*Background Information You Can Use!*

# The KPU White Minibook

*"Mary, Mary quite contrary how does your garden grow?"*

The following information has been written as an aid to growers who have decided to transition to sustainable agriculture, or to those who have already transitioned but are not sure why their new system works so well as it does....

It is not to be taken as a "scientific" document, most of it having stemmed from my own experience in the field rather than through laboratory studies. By no means do we wish to make our customers instant soil scientists. Rather, in light of the "chemical for every problem" approach postulated by chemical companies and land grant universities, we feel a basic knowledge of what happens in healthy soil can help growers reduce crop input costs while enjoying better productivity and quality.

## Mission Statement -The Business At Hand:

Somewhere along the line between the end of WWII and the present it became accepted agricultural practice to grow crops by force-feeding plants with massive doses of fertilizers, forgetting the basic agronomic principle that fertilizers don't grow crops. It takes properly balanced soil to grow crops - specifically, the electro-chemical energy generated in properly balanced soil, replete with thriving micro-flora and micro-fauna to grow crops.

Initial results seemed to reinforce pro-chemical thinking since early crop yields were indeed greatly increased. However, this trend has peaked and even reversed itself in recent years, a situation made worse by lowering vitamin, mineral and protein contents, complicated by deteriorating soil conditions. Deteriorating agricultural soil fertility, crops high in bulk but nearly devoid of nutritional value, vegetables that rot while still on store shelves, and above all, ever rising input costs, have prompted many growers to re-evaluate their fertilization programs. It has become obvious to some growers that their crops are being subjected to considerable chemical stress - stress of the type that attracts troublesome weeds and parasitic insects. Money spent to control parasites and weeds now represents a major percentage of input costs of growing crops. Chemical controls themselves only further deteriorate soil conditions, adding to stress and attracting even more parasite and weed problems. And so it goes, in a downward spiral of deteriorating soil fertility and an upward spiral of chemical costs. Passage of the **NAFTA** agreement has added to problems faced by American farmers since the high cost of "conventional" agriculture in this country has placed them in an unfavorable position to compete against cheap Mexican produce.

Our personnel are experts in the technology and expertise to restore agricultural soil by reconstituting organic matter, re-establishing soil microbial activity for plant nutrition and natural insect control, re-balancing micro-nutrients and trace elements necessary for photosynthesis, and designing state-of-the-art fertilizer programs that actually improve growing conditions with every crop cycle. In so doing, we significantly reduce crop input costs while greatly improving crop quality.

As we seem to be noticing more and more lately, it is far more productive to work with forces of Nature rather than against them. Our philosophy is to use natural forces to their best advantage by focusing and then accelerating them. Nature has had nearly five billion years to perfect an eco-system capable of feeding the world for years to come so long as it's managed properly, and we are the company that can save the farmer money while we help him make the transition to sustainable agriculture. We use the following approach:

When we come under contract, we visit the operation to inspect field conditions and survey current fertilization, weed, and pest control programs together with current overall costs.

We analyze soil test reports and reconcile them with weeds visible in the fields. Then we

perform our own soil compaction, water percolation, and soil pH tests. If we think it necessary, we will even take a sample of irrigation water for lab testing. We check drainage, water table, and average rainfall data. Then we check the farm equipment inventory to determine what machinery is available to work with.

Finally, we interview the farmer at length to determine his intentions as to which crops will be planted in which fields.

Armed with this data, we return with comprehensive preplant-to-harvest soil recovery and fertilization programs designed to provide superior crop quality and yield while improving soil fertility for future crops. These programs will come complete with hard number cost quotations for the products we recommend, and will be custom tailored to work with available equipment. Not only will overall fertilizer costs be lower, the farmer will also be able to greatly reduce or even eliminate his need for pest control chemicals and herbicides. In addition, we will provide him with all the training he will need to know why his new program is working. Also, at no additional cost, we will take charge of ordering materials for the farmer, ensuring he receives the materials he needs when he needs them. .

## IMPORTANT TIPS ON FOLIAR FEEDING

The value of foliar feeding was proven many years ago by Michigan State University. A project partially funded by the (then) Atomic Energy Commission used radioactive tagged nutrients to prove that a plant can feed through the leaves. In fact, the tests proved that it was 8-10 times more effective to foliar feed a plant with respect to the amount of nutrients utilized, and the speed with which those nutrients were utilized. In our opinion, foliar feeding is by far the best approach to insure maximum growth, yields, and quality by overcoming limitations of the soil and its ability to transfer nutrients into the plant.

The best time to foliar feed is between 7:00AM and 10:00AM or after 5:00PM. These are the periods when the stomata (small pores in the leaf bottoms) are open. However, if the temperature at 7AM is 80 degrees or above, the spray will have little effect. The optimum temperature is about 72 degrees. If the weather is extremely hot and dry, you may have to spray between 2-4 AM.

Most foliar sprays should contain small amounts of Nitrogen to act as an electrolyte to carry nutrients into the plant. A small amount of Phosphorous is also recommended for internal circulation.

The pH of a foliar spray should be between 6.2 and 7.0 whenever possible. As a rule, sweeter (alkaline) sprays are needed for young plant growth, and sour (acid) sprays are needed for the second, or "production" stage of development. Unless you use specifically formulated sprays, the easiest way to adjust pH in a spray is to add baking soda to make it sweeter, or vinegar to make it sour (more acid).

If the spray was effective, visible results will usually be seen in 48 hours. Results can be detected with a refractometer in as little as 4 hours. If spray was applied improperly and simply fell to the ground, results may be delayed up to two weeks.

Always mix the spray thoroughly and apply in as fine a mist as possible. Ideally, the speed through the field should be such that a swirling action is set up in the mist so as to moisten the underside of the leaves where the stomata are. The same rule applies when feeding by aircraft. When feeding through a center pivot, droplines should be used with nozzles turned up to insure wetting the underside of the leaves.

The "law of little bits" always applies in foliar feeding. It is better to spray smaller amounts of material more often rather than try to drown a plant in one large dose. Take care to avoid leaf burning when spraying in direct sunlight.

## INDICATOR WEEDS

The presence of weeds is usually an indicator of one or more soil deficiencies. The ability to "read your weeds" is a useful way to spot them. Here is what some weeds can tell you:

**BINDWEEDS** (Convolvus) ...tight, crusted soil; low humus.

**BROOMSEDGE** (Andropogon virginicus)...depleted oxidized soil, low in calcium and possibly magnesium; poor soil structure and possible overdose of high-salt fertilizer.

