acid: 10 gallons of seawater. 5 gallons of black strap molasses. 1 quart of household ammonia. 5 pounds of Calphos [soft rock phosphate]. Add water to make 100 gallons of mix and use three gallons of mix per acre.
SKOW: Calcium nitrate has been mentioned, 100% water soluble. It is not uncommon to use 100 to 200 pounds per acre on alfalfa, spread on a dry broadcast basis.
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 th e 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. NOTE: *Thi s claim must be considered along with Reams' claim that alfalfa can get all its potassium needs from the air.*
WHEELER: Alfalfa has been identified as particularly needing boron.
WHEELER: If the plant is a legume, such as alfalfa, clover, soybeans, peas, or dry beans, root examination should include nodule observation.
WHEELER: Alfalfa, lettuce or spinach that goes to blossom or bolts early indicates a fertility imbalance situation that may be worsened by weather extremes.
WHEELER: When farmers inquire 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, herbicid e 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.
WHEELER: The reason why it's so effective is they usually use it with something like comfrey. It's a great plant to grow, except that it's a high-moisture plant. Because it's a wide leaf, you can't dry it down as easil y as alfalfa.

ALGAE

`ALGAE
ANDERSEN SCIENCE: Common carbohydrates are sugar, molasses, humic acid, humates, fish meal, seaweeds, algae, yeasts, enzymes, biological brews, whey, and so on.
ANDERSEN SCIENCE: We often talk of the microorganisms in the soil. The majority of these microbes are single celled. They are the algae, fungi, which include yeasts, and bacteria. Some algae and fungi are also multi-celled.
ANDERSEN SCIENCE: Most algae, some fungi, and generally all plants have cell walls made of cellulose—chains of glucose. Most fungi have cell walls made of chitin—chains of molecules made of glucose-nitrogen complexes.
ANDERSEN SCIENCE: Herbicides especially are detrimental to soil algae, which are simply small plants.
ANDERSEN SCIENCE: Getting back to algae, several companies market blue-green products, accurately claiming the beneficial effect of such materials, particularly when herbicides have reduced or eliminated the natural algae populations.

ANDERSEN SCIENCE: Other organisms that are found in healthy rhizospheres include algae, yeasts, and actinomycetes. All of these organisms metabolize biotic products for the nutritional use of plants and other microbes.
WHEELER: Rhizobia bacteria, which form on the roots of legumes, are capable of fixing nitrogen from the air as are some forms of algae, especially the blue-green varieties.
WHEELER: Certain bacteria are capable of living in and digesting rather high levels of herbicides. Green and blue-green algae are available that can produce polysaccharides (long chain soil sugars) which are a component of humus.
NOTE: *There is much ballyhoo about how infinitesimal amounts of glyphosate herbicide ride into kitchen s via farm products so as to invade our bodies and "poison" us. Such simplistic slogans as, "it is indistinguishable from glycine" is the most common. It is a shame that so many people have been stampeded into anti-glyphosate campaigns, stampedes based not on truth, but emotion. I predict their emotional objections will fail. I fear they will be picked off one by one as the glyphosate purveyors hire yet more true scientists as naysayers. In their screeching rage, the nevers have become blind to the true damage from this obscene chemical: namely, glyphosate (and other) herbicides do not stop at killing highe r order weeds. They simultaneously severely damage the topsoil environment by destroying the many microorganism plants such as algae that provide so much richness to our soil's ability to generate higher quality and superior Brix.*

ALKALINE

`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.
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: 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 superphosphate about 100 lbs. to the acre and that releases a lot more energy.
ANATOMY: High salt buildup also occurs in alkaline soils, a compound problem common to U.S. soils.
ANATOMY: Hydrogen is the element, in this case the ion, whose concentration is the standard by which solutions, elements, compounds, etc., are classified as to their acidity or alkalinity.
ANDERSEN SCIENCE: 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 SCIENCE: 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 ho w 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 SCIENCE: 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 b e lowered even though you added an alkaline material. For example, adding calcium to a high-magnesium soil may actually lower the soil pH. NOTE: *Please observe that Dr. Andersen dances lightly on this subject with his use of "considered". He is well aware that the RBTI considers calcium, potassium, and chlorine as the only anions or "alkaline" substances. In Reams physics, pH is a measure of resistance and what may register as "alkaline" is only an indication of slow electron movement and not merely an overabundance of hydroxyl ions..*
BEDDOE BI: 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.
ENERGY RESEARCH: 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.
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.
PLANT FEED 1976: 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 *[in the refractometer view screen]* indicates a more acid condition while a fuzzy line indicates better calcium levels and a more alkaline condition.

ALUMINUM

`ALUMINUM
ADVANCED AG: (Track 071 "soil strata"): 1 carbon; 2 mag; 3 Phosphate 4 Potash; 5 silicon/sodium; 6 sulfur; 7 Aluminum; 8 iron; 9 copper 10 Calcium; Manganese is so minute there is no layer. We do not count zinc.
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 throug h the soil.
AG LECTURES: Student: How about aluminum? And zinc? Reams: Aluminum you don’t need.
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 superphosphate 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 throug h the soil.
AG LECTURES: Reams: 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. 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.
ANATOMY: From their industrial use these products pick up any number of heavy metals like lead, cadmium, or aluminum. When these cheaper fertilizers are applied to the soil, the heavy metals cause problems with the microorganisms and in many cases, contrary to cover-up reports, are taken into the crop , thus causing problems for the consumer.
ANDERSEN SCIENCE: *[Soil strata]* 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 SCIENCE: It [pH] can be used as an aid in evaluating what effect various minerals and materials, such as salts, aluminum, potash, chlorine, magnesium, calcium, and pesticides, are having on the soil relative to acid/alkaline reactions.
BEDDOE BI: Probable mineral strata levels (depth is variable) 1. Carbon; 2. Magnesium; 3. Phosphate; 4. Potassium; 5. Silica and Sodium; 6. Sulfur; 7. Aluminum; 8. Iron & Manganese; 9. Copper; 10. Calcium.
BEDDOE BI: Therefore, iron is heavier than aluminum and iron will also float on boiling lead.
BEDDOE BI: 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.
ENERGY RESEARCH: 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 is not growing satisfactory, and this is particularly important if you have some herbicide damage and you want to flush it out.
ENERGY RESEARCH: Question; Could that occur the first year on a low calcium (Ca) situation? Answer; Yes. So you could be out there, take the ERGS reading, have a high reading and feel it is possible that the acidifier has broken down in that soil to a point that you are releasing the aluminum out of the clay, and that's toxic. There is a quick way to correct it and it was done by Michigan State and that was by the application of calcium nitrate.
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 wil l float on boiling lead.
SKOW: If you record an ERGS 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.
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.
WHEELER: In the soil, some nutrients tend to rise while calcium and others tend to move downward. A soi l left undisturbed will stabilize from the top down in the following layers: carbon, magnesium, phosphate, potash, sulfur, aluminum, manganese and calcium.
WHEELER: Dynamin has a good detoxifying property that gets rid of microtoxins [mycotoxins?] similar to some synthetically produced calcium and sodium aluminum silicate products.

AMMONIA

`AMMONIA
ADVANCED AG: If you have a high calcium and your corn is knee high you would not use ammonium sulfate if the ammoniacal nitrogen was up near 150-200 as you could form nitrate. You would use 0-20-0 superphosphate instead.
ADVANCED AG: A source of bacteria for the land is always helpful. This includes hog manure, but go easy as it is high in sodium and ammonia.
ADVANCED AG: On potatoes you would be better off to use Chilean nitrate of potash with ammonium sulfate as a side-dressing instead of 0-20-0 (if you have plenty of ammonia nitrogen).
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.
AG LECTURES: Reams: What is the primary benefit of adding compost instead of manures whenever you disk them in or plow them under. Student: It is immediately available. Reams: That's one thing, but what i s 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 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.
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.
AG LECTURES: Student: So how do you get the salt out of the soil? Reams: Add your phosphates, potassium and other things to get them high enough. Potash is always a salt. Calcium nitrate is a salt, sulfate of ammonia is a salt. Nitrate of soda is a salt.
AG LECTURES: 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 at the same [*ambient*] 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.
ANATOMY: Here are the suggested values for nutrient levels using the LaMotte system for a healthy soil, in pounds per acre: Calcium 2000+; Phosphate 400; Potash 200; Sulfate 200; Nitrate nitrogen 200; Ammonia nitrogen 40; Iron 40.
ANATOMY: The ammonia nitrogen is needed later in the season for fruit and seed production. Don't expect tomatoes to set fruit if the nitrate nitrogen is high and the ammonia low.
ANATOMY: Ammonia nitrogen sources: Manures: cattle, bird, horse (be careful of hog manure due to high salt)
ANATOMY: Ammonia nitrogen sources: Urea.
ANATOMY: When purchasing nitrogen, know why it is being purchased. For example, usually you would no t want ammonia nitrogen for lettuce.
ANDERSEN SCIENCE: Reams tested calcium, phosphate, potash, nitrate and ammoniacal nitrogens, ERGS (conductivity in micromhos or microsiemens), and various trace elements.
ANDERSEN SCIENCE: You can get somewhat more sophisticated *[beyond "organic"]* and add to the vinegar and ammonia 1 to 4 pints of phosphoric acid, 1 pound of powdered fish, 2 to 6 ounces of seaweed, and 1 to 2 pounds of sugar and/or molasses mix.
ANDERSEN SCIENCE: This *[burning out the soil]* is why anhydrous ammonia should not be used directl y 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 SCIENCE: The pH of cow urine should be around 7.4. If the pH is much higher than this, ther e is a possibility that the rumen is malfunctioning, allowing too much free ammonia to pass into the blood .
ANDERSEN SCIENCE: 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 *[insects & pests}* to reject this production run due to inferior construction.
ANDERSEN SCIENCE: Nitrogen acts as an "isotope," alternating between the nitrate form and the ammonium form.
BEDDOE BI: A soil with excellent amounts of aerobic bacteria will have plenty of available ammonia nitrogen being produced by the bacteria.
BEDDOE BI: For example, if nitrate nitrogen is low and this field could use some extra calcium, then Calcium Nitrate could be considered for the seed bed. Or let's say that you have sufficient calcium but the nitrate nitrogen is low. Then you could consider using ammonium sulfate in the seed bed. You say, "Wait, that is a cationic nitrogen and I want anionic nitrogen at seed. Why ammonium sulfate? The reason it can be used at seed time is related to calcium levels. If the available calcium is above 3000 lbs. per acre, then the ammonia nitrogen will follow the line of least resistance and become a nitrate.
BEDDOE BI: Single superphosphate is also used in conjunction with ammonia nitrogen fertilizers to keep the ammonia from following the line of 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 superphosphate 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 superphosphate is also applied at the needed rate.
BEDDOE BI: 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 BI: The parts of the reserve soil TDN are calcium, phosphate, potassium (potash), nitrate nitrogen, ammonia nitrogen, iron, and copper.
BEDDOE BI: 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 [after] sprouting.
BEDDOE BI: On those *[crops]* grown for fruit, seed, root, or blossom, such as corn, wheat, tomatoes, apples, etc., you use both nitrate and ammonia nitrogen at the proper times.
BEDDOE NOURISH: Ammonium thiosulfate can also be used supply ammonia nitrogen. It is a liquid and so can be used in soil spray mixtures. It will also supply sulfates for other bonding relations in soil and plan t chemistry. It can also be used as a nitrate nitrogen source as long as the soil is high enough in calcium. The high calcium is required to keep the line of least resistance or magnetic force pushing in the anionic direction. When there isn't sufficient calcium to keep the soil anionic when ammonium thiosulfate us used, it will help switch the soil in the cationic direction and supply cationic nitrogen.
ENERGY RESEARCH: Student: Is calcium carbonate 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 yo u have a good ammonia level in the soil. It will become soluble because that is how they make calcium nitrate.
ENERGY RESEARCH: 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 *[ammonia]* despite what he says there.
ENERGY RESEARCH: Student: When do you start to bring ammonia levels up? Skow: The 45th day fro m emergence on seed crops primarily. That is why I am suggesting to go out and do a little side-dressing t o give that system a little kicker.
ENERGY RESEARCH: For instance, if you have a real high calcium soil and you put on ammonia nitroge n and you want to make the soil to the point of producing seed, you are going to have to use more than normal amounts of ammoniacal nitrogen. Otherwise it will switch it all to nitrate nitrogen and you will just get more growth.
ENERGY RESEARCH: We have put the phosphate (P2O5) in the 100 gallons. You added two quarts of ammonia and something happened that upset the whole apple cart. It will start, to foam. What do you do? One student says that the foam is escaping nitrogen. That's correct. So you are going to have to add a littl e more phosphate.
FOLIAR FEED 1981: There is a fill order to a tank. Ammonia first and if it foams too much (which is nitrogen loss), add phosphate.
FOLIAR FEED 1981: Student: If I use household ammonia, is the detergent harmful. Reams: No, not at all.
FOLIAR FEED 1983: An ordinary nitrogen need is 80 lbs of nitrate on leaf crops, but seed crops should switch to ammonia mid-season.

FRANK: How does ammonium sulfate do this? Ammonia is a longtime commercial refrigerant. If you heat ammonia it cools and if you cool ammonia it heats. When ammonia is put into the soil in the form of ammonium sulfate it does the same thing. Truly amazing.
FRANK: Nitrate nitrogen pushes growth. Ammonia nitrogen produces seeds. We did not need more growth. We needed more seed. We needed more fruit. And so, we started putting ammonium sulfate in there.
FWTK: On those *[crops]* grown for fruit, seed, root or blossoms (corn, wheat, tomatoes, apples, etc.), both nitrate and ammonia is used.
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: Ammonium sulfate both warms and cools the soil and controls the temperature. Ammonium nitrate has both nitrate and ammonia nitrogen in it. It can be used in the spring to supply the nitrate for the growth of the plant. When the nitrate runs out (after about forty days), the ammonia becomes available, and makes flowers, blossoms and fruit.
FWTK: The anionic form is found in nitrate nitrogen, and the cationic form is found in ammonia.
FWTK: There are many types of salts that can cause this problem. It could be chloride salts, nitrogenic salts, calcium salts, potassium salts, ammonia salt, iron salt or many other different kind of salts.
FWTK: Ammonium nitrate has both nitrate and ammonia nitrogen in it. It can be used in the spring to supply the nitrate for the growth of the plant. When the nitrate runs out (after about forty days), the ammonia becomes available, and makes flowers, blossoms and fruit.
PLANT FEED 1976: Reams: What is it that causes a loss of moisture in the soil? What is it about the soil that causes a fast loss of moisture in the soil? Student: Heat? Reams: What causes excessive heat in the soil? Loss of ammoniacal nitrogen. In other words, a quick change in soil chemistry means a loss of moisture.
PLANT FEED 1976: I've seen two soils with the same amount of carbon and one was very low in ammonia. Three days after a 6 inch rain, the one soil was like an ash bed, but where the ammonia was th e soil was moist. You need something in there to control soil temperature.
PLANT FEED 1976: Student: How long will it be before the cows will start eating the grass because of the ammonia where the chicken manure was spread? Reams: They don't mind. Spread the cage manure a t 1 to 2 tons per acre. Most of the ammonia will go directly into the soil [air?] in 2-3 days. You don't use chicken litter because you don't want too much potash on your grasses.
PLANT FEED 1978: If you have enough boron in your soil it will prevent the nitrate from turning to ammonia.
PLANT FEED 1978: If you realize your trees have been ammoniated, you would use a nutritional spray with Epsom salts, which would release ammonia nitrogen.
SAIT: What is the reason for your use of household ammonia in your foliar recipes? Why not use ammonium sulfate or any other ammonia source? Andersen: You have to be very careful with ammonia when you are putting it out on the crop. We always prefer to use ammonium sulfate in the soil to encourag e microbes and to get the calcium working, and we use a very diluted ammonia in the foliar recipes.
SKOW: The idea of a good strawberry is to have less seed on it. There is a case where you don't want to use very much fish on strawberries. You want to use mainly your phosphoric acid, ammonia, and calcium nitrate.
SKOW: Plant foods that cause seed production are ammoniacal nitrogen, phosphorus, metal trace nutrients, manures and composts.
WHEELER: A properly balanced soil will have sufficient quantities of organically active carbon — humus — which helps hold nitrogen in the ammoniacal form. In soils lacking this active carbon content, the soil will give up this ammoniacal nitrogen to bacterial conversion into nitrates or directly to the atmosphere in gaseous form. During the process of ammoniacal nitrogen leaving the soil, it passes by the plant and can act as an amplifier of the infrared signal coming from the plant.
WHEELER: The breakdown of ammoniacal nitrogen (NH4) into nitrate nitrogen (NO3) is a major cause o f soil acidification and loss of nitrates through leeching. Soil pH is lowered and lime is required to raise it.

AMMONIA, ANHYDROUS

`AMMONIA, ANHYDROUS
ANATOMY: As anhydrous ammonia usage became more and more popular, so did chlamydia in hogs on those same farms.
ANATOMY: When a farmer applies anhydrous, he uses a tool that knifes the ammonia several inches into the soil. It effectively reduces the usable oxygen in the soil needed by the aerobic microorganisms, burns

the organics that include the microorganisms, creates an ash, and sets in motion the process by which formaldehyde and pathological organisms abound.
ANATOMY: Anhydrous ammonia (avoid like the plague or convert to aqua ammonia).
ANDERSEN SCIENCE: This *[burning out the soil]* is why anhydrous ammonia should not be used directl y 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 SCIENCE: ...high nitrogen fertilization, particularly using anhydrous ammonia, creates a nutrient availability condition in the soil that is almost exclusively nitrogen and potash occupied.
ANDERSEN SCIENCE: Understand that several of the terms that are encountered in chemistry are frequently used in agriculture. In particular the term anhydrous is almost a household word to many farmers, but few know what it means. Anhydrous literally means, "no water." Hence, anhydrous ammonia means pure ammonia (NH3) with no water.
BEDDOE BI: Anhydrous ammonia is extremely detrimental to the soil chemistry.
BEDDOE BI: Ammonium sulfate is made by reacting anhydrous ammonia with sulfuric acid.
BEDDOE BI: This [anhydrous ammonia] will in turn reduce the carbons and the live bacterial protoplasm so that the soil can become very hard and sterile.
BEDDOE NOURISH: There are three nitrogen substances that any type of agriculturalist needs to be warned about. One is anhydrous ammonia. This compound is extremely detrimental to the soil chemistry .
BEDDOE OT: Anhydrous ammonia is very unstable. It is easily absorbed into the air, besides leaching into lakes, streams and water supplies. It causes fewer nutrients and a greater percentage of water in the crop.
FRANK: Coops typically use the very worst fertilizers that compromise soil health; potassium chloride, DAP , and anhydrous ammonia are the worst offenders.
FWTK: Fertilizers containing urea, potassium nitrate (containing chlorides) and anhydrous ammonia should be avoided because of their effect on the soil.
MANTHEI GARDENING: Never use anhydrous ammonia.
PLANT FEED 1976: Student: I remember seeing liquid fertilizer trucks. Reams: That's anhydrous ammonia - I'm against it. I don't like it, it is dangerous. It grows beef tripe instead of beer steak. It's making our people weaker and weaker and sicker and sicker. And it is getting less and less yield of sorrier and poorer foods. The quicker you get out of it and leave it alone, the better off you are.
SKOW: My best recommendations on the use of anhydrous ammonia is: don't!
SKOW: Anhydrous displaces calcium, but bonded with molasses makes it more effective and does less harm to the soil.
SKOW: There are two junk foods as far as agriculture is concerned — potassium chloride and anhydrous ammonia. These two substances are not needed, and when used they clog up cell metabolism and offend the quality requirement as expressed by specific gravity.
WHEELER: Every farmer knows he can grow corn with anhydrous ammonia. This chart helps him draw conclusions as to why, after he started using anhydrous, he had to increase his toxic chemical purchases fo r weed and insect control plus increase his feed mineral supplement purchases.
WHEELER: Aqua ammonia is ammonia water. This form of ammonia evaporates less than anhydrous ammonia, but is still not very stable.
WHEELER: Even non-pesticide-type materials, such as chemical fertilizers, have caused damage as countless wells have been declared unsafe for human use due to the high concentration of nitrates. Great damage has been caused by the concentrated toxic chemicals (previously advertised as "safe") and the use of the seemingly safe and necessary fertilizers, especially anhydrous ammonia, 0-46-0 and 0-0-60.

