TABLE OF CONTENTS

ACID, AMINO 15
ACID, GIBBERELLIC 15
ACID, HUMIC/HUMATE 16
ACID, ORGANIC 17
ACID, PHOSPHORIC 18
ACID, SULFURIC 19
ACIDS, MINOR 20
ADDITIVE 21
AERATE 21
AIR 22
ALCOHOL 25
ALFALFA 26
ALKALINE 30
ALUMINUM 31
AMMONIA 32
AMMONIA, ANHYDROUS 35
AMMONIA, AQUA 35
AMMONIATION/AMMONIFICATION 36
AMMONIUM 36
ANION-CATION RELATION 37
ANIONIC 38
ANTHRACNOSE 39
ANTS 40
ANY CROP 40
APPLE 41
ASPARAGUS 42
ATOMIZE/HOMOGENIZE 42
ATRIZINE/ATRAZINE 44
AVAILABLE 44
BACTERIA, AEROBIC 46
BACTERIA, ANAEROBIC 47
BALANCE/IMBALANCE 48
BANANA 48
BARK 48
BASIC SLAG 50
BEANS 50
BEANS, SOY 51
BEETLE 52
BEETS 53
BIOLOGICAL 53
BLIGHT 55
BLOSSOM 56
BLUE MOLD 57
BORON 58
BRIX 60
BROADCAST 62
BROCCOLI 62
BUYING/SELLING 63
CABBAGE 64
CALCIUM-MAGNESIUM RATIO 65
CALCIUM CARBONATE 66
CALCIUM HYDROXIDE 67
CALCIUM NITRATE 69
CALCIUM OXIDE 70
CALCIUM SULFATE/GYPSUM 70
CALCIUM(s) 71
CALCIUM, LIQUID 72
CARBOHYDRATE 72
CARBON 74
CARBON DIOXIDE/CO2 78
CARBON DISULFIDE 79
CARBON NITROGEN RATIO 80
CARBON, BIOLOGICALLY ACTIVE 80
CARROT 80
CATALYST 81
CATIONIC 82
CAULIFLOWER 82
CEC/CATION EXCHANGE CAPACITY 83
CELERY 84
CELLULOSE 84
CHELATE 85
CHERRY 86
CHICKENS/EGGS 86
CHIRON SPRAYER 87
CHLORDANE 87
CHLORIDE & CHLORINE 88
CHLOROPHYLL 89
CITRUS 90
COBALT 91
COLD 91
COLLOID 92
COLOR 93
COMFREY 94
COMPACTION 94
COMPLEX 95
COMPOST 96
CONDUCTOR 98
CONTAMINATE 99
COPPER 100
CORN 101
COTTON/COTTONSEED 103
COVER CROP 103
COWS/CATTLE 105
CRUST 106
CULTIVATION/TILLAGE 107
DEATH 108
DECAY 109
DECIDUOUS 109
DEFICIENCY 109
DEHYDRATE 111
DENSITY 112
DEPLETED 113
DETOXIFY 113
DISEASE 113
DOLOMITE 114
DRAINAGE 116
DRESSING, SIDE (N-P-K) 116
DRESSING, TOP (N + K) 117
DRY/DROUGHT 118
ELECTRICAL 120
ELECTROLYTE 120
ELEMENT 121
ENEMY 122
ENERGY 123
ENHANCE 124
ENZYME 124
ERGS-Energy Release Gram/Second 126
EROSION 129
ESSENTIAL 129
EVAPORATION 130
EXTRACT 130
FACTOR 131
FAILURE 132
FEED 133
FERTILE 134
FERTILIZER 135
FIBER 136
FISH 136
FLAVOR 137
FLOWERS 137
FOG 138
FOLIAR FEEDING 138
FOOD 140
FREEZE 142
FREQUENCY 143
FROST 145
FRUIT 146
FUNGI/FUNGICIDE 147
GAMBLING 147
GENETIC 148
GERMICIDE 149
GLANDS 149
GMO 149
GRAIN 149
GRAPEFRUIT 150
GRAPES 151
GRASS 151
GRASSHOPPERS 153
GRAZING 154
HARDPAN 154
HARVEST/MATURITY 155
HAY 157
HERBICIDES 157
HOGS/PIGS 159
HUMIDITY 159
HUMUS 160
HYBRID 161
HYDROGEN 162
HYDROGEN PEROXIDE 163
HYDROPONIC 163
INORGANIC 164
INSECTICIDE/PESTICIDE 164
IODINE 165
INSOLUBLE 165
IONIZATION 166
IRON 167
IRRIGATION 168
ISOTOPE 169