**FOXTAIL BARLEY** (Hordeum jubatum) .. wet soil, possibly high in salts and low in calcium; compacted, possibly acid; unavailable potassium and trace elements.

**COMMON BURDOCK** (Arctium minus)..high iron, acid, low calcium, excess of gypsum, dolomite lime, ammonium sulfate plus lime.

**CHEAT, CHESS** Bromus secalinus) wet, compacted, puddled, fine particles, no crumb structure.

**CHICKWEED** (Stellaria media)..high organic matter at surface but low mineral content.

**CHICORY (**Cichorium intybus) fairly food soil, clay or heavy soil.

**COCKLEBUR** ( Xanthium pennsylvanicum) good soil, high phosphorous but low zinc.

**CRABGRASS** (Digitaria sanguinalis) tight, crusted soil, low calcium, inadequate decay of organic matter.

**DANDELION** (Taraxacum officinale) low calcium, organic matter not decomposing.

DOCK (Rumex) wet, acid soils.

**FALL PANICUM** (Panicum dichotomiflorum) anaerobic, compacted soil.

**FOXTAIL, GIANT FOXTAIL (**Setaria) tight wet soil, possible high magnesium, seed germinates in anaerobic conditions.

**HORSENETTLE** (Solanum dulcamara) crusted soil, low humus

**JIMSONWEED** (datura stramonium) improper decomposition of organic matter (fermentation).

**JOHNSONGRASS** (Sorghum Halepense) depleted soil, low organic matter, low calcium, possibly high iron.

**LAMB'S QUARTERS** (Chenopodium album) rich fertile soil, good organic matter

decay, high humus.

**COMMON MILKWEED** (Asclepias syriaca) good soil, generally grown in fallow areas.

**MUSTARDS** (wild mustard, yellow rocket, wild radish, peppergrass) crust, hardpan, poor soil structure, poor drainage.

**NETTLES, STINGING NETTLE** (Urtica) anaerobic, toxic soil, wrong decomposition of organic matter (fermentation).

**PIGWEEDS** (Amaranthus)**REDROOT** (rough) good soil

**PURSLANE** (Portulaca loeracea) fairly good soil.

**QUACKGRASS** (Agropyron repens) wet anaerobic soil, high aluminum, (toxic), in West - high magnesium and sodium, low calcium.

**RED SORREL, SHEEP SORREL** (Rumex acetosella) acid soil, low calcium, low decomposition of organic matter.

**RUSSIAN THISTLE** (Salosa Kali var, tennifolia) salty soil, low calcium, low organic matter decomposition.

**SMARTWEEDS** (Polygonum) wet, poorly drained soil.

**THISTLES** (cirsium) & SOWTHISTLE (Sonchus oleraceus) good soil

**TUMBLEWEED** (Amaranthus albus) dry soil, low humus. Russian Thistle is also sometimes called Tumbleweed - see above.

**VELVET LEAF** (buttonweed)(Albutilon theophrasti) anaerobic soil, wrong decay of organic matter (fermentation).

## GENERAL MINERAL DEFICIENCY SYMPTOMS OF PLANTS

**NITROGEN**: Slow growth of tops and roots; leaves turn yellow-green when young, or to orange, red, or purple when mature(veins may turn purple), beginning from bottom leaves to top; reduction in number of flowers and yield of grain or fruit; slow growth and delay in opening of buds.

**PHOSPHOROUS:** Similar to Nitrogen except leaf color either dull bluish green with tints of purple instead of yellow or red - OR -leaves dull bronze with purple or brown spots; leaf edges often brown, especially in potatoes.

**POTASSIUM:** If deficiency is mild, stems are thin; if severe, stems stunt or die; leaves usually dull bluish green, often with yellow streaks between veins, followed by browning of tips and edges, with brown spots developing at edges; leaves rolled starting at bottom leaves; poor root growth, and poor development of fruit, flowers, or grain.

**CALCIUM:** Begins at the upper leaves; leaves very distorted and curled at edges; edges appear ragged and leaves may have thin yellow bands or be brown and die; roots develop poorly.

**MAGNESIUM**: Leaves turn yellow, sometimes between veins, sometimes in spots or streaks; then turn brown and die, beginning at bottom of plant.

**MANGANESE:** Similar to magnesium but symptoms start at top of plant.

**SULFUR**: Reduced growth; curling down of leaves at tips. Similar to Nitrogen deficiency except that lower leaves are not lost.

**BORON:** Begins at upper leaves; leaves become light green (lighter at base) veins turn purple, leaves may have faint streaks and yellowing, then turn orange. Plant stops growing; roots down at tips with tissue breakdown at base; poor growth of tops and roots; flowers drop off; no grain or fruit.

**IRON:** Severe yellowing of newer leaves (either spotted or total);
more often visible in trees than in yearly crops.

**ZINC:** Molted spots on leaves, first yellowish then yellow or purple-red. Appears late in summer, then leaves drop early. leaves become crinkled and small.

**MOLYBDENUM**: Similar to Nitrogen deficiency since molybdenum is required for nitrogen fixing bacteria; leaves become yellow between veins, first on mature leaves. Young leaves may become severely twisted and eventually die.

# SOIL



## Here's The Real Dirt

Obviously, one thing all farmers have in common is the medium into which they plant their crops: soil. Just as obviously, all soil is not created equal. What follows is a brief discussion of soil conditions, soil types**,** mineral and microbial content, and why these factors are of immense importance to the farmer.

Soil is the end product of eons of erosion of rock. Various natural processes combine to break down rock to the fine powder-like consistency with which you are familiar. These forces are usually a combination of exposure over time to wind and water. The rock itself can be of many forms, be it silicate (sandstone), calcite (lime), granite, basalt or other. Granite and basalt are usually found in volcanic areas, while calcite and silicate are usually associated with primordial seabed. Limestone is in fact the accumulation of innumerable microscopic ancient shelled sea creatures. Beach sand is almost pure silicon, and the rich loamy soils of the Midwest grainbelt are high in granite and basalt content. Much of Florida soil is heavy in coral deposits, also calcite in nature.