AMMONIA, AQUA

`AMMONIA, AQUA
ANATOMY: Anhydrous ammonia (avoid like the plague or convert to aqua-ammonia).
ANATOMY: This [anhydrous] is one of the most popular and widely used forms of agricultural nitrogens. It is a very profitable product for its manufacturers. "Anhydrous" means the water is removed, leaving only ammonia. The product is fine if water is added to get what is referred to as aqua-ammonia.
ANDERSEN SCIENCE: 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 soils already depleted humic acids.
ANDERSEN SCIENCE: Become familiar with them [fertilizers] so you can make an informed decision abou

t what to purchase: Anhydrous ammonia, NH3, Aqua-ammonia, N4OH • H2O
ANDERSEN SCIENCE: Instead, it [anhydrous] 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 soils already depleted humic acids.
BEDDOE BI: [Ammonium Thiosulfate] Best used in conjunction with Aqua-Ammonia and Molasses to regulate its energy reactions and inter-reactions in the soil.
BEDDOE BI: Aqua-ammonia is the name of the agricultural grade of ammonium hydroxide. The farmer must be careful in using this substance because it has a very, very pungent odor in the concentrated state. Aqua-Ammonia is also good to use directly on the soil for soil spray applications such as with Ammonium Thiosulfate.
BEDDOE BI: Aqua-Ammonia (28% N) Supplies cationic nitrogen. Used to warm trees to prevent frost damage.
BEDDOE BI: Ammonium thiosulfate is very good for soil activation and a source of sulfates. Best used in conjunction with aqua-ammonia and molasses to regulate its energy reactions and interreactions in the soil.
SKOW: The American fertilizer industry has made life difficult for a serious grower. Aqua-ammonia, for instance, is unavailable.
SKOW: First, make aqua-ammonia by trickling anhydrous through water, then mix molasses with it.
SKOW: Some growers are using aqua-ammonia and adding molasses. This works quite well, and much less is needed.
WHEELER: Farmers may also bubble it [anhydrous] through water and apply it as a liquid nitrogen solutio n called aqua-ammonia. Adding a carbohydrate or sugar source to the aqua-ammonia will greatly increase its stability and efficiency.
WHEELER: Aqua-ammonia is ammonia water. This form of ammonia evaporates less than anhydrous ammonia, but is still not very stable.

AMMONIATION/AMMONIFICATION

`AMMONIATION/AMMONIFICATION
ADVANCED AG: It is possible to ammoniate a grove by creating nitrification via adding chicken manure i f the chlorides are too high. This is dependent on the moisture status.
ANATOMY: In the presence of excess boron relative to calcium, high salt, or sulfur conditions, a deficiency of carbon may allow ammonification to occur, which is fatal to aerobic life.
ANDERSEN SCIENCE: 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.
ENERGY RESEARCH: 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.
ENERGY RESEARCH: 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 get ammoniation of the plant. What it does is simply kill them.
ENERGY RESEARCH: When the calciums are too low and the nitrogens are too high, you can get an ammoniation of the plant and wipe them out.
ENERGY RESEARCH: 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.
ENERGY RESEARCH: When spraying boron always add calcium or it may cause ammoniation.
FOLIAR FEED 1981: If the bark on the tree plant roots is loose from ammoniation, you must completel y foliar feed the entire TDN.
PLANT FEED 1976: 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 FEED 1978: If you realize your trees have been ammoniated, you would use a nutritional spray with Epsom salts, which would release ammonia nitrogen.
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 so as 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. In any case, Andersen's "ammonification" or even "root burn" may be the preferred term.*

AMMONIUM

`AMMONIUM
ADVANCED AG: On potatoes you would be better off to use Chilean nitrate of potash with ammonium sulfate as a side-dressing instead of 0-20-0 (if you have plenty of ammonia nitrogen).
ADVANCED AG: Strawberries won't blossom if soil temperature is above 80 degrees, add some ammonium sulfate.
ADVANCED AG: If you have a high calcium and your corn is knee high you would not use ammonium sulfate if the ammoniacal nitrogen was up near 150-200 as you could form nitrate. You would use 0-20-0 superphosphate instead.
AG LECTURES: And do you know where I *[living in the mountains of Georgia]* had to go to get ammonium sulfate? Orlando, Florida.
ANATOMY: Almost as detrimental is the use of industrial wastes. These include spent acids such as phosphoric or sulfuric acid that are first used by industry and then used to make fertilizers such as ammonium sulfate, liquid sulfur, liquid monoammonium phosphate and various other liquid blends.
ANATOMY: In regard to ammonium sulfate, the one recommended is dark, grayish-black material from Allied Chemical Company or a feed fermentation plant.
ANATOMY: Roto-till five to six inches deep or plow first. Apply soft rock phosphate, high-calcium lime, compost, and ammonium sulfate. Roto—till two to three inches deep two to three times for thorough mixing, and finally spread some type of cover crop for the winter, such as oats, rye grass, wheat grass, red clover, etc.
ANATOMY: Nitrate nitrogen sources: Sodium nitrate, Calcium nitrate, Ammonium nitrate, Chilean nitrate, Potassium nitrate, UAN.
ANDERSEN SCIENCE: Nitrogen acts as an "isotope," alternating between the nitrate form and the ammonium form [ammonia?].
BEDDOE BI: Ammonium sulfate is made by reacting anhydrous ammonia with sulfuric acid.
BEDDOE BI: 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 BI: Ammonium sulfate will also readily dissolve in water and therefore it can be used in foliar formulas to supply ammonia ions.
BEDDOE NOURISH: To raise the nutritional level of poor quality hay, you can do this. For each ton of chopped hay, mix and add five pounds of ammonium sulfate and five pounds of ammonium phosphate. Also add 80 pound of soft rock phosphate and 20 pounds of Kelp Meal. In addition, animals should be allowed to feed on molasses free choice.
BEDDOE NOURISH: The usual approach is to use ammonium sulfate to get the 20 lbs. per acre of nitrate and 20 lbs. per acre of ammonia at planting time in a high calcium and high phosphate soil. Ammonium sulfate is about 20% nitrogen. An application of 100 lbs. per acre will provide 20 lbs of nitrate because the line of resistance (or electric force), directed by the high calcium [present in a Reams-based soil] , will convert the ammonia type to nitrate type.
ENERGY RESEARCH: In the southern states growing cotton, they are having a terrible time with a lot of plant and no cotton. That doesn't do you much good. They keep pouring on the nitrate nitrogen and that's where the crux of the problem is. All they need do is to incorporate a little ammonium sulfate into their fertility program or a little ammonium nitrate and they would get along just fine. For some reason or another they haven't picked up on that yet.
FOLIAR SEMINAR 1983: For foliar nitrogen up to 40th day after emergence use calcium nitrate or nitrate of soda in tank, after that use ammonium sulfate or urea.
FRANK: How does ammonium sulfate do this? Ammonia is a longtime commercial refrigerant. If you heat ammonia it cools and if you cool ammonia it heats. When ammonia is put into the soil in the form of ammonium sulfate it does the same thing. Truly amazing.
FRANK: Nitrate nitrogen pushes growth. Ammonia nitrogen produces seeds. We did not need more growth. We needed more seed. We needed more fruit. And so, we started putting ammonium sulfate in there.
FWTK: Ammonium sulfate both warms and cools the soil and controls the temperature.
FWTK: Ammonium nitrate has both nitrate and ammonia nitrogen in it. It can be used in the spring to supply the nitrate for the growth of the plant. When the nitrate runs out (after about forty days), the ammonia becomes available, and makes flowers, blossoms and fruit.
FWTK: This *[using ammonium sulfate to warm the soil]* is especially profitable for fresh produce growers and farmers grazing cattle.
FWTK: An application of 100 to 200 lbs. per acre [of ammonium sulfate] either in the fall or early spring will often extend the growing season two weeks each in the fall and in the spring.
MANTHEI GARDENING: Ammonium Sulphate: 200 lbs to the acre 5 weeks before the soil freezes in th

e fall will add 25 to 30 days to the following yearbook growing season.
PLANT FEED 1976: Student: My corn ls about 2 feet high now and my nitrogen is down to about 30 pounds per acre. What do I do now? Reams: Increase your ERGS. Student: Increase my ERGS? Reams: Yes, use a top-dressing---in this case, ammonium nitrate.
PLANT FEED 1976: Did you ever see a little plant such as tomato or cucumber go to blossoming before it ever started growing? It is the soil. It is too acid when that happens. So then you use calcium nitrate, whic h is best, or you can use ammonium nitrate.
PLANT FEED 1976: Last year in [Blue Ridge] Georgia, We picked beans up to 2 days before Thanksgiving. Everyone said it couldn't be done - never been done before. We had applied ammonium sulfate in our bean patch for soil temperature control. There was frost right up to the bean patch, but the bean patch itself had no frost because of the soil temperature control.
SAIT: What is the reason for your use of household ammonia in your foliar recipes? Why not use ammonium sulfate or any other ammonia source? Andersen: You have to be very careful with ammonia when you are putting it out on the crop. We always prefer to use ammonium sulfate in the soil to encourag e microbes and to get the calcium working, and we use a very diluted ammonia in the foliar recipes.
SKOW: The best source of ammonium sulfate looks like it is dirty. It has a dark color to it. For optimum temperature control, approximately 200 pounds per acre is recommended.
SKOW: The first thing he [*Reams did to make sand productive*] was apply approximately one ton of soft rock phosphate. In those days the cost was $5 to $10 a ton. The next thing he did was apply high-calcium lime, and then he usually laced the fields with several tons of cage layer chicken manure, not broiler litter. To set this complex assortment of soil nutrients and microbial food in motion, he added 200 pounds of ammonium sulfate per acre.
WHEELER: Sulfur could be applied as dilute sulfuric acid, thiosulfate or ammonium sulfate.

AMMONIUM SULFATE

`AMMONIUM SULFATE
ADVANCED AG: On potatoes you would be better off to use Chilean nitrate of potash with ammonium sulfate as a side-dressing instead of 0-20-0 (if you have plenty of ammonia nitrogen).
ADVANCED AG: If you have a high calcium and your corn is knee high you would not use ammonium sulfate if the ammoniacal nitrogen was up near 150-200 as you could form nitrate. You would use 0-20-0 superphosphate instead.
ADVANCED AG: Strawberries won't blossom if soil temperature is above 80 degrees, add some ammonium sulfate.
ADVANCED AG: Skow advises that the farmer with a too-high calcium soil can investigate ammonium sulfate.
AG LECTURES: Reams: What is the primary benefit of adding compost instead of manures whenever you disk them in or plow them under. Student: It is immediately available. Reams: That’s one thing, but what i s 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 th e 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 *[he meant "days"]* 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.
ANATOMY: Use the form of nitrogen best suited to the growth stage, such as nitrate or ammonia, in a for m such as calcium nitrate, potassium nitrate, ammonium sulfate, household ammonia [Bo-peep] , or ammonium thiosulfate.
ANATOMY: In regard to ammonium sulfate, the one recommended is dark, grayish-black material from Allied Chemical Company or a feed fermentation plant.
ANATOMY: These include spent acids such as phosphoric or sulfuric acid that are first used by industry an d then used to make fertilizers such as ammonium sulfate, liquid sulfur, liquid monoammonium phosphate and various other liquid blends. Not all fertilizer companies do this, but many do.
ANATOMY: Roto-till five to six inches deep or plow first. Apply soft rock phosphate, high-calcium lime, compost, and ammonium sulfate. Roto—till two to three inches deep two to three times for thorough mixing, and finally spread some type of cover crop for the winter, such as oats, rye grass, wheat grass, red

clover, etc.
BEDDOE BI: For example, if nitrate nitrogen is low and this field could use some extra calcium, then calcium nitrate could be considered for the seed bed. Or let's say that you have sufficient calcium but the nitrate nitrogen is low. Then you could consider using ammonium sulfate in the seed bed. You say, "Wait, that is an cationic nitrogen and I want anionic nitrogen at seed. Why ammonium sulfate? The reason it can be used at seed time is related to calcium levels. If the available calcium is above 3000 lbs. per acre, then the ammonia nitrogen will follow the line of least resistance and become a nitrate.
BEDDOE BI: Ammonium sulfate is made by reacting anhydrous ammonia with sulfuric acid.
BEDDOE BI: 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 BI: Ammonium sulfate will also readily dissolve in water and therefore it can be used in foliar formulas to supply ammonia ions.
BEDDOE NOURISH: The usual approach is to use ammonium sulfate to get the 20 lbs. per acre of nitrate and 20 lbs. per acre of ammonia at planting time in a high calcium and high phosphate soil. Ammonium sulfate is about 20% nitrogen. An application of 100 lbs. per acre will provide 20 lbs of nitrate because the line of resistance (or electric force), directed by the high calcium, will convert the ammonia type to nitrate type.
BEDDOE NOURISH: To raise the nutritional level of poor quality hay, you can do this. For each ton of chopped hay, mix and add five pounds of ammonium sulfate and five pounds of ammonium phosphate. Also add 80 pound of soft rock phosphate and 20 pounds of Kelp Meal. In addition, animals should be allowed to feed on molasses free choice.
ENERGY RESEARCH: Don't use ammonium sulfate if the calciums are below 1800 lbs [Beddoe speaks of 3000 lbs] per acre using the LaMotte method of testing.
ENERGY RESEARCH: In the southern states growing cotton, they are having a terrible time with a lot of plant and no cotton. That doesn't do you much good. They keep pouring on the nitrate nitrogen and that's where the crux of the problem is. All they need do is to incorporate a little ammonium sulfate into their fertility program or a little ammonium nitrate and they would get along just fine. For some reason or another they haven't picked up on that yet.
FOLIAR SEMINAR 1983: Ammonium sulfate (200 lbs) in fall gives 3 weeks earlier for microbes to start before planting.
FRANK: Nitrate nitrogen pushes growth. Ammonia nitrogen produces seeds. We did not need more growth. We needed more seed. We needed more fruit. And so, we started putting ammonium sulfate in there.
FRANK: The problem with organics is that it was not defined by having a quality standard. Rather it is defined as a procedural standard with no requirement for food quality. In other words to be organic means that instead of using a commercial fertilizer such as ammonium sulfate, use compost. This is the procedural standard.
FWTK: This *[using ammonium sulfate to warm the soil]* is especially profitable for fresh produce growers and farmers grazing cattle.
FWTK: An application of 100 to 200 lbs. per acre [of ammonium sulfate] either in the fall or early spring will often extend the growing season two weeks each in the fall and in the spring.
FWTK: Ammonium sulfate both warms and cools the soil and controls the temperature.
PLANT FEED 1976: We had applied ammonium sulfate in our bean patch for soil temperature control. There was frost right up to the bean patch, but the bean patch itself had no frost because of the soil temperature control.
SAIT: Andersen: We always prefer to use ammonium sulfate in the soil to encourage microbes and to ge t the calcium working, and we use a very diluted ammonia in the foliar recipes.
SKOW: The first thing he [*Reams did to make sand productive*] was apply approximately one ton of soft rock phosphate. In those days the cost was $5 to $10 a ton. The next thing he did was apply high-calcium lime, and then he usually laced the fields with several tons of cage layer chicken manure, not broiler litter. To set this complex assortment of soil nutrients and microbial food in motion, he added 200 pounds of ammonium sulfate per acre.
SKOW: These lessons were not lost on Reams. His native Florida inspired a memorable response to the question, And what do you think about soil in Florida? The answer: It would be a good place for some! Man y of the acres he engineered were little better than Albrecht's naked colloidal clay. They were white sand, and as an agricultural engineer he had literally to titrate on the needed nutrients in the right balance. During most of his life he was guided by the Morgan Universal Testing Systems and the LaMotte procedures . The first thing he did was apply approximately one ton of soft rock phosphate. In those days the cost was $5 to $10 a ton. The next thing he did was apply high-calcium lime, and then he usually laced the fields

with several tons of cage layer chicken manure, not broiler litter. To set this complex assortment of soil nutrients and microbial food in motion, he added 200 pounds of ammonium sulfate per acre. That was his plan, to build a base magnetic field over the soil and to enhance life in the soil. In other areas of the country, soils are much better than blowsand, and therefore the fertility management program of necessity has to be different.
SKOW: The best source of ammonium sulfate looks like it is dirty. It has a dark color to it. For optimum temperature control, approximately 200 pounds per acre is recommended.
WHEELER: Sulfur could be applied as dilute sulfuric acid, thiosul [thiosulfate] or ammonium sulfate.
WHEELER: A dry product, ammonium sulfate, can be obtained in a variety of colors. The darker, grayer colored form, a by-product of the nylon industry, works best as a fertilizer. This product is good to use both for its nitrogen as well as sulfur content. Some alternative agriculture authorities [meaning Carey Reams] feel the product can work as a temperature control regulator for soils with active humus and calcium. This soil becomes less prone to high temperatures in the summer and to low temperatures in the late fall and early spring. It can be an excellent product when used at lay-by time and, depending on the source, can have good energy levels.

AMMONIUM THIOSULFATE

`AMMONIUM THIOSULFATE (Thio-Sul)
ADVANCED AG: Skow points out that ammonium thiosulfate is a powerful cationic substance and that it gives much energy release in anionic soils (mostly Western).
ANATOMY: Use the form of nitrogen best suited to the growth stage, such as nitrate or ammonia, in a for m such as calcium nitrate, potassium nitrate, ammonium sulfate, household ammonia, or ammonium thiosulfate.
ANDERSEN SCIENCE: To maximize fertilizer efficiency, some type of sugar or at least an organic acid should always be applied with nitrogen to provide energy to the microorganisms. For example, molasses or table sugar can be mixed with liquid 28% nitrogen or ammonium thiosulfate and sprayed on corn stubbl e or straw to aid in its decomposition.
BEDDOE BI: Ammonium thiosulfate is very good for soil activation and a source of sulfates. Best used i n conjunction with aqua-ammonia and molasses to regulate its energy reactions and inter-reactions in the soil.
BEDDOE BI: 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 NOURISH: Ammonium thiosulfate can also be used supply ammonia nitrogen. It is a liquid and so can be used in soil spray mixtures. It will also supply sulfates for other bonding relations in soil and plan t chemistry. It can also be used as a nitrate nitrogen source as long as the soil is high enough in calcium. The high calcium is required to keep the line of least resistance or magnetic force pushing in the anionic direction. When there isn't sufficient calcium to keep the soil anionic when ammonium thiosulfate is used , it will help switch the soil in the cationic direction and supply cationic nitrogen.
BEDDOE NOURISH: Ammonium thiosulfate is a liquid that can be used as a top dressing during the growing season. It will stimulate cationic energy release, in addition to adding the ammonia nitrogen. Since this is a liquid material it can be applied either through a spray or sprinkling can directly to the soil. Do not apply on the plant.
SKOW: One of my favorite formulations for small grain crops is a mixture of 28% nitrogen Thio-Sul [ammonium thiosulphate] 12-0-0-26 and molasses. This works well for about two years, at which time calcium must be checked.
SKOW: Thio-Sul [ammonium thiosulfate] is 12-0-0-26, and 26 is for sulfate. It is a double cationic substance and is very powerful. When there is trouble getting seed to set, that is the role for Thio-Sul.
WHEELER: A combination of sulfur with the magnesium results in a leachable compound called Epsom salts. Gypsum, ammonium sulfate or ammonium thiosulfate can all be used in this situation.
WHEELER: Sulfur could be applied as dilute sulfuric acid, thiosul [thiosulfate] or ammonium sulfate.