LEACHING 170
LEAVES 171
LEGUME 171
LETTUCE 172
LIME 173
HIGH-CALCIUM LIME 175
LINE LEAST RESISTANCE 175
LIVESTOCK 176
MAGNESIUM 177
MAGNESIUM SULFATE (Epsom Salts) 178
MAGNETISM 179
MANGANESE 179
MANURE 181
MANURE, GREEN 184
MARKETING 184
MELLOW 185
METABOLISM 186
METAL 186
METALS, HEAVY 186
MICROBIAL 187
MILK 188
MINERALS 188
MINERAL ENERGY 190
MINERALS FROM AIR 190
MOISTURE 191
MOLASSES 193
MOLD/MILDEW 194
MOLYBDENUM 194
MOTH 195
MOWING 195
MYCORRHIZA 196
NATURE 196
NEMATODES 198
NITRATE 199
NITROGEN 200
NO-NO 202
NUTRIENT 202
DENSITY, NUTRIENT 204
NUTS/PECAN/WALNUT 204
OATS 204
OIL 205
ONIONS 206
OPTIMUM 206
ORANGE 207
ORP (Oxidation Reduction Potential) 208
OSMOSIS 208
OXIDATION 209
OXYGEN 210
P2O5 211
PARAMAGNETIC 211
PASTURE 212
PEACH 213
PEPPERS, BELL 213
PEPPERS, HOT 213
PESTS 214
pH 215
PHLOEM TUBES 217
PHOSPHATE 217
PHOSPHATE FORM 220
PHOSPHATE, HARD ROCK 221
PHOSPHATE/POTASH RATIO 222
PHOSPHATE, SOFT ROCK 223
PHOSPHATE, SUPER 225
PHOSPHATE, TRICALCIUM 226
PHOSPHATE, TRIPLE SUPER 227
PHOSPHATE, WATER-SOLUBLE . 227
PHOTOSYNTHESIS 228
PITH 228
PLOW, MOLDBOARD/DISK 229
PLUGGING, PLANT 230
PONS 230
POROSITY 231
POTASSIUM as compound 231
POTASSIUM as element 232
POTASSIUM as potash 234
PROTEIN 235
PROTOPLASM 237
QUALITY 237
RAIN 239
RATIO 239
REFRACTOMETER 241
REPRODUCTIVE 242
RESIDUE 242
ROOTS 243
ROT 246
ROTATION 247
SALT 248
SAME SIZE 250
SAP 251
SAWDUST 252
SCALE 253
SEA SALT 253
SEASON EXTENSION 253
SEAWATER 253
SEAWEED 254
SEED 255
SHEEN/GLOSS 256
SILAGE 257
SODIUM 257
SOIL CONDITIONER 259
SOIL STRATA 259
SOIL TEMPERATURE 259
SOIL TESTING 260
SOIL, STERILE 261
SPECIFIC GRAVITY 262
SPINACH 262
SPRAY SAFETY 263
STALK 263
STARCH 264
STICKINESS 264
STIMULATE 265
STRAWBERRY 266
STRESS 266
STUMP 267
SUCROSE 267
SUGAR CANE 268
SUGAR CONTENT 268
SUL-PO-MAG 270
SULFATE/SULFUR 271
SUSCEPTIBLE 272
SYNCHRONIZATION 272
TDN-Total Daily Nutrient 273
TEAR GAS 274
TOBACCO 275
TOMATO 275
TOPSOIL 277
TOXIC 277
UNAVAILABLE 278
UREA 279
VAN ALLEN BELT 280
VINE/VINEYARD 280
VINEGAR 281
VIRUS 281
VITAMIN 282
WATER 283
WATER-SOLUBLE 284
WATERMELON 287
WEEDS 288
WHEAT 290
WIND 291
WINTER 292
WORMS 293
XYLEM 294
YEAST 294
ZINC 295
WHERE TO FROM HERE? 297

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: 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. Academicians insist that plants do not need to be fertilized with such sophisticated materials because they are able to synthesize these substances for themselves.

BEDDOE: The aerobes *[aerobic bacteria]* in the soil convert everything possible into protein molecules. This is because they absorb mineral energy and chelate (link) it into their bodies **amino acid structure** just like your body links mineral energy from your food into usable amino acid chelates.