The single most important element in the determination of whether soil is arable (capable of growing anything) or barren is Carbon. Sand is almost completely devoid of Carbon, and not much can grow on a beach. But the lush soils of the Mid-West are high in Carbon content, and the agricultural output from that area feeds the world. Carbon exists in the atmosphere in the form of Carbon Dioxide (CO2), but the primary source of soil-borne Carbon is the decomposition of living plant and animal matter to its basic elements. The term "organic matter content" is a way of expressing the percentage of organic Carbon in the soil. Simply put, the higher the organic matter (Carbon) of the soil, the more fertile and productive the soil. This is due to two primary reasons:

1. Carbon is instrumental in moisture retention, allowing just enough moisture to be available to plant roots, and:

2. Carbon conducts electricity. In future discussions it will be shown how electrical conductivity is directly responsible for the uptake of minerals necessary for plant nutrition by plant roots. Where there is no soil electrical energy there is no fertility.

The process by which soil minerals are altered to forms usable to plants is called "chelation". Unless minerals and elements are "chelated", they are absolutely useless to plants. Soil electricity is electro-chemical in nature, and the chemicals required to generate soil electricity are a function of the microbial activity in the soil. Soil micro-organisms thrive in the presence of organic matter (Carbon), but cannot survive in low Carbon soil.

The ability of a soil eco-system to allow the passage of air and water is fundamental to the "Soil Transpiration Cycle". To be of any use to a plant, rain water must be allowed to

penetrate through the soil to a level below the root system. Excess water must be allowed to drain away to prevent root rot and fermentation of decaying organic matter. But water on the way **DOWN** does the plant little good. After penetration to a depth below the root zone, capillary action caused by surface moisture evaporation draws moisture slowly back toward the surface. It is during this **UPWARD** flow that water picks up and carries soil nutrients to the roots.

The presence of organic matter (Carbon) in the soil is necessary to retain the proper amount of water for the job while excess water drains through.

Air must also penetrate through the root zone to ensure that aerobic bacteria, rather than anaerobic bacteria, are well supplied with oxygen. Aerobic bacteria are the organisms needed for the chelation process.

The most serious impediment to the transpiration cycle is soil compaction, whether it be caused by the physical weight of machinery operating on the surface or excessive applications of high-salt or synthetic phosphate fertilizers. More information will be presented on this subject in future discussions.

To recap briefly:

-Soil fertility is a function of organic matter content, or Carbon.

-Carbon provides the perfect medium for the aerobic bacteria necessary for the chelation process.

-Carbon allows for proper soil moisture retention for adequate root feeding.

-Carbon is an excellent conductor of electricity, also necessary for the chelation process which makes minerals and nutrients available to roots.

-Soil compaction by either physical or chemical means will inhibit the transpiration cycle required for root feeding, promote the growth of unwanted anaerobic soil bacteria, and physically impede root development.

-Low Carbon soil is essentially dead soil; compacted soil is essentially useless to agriculture.

-Synthetic phosphates and high-salt fertilizers are largely responsible for depleted soil Carbon, low bacteria counts, hardpan, and soil compaction.

# PHOTOSYNTHESIS

Photosynthesis is the cluster of interrelated chemical reactions by which plants capture energy from light and incorporate it as chemical bonds holding together organic compounds. Without this process, life as it has evolved on Earth could not exist, for photosynthesis alone utilizes such simple chemical substrates as CO2 and water in producing food materials necessary for all life. Today only certain purple bacteria containing bacteriochlorophyll and green plants with the pigment **CHLOROPHYLL** carry on photosynthesis; they rely upon CO2. In the Precambrian era of geological time, it seems likely that photosynthesis evolved in primitive plants as an efficient means for capturing energy, a means made possible by the gradual accumulation in the atmosphere of CO2 from fermentation carried on in the absence of oxygen by still earlier forms of life. Photosynthesis, however, added free oxygen to the atmosphere, making possible efficient respiration in both plants and animals and permitting sustained activity at high rates - the way of life we now associate with most animals.

**CHLOROPHYLL** acts as a photoreceptor, trapping solar energy and catalyzing at least two chemical steps which take place so rapidly that they reach an end point in 0.00001 second, and then cease until their products are removed by reactions for which light is not necessary.. These two or more chemical steps requiring light energy are grouped as the "light reactions" of photosynthesis. Those that follow in either illuminated or dark surroundings are called the "dark reactions".

One of the light reactions for which **CHLOROPHYLL** is necessary splits the water molecule by **PHOTOLYSIS**, adding one of the hydrogen atoms from H2O to a still unidentified hydrogen acceptor compound, and producing an OH group that is transferred through unknown dark reaction chains (one of them requiring manganese ions) until at last the oxygen is released as a by-product. The hydrogen acceptor is also used in at least one of the dark reactions for synthesis of other organic compounds.

A second light reaction, linked intimately to the photolysis of water, is known as **PHOTOPHOSPHORYLATION**. This reaction is effective in capturing units of solar energy and, by at least three steps, linking inorganic phosphate groups to adenosine diphosphate to yield the important nucleotide adenosine triphosphate (ATP). The high-energy bonds of ATP are available for use in a host of different reactions.

The dark reactions, which proceed equally well in light or dark, but are dependent on the products of the light reactions, require about 0.01 seconds to reach completion. Thus, if a plant is subjected to alternating periods of 0.00001 sec of light and 0.01 sec of darkness, it caries on photosynthesis at top speed - although it is dark 99.9% of the time. It may even operate more effectively than in continuous light, since light seems to inactivate or destroy some of the products of the dark reactions, within the 0.01 sec of their formation, before they can be used.

These dark reactions, in addition to those mentioned, include one conspicuous series whereby carbon dioxide as a substrate from the environment is linked to a 5-carbon phosphorylated sugar (ribulose diphosphate) that acts as a carbon dioxide acceptor. This reaction produces a 6-carbon compound, which promptly splits into two 3-carbon molecules (phosphoglyceric acid), which in turn are reduced to 3-carbon sugars (trioses) that serve as intermediate compounds in respiration.

All these reactions occur in the **CHLOROPLASTS** of green plants. Chloroplasts are microscopic, usually spheroidal, specialized parts of the cytoplasm, in which chlorophyll is spread in thin layers, these in turn being grouped into subdivisions of the Chloroplasts. Subsequent reactions are carried on in other parts of the cytoplasm, but usually within the same cell that contains the Chloroplasts.

Most chlorophyll-containing cells of green vascular plants are in the leaves, although some may be present and carry on photosynthesis in the stems as well.