ANION-CATION RELATION

`ANION-CATION RELATION
ADVANCED AG: When adding materials, always consider the anion-cation amounts and relations. Lime is usually the biggest factor by volume.
ADVANCED AG: Cationic materials are pulled downward by the earth's magnetic field and anionic materials are pulled upward by the Van Allen Belts.
AG LECTURES: Reams: How could an anion tie up a cation? Because your anionic energy is greater than your cationic energy and surrounds it. The cations are trying to get back to the cations and the anions are

trying to keep it from it, gets in its way. NOTE: *This instance has to do with applying sufficient anionic calcium to tie-up or "jail" cationic magnesium so that the latter does not drive the nitrogen from the soil.*
AG LECTURES: The only difference between anionic air and cationic air is the temperature. Did you know that? Student: No, cold air is cationic? Reams: Yes. Student: And hot air is anionic? Reams: Right. Student: Because of the anions coming from the sun? Reams: They're bouncing. The friction within the molecule makes the difference in temperature, cations will move very slow but anions will move very rapidly.
ANDERSEN SCIENCE: Anions appear to be reversed from cations because compression and rarefaction appear to be opposites if either is taken out of context, but each is actually the other half of the same cycle . In reality, spin is occurring in both directions simultaneously, as Reams said, but most people missed hearing this.
ANDERSEN SCIENCE: The positive or negative charges on the various ions result from the ions gaining an extra electron, which gives a negative charge on the ion (called an anion), or losing an electron, which gives a positive charge on the ion (called a cation). The charges on a compound are important because components with opposite charges attract to stabilize each other. NOTE: *Andersen's explanation is directly opposed to Reams' teaching that "like charges attract." Andersen deserves credit for struggling to fit Reams' theories into mainstream theories, but his effort ultimately bogs down. Perhaps any reluctance t o accept calcium as an anion will always be an anchor.*
BEDDOE BI: Nature senses anion-cation ratio reactions, not the pH. For an explanation of this rule refe r to the chapter dealing with pH.
BEDDOE BI: 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 ther e happens to be in the soil also takes part in this chemical action and can be affected by it.
ENERGY RESEARCH: Anionic substances go up seeking the Van Allen belt and cationic substances go down. Basically why a plant stands and stands up is because there are more anionic substances in the top and less in the bottom.
ENERGY RESEARCH: Once in the root, elements start synchronizing, which gives off anions. This causes the anionic specific gravity ratio to cations to be greater at a given instant which causes them to rise similar to gas making a balloon rise.
SKOW: Materials useful to making the proper anion-cation connection turn up in some unlikely places.
SKOW: On the facing page are chemical additives approved by health officials, all of which affect and disturb the fine-tuned balance anion and cation computations call for.
SKOW: Two terms Dr. Reams used were anions and cations. These terms are very familiar to someone who has studied chemistry. The problem is Dr. Reams attached a different meaning to terms used in chemistry. These terms are describing elements from an electrical point of view, not from a wet chemistry description. For example, calcium is a cation in wet chemistry, but it is an anion from an electrical point of view. Therefore, when you see these terms, do not think of them as you would in wet chemistry.

ANIONIC

`ANIONIC
ADVANCED AG: Nitrogen is an isotope that can switch from anionic (growth) to cationic (fruiting).
ADVANCED AG: Interestingly, water (hydrogen + oxygen) can be "pulled" in anionic-cationic directions.
ADVANCED AG: Cationic materials are pulled downward by the earth's magnetic field and anionic materials are pulled upward by the Van Allen Belts.
ADVANCED AG: Celery requires anionic nitrogen and should be planted on the level so close together that it will blanch itself.
ADVANCED AG: Adding too much lime can tie up potash (both are anionic and like attracts like).
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.
AG LECTURES: Reams: Do you know why it *[mixed fertilizer for side-dressing]* would get hard? Student: You are mixing anionic and cationic so as to create energy in the soil and it would get hard if you didn't put it on the soil quickly? Reams: That's right. So if it gets hard in the bag or mixer, what is it going to do in the soil? Student: Make a gum. Get gummy? Reams: That's right, it's going to make something like chewing gum that won't wash out in the rain. It will be right there until the plants use it.
AG LECTURES: Reams: How could an anion tie up a cation? Because your anionic energy is greater tha n your cationic energy and surrounds it. NOTE: *This instance has to do with applying sufficient anionic calcium to tie-up or "jail" unneeded cationic magnesium so that the latter does not drive the nitrogen from the soil.*
AG LECTURES: Anionic plant food makes growth, cationic plant food makes fruit. So now you're going

to change it from anionic to cationic.
AG LECTURES: Reams: I've talked to you now about side-dressing and replacement of side-dressing. Is there anything else you want to know about side-dressings? Student: Which should we use? Reams: Depends on what you are growing. Anionic plant food produces stalk and cationic produces seed.
AG LECTURES: You certainly want to use anionic plant food on lettuce, cabbage, cauliflower, broccoli.
ANDERSEN SCIENCE: 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.
ANDERSEN SCIENCE: If he [*Reams*] 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 materia l should be added.
BEDDOE BI: Making Sprays Anionic: 1. Use Calcium hydroxide (hydrated lime) or carbonate forms of calcium.
BEDDOE BI: 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 BI: 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.
BEDDOE BI: One substance that can be used to increase the osmotic reaction is gibberellic acid. It is best used in foliar sprays at very early stages of growth to stimulate anionic growth.
BEDDOE BI: From the time the seed sprouts until the 40-50 day period has passed, keep plants anionic.
BEDDOE BI: There are three main sources for base (anionic), or sweet plant food elements in soil chemistry. They are potassium (potash), calcium, and chlorine.
BEDDOE BI: Tomatoes do best when there is a minimum of available nitrogen. When nitrogen gets too high, excessive anionic growth (vegetative growth) will develop.
BEDDOE NOURISH: The three different formulas mentioned serve as illustrations of combination that can be used to stimulate the soil toward cationic energy release, when applied after the 40 to 50 day anionic growth period. It is a good idea to not stick to using the same formula all the time.
ENERGY RESEARCH: Osmosis is the process of moving nutrient up the plant via the phloem for storage and growth. Anionic process.
ENERGY RESEARCH: Anionic substances go up seeking the Van Allen belt and cationic substances go down seeking the earth. Basically why a plant stands or stands up is because there are more anionic substances in the top and less in the bottom.
ENERGY RESEARCH: If we take an average for anionic energy (this is a negative nitrogen) each electron shell will have 250 Milhaus units of energy. If you have 250 times 14 and you have one positive charge in the center which is cationic energy that has a value between 500 and 599 Milhaus units of energy which gives us an average of 750. You have 750 times one. That is your negative charged nitrogen. The problem is, depending on a given situation in the soil, you can have a positive charged nitrogen here and that would be 750 x 14 plus 250 x 1 for one single atom. Now there is a considerable difference in your totals here. Fo r one atom of negatively charged nitrogen (anionic) you would have 4,250 mhu of energy compared to a positive charged atom of nitrogen (cationic) at 10,750 Mhu of energy.
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: 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.
FWTK: Superphosphate is used for two things: one, as a catalyst, in order to change soil from an anionic condition of growth to a cationic condition of production; the second, to create energy.
FWTK: The anionic form is found in nitrate nitrogen, and the cationic form is found in ammonia. Isotopes in the soil will follow the path of least resistance, i.e., yield to the greatest magnetic attraction.
PLANT FEED 1976: 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.
PLANT FEED 1976: The goal to work toward in annual crops is 400-500 pounds of water-soluble phosphate per acre and only use superphosphate as a catalyst in order to change your soil from an anionic condition of growth to a cationic condition of production.
PLANT FEED 1978: Anions are negative.
PLANT FEED 1978: Sap moves upward because of anionic pull and cationic push.
SKOW: It is possible to manage a corn crop for silage so that no seeds set whatsoever. This can be done b

y putting on the right anionic fertilizer at the right time. This is not the usual intent, but it can be the end result.
SKOW: Most soils are switched during the winter months to anionic, and during the summer to cationic to set seed.
NOTE: *Sadly, there are no anionic entries for Wheeler. A close search of his book fails to turn up either "cationic" or "anionic." Some might say that his entire work should be cast aside, but there is much in it that causes one to understand Dr. Wheeler actually greatly admired and praised Dr. Reams' work. He tried his best to somehow extend CEC (see) concepts into the framework Carey Reams established with anions, cations and energy calculations. Having said all that, Dr. Wheeler wrote clearly about how ammonia nitrogen supports simple growth and nitrate nitrogen causes fruting.*

ANTENNA

`ANTENNA
AG LECTURES: Those blades out there are little antennas that pick up the mineral that is leaking out of the ocean. And if you get too far from the ocean a pineapple doesn't do too good, unless you supply the ionization. It gets about 98% of its feed from the air.
AG LECTURES: There are also little antennas, so to speak, that come out of the stomata.
ANATOMY: Dr. Philip Callahan of the University of Florida, a USDA entomologist, explains that insect antennae are actually like small semiconductors and, as they are coated with wax, are also paramagnetic structures.
ANDERSEN SCIENCE: Because the stoma are so minute (a magnifying glass is needed to see them), mist blowers or foggers work best for foliar feeding since these machines produce a tiny droplet of mist. Properl y charging the nutrient solution facilitates nutrient absorption because the solution will be more attracted t o the leaf antennas.
ANDERSEN SCIENCE: To be a good ground, the soil must be highly paramagnetic; this means that the soi l is a good antenna for solar and cosmic radiation. Paramagnetism does not guarantee fertile soil, but it is a prerequisite for fertile soil. Sterile soils are diamagnetic; they are poor antennas. Paramagnetism is achieved by both the mineral composition and the physical structure or form of the materials in the soil.
ANDERSEN SCIENCE: From a physics viewpoint, we can say that fertile soil is a living biological system. Plants are antennas plugged into the soil and function in direct proportion to the stability of the energetic characteristics of the soil.
ANDERSEN SCIENCE: First we must lay the foundation *[to build a ReamsAg soil]*. This includes the calcium, necessary to establish the capacitor characteristic, and the base minerals, necessary to initiate the magnetic susceptibility characteristic (antenna), particularly the paramagnetism Phil Callahan noted in his research.
ANDERSEN SCIENCE: Paramagnetism does not guarantee fertile soil, but it is a prerequisite for fertile soil . Sterile soils are diamagnetic; they are poor antennas.
BEDDOE BI: 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 antenna of the leaves at the time it contacts them.
BEDDOE BI: Leaves absorb sunlight, carbon dioxide, and molecular mineral through their surface openings and antenna.
BEDDOE NOURISH: Many leaf surfaces feel and look velvety, fuzzy, or woolly because they have what are called epidermal hairs. These hairs are outgrowths of epidermal cells. Biological Ionization recognizes these as potentially functioning as miniature antenna that attract and hold plant food energy for being taken int o the plant through the leaves.
BEDDOE OT: The fine hairs on the bottom of the leaf act as antenna which draw in ionized particles of nutrients. This activity is much greater in crops grown with the proper mineral levels in the soil.
ENERGY RESEARCH: *[Skow discussing stomates]* Once these elements have attached to the antennae they are sucked into the plant by an influx vacuum caused by the photosynthetic [?] flow in the plant. Sinc e the incoming material is highly cationic it seeks the area of least resistance which is the photosynthetic [?]area. As the sap moves downward it creates an influx which sucks in the elements attached to the antennae.
ENERGY RESEARCH: When we look at a plant out there in the field and it is waving in the wind, it is the same thing as having antenna on the roof of your house for a TV station or radio. It's a point that has the ability to draw elements in from the air. The catch is that the more nutrient in the sap, the stronger the antenna, the farther distance it can draw elements into it, and the more water there is, the less it can.
ENERGY RESEARCH: Stomata: These are the openings through which the plant breathes (corresponding to a person's nostrils). They are lined with minute hairs which act as antennae. These antennae are like

magnets charged by the electrical energy in the soil. These antennae draw to them any elements that are magnetized in the atmosphere around it. However, they have a magnetic attraction for only those elements that are present in the plant already, for they determine the type of magnetism.
FOLIAR FEED 1981: Zinc is needed with iron as it makes antenna of leaf more magnetic.
FOLIAR SEMINAR 1983: Leaves have little hairs like antennas. Different hairs pick up different frequencies.
FRANK: Microscopic hairs on leaves are antennae.
FRANK: Are plants more than an antenna but also a frequency generator that grasshoppers tune in to? D o grasshoppers need food to be on a specific frequency? Does fertility influence the frequency generated by plants?
FWTK: Through research he [Reams] found that many plants have the ability to take in nutrients from the air. The fine hairs on the bottom of the leaf act as antennae which draw in ionized particles of nutrients. This activity is much greater in crops grown with the proper mineral levels in the soil.
SAIT: Paramagnetism can be a difficult concept to grasp for growers. Could you provide a simple explanation of this phenomenon? Andersen: Well, when you increase paramagnetism, you are essentially setting up an antenna to receive magnetic energy.
SKOW: A balanced plant does not broadcast any color prominence, just white light, which the insect's antenna is not designed to receive. In this way, nature purges the food chain of deficient foodstuffs and maintains healthy consumers on up the food chain. It is truly perfect divine order.
SKOW: Miniature hairlike projections rise from around each orifice like antennas, which they are. The length of those antennas determines which elements the plant can fetch most effectively from the air surrounding it.
WHEELER: This magnetic stream carries ionized minerals along its flow. These minerals are then deposite d onto, or are attracted to, plants and/or soil along the path. The magnetic effect also functions above the soil, and plants will be poor or better antennae according to their nutritive state.
WHEELER: Infrared signals are emitted naturally by all living plant or animal bodies as well as from the gaseous emissions of all plant and animal life. Signal strength and configuration are affected by a variety of factors including nutrient balance and stress factors. Insects detect these signals with their antennae.
WHEELER: According to Dr. Callahan, the shape of the antenna determines the signal range received by the insect. Thus, the shape of [alfalfa] weevil antenna allows it to be attracted to alfalfa frequencies.

ANTHRACNOSE

`ANTHRACNOSE
AG LECTURES: Student: Going back to the tomatoes, you get these brown spots on the tomato with the black spot in the middle. They call it anthracnose. Reams: Yes, it is a copper deficiency.
AG LECTURES: Reams: No, I've never seen anthracnose as such on grass. It may be mislabeled, but it' s generally a mold. It can be too much potassium, it can be a lack of iron. You have to examine some of these things under glass to really evaluate them.
ANATOMY: *Included charts identify anthracnose as a fungus and include sequential nutrient deficiencies.*
· *Tomato: Ca, P, Cu*
· *Alfalfa: P, Ca, Vitamin C*
· *Raspberry: Ca, P, Fe*
· *Blueberry: Ca, P, Co, Mn (early season deficiency)*
· *Corn: Ca, P, Fe/Cu, Co*
· *Apple (Bull's Eye Rot): Ca, P, Vitamin C, Co*
FOLIAR SEMINAR 1983: *[There are two tracks in which anthracnose is mentioned as hard on honeydew and also that anthracnose is fireblight caused by manganese and iron deficiency.]*
FOLIAR SEMINAR 1983: If your honeydews are bothered by anthracnose [fireblight], experiment with growing them on black plastic as that may prevent much trouble from coming out of the ground.
WHEELER: [*In his book, Phil Wheeler reproduces part of Arden Andersen's short book, "The Anatomy of Life and Energy in Agriculture" which identifies anthracnose as a fungus.]*

ANTS

`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.
ANDERSEN SCIENCE: The first such study was done by Philip Callahan in 1956. He showed that ants would home in on a candle flame when there was no barrier between the candle and the ant, and even

when he placed a plastic sheet between the candle and the ant. However, when he placed a glass sheet between the candle and the ant, the ant did not home in on the candle.
FOLIAR SEMINAR 1983: Spray carbon whenever leaves out, watch out for ants & aphids as it's a food source.
PLANT FEED 1976: Every time 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 of it.
PLANT FEED 1976: 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. Pu t 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.

ANY CROP

`ANY CROP
AG LECTURES: 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 notice d it on peach leaves, orange leaves, any crop?
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 is 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 *[any crop]* 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 SCIENCE: 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 BI: 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.
ENERGY RESEARCH: Liquid fish is a real nice thing to use from the standpoint that it furnishes oil, amino acids, some nitrogen, phosphorus, potassium, 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.
ENERGY RESEARCH: Student: How long or how many times can you use manganese? Skow: This product you can use practically every time you spray on any crop that you want to harvest the seed.
ENERGY RESEARCH: 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 i s for seed crops only, Any crop that you want to harvest the seed. One crop that it is very important to maintain the manganese level is pecans, walnuts, and almonds. Spray, spray, spray, and spray some more with manganese.
FOLIAR SEMINAR 1983: Hollow stems in any crop is a boron deficiency.
FOLIAR SEMINAR 1983: Alfalfa needs more water-soluble calcium than any *[other]* crop.
PLANT FEED 1976: All plants can take all the magnesium they need out of the air. You do not have to ad d 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 the 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.

APHIDS

`APHIDS

AG LECTURES: The nutritional spray I have given you this morning will not work for aphids. If you want aphid sprays, then spray [something] that forms a gas. I would recommend Cystox for one. The best way t o use Cystox, is to take the small plastic bottles that hold 2-3-4 oz. That you get by the gross at drug stores. Your local pharmacist can get them for you. Take a hot needle, pair of pliers and a candle. Punch a hole in the top of that plastic bottle while the cap is on. It punctures very quickly and very easy. Get you some ordinary spools of fishing thread, the nylon thread, and tie a knot on the end of that thread and put it through the lip inside to the outside and tie another knot in it so it won't slide back through. Take the needle and punch 3 small holes ½ inch under the cap or there about, very small holes. Then fill that bottle full of ordinary Cystox spray, following the formula on the bottle or can. You can also add a little Chlordane or rubbing alcohol if you like. Put the cap back on and hang it in the tree and no aphid or bug will be on tha t tree. Do this about every 10 feet in your garden in your backyard and you won't need any sprays in your garden. It keeps all the bugs out and it works

ANATOMY: Sequential Nutrient Deficiency table lists "peach aphids" and associated deficiencies.

ANDERSEN SCIENCE: Many people believe that aphid infestation, for example, is due to a lack of pesticide or a lack of predator lady bugs. In actuality aphid infestation is due to nutritional disorder, particularly non-protein nitrogen.

FOLIAR FEED 1981: Reams urges his farmer audience to foliar feed the soil pre-plant so as to head off blue mold, cutworms, nematodes, wireworms, loopers, aphids, and other pests before they get a chance to cause harm.

FOLIAR FEED 1981: Aphids don't like high carbohydrate in leaves.

FOLIAR FEED 1981: They [aphids] do not like the citric acid in citrus leaves.

FOLIAR SEMINAR 1983: Spray carbon whenever leaves out, watch out for ants & aphids as it's a food source.

FRANK: [Denigrating toxic Ag procedures] *If aphids come because the plant is unhealthy, spray for aphids. If grasshoppers come to consume the crop unfit for higher life forms, spray them too—then eat the crop.*

WHEELER: Ladybugs, for example, will eat aphids. These predators play a useful role in maintaining balance within the insect kingdom.

APPLE

`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.

ANATOMY: Sequential Nutrient Deficiency table lists "apple scab" and associated deficiencies.

ANATOMY: Sequential Nutrient Deficiency table lists "cedar apple rust" and associated deficiencies.

ANATOMY: We are told that the quality of produce can be verified by its looks (apples are coated with wa x so they shine, lettuce is coated with sulfide so it remains green, meat is treated with nitrates so it remains red) and the lack of visual signs of insects and diseases. Little is said about the spectrum of rescue chemicals applied to produce the false visual perfection.

ANATOMY: *Included charts identify anthracnose as a fungus and include sequential nutrient deficiencies. · Apple (Bull's Eye Rot): Ca, P, Vitamin C, Co*

ANDERSEN SCIENCE: 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 SCIENCE: 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 SCIENCE: 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 BI: Without phosphate of copper, the bark of some trees, such as peaches, plums, cherries,

apples and pears, will show splitting.
BEDDOE BI: The basic goal that any farmer ought to set is to produce 45,000 lbs. of produce at the highest Brix reading per acre of land whether it is alfalfa, watermelon, or apples.
BEDDOE BI: On those *[crops]* grown for fruit, seed, root, or blossom, such as corn, wheat, tomatoes, apples, etc., you use both nitrate and ammonia nitrogen at the proper times.
BEDDOE OT: Pears, peaches and apples should run a minimum of 14% sugar; yet most will run from 9 -12%. maximum.
FWTK: On those *[crops]* grown for fruit, seed, root or blossoms (corn, wheat, tomatoes, apples, etc.), bot h 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 is 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 FEED 1976: 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 FEED 1976: It is not the same way for apples, but oranges can have a distinct readout.
PLANT FEED 1976: 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 *[you must]* put the nutrient back in the soil.
PLANT FEED 1976: How marry citrus leaves does it take to furnish the normal amount of carbohydrate fo r one orange? How do you know when your grove is producing a maximum crop of citrus? What is the criteria for citrus, peaches, pears, *[clusters of]* grapes, apples - how do you know when the tree has produced its capacity load? So many leaves per fruit. Fifty leaves per fruit.
PLANT FEED 1976: You cannot cross the kinds. You can bud citrus with citrus and apples with peaches. You can graft many nuts together---pecans with walnuts or hickory with pecan because they have the sam e frequency. Grafts will not take and live very long with unmatched frequencies. There are plants and buddings of plants that if the frequency is very close, down to the micron and milli-micron of color, the bud s will take very easy. But if not, it Is rather difficult to do. These are factors you must remember and it is the energy that does it.
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.
SKOW: Working with nursery crops, flowers for market, strawberries, apples, pears and cherries, agronomists started answering these growth cycle requirements with seaweed extracts many years ago, all with successes that were spectacular, erratic, and rejected.
SKOW: They [treated with Amaze apples] also averaged 40% more calcium than the control, which make s a big difference in storability. The treated apples will store much longer since the higher calcium levels wil l make the cell walls much stronger in the apple.
SKOW: Moreover, they [apples] 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 wit h 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.