BEDDOE: Amino Acid Core (AAC)---the center structure of an **amino acid** which contains the nitrogen.

ENERGY RESEARCH: Liquid fish is a real nice thing to use from the stand point 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.

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: 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**. The sequence for action is at once simple and complicated in the extreme. Bacteria have a stronger magnetic force than the corn stover. As they break down the corn residue, they lose their electrical charge. In a weaker form the breakdown product becomes an amino acid first, finally carbon.

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.

***COMMENTARY*:** *Remarkably, a diligent search of all the Reams-Ag 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

ADVANCED AG: **gibberellic acid** can be used to speed up osmosis.

BEDDOE: 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: 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: 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 g**ibberellic acid** to hasten process of osmosis, but you should never use more than 30 ppm.
FOLIAR SEMINAR 1983: gibberellic acid can create problems if the crops outgrow capacity of soil to give up elements to meet demand.
FWTK: Along with the N-P-K and trace elements, other products such as sea kelp *[seaweed]*, fish fertilizer, vinegar, and sometimes some g**ibberellic acid** can be added to foliar sprays.
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, HUMIC/HUMATE

ANATOMY: It is a proven fact that **humic acid** is eminently useful for solubilizing soil and plant nutrients, as any competent chemist can attest.
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.
ANATOMY: If compost is unavailable, any good organic such as liquid or **dry humates** will work fine.
ANDERSEN SCIENCE: As with the application of sulfuric acid and gypsum, some people [*foolishly*] reason that if a little **[*humic acid*]** is good, more must be better...
ANDERSEN 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: Common carbohydrates are sugar, molasses, **humic acid, humates**, fish meal, seaweeds, algae, yeasts, enzymes, biological brews, whey, and so on.
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 soil's already **depleted humic acids**.
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: 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.
BEDDOE: And of course the bacteria proliferates through the availability of the proper levels and ratios of phosphates, potassiums, and calciums, along with the **humic carbon compounds[?]**.
SAIT: Graeme: We have had tremendous results with **humates and humic acid**, and I'm aware that it is possible to use too much of a good thing with these materials. What are the negatives associated with overuse? Andersen: There are two problems here. I agree that humates can provide an invaluable boost to fertility, but, if overused, they are capable of tying up valuable nutrients. Humates have the capacity of binding pesticides and toxic chemicals in the soil.
SAIT: Andersen: It [**humic acid**] can be a very productive additive, but it can be easily overdone.
SAIT: Andersen: It is possible to build a good biological system without a microbial inoculation, simply by the use of fish, seaweed, **humic acid**, composts and sugar.
SAIT: Graeme: Yes, it's much the same with compost production. Your compost will only be as good as the ingredients it contains. The home gardener's lawn clipping compost is a prime example. If they were to add rock phosphate, **humic acid**, animal manure and molasses to the clippings, their end compost would be far more productive. **NOTE:** *Sait is in Australia, so we do not know if he means soft or instead hard rock phosphate.*
SKOW: The **need for humic acids** in a soil is very small. Too much is worse than no application at all. When humic acids are applied in liquid form on, say, the worst sands in Arizona or New Mexico, a gallon would be too much. Most of the time a pint to a quart per acre would be indicated.
SKOW: All plant root systems have a base exchange, and as the old rootlets drop off and new ones establish they supply nutrient for the bacteria introduced at planting time. This rootlet residue is rapidly **converted to humus and humic acids** which are powerful chelating agents and help the plant acquire plant foods more readily.

SKOW: **Humates** are known to stimulate plant enzymes which further aid the production of simple sugars in the plant leaf.

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: It *[humus]* contains several **factions of acids, such as humic**, fulvic, and ulmic, as well as active carbon sources such as polysaccharides (soil sugar/glue).

NOTE: *Wheeler's phrase "glue" may have connection to Reams' **PROTOPLASM** (see).*

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." Skow made a point that "water-soluble only" claims should be modified wherever found to include acids. Reams 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 subsequent 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: 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.

BEDDOE: Calcium is the main element to provide resistance against the **organic acids** in the soil, thereby creating the energy to grow a crop.

BEDDOE: 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.

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.

COMMENTARY: *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

COMMENTARY*: *P2O5 is *diphosphorus pentoxide, even though it is called "phosphoric acid" countless times by Reams-Ag people. True phosphoric acid is* ***H3PO4****.. Perhaps every Reams-Ag 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: 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: 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: **Phosphoric acid: H3PO4** liquid. 50-80% phosphate depending on the strength and grade. Cationic. Used in soil sprays and foliar sprays.