Some of the products of photosynthesis are used in satisfying the plant's own respiratory needs; others proceed through a series of steps involving 5-carbon sugars (penoses) and replenish the supply of carbon dioxide acceptor; still others participate in a ladderlike series of phosphorylations and produce more complex carbo-hydrates such as pentoses, hexoses such as glucose and fructose, disaccharides such as sucrose and maltose, polysaccharides such as starch, inulin, lignin, and cellulose.

Just as it is possible to list the amount of raw materials going into a factory and the number of products coming out, all without specifying the manufacturing operations going on inside, so it is possible to describe the over-all process of photosynthesis by a chemical equation linking substrates and products.

For each molecule of CO2 and each molecule of water removed from the environment, one molecule of oxygen is returned, and a portion of a molecule of carbohydrate (CH20) is produced. These over-all changes are exactly opposite those of aerobic respiration, in which the chemical energy stored in foods is released through oxidation, with the ultimate use of oxygen and release of carbon dioxide.

Many environmental factors influence the rate of photosynthesis. Plants require adequate soil moisture and nutrients for healthy growth. Temperatures between 50 and 122 degrees F are generally most favorable for plant metabolism, and in this temperature range photosynthesis also proceeds most rapidly. The most important factor controlling the rate of photosynthesis is light intensity. At low light intensities the rate of photosynthesis may be lower than the rate of respiration; at a slightly higher the rates of these two processes are equal (COMPENSATION POINT); and at all higher light intensities photosynthesis proceeds more rapidly than respiration, and the products of photosynthesis accumulate. Maximum rates are achieved only at light intensities approaching full sunlight. Rates of photosynthesis at saturating light intensities can be increased by raising C02 concentration beyond the 0.03% normally present in Earth's atmosphere. During the Carboniferous period of geological time, the CO2 content of the atmosphere was considerably higher than it is at present.. The excess productivity of plants of that age has been preserved as coal deposits, which are being used in our time as a source of energy in the form of fuel for home and industry.

**EXCERPTED FROM <u>THE HARPER ENCYCLOPEDIA OF SCIENCE</u>, Revised edition, 1967, Harper & Row, Publisher**

# NITROGEN FIXATION

Nitrogen fixation is considered second only to photosynthesis as the most important biochemical reaction on earth.

While nitrogen gas comprises about eighty percent of the Earth's atmosphere, it is not in a form useable by live organisms. To make it useable it must undergo a process called "Nitrogen Fixation", a process made possible only by a very small number of bacteria. No higher organisms have the ability to accomplish this task, even though it is critical to support life. Therefore these bacteria are in themselves critical to food production - indeed, life support on the planet.

There are two types of nitrogen fixing bacteria. One group lives in the soil and is termed "free living". It is comprised of Azotobacter and Klebsiella. These bacteria provide biologically useable nitrogen in measurable amounts to the soil. The other group, the Rhizobia group, also lives in the soil and fixes nitrogen only in conjunction with a plant. These nitrogen fixers and their plant hosts actually become intracellular, a situation which would normally be pathogenic (fatal). However, these species have evolved in such a way that they do not parasitize each other. The plants feed carbon compounds and other nutrients to the bacteria, and the bacteria fix nitrogen for the plants. This is what is known as a "symbiotic relationship".

The plants most affected by nitrogen fixing bacteria belong to the economically important class known as "legumes", which include soybeans, peas, beans, alfalfa, and clover. The seeds of these plants are very protein rich and therefore contain large quantities of fixed nitrogen. Each legume species is affected by a different species of Rhizobium.

There are complex sugars called polysacharides on the surface of the bacteria that interact with specific glycoproteins on the surface of the plant's root hair. These glycoproteins contain sugar residues in addition to amino acids, and belong to a class of compounds known as "lectins". Lectin is derived from the Greek word "legere", meaning to choose. The name is appropriate because each lectin chooses only the correct bacterium.

There is a pocket within the glycoprotein lectin which provides the correct complimentary structure for the specific sugars on the surface of the bacterium. The lectin interacts with the bacterial cell and so provides the plant with a means to specifically recognize its bacterial counterpart. After the bacterium attaches to the root hair it penetrates the host's cell wall and forms a structure called the infection thread. Eventually this infection leads to the formation of the nitrogen fixing nodules, which in turn enables the plant to take in the soil nitrogen it needs to grow.

The point of all this is that the presence of many different strains of beneficial soil bacteria is essential for nutrient uptake and nitrogen fixation. There is no question what would happen should these bacteria become depleted past the point of recovery. The

bacteria make possible the absorption of nitrogen into the root. Nitrogen is the carrier on which water and all other nutrients are carried into the plant. Without nitrogen fixation, plants starve and die, along with everything higher up on the food chain, including humans.

Yet each and every time fertilizers containing salt fillers or muriate of potash is applied to the ground these bacteria are destroyed in large numbers. The result of years of this treatment is now being seen in the form of low yields, low quality, and low protein content of the crops, with the subsequent degradation of food quality for higher animals and humans. It is imperative that only high quality low-chlorine fertilizers be used. Herbicides also have a severe negative effect on soil bacteria, and their use should be curtailed if not halted altogether. It has been demonstrated that proper natural balance in soil can control weeds to a significant degree without harm to the soil eco-system.

To restore natural microbial activity in soil, or to enhance crop quality, the use of a quality soil bacteria product is strongly recommended. We have available technology designed to replenish depleted soil bacteria. Your local representative is trained to detect low microbial activity and is prepared to help restore virtually all the micro-organisms necessary for nutrient uptake and nitrogen fixation.
We know how to restore life to dead soil, and can do so at surprisingly low cost.

# THE ABC's OF NPK'S WITHOUT THE BS

**or**

# HOW TO BUY THE FERTILIZER BUT NOT THE MANURE



Until recently, most farmers purchased fertilizers based on two criteria: NPK analysis and cost. Now, however, farmers are beginning to be more aware of the ingredients used to make their fertilizers, and for good reason. Since the end of World War Two, crop protein levels and mineral content have fallen even as yields have increased. The general nutrition level of livestock feed and the quality of food crops grown for human consumption have fallen even while yields have increased. Butterfat content of cow's milk falls every year and fruits and vegetables begin to rot while still on the supermarket shelf. And now, after nearly 50 years of booming agribusiness, farmers are beginning to see the first indications of falling yields. Even with massive increases in the costs of their fertilization programs and associated herbicide/pesticide/ fungicide costs, average output per acre is not what it was 20 years ago.