ARAGONITE

`ARAGONITE
ADVANCED AG: If you farm on the east coast, use Aragonite for calcium oxide [this appears to be a Reams mis-speak or transcription error as he no doubt meant "calcium carbonate.".
ANDERSEN SCIENCE: If the farmer desires an organic program, it might look like the following: apply 1 t o 3 tons of true compost, a dry blend mix of North Carolina black rock phosphate, soft rock phosphate (Idaho or Florida sources), potassium sulfate, Aragonite, possibly some gypsum, digested fish, and kelp

(seaweed). Then apply an organic liquid calcium---it cannot be calcium-nitrate based, but will probably be calcium-lignosulfonate based---with sugar or molasses and perhaps a trace element if needed.
ANDERSEN SCIENCE: At less than 2,000 pounds of [plant available] calcium, I would consider applying 200 to 500 pounds of fine, high-calcium lime, ideally Aragonite.
ANDERSEN SCIENCE: Aragonite—ground seashell, very-high-quality calcium carbonate.
BEDDOE BI: Aragonite: This is a type of substance referred to as "marl" and is of variable content in calcium. It is mined off the ocean floor and is purified for the paint industry in the manufacture of paint pigment. It can be obtained quite easily along the east coast of the US, but is not available outside of that area. It is an excellent liming medium.
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 sourc e them]*.
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.
FOLIAR SEMINAR 1983: Use Aragonite for calcium in nutritional sprays, should look like glass pearls.
SKOW: Finally, the product Aragonite rates some attention. It is merely pulverized seashells from off the coast of the Bahamas. It has a tendency to be soluble and very pure. It can be used much like Ag lime — calcium carbonate or calcium hydroxide. Aragonite is the trade name.

ASPARAGUS

`ASPARAGUS
ADVANCED AG: Skow: Asparagus likes table salt [but not too much].
ADVANCED AG: Asparagus appears as though it might be in the fern family, but it is on the frequency of lilies.
ADVANCED AG: Reams: I use 10% seawater for salt on asparagus.
ADVANCED AG: Use 10% ocean water for salt on asparagus.
ADVANCED AG: Reams: When growing asparagus, increase count [*planting 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.
BEDDOE BI: For example, in most plants there are acids produced similar to oxalic acid that is produced in spinach and asparagus.
MANTHEI GARDENING: Cut asparagus before the sun shines on it, early in the morning which will keep it from tasting woody.
PLANT FEED 1976: 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.
WHEELER: Additionally, the arsenic found in properly fertilized asparagus differed greatly from that found in improperly---usually conventionally---fertilized asparagus.

ATOMIZE/HOMOGENIZE

`ATOMIZE/HOMOGENIZE
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: Copper sulfate *[bluestone]*, how much per acre? Reams: For blue mold? Generall y 6 oz per acre for 100 gallons of spray, providing your 100 gallons of spray would cover it *[the acre]*. If you're homogenizing it, it will cover a lot more than that. Whether or not your spray is homogenized or not, use the came concentration. Do you understand what I am saying? It makes no difference whether or not your spray is homogenized or not, use the same concentration. But it goes a lot farther with a homogenized spray.
AG LECTURES: Student: What is the difference in a homogenized spray or homogenized substance and on e 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 ho w homogenization is done? How do you homogenize anything? Student: Pass it through a very fine orifice?

Reams: Yes, then what? It is not 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: Nutritional spray must be able to stick onto the leaf and if the droplets are too large, they cannot stick to the leaf. They must be very, very fine mists and the finer the mist, [the better]. Actually the particles should be homogenized.
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 BI: 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 BI: The smaller the spray particles, the more complete the molecule. This is another way to express the effect 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 BI: Sprays must be homogenized or micronized for the maximum benefit. The smaller the droplet, usually the more complete the homogenization.
ENERGY RESEARCH: 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.
ENERGY RESEARCH: 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.
FOLIAR FEED 1981: Add soft rock phosphate to homogenized spray to achieve sticker effect on waxy leaves like cabbage.
FOLIAR FEED 1981: Student: Will homogenization destroy enzymes? Reams: What is an enzyme? Student: Part of a vitamin. Reams: Homogenizing spray will not destroy a vitamin.
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.
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. Re-circulating 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 greenhouses to orchards.
PLANT FEED 1976: I want 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 is 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 FEED 1976: 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 homogenizing sprayer - under the leaf.
PLANT FEED 1976: 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 will 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 boo m 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 activ e 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.
NOTE: *The few quotes in this document are only a fraction of the testimony Reams gave to the [Chiron] device and its apparent important homogenizing action prior to ordinary fogging [as done by current machines]. Perhaps they only highlight that his students might not have mastered all he wanted them to know about the machine. Imagine the luck of the farmer who snares one from an auction of dusty machinery in a long-ignored barn---and knows what he has discovered.*

ATOMS PER ACRE

`ATOMS PER ACRE
ANDERSEN SCIENCE: "Experts" often scoff at the suggestion of using very small amounts of nutrients for fertilization. We might use 5 to 40 mg of B-12, 1 to 20 pounds of sugar, an ounce of vitamin C, a pint of humic acid, and so on. Yet these same "experts" insist on using similar quantities of pesticides and active ingredients designed to regulate plant growth. They also point out the importance of water dilution and soil moisture in obtaining the desired results from these products.
SKOW: Once this habit of computation becomes a way of thinking, fertility management takes on a new dimension. The active ingredient to be used is often not even a teaspoonful per acre.
SKOW: The secret is how to divide it up so that, say, one pound can cover an entire acre. So back to basic s and the intelligence that there are 10,000 drops in a pound, and approximately 5,000,000 atoms in each drop. The equation is simple — 10,000 x 5,000,000, or 50 billion. These 50 billion atoms properly distributed over an acre suggest plenty of atoms for every square centimeter of territory in that 43,560 square foot area. In fact, distribution of a herbicide at that rate could well serve up a disaster. The number of atoms per pound of soil seems astronomical, but it is also the key to understanding how to make fertilization more effective.
SKOW: This growing season can be shortened another ten days — perhaps more — by creating a more powerful magnetic field on that acre of land. More atoms per acre will govern that energy pull if there are no holes in the blanket.
SKOW: If each calcium atom gave up all 10,000 units of its energy, only four atoms would be required to capture one atom of manganese. No element will give up that much of itself, therefore a great many more than four will be required to capture that single atom of manganese. It may take as many as 15 or 20. 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.
NOTE: *Is is easy to imagine that of all Reams' students, Dr. Andersen and Dr. Skow best captured the concept of "the law of the little bit." Andersen has also lectured on his findings that powerful effects in agriculture can be traced back to vanishingly small inputs when dealing with herbicides and pesticides.*

ATRAZINE

`ATRAZINE
AG LECTURES: Student: I had farmer tell me one day he took and 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. Then he would go cultivate and cover everything up. Reams: Yes, I wouldn't have used Atrazine, I would just cover them up to start with. Student: Yes, I don't advocate Atrazine 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 tie s up is phosphates, terrifically. Every one of them does.
ANDERSEN SCIENCE: 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.
ANDERSEN SCIENCE: pH is a result of the interaction of all nutrients, minerals, and microorganisms in th e soil. It is not an indicator of the quantity or balance of these nutrients, minerals, or microbes. An exampl e of this is the heavy application of Atrazine herbicides. These herbicides seem to tie up phosphates in the soil, making them unavailable. Phosphate tie-ups raise the soil pH.
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.

AVAILABILITY

`AVAILABILITY
NOTE: *Review in conjunction with UNAVAILABLE*
ADVANCED AG: Sul-Po-Mag makes copper available.
ADVANCED AG: Skow: Only that plant food soluble in water or dilute organic acids and that will stand in suspension is available to the plant.
ADVANCED AG: The process of osmosis is not limited by time UNTIL seed sets. Prior to that the plant can grow very rapidly if the TDN is available.
AG LECTURES: Reams: What is the primary benefit of adding compost instead of manures whenever you disc them in or plow them under. Student: It is immediately available.
AG LECTURES: Reams: Which soil test reveals how much available plant food you have? Student: pH? Reams: No, that is your resistance. How can you test for amount? Student: Solubridge, ERGS? Reams: Yes , your ERGS test tells you how much energy you have. Which uses the most ERGS of energy, little plants o r big ones? Student: Big ones? Reams: Big ones, so when do you need the most ERGS? Student: When the plants begin to mature? Reams: When they're big, that's right. At what stage does your production increas e the most rapidly? Student: The latest stage of growth.
ANATOMY: When this product [muriate of potash] comes in contact with acids or acidified fertilizers such as 0-46-0 (triple super phosphate---the most commonly used commercial phosphate fertilizer), the chlorine will form muriatic acid (commonly known as hydrochloric acid), which will destroy any bacteria it contacts and will acidify the soil, causing such minerals as calcium and iron to become less available in the soil solution should they contact the muriatic acid.
ANDERSEN SCIENCE: The Morgan extract (UES) is a weak organic acid solution that acts on soil particles to dissolve nutrients that are likely to be made available by the exudate from plant rootlets. This test is often referred to as testing for water-soluble nutrients.
ANDERSEN SCIENCE: Also, because the microbes are ultimately responsible for nutrient availability, th e real crop is the microbe; it is what really needs feeding.
ANDERSEN SCIENCE: 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 SCIENCE: 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.
BEDDOE BI: It *[molybdenum]* has one primary benefit. It makes the grain kernel harder by making calcium more available.
BEDDOE BI: Calcium nitrate helps other calciums become available because of its nitric acid.
BEDDOE BI: 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.
ENERGY RESEARCH: Chelates are fine in low calcium soils. In other words, soils below 2000 lbs 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.
ENERGY RESEARCH: You can change the color of plants by increasing the density of nutrient in the plant which we have observed up here *[at the lectern]*with the two different oat plants of the same variety but yet we have evidently succeeded in getting more nutrient available to the one plant.
FOLIAR SEMINAR 1983: Be wary of applying too many sulfates as they may combine with available calcium to create unavailable calcium sulfate.
FOLIAR SEMINAR 1983: Zinc helps iron to become available.
FRANK: It is very important that SRP be included because it helps hold the calcium in the root zone. This i s one of the secrets of raising available calcium in rain-depleted soils.
FRANK: 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, mycorrhiza go dormant and aren't much use to roots. The best use of mycorrhiza is to use it on low fertility soils where remineralizing with phosphorous is not economical.
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]*.
FWTK: ERGS is a reading of how much plant food is available per second, per gram of soil.
FWTK: This type [carbon disulfide] 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: When the nitrate runs out (after about forty days), the ammonia becomes available, and makes flowers, blossoms and fruit.
FWTK-pH: All soil solvent testing reagents that are foreign to what is available in the soil should not be used.
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.
PLANT FEED 1976: The flame photometer is valuable for testing colloids simply because 100% of colloids are available to the plant, unlike ordinary elements which may or may not be available.
PLANT FEED 1976: There are 192 forms of nitrogen, 50 different kinds of phosphates, and 20 kinds of potash that are available to you.
PLANT FEED 1976: It must 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: For example, using liquid calcium with Vitamin B-12 and sugar is primarily a chemical catalyst to make calcium available, but introducing a microbial or enzyme-based material is a biological catalyst.
SKOW: One of the biggest problems in maintaining nut trees is the failure to keep enough phosphate of manganese available to the tree. The best and cheapest way to supply these nutrients is via foliar spray.
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.
SUCROSE: Much of the carbon can be taken in through the roots, as this supply is mined out of the soil by the sugar cane; and its yield will decrease in direct ratio to the supply of the available carbon in the air and the soil.
WHEELER: In fact, soil microbes consume fertilizers as well as organic matter and hold them in then bodie s (primarily protoplasmic fluid) as a highly insoluble, but available, form of plant food.
WHEELER: Often weeds will benefit a corn or other crop by making water and minerals available which would not otherwise be accessible.
WHEELER: These *[chemical supply trace nutrient]* 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: 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.

BACTERIA, AEROBIC

`BACTERIA, AEROBIC
ADVANCED AG: To prevent nematodes, create a soil environment promoting aerobic bacteria.

ADVANCED AG: The reasons for cut worms and rootworms are the same as for nematodes. Aerobic bacteria will eat them for lunch.
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.
ANATOMY: When a farmer applies anhydrous, he uses a tool that knifes the ammonia several inches into the soil. It effectively reduces the usable oxygen in the soil needed by the aerobic microorganisms, burn s the organics that include the microorganisms, creates an ash, and sets in motion the process by which formaldehyde and pathological organisms abound.
ANATOMY: It is the aerobic microorganisms in the soil, alive and active, that make the soil fertile.
ANATOMY: In the presence of excess boron relative to calcium, high salt, or sulfur conditions, a deficiency of carbon may allow ammonification to occur, which is fatal to aerobic life.
ANATOMY: This [carbon deficiency] in turn results in a decreased aerobic microbial life, reduction of the carbon cycle, and finally sterile soil.
ANATOMY: In areas where the clippings will not compost back into the soil but rather create a thatch buildup, there is a lack of aerobic microorganisms, an excessive salt concentration and poor aeration.
ANDERSEN SCIENCE: The aerobic zone of the soil ranges from nothing to only a couple of inches.
ANDERSEN SCIENCE: 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. A s 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 cro p is the microbe; it is what really needs feeding.
BEDDOE BI: 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 BI: A soil with excellent amounts of aerobic bacteria will have plenty of available ammonia nitrogen being produced by the bacteria.
BEDDOE BI: 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 BI: As the bacteria feed and function they leave both their excrement as well as their body remains when their 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.
BEDDOE NOURISH: By the way, they [bacteria] consume the mineral salts in their growth and reproduction process, binding and preventing leaching from the topsoil.
BEDDOE NOURISH: Boron: Deficiency: poorly developed pith in the plant stem which interferes with sap flow plant growth, thus reducing yield and health. Hollow stems as well as some fruit will split. Excess: can cause toxic nitrite formation on high chloride soils, toxic to bacteria.
ENERGY RESEARCH: Without carbon, ammoniation can occur which is fatal to aerobic life.
ENERGY RESEARCH: Aerobic Any organism that breaths oxygen. These bacteria convert unavailable nutrients to usable form. They include sulfa ammonis[?], nitrous ammonis[?], lactobacillus, and europa.
ENERGY RESEARCH: Aerobic microorganisms breathe oxygen. These bacteria convert unavailable nutrients to usable form.
ENERGY RESEARCH: If there is a carbon deficiency there is a CO2 deficiency which will result in a carbohydrate deficiency and an oxygen deficiency which will result in decreased aerobic microbial life which will result in increased toxicity, reduction of carbon cycle and finally sterile soil, loss of the magnetic field, and a favorable environment for all types of pests both above and below the ground.
FWTK: Aerobic bacteria take nitrogen out of the air; they also yield some from the rain and snow.
FWTK: More cultivation is recommended with this program, to aerate the soil, and to stimulate the aerobi c bacteria.
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.
PLANT FEED 1976: 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 tryin g 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: In recent years, the topsoil layer has been greatly reduced. This is not all a by-product of chemical fertilizer, but is related to bacterial action. If bacterial numbers are reduced, they will take up less "space" and no longer work to flocculate or loosen the soil. As their numbers continue to fall, the topsoi l layer will continue to degrade, and compaction will increase.
WHEELER: To moldboard plow residue 8 to 10 inches deep in this soil condition is to almost guarantee tha t 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.
NOTE: *While most farmers are comfortable with "aerobic" and "anaerobic," some purists are interested t o know that Reams stated to a RBTI class that, "Fungi are plants that require CO2 gas and bacteria require oxygen." He furthered this by mentioning that, "anaerobic fungus" is a better description."*

BACTERIA, ANAEROBIC

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ADVANCED AG: Add lime if your manure slurry pit is anaerobic.
ANATOMY: Organic matter can take two pathways: anaerobic, resulting in organic salts, formaldehydes, and soil demise, or aerobic, resulting in humus soil maintenance and rejuvenation.
ANDERSEN SCIENCE: Many sporiferous bacteria (anaerobic) have toxic or herbicidal properties on man y plants, suppressing growth and lowering the percentage of germinating seeds.
ANDERSEN SCIENCE: The plugging *[in a corn stalk]* 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 SCIENCE: 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 u p 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.
BEDDOE NOURISH: Boron: Deficiency: poorly developed pith in the plant stem which interferes with sap flow plant growth, thus reducing yield and health. Hollow stems as well as some fruit will split. Excess: can cause toxic nitrite formation on high chloride soils, toxic to bacteria.
ENERGY RESEARCH: You must avoid anaerobic conditions. Essentially, this is where the ground crusts over and then your aeration and normal biological system cannot work. When you get into that crusted situation, you will have a salt build up and anaerobic bacteria produce toxic substances.
ENERGY RESEARCH: There is vinegar, propionic acid, and deuteric acid. Deuteric acid usually has a bad smell (which is produced by anaerobic bacteria which you really don't want).
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: To moldboard plow residue 8 to 10 inches deep in this soil condition is to almost guarantee tha t 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

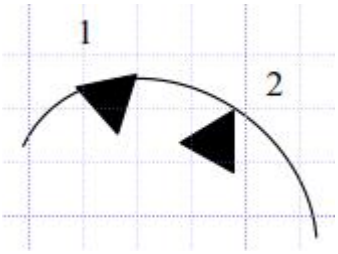
ferment, producing an alcohol or aldehyde. These substances kill off the aerobic bacteria and preserve the trash.
WHEELER: Compaction has induced the anaerobic bacteria supposedly found only in the lower levels of the soil to populate the majority of the soil bed. Potassium chloride is not the only culprit. Herbicides, pesticides, and other farm chemicals also contribute to the decrease of proper soil life.
NOTE: *While most farmers are comfortable with "aerobic" and "anaerobic," some purists are interested t o know that Reams stated to a RBTI class that, "Fungi are plants that require CO2 gas and bacteria require oxygen." He furthered this by mentioning that, "anaerobic fungus" is a better description."*

BALANCE/IMBALANCE

`BALANCE/ IMBALANCE
AG LECTURES: There is a delicate balance in soil and you can usually switch it from anionic to cationic if the blossoms shed with no fruit.
ANATOMY: If the biological balance is disrupted by the misapplication of mineral elements, this causes electrical chaos, which leads to the degeneration of biologically active carbon.
ANATOMY: Diseases are self-destruct or red—light mechanisms with the same purpose---to signal a mineral deficiency or imbalance. Correct the deficiency and the disease disappears.
ANATOMY: Since there is a phosphate deficiency in this fertilizer program, there will be an imbalance caused by an excess of nitrogen.
ANDERSEN SCIENCE: 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 onl y the symptoms, not the cause of the problem.
ANDERSEN SCIENCE: pH is a result of the interaction of all nutrients, minerals, and microorganisms in th e soil. It is not an indicator of the quantity or balance of these nutrients, minerals, or microbe
ANDERSEN SCIENCE: To notice that one field of beans has a sheen and the adjacent field does not indicates a difference in nutritional balance.
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.
FRANK: A continuous supply of potassium over time will imbalance the soil with respect to calcium.
FWTK: If the mineral balance in the soil can be matched to suit the frequency of the crop, the plants will be fed as fast as they can assimilate the food.
PLANT FEED 1976: 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.
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.
SKOW: On the facing page are chemical additives approved by health officials, all of which affect and disturb the fine-tuned balance anion and cation computations call for.
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.
WHEELER: Alfalfa, lettuce or spinach that goes to blossom or bolts early indicates a fertility imbalance situation that may be worsened by weather extremes.
WHEELER: 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.
WHEELER: In the traditional Reams model the Ca:Mg ratios would be 7:1 (some say 10:1) to indicate a well-balanced soil.