BEDDOE: 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 to 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 of 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 acid** (P2O5) to offset it.

FOLIAR SEMINAR 1983: You should start out with **food grade phosphoric acid**, but you can experiment with cheaper ones.

F**RANK:** We use a 2-5-0.2 fish from Dramm that is acidified with **phosphoric acid**.

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 Reams-Ag 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. 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.

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: You can experience this heat loss by placing a small amount of **strong acid like sulfuric** in water. The water will immediately get warm. It is this type of reaction heat from anion-cation encounters that causes burning and dehydration of the roots. The result can be seen as a sudden die back in the leaves because of reversing the normal osmotic flow. So the water in the plant is drawn right out through the roots. Only abundant water will compensate for this problem until the reaction weakens.

BEDDOE: Ammonium sulfate is made by reacting anhydrous ammonia with **sulfuric acid**.

BEDDOE: Sulfur is a very active material, because when it contacts the soil moisture and bacteria it has the **effect of sulfuric acid**. This means it creates a lot of resistance as well as heat. The ideal time to use flowers of sulfur is when the soil is in a very wet condition and the weather has been cool.

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.*

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 Reams-Ag.*

NOTE: *From Wikipedia: Sulfuric acid can be produced in the laboratory by burning sulfur in air and dissolving the gas produced in a hydrogen peroxide solution. There are other websites that claim hydrogen peroxide can be produced from sulfuric acid and water. A review of the entries here should make it clear that Reams felt he was on a strong chemical footing.*

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's 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: 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: 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: Calcium nitrate helps other calciums become available because of its **nitric acid**.

BEDDOE: 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 active carbon sources such as polysaccharides (soil sugar/glue). **NOTE:** *Wheeler's phrase "glue" may have connection to Reams'* ***PROTOPLASM*** *(see).*

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**.

FOLIAR SEMINAR 1983: Be very cautious, motor oil sometimes has a lot of chemical **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 conditions 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.

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 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.
BEDDOE: 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 strikes 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 aerobic 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

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 H20 (18), C02 (44), N2 (28), and 02 (32), which are the **major components of air**. Thus, because chlorine gas is heavier than air, it will remain close to the ground.

ANDERSEN 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: 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: **Air is probably the most important source** of the colloids. These air-borne colloids come from the oceans of the world.

BEDDOE: 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: And it is more than just nitrogen and oxygen that the **plant takes from the air**. A vast amount of trace elements exist in the atmosphere due to the cleansing action of the oceans of the world.

BEDDOE: 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: 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: 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: 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 up 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 **competition 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. Isn't that easy?

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 sugarcane; 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 that there will be little decay system and no new humus formed. The aerobic bacteria will be buried below the oxygen level while the anaerobic bacteria will be left on top **exposed to the air**. The residue will ferment**,** producing an alcohol or aldehyde.
WHEELER: The **air *[introduced by cultivation]*** assists the development of root mass and supplies microbial life with needed oxygen.

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 build-up or hardening of the arteries); alcohol further stresses the liver, precipitating calcium and causing cirrhosis of the liver. Animals that **are fed alcohol** are certain to need more mineral supplementation which is convenient if you are selling both.
ANDERSEN SCIENCE: An area may have much organic matter but very little actual humus because humus 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: 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. When 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 that 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 human being is nothing compared to the same malaise in an insect.

WHEELER: To moldboard plow residue 8 to 10 inches deep in this soil condition is to almost guarantee that there will be little decay system and no new humus formed. The aerobic bacteria will be buried below the oxygen level while the anaerobic bacteria will be left on top exposed to the air. The residue will ferment**, producing an alcohol** or aldehyde.

WHEELER: *[Higher Brix plants]* will **produce more alcohol** from fermented sugars and be more resistant to insects, resulting in a decreased insecticide usage.

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 harvester. This is a harvester or 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 those little black dots? Have you noticed it on peach leaves, orange leaves, any crop?

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 harvester.

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 phosphate 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 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: 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.

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 and **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: 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: Potassium is what determines the caliber of a corn stalk or the caliber of an **alfalfa stem**.

BEDDOE: **Alfalfa** can have this [black spots on leaves] happen and the condition is said to be a virus. The problem is actually a potassium excess which opens the way for the virus to set up housekeeping.