If not to the Government or the chemical industry, it is becoming evident to the farmer that something is fundamentally wrong with "conventional agriculture". But what?

Let's start with the basics. What is a fertilizer, anyway?

Since the dawn of civilization, mankind has known that farming a specific crop repeatedly will take more out of soil than is replaced naturally. They knew that while plants grow just fine in the wild year after year, witness any field of wild flowers or prairie, growing a particular plant for its fruit would over time deplete the soil. Then they noticed that by burying stalks and other crop residue along with animal waste they not only forestalled soil depletion but also improved the quality of their foods. Before long they discovered two materials that would cause their crops to grow faster, stronger, more resistant to insects and blight, and what's more, almost eliminate the problem of soil depletion. These two materials were the first known fertilizers: fish and seaweed.

"Primitive" civilizations the world over became familiar with this technology and used it for centuries. Even so, the Pilgrims were astonished to see native Americans planting fish under their corn seeds, and even more astonished to see the results. So impressed were they that they quickly adapted the technology to crops with which they were more familiar, and by the middle of the eighteenth century Colonial food crops were exported in profitable quantity back to Europe.

Today's fertilizers are classified according to their NPK analysis. This analysis appears in the form of three numbers prominently labeled on the bag, container, or tag. The numbers represent percentages present in the mixture of Nitrogen (N), Phosphate (P), and Potash (K for Potassium). The letters are in fact chemical symbols as they appear on the chemist's Periodic Table.

A bag of fertilizer labeled 16-4-8 therefore is represented to contain 16% Nitrogen, 4% Phosphate, and 8% Potash. The rest of the material in the bag is listed as "inert ingredients", an area this discussion will return to later.

Nitrogen, Phosphate, and Potassium are by far the three most important nutrients required by plants, but not the only nutrients. Also required, but in lesser amounts, are Calcium, Sulfur, and Iron. In addition, a host of other nutrients is required in trace amounts; these include magnesium, manganese, boron, and others, all absolutely necessary to facilitate photosynthesis and for the internal circulation and metabolism of the major elements. Different phyla of plants have different nutritional requirements.

Nitrogen is the primary electrolyte of the system. Its presence allows the plant to take in the other nutrients, but perhaps its most significant contribution is its ability to convey water into and throughout the plant. Like all living things, plants are after all about 97% water. Nitrogen, therefore, is the growth nutrient. It is directly responsible for the physical growth and size of a plant as well as for keeping it green. Remember its job of trucking other nutrients into the plant? Without Nitrogen the plant simply will not grow. The air we breathe is comprised of nearly 80% Nitrogen and most plants are able to assimilate some of their Nitrogen requirement from the atmosphere through a complicated soil micro-biological process. While suitable for most wild-growing plants, this process is soon overwhelmed by the needs of intensive agriculture. Hence its status as a primary ingredient in fertilizers....

Phosphate is the second most important nutrient. It has at least two vital functions for the maintenance of life in the plant. It is necessary for some of the chemical reactions that take place in photosynthesis, the process whereby the plant takes in Carbon dioxide and water and synthesizes them into complex sugars and carbohydrates for use by the plant, at the same time releasing free oxygen to the atmosphere for us to breathe. It is also fundamental, along with Nitrogen, in the transportation through the plant's vascular system of all the other nutrients. In plants that flower or develop fruit or vegetables, Phosphate is directly responsible for their mineral content. Flowering plants that are well supplied with Phosphate have deeper, brighter flowers that smell better and produce sweeter nectar to attract beneficial insects for pollination. It also is responsible for high "Brix", that is, the sucrose content of the plant.

Brix is a direct indication of the health and vitality of the plant. It is measured with a refractometer by squeezing juice from a leaf onto the lens of the instrument and reading the scale. High Brix means high system sucrose; the higher the sucrose the better the condition of the plant. Substantial levels of system sucrose emit an odor anathema to parasitic insects and viruses, and enables the plant to resist all but the direst of stress. Insects capable of detecting a weak crop twenty miles away will avoid a high-Brix crop like the plague. Since excess sucrose tends to ferment to alcohol in the leaf, any insect blundering into a healthy crop by accident for lunch is dealt with summarily by the toxic effects of the alcohol. The very same sugar and mineral content that attracts bees, butterflies, and birds for pollination and reproduction of the plant is also responsible for

repelling parasites.

Finally, the vitamin, protein, and mineral content of a fruit or vegetable is contingent upon the amount of Phosphate made available to the plant. Crops deficient in Phosphate produce yields that are tasteless, low in nutritional value, and that rot quickly after picking. They are also likely to be contaminated by any number of chemical pesticides, herbicides, and fungicides applied in large doses in an effort to kill the same parasites Nature took care of in healthy high-brix crops.

Potash, or Potassium, is the third most vital nutrient for plants. Along with Phosphate, it is responsible for root growth. It also is required in the chemical reactions of photosynthesis, but of more immediate importance to the farmer, it is responsible for root and stem thickness (caliper) and the formation of bud nodules for fruit set. If you have a Potassium deficient fruit tree you have a tree that will bear little if any fruit. Potassium has also been described as the element that makes wood woody; it also has an effect on Brix and stress resistance. Along with Calcium, Potassium is the element responsible for the structural strength of the plant, a point to remember if you are trying to grow corn in wind-swept Kansas. Early fruit drop is a symptom of Potassium deficiency since the fruit (or vegetable) grows too heavy for the connecting stem.

This concludes the discussion of the three primary nutrients listed as "NPK" on a fertilizer label. While it is certainly necessary to understand the functions of these elements in plant biology, this understanding is not enough for the prudent farmer or the salesman who sells him his materials. The next bulletin, entitled "Fertilizers and the Sad Saga of Salt", will show how things get complicated since not one of these nutrients exist in Nature in forms useful to plants. It will show how many of the problems confronting Agribusiness today are the end results of poor choices made in the selection of raw materials used in fertilizer production.

# THE REST OF THE STORY



or

# MURDEROUS MURIATE - THE SAD SAGA OF SALTS

The previous bulletin discussed NPK analysis and generally described the functions of each of the three elements involved. This bulletin will focus on sources of raw materials used in fertilizer manufacture, and how to avoid pitfalls when purchasing or selling growing materials for crops.