BANANA

`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.
AG LECTURES: ...grapes, oranges, citrus, papayas, bananas, and pineapple are other [high temperature crops].
AG LECTURES: If you will examine very closely the stem of any fruit or vegetable, banana, tomato, or radish, etc. If decay is like this (1) then the cause is something from the outside. But if the decay is like this (2) coming to the outside, then it’s a mineral deficiency.



ANDERSEN SCIENCE: Farmers also know that corn is fertilized differently from potatoes, which are fertilized differently from grapes. In turn, grapes are fertilized differently from bananas and tobacco. The nutrient ration that is suitable for ocean plants would be deadly for freshwater plants or alfalfa.
BEDDOE NOURISH: Evergreen tree fruit: Typical trees belonging to this group include: avocados, bananas, bread fruit, grapefruit, oranges, lemons, tangerines, mangoes, papaya, etc., and sometimes figs i n more tropical climates.
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 FEED 1976: 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.
REAMS/SKOW COOK: Foods rich in potassium are bananas, celery, fish, [and hominy].
SKOW: When carbon — or generally the absence thereof — fails to maintain the peace between nitrogen and potassium, the fires of war erupt, and in the process plants get burned by the formation of resultant salts. The principle can be best illustrated by considering grape juice, perhaps bananas. The brain has a high requirement for potassium. Heavy brain work — writing, lecturing, making computations or answering the demands of scientific investigation, all burn potassium in breath-taking amounts. Yet if I take the water and carbon out of grape juice, I end up with a salt. A salt brine solution will draw the water out of a plant and condense it. This will eventually bum plant roots.

BARK

`BARK
ADVANCED AG: Copper allows bark to stretch
AG LECTURES: But the copper makes the bark elastic. Just like a little boy that outgrows his britches, they're too tight. It makes the bark elastic and lets the sap flow.
AG LECTURES: It doesn't matter which kind of a tree it is whether it is deciduous or an evergreen. Just what does the copper do for the tree? How does the tree bark grow? It splits and heals up, splits and heals up, so this is the way a bark grows on the tree.
AG LECTURES: Then it *[copper]* also makes the bark stretch in the plant and gives you greater yields.
AG LECTURES: The nematode cannot attack the root until the salt weakens the root, until the bark will slide off and then he gets in.
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.
ANATOMY: Bark splitting on trees is due to a plugged vascular system. It is caused sequentially by the following nutrient deficiencies: calcium, phosphate, selenium, cobalt/copper. Sul-Po-Mag applied between July 15 and September 15 acts as a cathartic (laxative) for the vascular system but it is only a symptomati c correction and the nutrient deficiencies must be corrected to solve the problem.
ANDERSEN SCIENCE: 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.
ANDERSEN SCIENCE: Pinch the roots slightly and pull to check whether the root bark sloughs off easily . If it does, there is a salt problem.
BEDDOE BI: Trees that retain the stumps of pruned or broken off limbs in their bark are also showing lack of copper. When copper is being supplied, those stumps will be thrown out of the bark and leave no scaring.
BEDDOE BI: It is usually the sulfate form of copper that is in common use. However, copper in the phosphate form is needed in order for the bark of trees to have good elasticity so that they can stretch properly during the growing process. Without phosphate of copper, the bark of some trees, such as peaches, plums, cherries, apples and pears, will show splitting. This problem is especially detrimental to cherries and peaches, as it allows bacterial infections (called gummosis) to enter the tree and can be fatal to entire orchards.
BEDDOE BI: Phosphate of copper is vital to the bark on the trees stretching properly. If there is not

enough then trees either will have symptoms associated with their barks splitting and oozing sap or being too tight so that the tree does not have proper sap flow.
BEDDOE BI: Without phosphate of copper, the bark of some trees, such as peaches, plums, cherries, apples and pears, will show splitting. This problem is especially detrimental to cherries and peaches, as it allows bacterial infections (called gummosis) to enter the tree and can be fatal to entire orchards.
BEDDOE NOURISH: Copper is the second most important trace element. It's importance relates to the way the plant bark or cuticle can grow and stretch. Copper, in the phosphate form, must be in proper supply for the bark to expand at the proper rate for plant growth. When the proper phosphate of copper is not present, there are two types of responses by the plant. One reaction is that the bark of the plant or tre e will split open at a greater rate than it heals over.
ENERGY RESEARCH: Molybdenum can be used with soap on fruit trees and grapes during cold times to shield them from frost damage. It is a catalyst for iron in the bark or epidermis. If deficient the bark will become sharp like a husk and have a low TDN. It gives the transparent look to the sheen on the bark. If deficient then the sheen will look cloudy.
ENERGY RESEARCH: Cobalt it is very important for the formation of bark and cellulose.
ENERGY RESEARCH: One of the basic things for tree crops is that they need a lot of iron in a lot of the areas of the country. You can tell that by the scale on the bark of the tree. That is a good indication of an iron deficiency.
ENERGY RESEARCH: Two things that limit the effectiveness of foliar sprays in general; number one is insufficient available calcium to the rootlet of the plant and number two is the failure of not having enough Sul-Po-Mag so the bark can stretch to allow the sap to flow.
FOLIAR FEED 1981: Add copper for tight bark.
FOLIAR FEED 1981: If the bark on the tree plant roots is loose from ammoniation, you must completel y foliar feed the entire TDN.
FOLIAR FEED 1981: In cold weather a little molybdenum chelate added to the complete spray can hold back damage in fruit trees, vines, and grains. It forms a protective film over the bark.
FOLIAR SEMINAR 1983: Carbons work in winter months and have a base exchange like leaves. You should notice that especially in the tree bark.
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.
FWTK: Once the [salty] soil dehydrates the root, the bark will slide off it, allowing the nematode to enter the plant.
GARDENING: It is not unusual to have peach trees 20 or 30 years old if you put the mineral back in the soil to make the seed. The bark will be pretty and clean. But when the bark gets so tight that the sap can't flow, then you get little old knotty peaches, like the little boy that outgrows his britches.
PLANT FEED 1976: Copper gives the bark an ability to stretch without splitting wide enough for the sap to leak out.
PLANT FEED 1976: 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 FEED 1976: Blue mold points to a copper deficiency. *[Adequate copper]* allows bark to stretch.
PLANT FEED 1976: I want to give you a very simple rule to know whether your soil has too much nitroge n or not enough, without a soil test. Get one of the little rootlets the size of a small string and see if the bark will slip off it and if it does, there is too much nitrogen. That is, if the rootlet is still looking alive.
SKOW: When too much salt ends up in the root zone, it is often possible to pull a plant out of the soil and slide off the rootbark.
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.
SKOW: When the bark cannot stretch, sap can't flow. This situation can be remedied at times by applyin g 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.
SUCROSE: During the summer months, see to it that the phosphate, copper, and magnesium join. This union keeps the outer skin of the sugar cane growing and prevents it from becoming hard and woody and retarding growth. This tough, woody bark will make the sugar cane slow in coming up when planted because water cannot get in to start growth. When the sugar cane has a dry, woody bark, it will come up quicker when the joints are cracked or mashed to permit water to get in, and then growth begins. Unless the bark is pliable and elastic, the sugar cane cannot grow as it is hide bound and will sometimes split because it cannot stretch.

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.
WHEELER: Reams claimed Sul-Po-Mag works best in the northern hemisphere when applied between July 15 and September 15. During this time, it supposedly works to release copper which allows plant bark to expand and stretch.
WHEELER: Free-choicing of minerals and additives is a controversial concept. It is said to be impossible by some experts for an animal to choose, free-choice, what it needs. Why then, do animals chew bark, eat dirt, drink from corral urine pools, and crib? Why do they stop that activity when given specific supplements?

BASE EXCHANGE

`BASE EXCHANGE
ADVANCED AG: Phosphorus grows roots and base exchange is an important carbon source as the old roots are recycled.
BEDDOE BI: Base exchange: The term refers to a designated period of time a plant maintains cellular structure. After this time it throws out the old cell and builds a new one in its place.
BEDDOE BI: Phosphate works with nitrogen to increase the digestion speed of the plant for optimum base exchange or cell tum over.
BEDDOE NOURISH: Phosphate works with nitrogen to increase the digestive speed of the plant. This means a faster base exchange or cell turnover in the plant.
ENERGY RESEARCH: Now at noon and in this particular situation being at zero the thing you need to understand is that the base exchange is not keeping up with the demand of the plant. In other words, nutrient is not being released into the system. Really what it is telling you is that you are short on basic carbon or humus.
FOLIAR SEMINAR 1983: Carbons work in winter months and have a base exchange like leaves. You should notice that especially in the tree bark.
GARDENING: So, a pecan has a base exchange of 18 months, where most trees have only 7 or 8 months. In other words, most only store up food for 6 or 8 months before the blossom time in order to make the crop. But a pecan tree needs 18 months; kind of a long time.
PLANT FEED 1976: 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 FEED 1976: A baby chick has a base exchange of every cell of its body every two days and it doesn't have cancer, it's in perfect health.
SKOW: All plant root systems have a base exchange, and as the old rootlets drop off and new ones establish they supply nutrient for the [Arouse] 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 acquir e plant foods more readily.

BASIC SLAG

`BASIC SLAG
ADVANCED AG: Use 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.
AG LECTURES: You who can get basic slag *[for calcium]* 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.
ANATOMY: Calcium can be obtained from several sources. Basic slag (beware of contaminants, i.e., heav y metal)
BEDDOE BI: 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 BI: Iron sources include soft rock phosphate, basic slag, iron sulfate, molasses, and various chelated irons as can be used in foliar applications.
BEDDOE NOURISH: Other calcium sources include, basic slag (a by-product of the iron making industry) , gypsum (calcium sulfate), calcium hydroxide (hydrated lime), beet lime (a high calcium lime by-product o

f sugar beet processing) and calcium nitrate.
BEDDOE OT: Basic slag, in addition, contains plant foods other than calcium, such as iron, and often may be obtained for the simple hauling of it from a steel mill.
ENERGY RESEARCH: Manganese sulfate and basic slag are excellent materials for getting manganese into the soil on a long term basis.
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 sourc e them]*.
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 FEED 1976: 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. Th e recommended application rate is 500 pounds per year, which will put about 25 to 40 pounds of actual iro n 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.

BEANS

`BEANS
AG LECTURES: Cucumbers, squashes, green beans, bell peppers, hot peppers, rutabagas, turnips, onions should have between 6 & 8 Brix.
AG LECTURES: With [bush] beans you have a genetic problem. [Although you may harvest more] a lot o f them are not marketable. A lot of them are short, dwarf, some of them get specks on them, etc.
AG LECTURES: Reams: What is the primary benefit of adding compost instead of manures whenever you disk them in or plow them under. Student: It is immediately available. Reams: That's one thing, but what i s 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 th e 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 *[he meant "days"]* 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.
AG LECTURES: Another cover crop to use occasionally is Castor beans, a crop of Castor beans about every 5 years, short term. Now let me tell you about your Castor beans. That's something you can plant real early in the year, and they'll come up and start to grow like mad. About the time they get this high, just cut them in and plant your corn. You got a lot of oil in the ground. Don't wait until they go to seed, if you do, you'll be fighting Castor beans the rest of the year.
AG LECTURES: 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 wor k it out one time then. Student: Like beans or so, you can put a little closer? Reams: No. Beans are a littl e different crop. You need a little bit more room on beans than you do corn.
ANATOMY: Interference can happen when you fertilize a fruit or seed-producing vegetable so it will set fruit, that is, tomatoes, pepper, peas, beans, melons, squash, eggplant, corn, cucumbers, etc., when there is a leafy or non-fruit vegetable close by or next to it, such as celery, lettuce, broccoli, cauliflower, radish, carrot, romaine, endive, onion, collards, or cabbage.

ANDERSEN SCIENCE: To notice that one field of beans has a sheen and the adjacent field does not indicates a difference in nutritional balance.
BEDDOE BI: 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.
ENERGY RESEARCH: 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.
FOLIAR FEED 1981: You can use sunflowers to support pole beans.
FRANK: Why not raise our own super foods like super food green beans or super food beets and so on. I f 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.
FRANK: I had to create a new classification for beans less than 4 Brix. I called them *Deficient*. With dry matter so low, what you are really getting is a lot of moisture that just looks like a green bean but is mostly only water.
FRANK: Brix was only on the upper side of average. I can say that whenever my wife cooked these green beans we all enjoyed the flavor and taste. They were notably better than anything we could buy.
FRANK: Adding a surfactant and transporter designed to reduce surface tension sharply increased leaf absorption and flow of nutrients from leaves into the filled pods and beans. Thus both absorption and translocation were enhanced.
FWTK: The process of osmosis is not limited by time. When Reams was a boy, it took fifty-five to sixty-five days to grow green beans; in the 1950's they were grown in thirty-five days: and now he has grown them on 1,000 acre fields in eighteen days, from seed to harvest.
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.
GARDENING: The process of osmosis and photosynthesis is not limited by time. When I was a boy it took 48-60 days, no 55-65 days to grow green beans. And during the ‘30s I learned how to do it in 35 days in 1000 acre fields and harvest them. Now it’s being done in 18 days.
GARDENING: The average green beans you see on the market today have less than 1% sugar. They should have between 6 to 7 ½% sugar. The greater the amount of sugar, the greater the specific gravity. I have seen ¾ bushel of beans weigh 32 lbs. (which is required by law in order to be called a bushel of beans). As long as it weighs 32 lbs, it’s called a bushel of beans. I have also seen them stacked on the hamper 6 or 8 inches high above the hamper and they barely weighed 32 lbs. So, which was the most nourishing, the one that was stacked 6” above the hamper and weighed 32 lb., or the one that filled the hamper ¾ full? The one at ¾ full had more mineral in it, because it had a greater density in it. And when you eat that kind of vegetable, you don’t feel like a stuffed teddy bear. Or a little bit of it makes you feel real good. You don’t feel stuffed.
PLANT FEED 1976: Last year in [Blue Ridge] Georgia, We picked beans up to 2 days before Thanksgiving. Everyone said it couldn't be done - never been done before. We had applied ammonium sulfate in our bean patch for soil temperature control. There was frost right up to the bean patch, but the bean patch itself had no frost because of the soil temperature control.
SKOW: The home grown beans that were beneficiaries of Biological Theory of Ionization treatment presented a lush, straight stand from one end of the field to the other. Not one seed seemed to fail. The commercial seed was marginal. The Biological Theory of Ionization seed exhibited potential five-fold stronger.
SKOW: I recently had an account call and tell me about his snap beans and their Brix readings. He said h e had leaf readings of 15 Brix and pod readings of 9 Brix. These readings were much higher than anything I have experienced before. He accomplished this by keeping the phosphates high in the soil by using a product called Growzyme and "fertigated" urea and calcium sulfate. He used 30 pounds of urea and 30 pounds calcium sulfate per acre three times after planting to get these Brix levels. The best I have heard of before is about 10 Brix in the leaf and 6 to 7 in the pod and stem.
SKOW: I have experimented with string beans at my farm in Minnesota. I've pushed plants to an 18 inch height by forcing nutrients into them. Oddly enough, getting super growth seems to cancel out a seed set. At one time it took Florida growers 70 to 80 days to grow a seed bearing bean crop, but now they are down to between 30 and 40 days.
WHEELER: If the plant is a legume, such as alfalfa, clover, soybeans, peas, or dry beans, root

examination should include nodule observation.

BEANS, SOY

`BEANS, SOY

ADVANCED AG: There are some crops that ordinarily are a no-no. Only grow tomatoes under contract to a canning company. Soybeans are no-no because someone else determines the price.

ADVANCED AG: Some types of alfalfa, corn, or soybeans require less water than others. Experiment and discover them.

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.

AG LECTURES: 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 am talking about the dry or comparatively dry that stacks up under the cages.

ANATOMY: As you read the following recipes, keep in mind that today we must ensure that the ingredients, such as soy and corn, are GMO free.

ANATOMY: There are several chemical companies that add humic acid to their herbicides to buffer the damage done to the crop it is used on, such as soybeans.

ANDERSEN SCIENCE: To notice that one field of beans has a sheen and the adjacent field does not indicates a difference in nutritional balance.

BEDDOE BI: 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.

ENERGY RESEARCH: You want leaves early in the spring for your corn, soybeans, lettuce, romaine lettuce, cabbage or anything where you want growth. Even on your small grain, you want growth and that is when you use your nitrate nitrogen. That is why it is important in your spray formulas to have some for m of nitrate nitrogen.

ENERGY RESEARCH: It [field of healthy corn, beans, or oats] is kind of a miserable place for insects. If they happen to stop and have lunch there, the juices are so strong that if it doesn't electrocute them, it will get them some other way.

FOLIAR FEED 1981: Student: When should we last foliar feed soybeans? Reams: About 5 weeks after blossoms are done.

FOLIAR FEED 1981: Also add iron chelate or iron sulphate *[to soybean foliar formulas]*.

FRANK: Adding a surfactant and transporter designed to reduce surface tension sharply increased leaf absorption and flow of nutrients from leaves into the filled pods and beans. Thus both absorption and translocation were enhanced.

FRANK: The use of Non-GMO soybeans fermented into soy sauce is fine to use in my book but consider the fact that 90 percent of the soybeans planted in the U.S. are genetically altered.

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...

PLANT FEED 1976: On the other hand, you want to keep a high manganese if you grow such as wheat, corn, peanuts, or soybeans. It is important to zero in on this for economics. However, you really pay little attention to this as a backyard grower because soil analysis expenses can run away on you.

PLANT FEED 1976: One of the finest things you can do for all of your crops to get your nutrients and minors is to spray with a homogenizing sprayer under the leaf. In 2 hours time you can tell the difference by the looks. This is the way we did it with the beans to shorten the time. It has to be a liquid plant food on the frequency of the plant that you make up yourself. It is highly profitable.

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.

SKOW: If the manganese uptake is sufficient for soybeans, flowers won't drop off. The plant will continue to set pods. After that there will have to be sufficient cationic fertility to deliver the beans set up by ample flowering.

SKOW: The home grown beans that were beneficiaries of Biological Theory of Ionization treatment presented a lush, straight stand from one end of the field to the other. Not one seed seemed to fail. The

commercial seed was marginal. The Biological Theory of Ionization seed exhibited potential five-fold stronger.
WHEELER: If the plant is a legume, such as alfalfa, clover, soybeans, peas, or dry beans, root examination should include nodule observation.

BEETLE

`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.
ANATOMY: Sequential Nutrient Deficiency table lists "beetles" and associated deficiencies.
ANDERSEN SCIENCE: Squeeze the juice from the stalk next to an ear and take a refractometer reading. I f 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 SCIENCE: Pollination is a critical stage in crop production. In corn, extremely hot days often impair pollination; adult corn rootworm beetles hinder pollination by chewing off the ear silks. Nutritional levels seem to be the most limiting factor, however.
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 FEED 1976: 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. Pu t 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.

BEETS

`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 you r 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 th e 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.
ANATOMY: Beet sugar is genetically engineered [GMO] and sprayed with glyphosate, so avoid completely.
ANATOMY: Select sugar cane molasses over beet molasses. The mineral content and palatability of the sugar cane molasses are usually better.
ANDERSEN SCIENCE: 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 SCIENCE: Sugar-beet lime—fair [calcium source], depending on area of the county and the soil it is going on; inferior to CaCO3.
BEDDOE BI: 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 BI: 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 o f phosphate than ordinary lime due to the process it went through.
BEDDOE NOURISH: If you are adventurous and want to try other compost enhancers, then there are suc h things as bacterial additives, yeast, rock dust from rock crushers, decomposed granite, bat guano, citrus or beet pulp, black peat moss and kelp.
FOLIAR SEMINAR 1983: Sugar beets should be 4 lbs each & planted in 6 inch rows in beds & watered in beds. Sugar beets double in last weeks if they have enough water & TDN.
FOLIAR SEMINAR 1983: Foliar formula for red beets is the same as for sugar beets,
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.
GARDENING: Phosphate is what determines the amount of sugar that's in the leaf and in the carrot, in th e potato, in the beet and everything else.
PLANT FEED 1976: Sugar beets will vary in content according to the phosphate in the soil . 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. S o is watercress. Watercress has high magnesium in it, and so do some mangoes.