BEDDOE: A dairy cow which is **eating alfalfa** that has a 16 Brix sugar level will need only 10-l2 pounds of l2 Brix grain mix to produce 100 pounds of milk. But the same cow eating 7 Brix alfalfa will require 30 pounds of the same gain to produce 100 pounds of milk; besides that, the cow is very vulnerable to disease.

BEDDOE: 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: ...hollow stems on grasses and forage crops, **such as alfalfa**, are not normal. It is an expression of phosphate of boron deficiency.

BEDDOE: **Alfalfa has the ability** to take practically all its required potash from the air, and so needs little from the soil.

BEDDOE: Remember, that "normal" in agriculture, as in medicine, basically means an average of a bunch of sick things. In other words, if production levels of a certain farm crop such as alfalfa is randomly sampled and averaged it would show that high "normal" alfalfa production is around 6-7 tons per acre. However, what this statistic does not tell us is what was the soil condition of the fields that the production information was sampled from. If the farmer does not scrutinize this kind of "normal" information he will never realize what the real production potential could be for his particular crops. And **in alfalfa that should be at least 20 tons per acre** with a six month growing season.

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: 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 acre of watermelons at l2% sugar; 1.000 boxes of oranges per acre; 20.000 quarts of strawberries per acre at 10-12% sugar; 20 tons per acre of cabbages - the list goes on and on.

GARDENING: There are people growing alfalfa today, 4 or 5 tons per acre, who think they are pretty good because that's what the neighbors do. They ought to be ashamed if they cannot produce **20 tons of alfalfa** per acre in a six month growing season.

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.

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: **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...**

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: 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 part potassium. For leaf crops and forage---spinach, lettuce, **alfalfa**---the ratio of potassium should be four to one.

WHEELER: When farmers remove every cutting of alfalfa or chop corn for the silo, they are returning little organic matter to the soil. The alfalfa farmer is returning nothing while the corn farmer is returning only the root mass developed during the year. This is poor organic matter practice, and it is why recent emphasis has been given to growing cover crops which will at least provide a green manure to return to the soil. A good suggestion would be to cut and **leave the last crop of an alfalfa field each fall** as an additional humus builder or apply manures.

WHEELER: Farmers have another option when potassium levels are high. Cropping of potassium-loving plants, such as **alfalfa, removes the K** in the harvested crop and it can be sold off the farm. **NOTE:** *This 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, herbicide the weeds, use 18 pounds of seed per acre, and all the other wrong or wrongly reasoned advice. The failure of standard forage fertility programs is appalling.

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

ANDERSEN 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 be 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: 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

ADVANCED AG: (Track 071 "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: 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 through 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: 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: Therefore, iron is **heavier than aluminum** and iron will also float on boiling lead. For this reason, heavier elements in the soil naturally go down and very often too far down out of the range of the plant roots.

BEDDOE: Metallic substances, such as iron, sulfur, and **aluminum are often the culprits** that give low pH readings in soil where there is already an over-supply of water-soluble calcium.

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 isn't growing satisfactory, and this is particularly important if you have some herbicide damage and you want to flush it out.

FWTK-pH: Metallic substances, such as iron, sulfur and **aluminum**, are often the culprits that give low pH readings in soil where there is already an over-supply of water-soluble calcium.

FWTK-pH: Therefore, iron is heavier than **aluminum**, manganese is heavier than magnesium, and iron will float on boiling lead.

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: A soil 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

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 is the something else I am trying to get across to you? It doesn't burn the plants. The raw manure creates a heat in the soil. If you have a dry year what happens? It releases too much moisture and you're really suffering from a drought. But compost does just the opposite, it draws 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 not 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 directly on the soil. Instead, it should be mixed with water to form aqua ammonia and a carbohydrate like sugar or molasses to help retain it in the soil, and some humic acid to help chelate it for better use rather than reducing further the soil's already depleted humic acids.

ANDERSEN SCIENCE: The pH of cow urine should be around 7.4. If the pH is much higher than this, there 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: A soil with excellent amounts of aerobic bacteria will have plenty of **available ammonia** nitrogen being produced by the bacteria.

BEDDOE: 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: 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: The parts of the reserve soil TDN are calcium, phosphate, potassium (potash), nitrate nitrogen, **ammonia nitrogen**, iron, and copper.

BEDDOE: Probably corn has one of the **highest demands for ammonia nitrogen**, so it is a good idea to work up to 200 lbs. per acre for its needs at 40-50 days from sprouting.