Pure Nitrogen exits in Nature as a gas, about 80% of the atmosphere of the Earth. Plants are able to utilize some atmospheric Nitrogen through a complicated soil micro-biological process by which beneficial soil bacteria form specialized nodules on root hairs. This process is called "Nitrogen Fixation" and is probably the second most bio-chemical reaction in Nature. Only a select few strains of bacteria are capable of performing this function, so it follows that their presence in agricultural land along with the presence of other micro-organisms responsible for nutrient chelation, nematode and other pest control is vital to food production. Unfortunately, all of these microbes are seriously depleted with applications of cheap fertilizers containing salts and/or muriate of Potash.

While high quality natural sources of Nitrogen are available on the market - fish products to name just one - Nitrogen in most fertilizers is derived from Urea, Nitrates of one sort or another, ammonia-based compounds or a combination of both. Many of these are very high in salt content and lethal to soil micro-organisms.

The reason salt is so destructive to soil eco-systems is its Chlorine content. Chlorine is highly toxic to all living things from bacteria to humans. Witness its use in swimming pools as a bactericide and fungicide. It wouldn't take much of an increase in its application to start killing swimmers. Salt (NaCl) is 50% Chlorine.

Coastal flood plains and areas once covered by salt water such as most of Kansas have salt problems that are natural in Nature and can be dealt with and controlled. Fertilizers present more of a problem because they are applied continuously and the toxic effect is cumulative. Probably the most detrimental Nitrogen source is high biurette (Chlorine index) Urea. Low biurette Urea is not only safe, it is very effective as a fertilizer. Unfortunately it is also expensive. Cheap fertilizers are usually made with high biurette Urea. Another extremely toxic Nitrogen source is Anhydrous Ammonia, also popular because it is cheap. This is a lethal gas injected under pressure into soil prior to planting and has a distressing tendency to kill its applicators as well as soil organisms.

Many farmers are discovering alternative non-toxic Nitrogen sources such as Ammonium Nitrate and Ammonium Sulfate. Both are relatively inexpensive and extremely effective fertilizers. But they are in liquid form and require special equipment for application, which works against them in the agriculture market since a majority of farmers are set up

to spread dry granular material.

Nitrogen sources are not the only toxic Chlorine-bearing materials used in fertilizers. Even more common is the source of Potassium, "Muriate of Potash". Beware of ANYTHING derived from muriate. Muriate of potash is actually the compound Potassium Chloride, which is 40% Chlorine and lethal. An inspection of fertilizer bag labels in any store will show that over 90% of them show the "K" derived from muriate of potash. Quality fertilizers on the other hand will contain "K" derived from Chlorine-free Potassium compounds such as Potassium Nitrate, Potassium Sulfate, or Potassium Hydroxide.

The point of all this is that any materials applied to the ground that kill soil micro-organisms, whether they be salt and Chlorine laden fertilizers, insecticides, herbicides, or fungicides, ultimately destroy soil fertility. The net result to the farmer is low crop quality as measured by test weights, low nutritional value, and, eventually, lower crop yields requiring the use of even more fertilizers, thus perpetuating the downward cycle of productivity.

Finally, a word about Phosphate sources....Again, care must be taken in selecting the fertilizer. Phosphorus does exist in pure form in Nature, but is unstable, radioactive, and completely useless to plants. The Phosphate used in agriculture is P2O5, or Phosphoric Acid.. The difficulty arises in the fact that Phosphoric Acid is available from a whole range of sources. The best source is mined as an ore and is considered "organic". Another excellent source is food or hospital grade ortho-phosphoric acid which is free of contamination and highly effective as a fertilizer. Both of these sources are expensive.

Many fertilizer manufacturers use phosphoric acid derived from industrial wastes. Not only do these materials contain all kinds of toxic and corrosive spent acids, they also often contain contamination in the form of heavy metals like mercury and lead. They get past the EPA because the amounts are small, but heavy metal toxicity is cumulative - once in your system it stays there. Only recently have the cumulative toxic effects of lead paint led to government regulation. Unfortunately, heavy metal contaminated fertilizers can still be sold in the United States.

**CAUTION! NEITHER THE SOURCE OF PHOSPHATE NOR THE HEAVY METAL CONTAMINATION IN IT IS REQUIRED TO APPEAR ON FERTILIZER LABELS! CHECK BEFORE YOU BUY!**

## THE SORRY SPIRAL OF SOIL STERILITY

**or**

## WHEN ARE WE EVER GOING TO LEARN?



Twenty five hundred years ago the Ionians of Greece discovered the concept of opposites. For every up there was a down, for every right a left, for every good an evil, and so on. About the same time, the Chinese hit upon the idea of natural balance of energy flow in the body they called "Chi" and the opposing forces that affect it - they call them "Yin" and "Yang" - by which they could describe and diagnose all phenomena of nature as they saw it. Ripples in the forces of the positive Yin or the negative Yang were held responsible for everything from headaches to famines to epidemics. The Chinese have over time developed herbal medicines, remedies, and techniques to restore balance in what they see as the natural order of things. They see natural balance as the key to health, happiness, and productivity.

Interesting idea, that. Until recently, this holistic approach to nature was considered just so much nonsense by western medicine and industrial society. Rapid developments in industry and science since the Industrial Revolution have convinced western man that he has the power to mold nature to his own will. In agriculture, during the mid 1900's it was determined that natural balances and forces of nature could be eschewed in favor of synthetic fertilization when it became evident that intensive agriculture needed to be stepped up to provide for the needs of an exploding world population. For eons, people had been using natural materials like fish and seaweed to replenish nutrients taken from the soil when food crops were grown. Now, however, man has chosen to force-feed plants for rapid production of more and more food. The chemical industry, having emerged from World War II with a whole panoply of materials originally planned for biological warfare, saw the value of some of these materials as fertilizers which could be sold to farmers. And of course it worked! In no time at all, the United States became the largest producer of grain in the world. As farm production and profits rose, more and more real estate was put to the plow. Few people, then or now, have given much thought to long term degeneration of the mother soil. Agriculture has indeed become big business.

Almost without notice, with production rising beyond anybody's expectations, nutritional value of crops has slowly begun to decline. To complicate matters, parasitic insect infestations, fungal attacks, and weeds are now a major problem - more so than ever before. Crops are showing signs that they cannot cope with stress as they once could. And now, in recent years, even yields have begun to decline.