BICARBONATE

`BICARBONATE
ANDERSEN SCIENCE: Also, the elevated blood ammonia levels can result in nitrates in the blood, both of which (N03 and NH4) lower the blood's oxygen-carrying capacity, further reducing the animal's natural defenses and energy levels. All of these symptoms can be attributed to improper diet and poor feed quality , causing rumen malfunction. In an attempt to prevent the chain of events outlined above, nutritionists add sodium bicarbonate to the feed to buffer the rumen so that it does not become too acid. However, sodium bicarbonate is not saliva and therefore does not contain the ptyalin and other enzymes necessary for digestion of starch and other compounds.
FOLIAR SEMINAR 1983: When building foliar spray, use bicarbonate, calcium hydroxide, or calcium carbonate to keep it at or above 7 pH.
SKOW: Sodium bicarbonate is in the list of known water contaminants.
WHEELER: Nutritionists often rely heavily on an approach which involves the use of buffers (sodium bicarbonate) to raise the pH of the rumen or digestive juices. This practice is an admission of improper functioning of the animal usually due to lack of long-stem fiber stimulation in the rumen.
WHEELER: High producers generally use too much sodium bicarbonate in feeding steers and dairy cows and the result is the animals don't produce enough bicarbonate from their own saliva.
WHEELER: Even if you have great forages in the field, you can still lose quality before it reaches your livestock. The first way is to chop too short. Not only do you lose more fluids (sugar and energy), but you can lose your butterfat potential. The butterfat level is largely a function of the tickle factor of longer stems in the rumen plus the natural bicarb [bicarbonate] production of the cow. Try to stay at an inch or longer.

BIOLOGICAL

`BIOLOGICAL
ANATOMY: Nutrients in all biological life, including soil, are transported via electricity.
ANATOMY: We still have a lot of work to do, but the grassroots movement in biological agriculture is strong and much larger than in 1989 when the first edition of this book was published.
ANATOMY: Ideally (since it is the foundation element upon which all else is built), when calcium is sufficiently present, the biological entity, whether it be a single cell, a plant, an animal or human, is able to discard toxins readily and does not have any magnetic attraction for environmental toxins such as pesticides, herbicides, or drugs.
ANATOMY: Biologically active carbon is not always that found in humus. Under sterilization fertility programs the humus also becomes sterile and actually forms a carbon salt or chlorinate hydrocarbon.
ANATOMY: This [root residue] is sixty pounds of organic material, including carbohydrates, enzymes, vitamins, and minerals, to add to the soils fertility provided there is a living biological system to process it.

ANATOMY: Many soils show a high level of phosphate, but in these insoluble forms. it requires rigorous biological activity to solubilize the calcium and phosphate, or strong reagent chemicals to break the bonding.
ANATOMY: Some patterns and frequencies are detrimental to biological life and some are beneficial. Our goal is to minimize the detrimental and maximize the beneficial.
ANATOMY: Composting gives nutrients to the biologically active organic forms essential to self-sustaining soil.
ANATOMY: There are very few sources of carbon per se. It is an element best obtained by biological activity.
ANATOMY: Carbon is the element that makes anything organic. It is the primary buffer in the biological world. Without carbon there is no stabilization of nutrients.
ANATOMY: If the biological balance is disrupted by the misapplication of mineral elements, this causes electrical chaos, which leads to the degeneration of biologically active carbon.
ANATOMY: When carbon is deficient, the nitrogens can form nitrogen-funny proteins, nitrites, and nitrous oxides, the latter two always toxic to biological life.
ANDERSEN SCIENCE: 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.
ANDERSEN SCIENCE: 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 SCIENCE: Colloidal particles are the key to biological systems.
ANDERSEN SCIENCE: The biologically active carbon (humus) content of the soil determines its sustainability, efficiency, and productivity.
ANDERSEN SCIENCE: Common carbohydrates are sugar, molasses, humic acid, humates, fish meal, seaweeds, algae, yeasts, enzymes, biological brews, whey, and so on.
ANDERSEN SCIENCE: From a physics viewpoint, we can say that fertile soil is a living biological system. Plants are antennas plugged into the soil and function in direct proportion to the stability of the energetic characteristics of the soil. These soil characteristics are directly correlated to the biological integrity of the soil. Therefore, soil fertility is directly proportional to biological activity.
ANDERSEN SCIENCE: Eventually, all herbicides and insecticides will be eliminated from the program. The y do as much as or more than anything else to inhibit the regeneration of the biological system in the soil .
ANDERSEN SCIENCE: Such an awareness *[Reams lessons about biological life]* allows one to notice that a particular flock of chickens cackles more than or at a different pitch from another flock, and encourages the sensitivity to observe that one hen house is two degrees cooler than another without looking at a thermometer.
ANDERSEN SCIENCE: Quoting Weinstein: "*The more intense the growth of microbes, the faster the decomposition process of substances. Certain compounds, for instance, tricalcium phosphate, do not dissolve in the sterile rhizosphere of plants, but when soil microbes are added to the vessel the substance becomes available to the plants."* The above cited work is of particular interest because it points out that the availability of plant nutrients is a biological phenomenon as much as or more than it is a chemical phenomenon. Carey Reams repeatedly stressed this, and Dan Skow still does.
ANDERSEN SCIENCE: Sources of phosphate are: Mycorrhiza fungi—varies with bioactivity, good.
ANDERSEN SCIENCE: Therefore, the response of earthworms to various environments accurately represents desired biological compatibility.
ENERGY RESEARCH: Student: Is calcium carbonate 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.
ENERGY RESEARCH: You must avoid anaerobic conditions. Essentially, this is where the ground crusts over and then your aeration and normal biological system cannot work.
ENERGY RESEARCH: Calcium is needed more by weight and volume than any other nutrient for biologica l life.
ENERGY RESEARCH: Skow quoting "Rules of Biological Life": Plants live off of the loss of energy from the elements during the synchronization of these elements.
ENERGY RESEARCH: The primary electrolyte in biological life is nitrogen.
FOLIAR FEED 1981: NOTE: *Reams insisted that grapes in certain areas had to be toxic sprayed to deal with Blossom spiders. He suspected they bred in the sand and he never found a biological way to deal wit h their silk binding up the grape blossom.*

FRANK: Soft rock phosphate is this colloidal clay impurity. What were the impurities? Clay and trace minerals. It has proven to be one of the best phosphate fertilizers for organic and biological growers.
MANTHEI GARDENING: Catalyst: any substance or compound that helps bring 2 or more elements, compounds, or substances together without becoming part of that union. Rain water the best catalyst in dealing with biological life.
SAIT: Andersen: For example, using liquid calcium with Vitamin B-12 and sugar is primarily a chemical catalyst to make calcium available, but introducing a microbial or enzyme-based material is a biological catalyst.
SAIT: Andersen: It is possible to build a good biological system without a microbial inoculation, simply b y the use of fish, seaweed, humic acid, composts and sugar.
SAIT: Andersen: However, from a biological perspective, the more fertile the soil is, the higher the magnetic susceptibility. It must be made clear that this doesn't guarantee that the higher the magnetic susceptibility, the more fertile the soil, because it depends totally on what makes up that magnetic susceptibility.
SKOW: When we study how Dr. Reams rated the different elements according to his biological theory of ionization, we have two complete opposites: one turning clockwise and one turning counterclockwise. This gives a tremendous energy release to the plant when these two elements are sprayed together. The problem has always been that when they were mixed, they formed tricalcium phosphate, which was not readily taken in by the plant.
SKOW: For instance, use of 18-46-0 in a high calcium soil will result in a rapid tie-up into tricalcium phosphate if the soil has low organic matter and low biological activity.
SKOW: Tricalcium phosphate is a highly insoluble calcium. I would not even consider it unless the price wa s extremely right and I had a biologically active soil.
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: 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.
WHEELER: These *[chemical supply trace nutrient]* 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: More permanent damage can be done by playing the high Brix game on a late fall cutting. If you are new to a biological program, your crop may not be able to sustain adequate sugars in the leaf and the roots for winter survival.
WHEELER: Ideally, bacteria will consume these fertilizers and hold them in the soil in the form of their ow n protoplasmic remains. Once this happens, the fertilizer is now considered stabilized and is not subject to leaching. It is available in a biologically active soil for the needs of the plant. It is extremely important, therefore, to use fertilizers and other chemicals which will feed the soil and not just feed the crop.
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.
NOTE: *There was concern when starting the literature search for "biological" that Reams Biological Theory of Ionization would swamp the results. Thankfully, it did not as the full term is seldom used.*

BLACK PLASTIC

`BLACK PLASTIC
ADVANCED AG: There are good reasons to grow on black plastic, not sandy, easy to harvest, no weeding.
ADVANCED AG: Black plastic allows for better irrigation on strawberries and helps with temperature control.
ADVANCED AG: Mulch is good idea, but black plastic not good idea on watermelons.
AG LECTURES: When stockpiling chicken manure, you ought to have a certain amount of moisture in it. You ought to get black plastic and put over it so it won't rain on it. Water on compost piles keeps your temperature too low. And you should let the temperature get up to 144°.
AG LECTURES: I suggest you put black plastic around tomatoes. Cover the ground with it. Try to keep their feet a little bit drier. Also have a lot of compost in the soil where you grow tomatoes.
BEDDOE NOURISH: The only time it is necessary to cover the [composting] stack is to keep off excess rain. If rain is a problem, cover with a plastic tarp [black or clear] that has one-inch diameter holes cut on a 12 inch grid.
FOLIAR FEED 1981: Reams: You can increase ionization by laying black plastic on the ground because

laid there it helps conduct electricity.
FOLIAR SEMINAR 1983: If your honeydews are bothered by anthracnose [fireblight], experiment with growing them on black plastic as that may prevent much trouble from coming out of the ground.
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.
WHEELER: Some of Dr. Wheeler's clients are running as high as 1,200-2,000 ERGS under plastic with dri p irrigation and achieving excellent results.
WHEELER: Utilize plastic mulch [as an IPM adjunct].

BLIGHT

`BLIGHT
AG LECTURES: Student: Are you going to discuss anything about the tomato blight that's common here in the south that they don't have in the north? Reams: I don't know of any blight that you have here and not up there. Student: I never had any black blight in tomatoes up north, but I've got it down here. Reams : Black blight in tomatoes is caused because there's too much potassium in the soil.
ANATOMY: Diseases are self-destruct or red-light mechanisms with the same purpose---to signal a minera l deficiency or imbalance. Correct the deficiency and the disease disappears. You can prove this for yourself by the same method as for the insects, only this time monitor the potato plant for blight or some other malady.
ANATOMY: Sequential Nutrient Deficiency table lists various "blights" and associated deficiencies.
ANDERSEN SCIENCE: Zinc helps to make acetic acid in the root to prevent rotting; it is used to control blight and allows dead twigs on trees to shed off.
BEDDOE BI: As far as excess potassium problems, this is noted by blight and related infections.
BEDDOE BI: The chelates Manzate and Zineb can be used to help control some types of blight. When use d for this do not use at the same time or will require a larger amount of each.
ENERGY RESEARCH: 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 acetic acid in the root to keep it from rotting.
FOLIAR FEED 1981: Leaf blight is a zinc deficiency.
FOLIAR FEED 1981: You can use some Nemagon on tomatoes for blight, but don't use it on peppers.
FOLIAR SEMINAR 1983: *[There are two tracks in which anthracnose is mentioned as hard on honeydew and also that anthracnose is fireblight caused by manganese and iron deficiency.]*
MANTHEI GARDENING: Manganese and zinc deficiency causes tomato blight.
SKOW: If potassium is replacing calcium in the leaf, both the leaf and the stem will exhibit small black specks. This is often diagnosed as blight, but treatment with sprays won't make the spots disappear.
WHEELER: Although most farmers spray toxic chemicals for blight, fungus or insect control, it is obvious that supplementing these toxic sprays with a good nutritional "diet" will be very effective.

BLOOD

`BLOOD
AG LECTURES: If you are feeding the cow a lot of alfalfa, you need to feed some wheat to offset the tendency of alfalfa to make the blood too thick. If you thin the blood a little, the cow will produce a lot more milk.
AG LECTURES: 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: Student: Alfalfa must be good for us, if you grind it up and eat it or something? Reams: It thickens your blood. It is certainly a good thing for people who have blood [clotting] problems. It is rich in Vitamin K. Student: Then people who have low calcium can go on alfalfa? Reams: No, you could have low calcium and thick blood, too.
ANATOMY: Refractometers are used extensively in industry and research fields for measuring the concentration of all kinds of aqueous solutions such as pharmaceuticals, tissue fluids in plants, and urine and blood protein.
ANDERSEN SCIENCE: The pH of cow urine should be around 7.4. If the pH is much higher than this, ther e is a possibility that the rumen is malfunctioning, allowing too much free ammonia to pass into the blood.
ANDERSEN SCIENCE: When there is excess nitrogen in the blood (electrolytes), the body attempts to discharge it in every possible body excretion, including milk. Consequently, the conductivity reading of the milk increases and the integrity of the milk further deteriorates until the conductivity reaches 6800 micromhos, at which point it becomes suitable for pathogenic proliferation and eventual clinical mastitis.

NOTE: *When studying this item, consider the possibility of human similarity.*
ANDERSEN SCIENCE: A number of other maladies are associated with digestion, particularly rumen malfunction. As the blood becomes loaded with more and more debris, such as NH4, CO2, and so on, the animal's body attempts to eliminate this waste in every possible body excretion. One place it dumps the waste is in the lungs. As in the mammary glands, this extensive dumping causes debris buildup. As debris, especially anaerobic gases, builds up in the lungs, congestion sets in and the ideal atmosphere for pneumonia pathogens is put in place and pneumonia develops. Again, the cause is a malfunctioning rumen.
ANDERSEN SCIENCE: Also, the elevated blood ammonia levels can result in nitrates in the blood, both of which (N03 and NH4) lower the blood's oxygen-carrying capacity, further reducing the animal's natural defenses and energy levels.
ANDERSEN SCIENCE: 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 buildup 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.
ANDERSEN SCIENCE: Antibiotics make the villi membrane walls more permeable or porous so more nutrients can pass into the blood stream. However, this also makes it easier for pathogens and toxins to enter the blood stream, resulting in greater blood toxicity, liver and kidney stress, and chronic subclinical and clinical infections.
BEDDOE BI: If a fertilizer is 50% organic, that means that 50% of the nitrogen comes from a fertilizer source containing carbon such as dried blood, cottonseed meal, or synthetic organics like urea.
BEDDOE BI: Without the colloids in the bones of animals and man the weaker the skeletal structure will be. The weaker the bony structure, the poorer the blood formation, because the blood is ionized in the bones and the more mineral in the bone the better the ionization process.
BEDDOE NOURISH: One farmer who has used soft rock phosphate with the proper amounts of calcium on his land for years, showed some cross sections of long bones from cattle he had raised. It was amazing to see what is considered “normal” for cattle bones is a large spongy marrow, while the bone marrow area on his cattle looked very small. In fact, the cross sections of the highly mineralized cattle looked almost like solid ivory with small blood channels. When compared to cross sections of long bones from the usual slaughterhouse animals, you could see that what is typically considered healthy animal bone is in fact bone in the advanced stages of osteoporosis. This is nothing but plain mineral deficiency, resulting from ongoing and unnatural degeneration, primarily from lack of phosphate electro-chemical compound colloids and calcium.
FOLIAR SEMINAR 1983: "Protein" shortens production life & causes heart attack because it is indigestibl e so builds up in blood. NOTE: *Be wary of "protein" that is nothing more than a calculated value of raw nitrogen multiplied by 6.25 to give a percentage.*
FRANK: As an example let’s look at copper. You [and livestock] have a physiological need for copper. This element helps blood vessels and arteries remain elastic. It does the same thing in the colon. Copper also helps fight fungal imbalances.
FWTK: If a fertilizer is 50% organic, 50% of the nitrogen comes from a fertilizer containing carbon such as dried blood, cottonseed meal or synthetic organic like urea.
PLANT FEED 1976: Even cottonseed meal, horse manure, bat droppings from caves, dried blood, tankage, rice hulls or any or these things [can be used to make organic fertilizer].
SKOW: All life forms have their circadian rhythms. The breath of life, the heart beat that pumps 60 gallons of blood an hour in the human being, the times for nutrient intake, for sleep, for all the functions of life, are not governed by chaos, but by rhythm.
WHEELER: Tankage usually consists of rendered, dried, and ground waste of slaughtered animals, i.e., hides and blood.
WHEELER: However, all the chemistry aside, Dr. Reams felt the concept was flawed. He argued that in a laboratory situation, the idea of measuring the absolute amount of H+'s in a water solution provided a workable concept (pH). But when you work with a living solution, as in human blood or a soil solution, he felt the other materials in the blood or soil couldn't possibly allow you to measure the actual amount of H+ ions with the same meter accuracy because now you have an interference factor. Now the H+'s have to fight their way across the space between the pH meter electrodes and this effect would alter how many H+'s were measured. It's like saying you can run the length of a football field just as fast dodging all the players on it as you can doing a straight 100-yard dash.
WHEELER: [Excess] Nitrogen is a big problem for cows (particularly dairy), because what you create is a condition known as BUN, blood urea nitrogen. BUN conditions are not natural; they come about from the

feeding process. The cows won't breed, they abort, develop mastitis that won't clear up, and experience poor feed conversion.

BLOSSOM

`BLOSSOM

ADVANCED AG: Tomatoes that appear all vine can be induced to blossom with cationic substances such as vinegar.

ADVANCED AG: Apple or citrus trees always bear because they have both male and female blossoms.

AG LECTURES: There is a delicate balance in soil and you can usually switch it from anionic to cationic if the blossoms shed with no fruit.

AG LECTURES: What I am trying to tell you is how to produce higher protein hay. You cannot let it lay out there and have high protein hay. You must cut it at the blossom stage and if you cut it at that stage, you must dehydrate it.

AG LECTURES: ...when the blossoms starts to shed off, what are you going to do to stop it? Student: Add acid? Reams: Well, what is 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.

AG LECTURES: Do you know there won't be a week's 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 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 peaches that blossom anywhere, we'll say over a 40 day period, will mature at the same time?

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: What is 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.

ANATOMY: If you fertilize a leafy vegetable to encourage more growth, the possibility exists for the fruit producer to drop its fruit or blossoms or not set fruit.

ANATOMY: Sequential Nutrient Deficiency table lists "blossom end rot" and associated deficiencies Ca, P, Mn/Cu equally.

ANATOMY: [High quality] Oranges should have a five-star calyx on the blossom end.

BEDDOE BI: On those *[crops]* grown for fruit, seed, root, or blossom, such as corn, wheat, tomatoes, apples, etc., you use both nitrate and ammonia nitrogen at the proper times.

BEDDOE OT: Also, by applying manures as they should be, the nitrogen levels can be manipulated to regulate blooming in the spring. By spacing blooming over a longer period of time, there will be less possibility of losing all the blossoms to frost before pollination.

FWTK: On those *[crops]* grown for fruit, seed, root or blossoms (corn, wheat, tomatoes, apples, etc.), both nitrate and ammonia is used.

FWTK: Ammonium nitrate has both nitrate and ammonia nitrogen in it. It can be used in the spring to supply the nitrate for the growth of the plant. When the nitrate runs out (after about forty days), the ammonia becomes available, and makes flowers, blossoms and fruit.

FOLIAR FEED 1981: Student: When should we last foliar feed soybeans? Reams: About 5 weeks 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.

FOLIAR FEED 1981: NOTE: *Reams insisted that grapes in certain areas had to be sprayed to deal with Blossom spiders. He suspected they bred in the sand and he never found a biological way to deal with their silk binding up the grape blossom.*

FOLIAR FEED 1981: If everything seems right, but tomato blossoms fall off, it means the manganese is low.

FRANK: ...2 types of energy--those that increase the growth of stalks, stems, and leaves, i.e. growth energy, and those that increase the growth of flowers, blossoms, and pods being set, i.e., reproductive energy.

FWTK: The secret of a plant's frequency lies in its stump. The nutrients coming up into a plant in the sap pass through the stump, where they are formed according to the micronage of the part of the plant they are to become - a stem, a leaf, a seed, a blossom or fruit.