BEDDOE: 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.

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: 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 from emergence on seed crops primarily. That is why I am suggesting to go out and do a little side-dressing to give that system a little kicker.

ENERGY RESEARCH: For instance, if you have a real high calcium soil and you put on **ammonia nitrogen** 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 little 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 the 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 at 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 encourage 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.

AMMONIA, ANHYDROUS

ANATOMY: As **anhydrous ammonia** usage became more and more popular, so did chlamydia in hogs on those same farms.
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 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.
BEDDOE: **Anhydrous ammonia** is extremely detrimental to the soil chemistry.
BEDDOE: Ammonium sulfate is made by reacting **anhydrous ammonia** with sulfuric acid.
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.
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 for weed and insect control plus increase his feed mineral supplement purchases.

AMMONIA, AQUA

ANATOMY: Ammonia Nitrogen Sources: Anhydrous ammonia (avoid like the plague or convert to **aqua ammonia**), **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 about what to purchase: Anhydrous ammonia, NH3, **Aqua ammonia**, N4OH • H2O
BEDDOE: [Ammonium Thiosulfate] Best used in conjunction with **Aqua Ammonia** and molasses to regulate its energy reactions and inter-reactions in the soil.
BEDDOE: 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: **Aqua Ammonia** (28% N) Supplies cationic nitrogen. Used to warm trees to prevent frost damage.

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 solution called **aqua ammonia**. Adding a carbohydrate or sugar source to the aqua ammonia will greatly increase its stability and efficiency.

AMMONIATION/AMMONIFICATION

ADVANCED AG: It is possible to **ammoniate a grove** by creating nitrification via adding chicken manure if 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.
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 completely 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" may be the preferred word.*

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: 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: 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: **Ammonium sulfate** is made by reacting anhydrous ammonia with sulfuric acid.
BEDDOE: Other fertilizer materials that can be used as catalysts in certain situations include: **ammonium sulfate, ammonium thiosulfate, ammonium phosphate**, calcium sulfate, calcium nitrate, potassium sulfate, and potassium nitrate.
ENERGY RESEARCH: Don't use **ammonium sulfate** if the calciums are below 1800 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.
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.
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, which 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 encourage microbes and to get 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.
WHEELER: Sulfur could be applied as dilute sulfuric acid, thiosulfate or **ammonium sulfate**.

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 his reluctance to accept calcium as an anion will always be an anchor.*

BEDDOE: Nature senses **anion-cation ratio reactions**, not the pH. For an explanation of this rule refer to the chapter dealing with pH.

BEDDOE: Acids (cations) coming into contact with bases (anions) are heat and energy producing because of the resistance between the **anions and cations**. Whatever organic or inorganic substance there happens to be in the soil also takes part in this chemical action and can be affected by it.

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

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** than 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 material should be added.**

BEDDOE: Making Sprays Anionic: 1. Use Calcium hydroxide (hydrated lime) or carbonate forms of calcium.

BEDDOE: Hydrated lime (also called slaked lime and calcium hydroxide): dry powder, 54% pure calcium, **anionic**. This is a "hotter" calcium source. It can make more soil heat because of the resistance it makes and it will then cause the soil to dry out. It is best used in the fall so that it can sit all winter long.

BEDDOE: 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: 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: From the time the seed sprouts until the 40-50 day period has passed, **keep plants anionic**.

BEDDOE: There are three main sources for base (**anionic**), or sweet plant food elements in soil chemistry. They are potassium (potash), calcium, and chlorine.

BEDDOE: Tomatoes do best when there is a minimum of available nitrogen. When nitrogen gets too high, **excessive anionic growth** (vegetative growth) will develop.

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.

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 cata1yst 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 by 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.

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.*

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.]*

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

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.

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 or it.

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 noticed 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: 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 stand point 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 is 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 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.

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.

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.
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: Without phosphate of copper, the bark of some trees, such as peaches, plums, cherries, **apples** and pears, will show splitting.
BEDDOE: 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: 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.
FWTK: On those *[crops]* grown for fruit, seed, root or blossoms (corn, wheat, tomatoes, **apples**, etc.), both nitrate and ammonia is used.
GARDENING: **M**any 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 for one orange? How do you know when your grove is producing a maximum crop of citrus? What is the criteria for citrus, peaches, pears, *[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 same 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 buds 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.
WHEELER: Reams suggested you avoid dolomite for three reasons. The most impressive one has to do with nitrogen release. Magnesium is antagonistic to nitrogen as seen in the use of Epsom salts as a treatment for nitrate

poisoning in cattle or an Epsom **salt spray on fruit trees to stop apple drop due to nitrate-weakened stems**. When the magnesium releases from dolomite, it can cause nitrogen to release as a gas.