Ancient farmers knew they had to replenish soil nutrients removed by the growing of crops for food. They learned that picking fruit or vegetables interrupted the natural

cycle of plant reproduction and nutrition, and found, though they didn't know why, that applying natural fertilizers like fish and seaweed kept their crops growing year after year. More to the point, they were able to grow their crops in the same locations, a significant development since until they learned about fertilizers, most ancient farmers were nomadic, always searching for new ground to plant. Modern industrial farmers have come upon the idea that today's conventional fertilizers can alone grow plants with little regard for soil conditions, an idea loudly proclaimed by the chemical industry and by land grant universities who depend on their sponsorship. To make matters worse, today's conventional fertilizers are usually manufactured as cheaply as possible. After all, there are huge profits to be made! Urea loaded with salt is commonly used as a Nitrogen source, leaching nitrates and carcinogenic nitrites into groundwater. Phosphates derived from industrial waste just beg for a market and nobody advertises the fact that they are often laced with heavy metals and spent acids. Muriate of Potash is just as cheap as cheap can be to make. Who cares if it is 40% Chlorine? Yet it is the primary source of potash used in agriculture today.

Why are these not-so-nature-friendly materials so widely used? Until recently, the short answer would have to have been profitability. Materials costs were low to the point where farmers could afford to apply them in reasonable amounts and not adversely affect profitability. However, in recent years, declining soil fertility has meant increasing application rates while costs per ton have steadily increased. So long as farmers could increase prices to cover costs, the problem was manageable. Still, no attempt was made to correct the base problem of detrimental fertilizer programs. Foreign competition has begun to impose limits on pricing, however, and agriculture today is in a financial bind. For example, the NAFTA agreement has put many Florida farms out of business.

The sad fact is that persistent use of harsh high-salt and polyphosphate fertilizers have a devastating effect on soil micro-organisms, including those necessary for the manufacture of enzymes that chelate inorganic soil nutrients . "Chelation" is the process by which inorganic soil elements are altered to forms able to be taken in by plant root systems. Without a healthy soil eco-system of micro-flora and micro-fauna producing the necessary enzymes, you could conceivably plant a crop directly above a mineral deposit only to have it starve to death. Water is also a primary need for root systems to work properly, and polyphosphates can form a layer of hardpan in the root zone dense enough to hinder the downward passage of water to where it is needed most. It also inhibits oxygen penetration to the root zone, causing major reductions in aerobic bacteria counts and fostering growth of anaerobic bacteria. Anaerobic bacteria produce enzymes that chelate all the wrong soil minerals, which is a major inducement to weed development.

Ironically, to compensate for reduced nutrient chelation and poor water and air penetration, farmers have had to increase application rates of the very same materials that caused their problems in the first place, thereby compounding their difficulties. The immediate result is crop malnutrition to the point where Nature's clean-up squads - parasitic insects and weeds - are attracted. Weak plants, that is, plants under stress, emit

an infra-red aura detectable by parasites miles away. These insects can also detect specific odors emitted by weak plants from surprising distances away. Growers using conventional wisdom soon find themselves spending huge amounts of money in fungicides and pesticides which kill beneficial insects and micro-organisms as well as parasites - something like throwing the baby out with the bath water. While these chemicals seem to work in the short term, they subject crops to even more of the same stress that first attracted the parasites, and applications usually must be repeated with increasing frequency. As the soil eco-system is degraded, growers must again increase application rates of synthetic fertilizers to maintain production. The cost of growing their crop has now essentially doubled and the downward spiral to soil sterility has now begun in earnest.....

As gloomy as all this sounds, it must be said that almost never is the natural eco-system completely destroyed by conventional agricultural fertilizer programs. Nature has a way of recovering, at least partially, in spite of technology. Otherwise, even synthetic fertilizers applied in gross quantities would have little effect since the very same bacteria that destroy are needed to chelate them. To work at all, these materials must be ever heavily applied, thus positioned to leach into ground water and run off into ponds, lakes, streams, and rivers. There are towns in Iowa where water has to be piped in from hundreds of miles away because of ground water pollution.

Casualties of currently accepted fertilization programs in commercial agriculture, domestic and abroad, can be listed as follows:

1. **AGRICULTURAL SOIL**

In this country, agricultural soil is rapidly approaching the point of total sterility. In consequence, farm productivity is decreasing while fertilizer costs, combined with costs of requisite pesticides are skyrocketing. In the not-so-distant future, much of the ground now used in farming will be rendered dead.

2. **GROUND WATER**

Excessive use of harsh high-salt fertilizers has been depositing huge amounts of nitrate, nitrite, salt, and phosphate pollution in the countries water supplies. As mentioned, there are whole towns in Iowa whose water has been so polluted by agricultural leaching that the must have their potable water piped in. Huge tracts of the American mid-west are looking at similar situations. We may again see "water wars".

3. **RIVERS, LAKES, RESERVOIRS, & WETLANDS**

Sadly, little of the huge amounts of conventional fertilizers applied to agricultural fields is used right away. Much of it simply runs off during rains into the nearest available catch basin, whatever it may be. Phosphate pollution in the Everglades from nearby sugar fields is just one example. As a result, the "Glades" has been inundated by vegetation and algae that feed on the phosphate, but also take in most of the free oxygen in the water. There are whole canal systems in South Florida where no fish or aquatic wildlife can any longer exist. In Florida as well as other parts of the country, watersheds are becoming so polluted that effects are showing up in cattle and other

livestock, tourists are finding fishless fishing holes, and populations of birds and other wildlife are suffering as well.

4. **FARMERS AND AGRICULTURE ITSELF**

Many of today's farmers are caught in the grip of the deadly downward spiral of soil sterility: the use of harsh chemical fertilizers causing soil sterility forcing the farmer to use more of those same harsh fertilizers to maintain production of crops whose quality as measured in protein content and test weights is steadily declining because of the soil sterility, which means they must use even more fertilizer to compensate. The bottom line is farmers are having to pay ever-higher costs to grow crops of ever-lower quality, and harvesting less and less each time. To make matters worse, nothing attract parasitic insects, nature's clean-up crews, like malnourished plants. Farmers must buy the Bug-Spray-of-the-Week in an attempt to keep pace with the insects, only to buy more when the bugs quickly develop a tolerance for the spray. Supplying farmers with an always new Bug-Spray-of-the-Week is a lucrative business, indeed. Farmers are finding themselves forced out of business in record numbers, their family-held lands, handed down through generations, going on the auction block. More and more food is being grown by fewer and fewer large, often multinational agribusinesses, themselves controlled by the very same concerns that own the chemical companies who make conventional fertilizers and pesticides.....and the spiral continues.