FWTK: When the nitrate runs out (after about forty days), the ammonia becomes available, and makes

flowers, blossoms and fruit.
FWTK: On those [crops] grown for fruit, seed, root or blossoms (corn, wheat, tomatoes, apples, etc.), bot h nitrate and ammonia is used.
FWTK-Original: Student: Why do my tomato and bean blossoms shed off instead of making fruit? Reams: When there is too much nitrogen in the soil, the blossoms flush off instead of setting fruit. The same is true of any trees or plants that do not set fruit.
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 is 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.
GARDENING: Many people lose their crop because they fertilize the tree when it's in blossom. It flushes all the blossoms off.
PLANT FEED 1976: Did you ever see a little plant such as tomato or cucumber go to blossoming before i t ever started growing? It is the soil. It is too acid when that happens.
PLANT FEED 1976: The reason I selected citrus to discuss is that there is a cute little phenomenon about citrus different from all other plants. The male blossom petals of citrus have four petals and the female ha s either three or five petals. This does not hold true elsewhere in the plant realm.
PLANT FEED 1976: When all the blossoms fall off your fruit trees, there is too much nitrate nitrogen in th e soil. If you can save 10% of the blossoms, you will have a normal heavy crop.
PLANT FEED 1976: Alfalfa is a grass and if the 1.5-.5 ratio between your P2O5 and your potash gets higher than that on alfalfa, you know what's going to happen? It will go to blossom when it is waist high. NOTE: *In other places it is clear that Reams meant that the phosphate:potash ratio should not narrow to less than 4:1. In this document Reams then held out the possibility that alfalfa should grow 12 feet high.*
PLANT FEED 1976: Most plants will not have a base exchange until it starts to blossom or fruit or both.
PLANT FEED 1978: You must spray grapes the first six weeks after they start blossom. You can use pyretheums, Black Leaf 40, snuff or various other treatments to deal with the Blossom spiders.
SKOW: A half gallon of vinegar with a quart of Bo-Peep *[ammonia]* in 20 gallons of water made a perfect spray for the crop *[that had no blossoms].*
WHEELER: Alfalfa, lettuce or spinach that goes to blossom or bolts early indicates a fertility imbalance situation that may be worsened by weather extremes.
WHEELER: When farmers inquire 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.
WHEELER: Its use *[muriate of potash]* will cause growth to occur, but the alfalfa will produce hollow *[no pith]* (empty) stems, will bloom before potential growth has occurred, and will be high in both nitrates and potash.

BLUE MOLD

`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 fro m rotting off at the ground? It's a germicide, it kills the blue mold.
AG LECTURES: 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 gives you greater yields. It's a germicide [fungicide?].
AG LECTURES: Student: Copper sulfate *[bluestone]*, how much per acre? Reams: For blue mold? Generally 6 oz per acre for 100 gallons of spray, providing your 100 gallons of spray would cover it *[the acre]*. If you're homogenizing it, it will cover a lot more than that. Whether or not your spray is homogenized or not, use the came concentration. Do you understand what I am saying? It makes no difference whether or not your spray is homogenized or not, use the same concentration. But it goes a lot farther with a homogenized spray.
ANATOMY: Sequential Nutrient Deficiency table lists "blue mold rot" and associated deficiencies.
BEDDOE BI: 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.
FOLIAR FEED 1981: Reams urges his farmer audience to foliar feed the soil pre-plant so as to head off blue mold, cutworms, nematodes, wireworms, loopers, aphids, and other pests before they get a chance t

o cause harm.
PLANT FEED 1976: There is only one reason why blue mold is present on a young plant. For lack of copper---a deficiency in the plant.
PLANT FEED 1976: Blue mold points to a copper deficiency. *[Adequate copper]* allows bark to stretch.
NOTE: *Fungi and bacteria are antagonistic. The astute observer understands that there is a reason we have "fungicides" as opposed to "bactericides." However, what is a "germicide"? Does such a substance affect both equally? What are "microbes"? As you study these notes, you will soon learn that some teachers, including Reams, were less than specific.*
See entries MOLD/MILDEW, GERMICIDE, FUNGICIDE

BO-PEEP

`BO-PEEP
ANATOMY: Use the form of nitrogen best suited to the growth stage, such as nitrate or ammonia, in a for m such as calcium nitrate, potassium nitrate, ammonium sulfate, household ammonia [Bo-Peep] , or ammonium thiosulfate.
ENERGY RESEARCH: 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 *[ammonia]* despite what he says there.
SKOW: So I told the tomato grower to purchase apple cider vinegar for carbon *[cationic energy?]*. A half gallon of vinegar with a quart of Bo-Peep *[ammonia]* in 20 gallons of water made a perfect spray for the crop *[that had no blossoms]*. Forty-eight hours later that tomato patch sported the most beautiful layer of blossoms ever. At the end of a week, the tomato patch was loaded with marble-sized tomatoes.
SKOW: My formula follows: Put in water, a humate, calcium hydroxide, magnesium sulfate, Bo-Peep *[ammonia]*, a special amine compound, Castor oil, sodium carbonate and water---it has to be distilled wate r or good reverse-osmosis water---and seaweed extract.

BORON

`BORON
ADVANCED AG: Optiumum boron is 4 pounds per acre. This can be higher if the TDN is higher.
ADVANCED AG: Celery or cabbage with rotten core has boron deficiency.
ADVANCED AG: Proper boron prevents grain from molding and fruit from rotting.
ADVANCED AG: If you have no pith at all in pasture grasses or alfalfa, you have boron deficiency.
ADVANCED AG: Excessive boron can be a problem for many years.
ADVANCED AG: Don't use chicken manure on strawberries because of the boron. Instead use soft rock phosphate.
ADVANCED AG: Adequate boron helps prevent mold from forming in hay that has been pelletized.
ADVANCED AG: Adequate boron is very helpful in keeping grains from molding.
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: Student: How do you go about marketing that quantity? Reams: Through your supply houses, your grocery chain will take all you've got if they are high quality strawberries that will hold up, won't rot, red all over, no hollow heart, and high sugar content. You may have to add a pound per acre of 20 Mule Team borax *[for boron]* to prevent hollow heart.
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 firs t 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.
ANATOMY: In the presence of excess boron relative to calcium, high salt, or sulfur conditions, a deficienc y of carbon may allow ammonification to occur, which is fatal to aerobic life.
ANATOMY: Avoid applying chicken manure compost on strawberries because it will make them taste wood y from the high boron content of that particular waste product.
ANATOMY: Boron is the key element for filling the center of stems and fruits. Hollow-stemmed grains and

alfalfa and hollow heart or black heart in potatoes is an indication of a boron deficiency.
ANDERSEN SCIENCE: 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 BI: In fact any hollowing of stems such as in lettuce and the hollow black centers of potatoes is a boron deficiency.
BEDDOE BI: 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 BI: Boron should be of concern for one important reason, sap flow. Boron is related to the plant stem pith development When there is a deficiency in available boron, the pith does not completely fill. This lack of filling will then interfere with the development of the part of the stem called the xylem in which the movement of the sap, with the mineral energy from the soil, flows into the plant. When farmers are asked whether their crops have hollow stems or not, most either have never paid attention or think that it is normal for most crops. What is not realized, is that hollow stems on grasses and forage crops, such as alfalfa, are not normal. It is an expression of phosphate of boron deficiency.
BEDDOE BI: Lack of boron also contributes to providing areas for plant pests to proliferate.
BEDDOE BI: Borax: Not a preferred source [of boron]. Best to use chicken manure tea.
BEDDOE BI: High boron--has been counteracted by the use of Bordeaux mixture, which is combination of hydrated lime and copper sulfate. Boron is a strong bacteria killer in excessive amounts. So if the soil has excess it will prevent bacterial growth.
BEDDOE BI: 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.
BEDDOE OT: Furthermore, healthy plants take a large part of the trace elements they need from the air. Magnesium, manganese, zinc, cobalt, copper, sulfur and boron are supplied in this way. The soil must contain proper mineral levels, however, for this process to take place.
BEDDOE BI: When there is a deficiency in available boron, the pith does not completely fill. This lack of filling will then interfere with the development of the part of the stem called the xylem in which the movement of the sap, with the mineral energy from the soil, flows into the plant.
BEDDOE NOURISH: High TDN (Total Daily Nutrient) is very important as a preventive of boron toxicity. The higher the phosphate, the more of all trace elements you can get away with before toxicity sets in.
BEDDOE NOURISH: Boron: Deficiency: poorly developed pith in the plant stem which interferes with sap flow plant growth, thus reducing yield and health. Hollow stems as well as some fruit will split. Excess: can cause toxic nitrite formation on high chloride soils, toxic to bacteria.
BEDDOE NOURISH: High TDN (Total Daily Nutrient) is very important as a preventive of boron toxicity. The higher the phosphate, the more of all trace elements you can get away with before toxicity sets in.
ENERGY RESEARCH: 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.
ENERGY RESEARCH: But if the carbons are low and you have an excess of boron in relation to calcium o r a high salt or sulfur content, you can get ammoniation of the plant. What it does is simply kill them.
ENERGY RESEARCH: Now another thing you don't do is to use boron on strawberries because it will mak e them go to seed and become hard.
ENERGY RESEARCH: 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.
FOLIAR FEED 1981: Boron makes pith and is a germicide except in chicken manure because the calciu m makes it non-toxic.
FOLIAR FEED 1981: Copper and boron in the same spray tank are a no-no because of cross purposes.
FOLIAR SEMINAR 1983: Hollow stems in any crop is a boron deficiency.
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 boron in the nutrient solution to kill them."

MANTHEI GARDENING: Boron deficiency is evidenced by hollow stems or rotten centers. A black heart in a potato is also a boron deficiency. Boron is a germicide.
PLANT FEED 1976: Reams: If you had grass that had a hollow stem *[no pith]* what kind of fertilizer would you use? Student: Chicken manure? Reams: That is right---chicken manure---why? Student: It has boron in it? Reams: Right.
PLANT FEED 1976: 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 FEED 1978: If you have enough boron in your soil it will prevent the nitrate from turning to ammonia.
REAMS/SKOW COOK: This grapefruit I am holding has a tight core in the middle. A lot of them are hollow 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.
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.
SKOW: If you know what a healthy crop looks like, then you can measure your success. When you go to a grocery store to buy cauliflower or broccoli, examine the produce to see if it has a hollow area in the stem. If it has such a spot, it has a boron deficiency.
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: Boron is a natural germicide. It is used generally as a wash disinfectant.
SKOW: Hollow stem is the favorite indicator *[of boron deficiency]*, not only for alfalfa, but also for cauliflower and broccoli. This may or may not be the case, there being so many other possible deficiencies, any one of which can affect the color.
SUCROSE: ...by first noting some things that will decrease yield: #15. an oversupply of nitrogen salts, potash salts , 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.
WHEELER: Calcium, boron, iron, magnesium and molybdenum tend to remain in the leaf after they are absorbed and have little tendency to translocate.

BRIX

`BRIX
ADVANCED AG: Brix is a shortcut to measuring your mineral content.
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 is not. The law says it has to have Brix of 9.25 in order to ship (which is too tart).
ADVANCED AG: A high Brix strawberry is uniformly red. If the tip is redder, it is a third rate strawberry, probably sour.
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 to start about 4 o'clock in the morning to cut them and then about 10 o'clock start putting them in your Harvestore. 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.
ANATOMY: As a broad generalization, produce over 12 Brix is considered good because crops above this value are usually not bothered by insects or diseases, so the produce will be fit for human and animal consumption according to the law of natural selection. Keep in mind that this 12 Brix is from the weakest part of the fresh plant, 24-7. In other words, if we check sweet corn and the ear is 24 but it is still infested with ear worms, one will find that the stalk opposite the ear shank will have a Brix less than 12. Further, understand that the longer fruit and vegetables sit around after harvest the more they dehydrate. This dehydration will result in a higher Brix reading so one can be deceived into thinking this is an excellent frui t or vegetable. The reading at time of harvest is the more correct indicator of absolute quality.
ANATOMY: This is done by growing plants at or above minimum Brix values and observing that they are completely free of all the maladies and infestations that plague the conventional system.
ANATOMY: It is possible, though not very common, to get a relatively high Brix reading with the refractometer and not have a premium quality item. Probably the most common occurrence of this is when sweet corn ready for harvest has a high Brix reading in the ear though it is infested with corn ear worms.
ANATOMY: It [higher Brix crop] will produce more alcohol from fermented sugars and be more resistant to insects, thus resulting in a decreased insecticide usage.
ANDERSEN SCIENCE: Squeeze the juice from the stalk next to an ear and take a refractometer reading. I f 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 SCIENCE: 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 SCIENCE: 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 SCIENCE: The belief that healthy soil grows weeds equally as well as the desired crop is base d 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!
ANDERSEN SCIENCE: 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.
BEDDOE BI: The basic goal that any farmer ought to set is to produce 45,000 lbs. of produce at the highest Brix reading per acre of land whether it is alfalfa, watermelon, or apples.
BEDDOE BI: A dairy cow which is eating alfalfa that has a 16 Brix sugar level will need only 10-12 pounds of 12 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.
BEDDOE BI: Brix is a unit of measure used in the refractometer. When the Brix reading is divided by 2 i t will be equal to the percent of crude sucrose in plant tissue.
BEDDOE NOURISH: When the sugar content of a plant, as measured by the refractometer in Brix is unstable—changes in time of day as well as weather can cause large drops in Brix reading—the nitrogen is not in the right ratio with the phosphate. When the ratio of phosphate to nitrogen is at its best, the Brix reading will range within one to two points in each 24 hour period that the Brix level is checked.
FRANK: I had to create a new classification for beans less than 4 Brix. I called them *Deficient*.
FRANK: Duane: The third time I went in the health food store with the high Brix tomatoes, I had them bagged up and the owner's wife was there at the counter. When she saw the tomatoes, she said, “Duane, they are not going on the shelf. Those are going home with me. I'm gonna be selfish.
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.
NOTE: *Be wary of wrong comparison because in various places Reams says that a Brix reading is 1/2 sugar.*
FWTK: The average reading you will find in oranges is nine to 10 Brix, but it should be sixteen to 18 Brix.
FWTK: If they offered a horse or cow some carrots with a sugar content of 12% Brix and some with 7% Brix, the animal would eat those with the highest sugar content.
PLANT FEED 1976: 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: 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.
SAIT: Andersen: Let's take sweet corn as an example. You may take a reading of the ear and you may have 24 Brix, yet the corn borers are running rampant. What you will find with that sweet corn 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: 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.
SKOW: Vitamin B-12 added to sprays on a regular basis not only improve flavor, it also presides over improved Brix readings.
SKOW: In order to keep all insects out, the *[corn]* stalk sap must be above 12 Brix before it confers complete insect resistance.
SKOW: Parenthetically it may be noted that soft rock phosphate is the one soil additive most likely to affec t Brix readings favorably.
SKOW: There is not one chemical of organic synthesis---pesticide, fungicide, herbicide---that can raise anything even one Brix degree, and therein lies a distinction.
SKOW: My experiences suggest that if you kick dry water-solubles or even N , P and K [NPK] formulations with fish and seaweed extracts, the resultant impact can be breath-taking, more so than if any one of the kickers is added singularly. These materials are quite compatible. By marrying fish and seaweed extracts, the combination can have a fantastic effect on 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: More permanent damage can be done by playing the high Brix game on a late fall cutting. If you are new to a biological program, your crop may not be able to sustain adequate sugars in the leaf and the roots for winter survival.
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.
WHEELER: *[Higher Brix plants]* will produce more alcohol from fermented sugars and be more resistant to insects, resulting in a decreased insecticide usage.
WHEELER: This can be shown by taking refractometer readings and observing that the Brix reading measured as percent sucrose on attacked plants is lower than plants not being attacked. The Brix reading i s a good indication of the efficiency of the plants' output of carbohydrates which is the result of photosynthesis.
WHEELER: Crops may test below the poor or above the excellent readings. Within a given species of plant, the crop with the higher refractive index [Brix] will have a higher sugar content, higher mineral content, higher true protein content, and a greater specific gravity or density.
NOTE: *"Brix" refers to a measurement scale of degrees developed by Professor A. F. W. Brix and is capitalized similar to Celsius or Fahrenheit. The common Brix charts showing the values of poor, average, good, or excellent produce were developed by Dr. Carey A. Reams.*

BROADCAST

`BROADCAST

AG LECTURES: Reams: What is a "soil" top-dressing? Student: Something you broadcast on the soil to make a late change adjustment to? What is the difference between that and a side-dressing? Reams: There is a lot of difference. Top-dressing is any plant food containing more than 16 units of nitrogen products. It does not contain any appreciable phosphate. If it contains phosphate it's a side-dressing. If your soil is low in potash you could apply some as a part of the top-dressing.
AG LECTURES: Student: Do you dress the sides of the row with manure? Reams: You put your compost in the row. Your manure, you broadcast it.
ANDERSEN SCIENCE: If we can at least get a foot in the door with inexpensive banding, then farmers see the results, and they begin to see the potential for improvement. Maybe they will be able to afford to broadcast after these improvements. We simply have to work with whatever parameter we are given. It is undeniably better to broadcast, but what happens when we can't afford the luxury?
BEDDOE BI: The best results come when you broadcast the fertilizers before planting; then placing them down the middle of the row when the crop is up. It is usually better to apply nitrogen in two applications: one before planting, and one after the crop is up. A single larger application results in a loss o f energy in the soil.
FRANK: With a drip tape underneath plastic, you can't do as much as you can with the broadcast, but yo u can change that little micro climate right around the roots and you can do a lot of good with that.
FRANK: Duane dug his 3 Brix carrots near the end of May and the children would not eat them. He applie d a broadcast mix at our suggestion and in the fall dug 13 Brix carrots.
FRANK: We must supply all minerals that are deficient including trace minerals and rare earth elements that are not even measured on the soil test. These minerals must be included in the yearly broadcast of minerals.
FWTK: Orchards and groves should be fertilized from tree to tree, so the fertilizers should be broadcast . This broadens the magnetic field and extends the spread of the roots, which results ultimately in higher yields.
SKOW: Calcium nitrate has been mentioned, 100% water soluble. It is not uncommon to use 100 to 200 pounds per acre on alfalfa, spread on a dry broadcast basis.
SKOW: A balanced plant does not broadcast any color prominence, just white light, which the insect's antenna is not designed to receive. In this way, nature purges the food chain of deficient foodstuffs and maintains healthy consumers on up the food chain. It is truly perfect divine order.
WHEELER: Thus, broadcast spraying only 10 pounds of 12-50-0 dry soluble fertilizer can sometimes provide adequate phosphate energy in a balanced soil to attract or release sufficient amounts of phosphate energy for successful crop use.
WHEELER: Correct magnesium deficiency problems using Epsom Salts or chelated forms of magnesium either broadcast or foliar applied. When soils are low in magnesium and in low-CEC soils, consider using dolomite in the prill-lime form.

BROCCOLI

`BROCCOLI
ADVANCED AG: It is best to plant broccoli, cauliflower, and cabbage on 30 inch rows raised on beds or mounds.
ADVANCED AG: While cabbage should routinely yield 20 tons, broccoli may be half that because it comes off as several cuttings and is much lighter.
ADVANCED AG: Keeping the carbohydrate *[Brix]* high in broccoli allows you to break it off instead of cutting. It is not good if it won't break.
ADVANCED AG: You should sell your broccoli to the plant *[processor*] except the third and last cutting ca n be bunched for sale to stores.
AG LECTURES: You certainly want to use anionic plant food on lettuce, cabbage, cauliflower, broccoli.
ANATOMY: Interference can happen when you fertilize a fruit or seed-producing vegetable so it will set fruit, that is, tomatoes, pepper, peas, beans, melons, squash, eggplant, corn, cucumbers, etc., when there is a leafy or non-fruit vegetable close by or next to it, such as celery, lettuce, broccoli, cauliflower, radish, carrot, romaine, endive, onion, collards, or cabbage.
ENERGY RESEARCH: When you build a spray for leaf crops you don't want to be adding manganese to it unless you are raising it for seed. Leaf crops would include spinach, lettuce, cabbage, cauliflower, and broccoli, things like that.
FOLIAR SEMINAR 1983: On cabbage, cauliflower, broccoli, strawberries, lettuce, and others, keep manganese low or they go to seed.
FRANK: We use a 2-5-0.2 fish from Dramm that is acidified with phosphoric acid. It is a great foliar spray but it is also strongly reproductive so do not use on growth dominated crops such as cabbage, spinach,

broccoli, or cauliflower.
PLANT FEED 1976: Commercial farmers should keep their manganese low if they are growing such as cabbage, head lettuce, broccoli, escarole, or romaine so that they don't bolt on you.
SKOW: Some farm crops go directly to the dinner table. In crops where the calcium has been replaced by potassium---lettuce, broccoli, Brussels sprouts, spinach---this causes heart trouble and kidney disease.
SKOW: If you know what a healthy crop looks like, then you can measure your success. When you go to a grocery store to buy cauliflower or broccoli, examine the produce to see if it has a hollow area in the stem . If it has such a spot, it has a boron deficiency.
SKOW: Hollow stem is the favorite indicator *[of boron deficiency]*, not only for alfalfa, but also for cauliflower and broccoli. This may or may not be the case, there being so many other possible deficiencies , any one of which can affect the color.
SKOW: Crops that need a lot of calcium are alfalfa---unless you're going to harvest the crop for seeds---lettuce, cabbage, broccoli, Brussels sprouts and spinach.