ASPARAGUS

ADVANCED AG: Skow: **Asparagus** likes table salt [but not too much].

ADVANCED AG: **Asparagus** appears as thought 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: 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: 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

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? 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.

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

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

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

BEDDOE: **Homogenized foliar spray solutions have 10 times the effect** of non-homogenized. Homogenization is when each molecule within the spray contains all the elements in exactly the same solar system relationship. The process of homogenization is one of adding a high degree of energy to the molecule of plant food spray. What actually happens involves the outer electrons in the molecule. They are forced into a higher speed without

changing their positions. When homogenization is accomplished, the end result will give a solution that has a greater density, while the molecule enlarges and increases in porosity. It is this porosity that sets the stage for a shrinkage that locks the molecule on the antennae of the leaves at the time it contacts them.

BEDDOE: The smaller the spray particles, the more complete the molecule. This is **another way to express the 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: **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 green houses 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 homogenized 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'll homogenize, but it only holds about a pint and it works by electricity and it's only good for a backyard garden.

WHEELER: When temperatures soar, the effectiveness of the spray drops considerably. When using a boom sprayer, use high pressure and purchase **atomizer nozzles** if possible. Tip standard nozzles back about 90 degrees so the spray will roll up under the leaves. Keep active ingredients on the dilute side, e.g., 1 to 2 quarts per acre for majors and a few ounces for traces. It may be possible to use as little as 2 cups of active ingredient per acre and still be effective, especially when using a mist blower. The use of a wetting agent will often assist the solution to **break down and homogenize**.

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. See entry CHIRON SPRAYER*

ATRIZINE/ATRAZINE

AG LECTURES: Student: I had farmer tell me one day he took and sprayed his corn when it was just coming up with Atrizine, at the rate of 1/3 pound per acre. And he said it didn't kill the weeds, but it just stunted them enough that the corn grew up away from the weeds. Then he would go cultivate and cover everything up. Reams: Yes, I wouldn't have used **Atrizine,** I would just cover them up to start with. Student: Yes, I don't advocate Atrizine either, but that's what he did. Reams: I don't advocate it at all, period. I have never seen a weed killer that didn't do harm in the long run. One of the greatest things it ties up is phosphates, terrifically. Every one of them does.

ANDERSEN 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 the soil. It is not an indicator of the quantity or balance of these nutrients, minerals, or microbes. An example of this is the heavy application of triazine **[atrizine?]** 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.

AVAILABLE

Please 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 or 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 increase 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: 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: It *[molybdenum]* has one primary benefit. It makes the grain kernel harder by making calcium **more available**.

BEDDOE: Calcium nitrate helps other calciums **become available** because of its nitric acid.

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

ENERGY RESEARCH: Chelates are fine in low calcium soils. In other words, soils below 2000 1bs of **available calcium**. If you have a high calcium soil and you start using such as an iron chelate, manganese chelate, copper chelate, watch out. You will completely defoliate the crop.

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 is 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 **f**oliar 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 sugarcane; and its yield will decrease in direct ratio to the supply of the **available carbon** in the air and the soil.

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.

WHERE TO FROM HERE?

The purpose of this critique is to examine what we think Reams said, what his primary students have written that he said, and what we have learned in the 30+ years since the death of a great agricultural engineer.

As stated at the beginning, I stand ready to make corrections to this volume when better or more complete information finds its way back to me. For instance, that can be in the form of a critiqued author revising their work to enhance what they feel they meant to say by an errata sheet or a new edition. Corrections may also come about because of new or revised transcription work. Another way that might bring updating to these pages is if improved technology leads us toward better solutions than Reams had available. For instance, the now banned Chlordane smell that he so favored to chase away moths could be replaced by an effective non-toxic "stink" that would probably delight him even as it offended his nose.

Whatever the changelog for these pages, the hope is always that the fresh data will move Reams' vision of a better agriculture constantly upward. Our children deserve it. The world deserves it. Write if you share that vision.

Rex Harrill
brixmanus@gmail.com
26842 Forest Hills St.
Leesburg, FL 34748