BURN

`BURN
AG LECTURES: 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.
AG LECTURES: It [compost] doesn't burn the plants. The raw manure creates a heat in the soil.
AG LECTURES: You who can get basic slag *[for calcium]* from the iron mills, it is an excellent product, eve n 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.
ANATOMY: When a farmer applies anhydrous, he uses a tool that knifes the ammonia several inches into the soil. It effectively reduces the usable oxygen in the soil needed by the aerobic microorganisms, burns the organics that include the microorganisms, creates an ash, and sets in motion the process by which formaldehyde and pathological organisms abound.
ANDERSEN SCIENCE: This *[burning out the soil]* is why anhydrous ammonia should not be used directly on the soil.
ANDERSEN SCIENCE: Dehydrated lime, burnt or calcined lime has had the water removed and is termed calcium oxide (CaO).
ANDERSEN SCIENCE: The *[ERGS]* 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.
BEDDOE BI: 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.
BEDDOE BI: 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.
FOLIAR SEMINAR 1983: Elements while synchronizing can generate much heat and can burn plants if in excess. A slow energy release is how plants grow.
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.
FWTK-pH: Excessive heat causes the roots to sweat or to be dehydrated. Moisture flows out instead of in. The process of osmosis can no longer function. Such conditions are called burning of the roots. The plant i s severely shocked and may die unless the condition is corrected or runs its course.
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.
PLANT FEED 1976: All plants can take all the magnesium they need out of the air. You do not have to ad d 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 the roots.
SKOW: When carbon — or generally the absence thereof — fails to maintain the peace between nitrogen and potassium, the fires of war erupt, and in the process plants get burned by the formation of resultant salts.

SUCROSE: When there is not enough water, raw manure salts may burn the roots.
WHEELER: Quick lime, CaO (46% 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: In composting operations, readings higher than 32 [rH]will have an excess of carbon dioxide which will be lost to the atmosphere---essentially the compost is burning itself up.
WHEELER: College courses are taught to convey the information needed to properly raise and care for livestock. However, the basic feed knowledge seems to have been somehow perverted into a system of requiring hormones, antibiotics, excessive proteins, and excessive silage. This perversion has resulted in a variety of problems involving early burnout of dairy cows, acidosis, anemic-looking eggs, chicken with no flavor, rejection of U.S. meats by foreign buyers, and anti-cholesterol (egg and dairy product) publicity.

BUYING/SELLING

`BUYING/SELLING
ADVANCED AG: When buying calcium, there is no way to know if one batch is higher in energy than another batch of the same type.
AG LECTURES: Student: How do you go about marketing that quantity? Reams: Through your supply houses, your grocery chain will take all you've got if they are high quality strawberries that will hold up, won't rot, red all over, no hollow heart, and high sugar content.
AG LECTURES: One of the greatest causes of farming failure is because the farmer buys stuff like fertilizers he already has enough of and doesn't buy what he really needs. So ignorance is the greatest cause of failure because he simply doesn't know.
AG LECTURES: It is not fair to you to sell top quality produce at the same price they are buying junk for. It's not fair to you. And if you don't know what you've got, no one is going to tell you.
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.
ANATOMY: Farmers have often been heard saying they aren't concerned with quality, just volume, because they are selling the crop anyway. What would you think of a doctor or pharmaceutical company with that attitude?
ANDERSEN SCIENCE: Animals that are fed alcohol are certain to need more mineral supplementation which is convenient if you are *[unscrupulous and]* selling both.
BEDDOE BI: When buying lime, the farmer has to be on guard against buying dolomitic lime. Some states allow the packaging of dolomite under the label called "Agricultural lime." So be careful what you purchase. For a lime to be acceptable, it is best to have a magnesium content less than 5%.
BEDDOE BI: Average corn seed will weigh approximately 56 pounds per bushel. Optimum corn can run as high as 66 pounds per bushel. With this information it can be seen that high quality seed corn is 17% heavier than the average quality seed. Not only is it heavier per bushel, but also as we said earlier there will be fewer seed per unit weight. This principle will be seen in most all seed buying and sowing *[selling?]* situations the farmer is involved in.
ENERGY RESEARCH: It is important to know who is making it if you are buying a commercial product *[i.e., foliar spray]* and whether they really do know or not whether it was put together correctly.
FOLIAR SEMINAR 1983: Make sure when buying liquid fertilizers that they contain no chlorides.
FRANK: Buying direct from the producer in bulk is one way to significantly cut down on your costs. This not only cuts out the expense of the middleman, it also means there is much less packaging and processing costs.
PLANT FEED 1976: 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.
PLANT FEED 1976: On the side of some refractometers you'll notice a small thermometer. In testing fruit juices for home use, you do not need to pay any attention to the thermometer. But, if you're buying juices commercially for canning in thousands and thousands of gallons, It is very important to pay attention to your thermometer. NOTE: *You can alternatively use an ATC (Automatic Temperature Compensated) refractometer.*
PLANT FEED 1976: I'm telling you that the public doesn't mind paying for top quality produce if it tastes good, but what they do hate to buy is trash for their family---junk. The housewife wants her family to have the very best. Let me tell you something else about good foods, they cost more, but you eat a lot less of them. *[Reams led up to this with a story about how as a young man he was able to sell mineralized blackeyes for 15 cents a pound when his competitors could only get 7 or 8 cents a pound. As the season went on, their peas dropped to 2 cents and Reams was able to get 10 cents as he sold all he could grow.]*
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 aroun d 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.
SKOW: It is safe to say that 75% of the monocalcium phosphate *[from factory acid treated hard rock phosphate]* reverts back to stable tricalcium phosphate within 90 days. In some soils the reversion takes place within hours. As soil conditions worsen, release of nutrients from rock phosphate worsens, and the chemical amateur becomes married to buying [*N-P-K*] salt fertilizers, each go-round worsening still further the structure of that soil.
WHEELER: The momentum of giant national and multi-national manufacturing companies assures the continued sale and use of toxic materials for a long time to come. Many of the chemical companies are now buying seed companies so they can breed plants which tolerate their chemicals.

CABBAGE

`CABBAGE
ADVANCED AG: Celery or cabbage with rotten core has boron deficiency.
ADVANCED AG: Cabbage should be planted 20,000 plants to the acre and 20 mature cabbage should weigh 50 pounds.
ADVANCED AG: It is best to plant broccoli, cauliflower, and cabbage on 30 inch rows raised on beds or mounds.
ADVANCED AG: While cabbage should routinely yield 20 tons, broccoli may be half that because it comes off as several cuttings and is much lighter.
AG LECTURES: Student: I've heard people, even doctors, say that collards do not have any food value. Reams: Collards are very rich in iodine and in iron, very rich. They have more nutrient than cabbage.
AG LECTURES: Reams: What happens to the milk when you feed your cows cabbage? Student: It tastes like cabbage? Reams: No it doesn't, it gets 'ropey.' The milk gets ropey and if they eat cockleburs, it will ge t ropey. Stringy, the milk will get stringy. Student: You mean a mastitis infection?
Reams: No, not mastitis. I'm not talking about mastitis. I'm just talking about the milk will be stringy. Student: You mean raw milk? Reams: Yes, it gets stringy.
AG LECTURES: Reams: Would you ever use manganese on cabbage or lettuce? Student: No. You're not working toward seed. Reams: That's right.
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've never had to add zinc to plants at all. I have made hydrogen peroxide of zinc in order to get the rotten cabbages out of our woods, in an oak or an orange tree or something, in order to keep the bacteria from rotting the limb off or something.
AG LECTURES: You certainly want to use anionic plant food on lettuce, cabbage, cauliflower, broccoli.
AG LECTURES: Reams: 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: Yes and what is the best way to get boron onto you r fields? Student: Chicken manure? Reams: Chicken manure is very rich in boron.
AG LECTURES: Reams: Can you figure out a bad worm diet, Floyd? Student: Spray them with nicotine? Reams: Right, that's exactly right. That's one thing you could do. Why would you use nicotine? Student: Because it's harmful to eggs, bugs and insects and safe for people. Reams: Alright, suppose you can't get it? You've got to try something else now. Student: Will Rotenone work? Reams: It's a little dangerous, because your cabbage has already begun to head up a little bit.
ANATOMY: Interference can happen when you fertilize a fruit or seed-producing vegetable so it will set fruit, that is, tomatoes, pepper, peas, beans, melons, squash, eggplant, corn, cucumbers, etc., when there is a leafy or non-fruit vegetable close by or next to it, such as celery, lettuce, broccoli, cauliflower, radish, carrot, romaine, endive, onion, collards, or cabbage.
BEDDOE BI: On crops that are grown for their leaves or stalk, such as cabbage, lettuce, celery, grasses, etc., you use nitrate nitrogen.
BEDDOE OT: An example of some of the commercial yields that are achieved under this program: 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, 2 to 3 bales of cotton per acre, 90 bushels per acre of wheat, 4,500 lbs. peanuts per acre, 40,000 lbs. per acre of watermelons at 12% sugar, 1,000 boxes of oranges per acre, 20,000 quarts of strawberries per acre at 10 to 20% sugar, 20 tons per acre of cabbages -the list goes on and on. Not only has he obtained this type of yield, but the quality is greatly improved.
ENERGY RESEARCH: You want leaves early in the spring for your corn, soybeans, lettuce, romaine lettuce , cabbage or anything where you want growth.

ENERGY RESEARCH: When you build a spray for leaf crops you don't want to be adding manganese to it unless you are raising it for seed. Leaf crops would include spinach, lettuce, cabbage, cauliflower, and broccoli, things like that.
FOLIAR FEED 1981: Add soft rock phosphate to homogenized spray to achieve sticker effect on waxy leaves like cabbage.
FOLIAR SEMINAR 1983: On cabbage, cauliflower, broccoli, strawberries, lettuce, and others, keep manganese low or they go to seed.
FOLIAR SEMINAR 1983: Potash on cabbage helps develop a larger caliber stem & more sap movement.
FRANK: We use a 2-5-0.2 fish from Dramm that is acidified with phosphoric acid. It is a great foliar spray but it is also strongly reproductive so do not use on growth dominated crops such as cabbage, spinach, broccoli, or cauliflower.
FWTK: On crops grown for their leaves or stalk such as cabbage, lettuce, celery, grasses, etc., nitrate nitrogen should be used.
FWTK: Reams ag shows the way to 20 tons of cabbage per acre.
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 acr e of watermelons at 12% sugar; 1.000 boxes of oranges per acre; 20.000 quarts of strawberries per acre a t 10-12% sugar; 20 tons per acre of cabbages - the list goes on and on.
GARDENING: Do you know in order to be US #1 cabbage you got to grow 19 cabbages to weigh 50 lbs.? Why? So some will be ½ lb. some will be 2 lbs. And this is the size the housewife wants.
GARDENING: [Crop rotation] is one of the worst scams that's ever been pulled on American farmers. Never, never, rotate crops! It doesn't make any sense. Did you ever see a peach orchard rotated? Or an orange grove? Or a grape vineyard? Or a pecan orchard? Do you rotate those? It's just as foolish to think about rotating an orchard as it is the cabbage field or green bean field or peanuts or popcorn or whatnot. So it's the idea of of rotating is to finally get the last little dab of mineral out of the soil, so the farm won't be any good any more.
PLANT FEED 1976: You want your good plants to reach their climax of nutrients at the stage you wish to eat them, 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.
PLANT FEED 1976: Commercial farmers should keep their manganese low if they are growing such as cabbage, head lettuce, broccoli, escarole, or romaine so that they don't bolt on you. On the other hand, you want to keep a high manganese if you grow such as wheat, corn, peanuts, or soybeans. It is important to zero in on this for economics. However, you really pay little attention to this as a backyard grower because soil analysis expenses can run away on you.
PLANT FEED 1976: 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, especially on cabbage, wheat, or oats. So many things in your grain growing and your truck growing will show a blue tint meaning it needs more fertilizer.
PLANT FEED 1978: Be sure and tell the brokers what you have and when it is coming, as it takes them a couple of years to know you are a grower. If your cabbage is high quality and high Brix, they will be bidding against each other soon.
PLANT FEED 1978: Starting with depleted land even if you apply everything I say, you will be lucky to get 10 tons of cabbage to the acre. However, you should get 20 tons the second year. Be sure and tell the brokers what you have and when it is coming as it takes them a couple of years to know you are a grower. If your cabbage is high quality and high Brix, they will be bidding against each other soon.
SKOW: Sodium nitrate is not often used anymore. It is used more in the food industry and the price has taken it out of the marketplace. It is a negatively charged element. It would prove useful on lettuce, celery , spinach and cabbage crops.
SKOW: Crops that need a lot of calcium are alfalfa---unless you're going to harvest the crop for seeds---lettuce, cabbage, broccoli, Brussels sprouts and spinach. If you want really crisp lettuce, calcium confers that crispness to the outer cell wall.
SKOW: Boron deficiency: Cabbage, oranges, apples split.
SKOW: He [Reams] was a consultant for a farm with 100 acres of cabbage. The weather forecast promised a heavy freeze, almost guaranteed to wipe out the crop. Reams knew that a heavy freeze would switch the soil to strong cationic in the absence of an anionic situation. Calcium hydroxide is a very powerful anionic substance. Reams had the farm workers trickle calcium hydroxide along the side of the cabbage rows in a line on top of the soil. These cabbage plants wilted and fell over, for all practical purpose s they appeared to be dead. But within 24 to 48 hours they came back, and by the end of the week they

were growing normally.

CALCIUM-MAGNESIUM RATIO

`CALCIUM-MAGNESIUM RATIO

AG LECTURES: You who can get basic slag *[for calcium]* from the iron mills, it is an excellent product, eve n 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.

ANDERSEN SCIENCE: If the calcium level is less than 2,000 pounds per acre, there will be possible energy-reserve deficiencies, weakened skin and cell strength, bruising susceptibility of fruit, soil compaction---especially if there is a narrow calcium-to-magnesium ratio (7:1)---weakened stems or stalks, and grass-weed problems. Further related to the calcium-to-magnesium ratio is the fact that a narrow ratio reduces nitrogen efficiency, requiring additional applications of that nutrient.

ANDERSEN SCIENCE: Adding high-calcium lime, one in which the calcium carbonate component is extremely dominant to a high magnesium soil might actually lower the pH.

ANDERSEN SCIENCE: 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 SCIENCE: Whenever there is less than a 7:1 calcium-to-magnesium ratio (Reams test), there will be an increased nitrogen demand because of less efficient nitrogen use, requiring increased applications of nitrogen fertilizer.

BEDDOE BI: Excesses of magnesium can cause soil compaction and loss of aeration. Magnesium should be kept in the correct ratio to calcium (Ca 7:1 Mg)

BEDDOE BI: Excess magnesium can be reduced by liming to keep it in an oxide form so it is insoluble.

BEDDOE BI: When buying lime, the farmer has to be on guard against buying dolomitic lime. Some states allow the packaging of dolomite under the label called "Agricultural lime." So be careful what you purchase. For a lime to be acceptable, it is best to have a magnesium content less than 5%.

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.

FRANK: Here is the pattern on the Morgan soil test to shoot for if nutrient density is your goal: Calcium to Magnesium ratio from 7-15:1.

PLANT FEED 1976: 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.

REAMS/SKOW COOK: Red beets have something besides calciums, they are quite high in magnesium.

SKOW: Calcium and magnesium should be about 7:1. Most farmers have a 3:1 or even a 1:1 ratio. An y ratio narrower than 5:1 means problems beyond instant comprehension. It means compacted soils, bacteria that can't proliferate, and weed takeover---in short, a marginal production sequence. For every pound of water-soluble magnesium in the soil, one pound of nitrogen is released straight into the air. This means that until you get the ratio correct, you are going to have to add increasing amounts of nitrogen to grow a crop that will support payment of bills.

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...

WHEELER: In the traditional Reams model the Ca:Mg ratios would be 7:1 (some say 10:1) to indicate a well-balanced soil. Narrower Ca:Mg ratios, say, 4:1, indicate compaction. The tighter the soil the less drainage and the less favorable the soil for microbes.

WHEELER: It may be necessary to loosen tight soils or break hardpan. If the soil magnesium level is to o high relative to the calcium level, the desired improvement in soil structure and aeration will probably not be permanent.

WHEELER: What lime do I use? The first choice, in most situations, would be a fine grind of a high-calcium lime with as little magnesium as possible.

WHEELER: In the traditional Reams model the Ca:Mg ratios would be 7:1 (some say 10:1) to indicate a well-balanced soil.

NOTE: *Contrary to suggestions by his students, Reams strongly warned against magnesium supplementation, possibly because of its ability to drive nitrogen out of soil, plant, and animal.*

CALCIUM CARBONATE

`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.
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: 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.
ANATOMY: Calcium can be obtained from several sources. The following is a listing of commonly available forms: Calcium carbonate (AG lime, hi-cal lime), CaCO3
ANDERSEN SCIENCE: 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 SCIENCE: 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 SCIENCE: In most of the cases where calcium is listed as a correcting material for the weed, the first choice of material to provide this is high-calcium lime, calcium carbonate, which should preferably be applied in fertilizer quantities, e.g., 100 to 300 pounds per acre, on a regular basis.
ANDERSEN SCIENCE: Reams used calcium carbonate, never dolomite. He observed that sufficient magnesium would be available if he balanced the calcium, phosphate, and microorganisms and then applie d fertilizer quantities of Sul-Po-Mag.
BEDDOE BI: 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 o f phosphate than ordinary lime due to the process it went through.
BEDDOE BI: 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 tha t it does not bake hard when dry.
BEDDOE BI: 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.
ENERGY RESEARCH: Student: Is calcium carbonate 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.
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.
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. Calciu m 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.
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 *[contaminated]*.
SKOW: Calcium oxide and calcium carbonate also go together quite well. Generally speaking, lime from the pits means ag lime.
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.
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 ato m 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 ho w 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.

CALCIUM HYDROXIDE

`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 o f 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.
ANATOMY: Calcium can be obtained from several sources. Calcium hydroxide (slake lime, hot lime, hydrated lime). Ca(OH)
ANDERSEN SCIENCE: The term "hydrated lime" means that calcium oxide (CaO) has had water added to i t to get Ca(OH)2. Its proper name is calcium hydroxide.
ANDERSEN SCIENCE: Sources of calcium are as follows: Calcium hydroxide—hydrated lime, quick lime; use with caution.
ANDERSEN SCIENCE: Finally, this *[typical not-so-great organic]* 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 th e depression of the biosystem.ANDERSEN SCIENCE: 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 BI: 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.
BEDDOE BI: 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 BI: ...calcium hydroxide can be used to increase soil temperatures. It works this way because i t 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.
BEDDOE BI: 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 BI: 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 ca n 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.
ENERGY RESEARCH: 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 coul d get our positive and negative current going again. We had all positive and no negative and that doesn't work too well.
ENERGY RESEARCH: 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 bu t 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.
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.
SKOW: My formula follows: Put in water, a humate, calcium hydroxide, magnesium sulfate, Bo-Peep *[ammonia]*, a special amine compound, Castor oil, sodium carbonate and water---it has to be distilled wate r or good reverse-osmosis water---and seaweed extract.
WHEELER: Soil pH will rise from adding a liming material like calcium carbonate, calcium oxide, or calciu m hydroxide. But pH will also rise if any positive ion is added. The major positive ions that attach themselves to the negative clay colloids *[see note below]* 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.
NOTE: *"Clay colloids" are not the "chemical compound colloids" of ReamsAg.*
NOTE: *Wheeler's calcium, magnesium, potassium, and sodium as "positive ions" is a far cry from Reams and ReamsAg.*