5. **FOOD CONSUMERS**

Of course it is the consumer who pays for this chicanery, both in the prices paid at the supermarket for often inferior, nutritionless food and in health risks associated with consumption of pesticides and fungicides. Nationally, cases of all types of cancer, leukemia, and other diseases associated with allergies and toxic hypersensitivity are on the rise. Many can be attributed directly or indirectly to improper agricultural practices. Think about green lakes, sick cattle, and even sicker farm workers next time you are in the checkout line with a basketful of food laced with synthetic vitamin and mineral supplements to make up for the natural nutrition no longer there.....

The United States is on the verge of becoming a grain importing nation for the first time in recent history. Already high costs of feeding a family will only get higher, and our national health will continue to deteriorate. Is all this really necessary? The short answer is a definite, resounding "no". There is a small but growing movement afoot to educate the agricultural community and the public, alerting them to the dangers of the present system, and chipping away at monolithic resistance to sustainable and organic agriculture. No longer is it true that farmers can't make money without the petrochemical industry, and growing numbers of farmers are beginning to make the transition. We are in the forefront of this movement. Our personnel have the expertise, experience, and training to help transform marginal farms to profitable farms using natural, non hazardous, non toxic materials. Our approach is simple: diagnose the ground and fix it, then institute a biological fertilizer program using organic fertilizers that focus and accelerate nature rather than ignore them. On average, our clients can save up to 20% of their crop input costs the very first year of transition. Soon after, they may see total saving up to 50%. They find they need apply much less fertilizer and almost no

pesticide at all. Also, many are finding they can market their crops in specialty markets at premium prices. As the general public becomes aware of health dangers in the food they eat, more and more attention is being paid to the organic industry. Finally, these farmers are delighted to discover their soil is in better condition after every harvest than it was the previous season. Our transition programs to sustainable agriculture actually rebuild and revitalize soil with each successive crop.

If your farm or agribusiness finds itself enmeshed in the downward spiral, you now have a way to solve your problem short of selling out. Try giving us a call, writing, or e-mailing us for details on how we can help you:

We are waiting to hear from you.

# HOW TO CUT BACK ON HARMFUL CHEMICALS

**Reducing pesticide and herbicide use**

We've all heard or felt the increased pressures on growers concerning the use of pesticides, herbicides and fungicides. Problems of water and plant contamination are very serious. We believe it's time to protect, rather than continuing to destroy our environment. We are committed to sustainable agriculture and the production of non-toxic products. Here are a few ideas for your attention.

## SUGAR CONTENT IN CROPS: INSECTS, PESTS AND FROST DAMAGE

One very important benefit of producing top quality crops, fruit and produce is that it will not rot. If produce is grown in properly fertilized soil, it will dehydrate in time but will not decompose. Top quality crops can also be stored much longer without spoilage.

A plant with a high sugar (brix), protein and mineral content will not be as susceptible to insect damage. The leaves of a healthy plant will have a glossy sheen, and egg-laying insects will not lay their eggs on a healthy leaf as readily as they will on a sick, dull leaf. Insects and pests are not as attracted to a plant with a high sugar content, attacking it last. Damage produced from chewing insects is also reduced because of the conversion of the sugar in the sap of the plant into alcohol. The alcohol is toxic to the insects, killing them. This can only happen if the plant contains a high sugar content, also referred to as Brix.

The higher the sugar content, the lower the freezing point of a fruit or vegetable. A plant is most vulnerable to frost damage when it contains large amounts of water and not enough sugar. The expansion of the cells when they freeze is so great that it destroys the tissues, causing the plant to dehydrate and be ruined. With a high sugar (brix) content plants are less susceptible to damage from the cold.

There are many more benefits to raising high quality crops, but we cannot go into all of them. One that is immediately noticeable is the taste of high quality fruits and vegetables. Another is storage and longer shelf life.

## WHY USE HUMATE?

I. Physically modifies the soil.
II. Chemically changes the fixation properties of the soil.
III. Biologically stimulates the plant.

### PHYSICAL BENEFITS:

l. Increases water holding capacity.
2. Increases aeration of soil.
3. Improves soil workability.
4. Helps resist drought.
5. Improves seed bed.
6. Makes soil more friable or crumbly.
7. Reduces soil erosion.

### CHEMICAL BENEFITS:

l. Retains water soluble inorganic fertilizers in the root zones and releases them to plants when needed.
2. Promotes the conversion of a number of elements into forms available to plants.
3. Possesses extremely high ion-exchange capacities.
4. Participates in the decomposition of rocks and minerals.
5. Increases buffering properties of soil.
6. Chelates metal ions under alkaline conditions.
7. Rich in both organic and mineral substances essential to plant growth.

### BIOLOGICAL BENEFITS:

1. Stimulates plant growth by accelerating cell division, increasing the rate of development in root systems, and increasing the yield of dry matter.
2. Increases germination of seed and viability.
3. Increases vitamin content of plants.
4. Increases the permeability of plant membranes; promoting the uptake of nutrients.
5. Stimulates root growth, especially lengthwise.
6. Increases root respiration and formation.
7. Stimulates growth and proliferation of desirable soil micro-organisms as well as algae and yeast.
8. Aids in photosynthesis.
9. Stimulates plant enzymes.
10. Acts as an organic catalyst.
11. Has no detrimental effects on quality of product.

# ORGANIC CARBON



## GENERAL INFORMATION

Organic carbon-containing compounds are formed from the biological and chemical breakdowns of animal and plant life. Organic carbons play a key role in determining the production potential of the soil**.** The importance of organic matter in soil is not a recent discovery. In early agricultural systems, soil fertility was based on the recycling of organic wastes; the addition of decomposed organic materials improved plant growth. With the creation of mineral fertilizers, growers were able to supply plant nutrients directly to the soil. The result was fantastic growth in agricultural productivity.

While carbon compounds are very important to all soils, they are vital in soils void of significant quantities of clay materials and organic matter. The addition of organic carbons to poor soil can noticeably improve plant growth. Organic carbons enhance plant growth both directly and indirectly. Physically, they promote good soil structure and increase the water-holding capacity of the soil; biologically, they affect the activities of microorganisms, while chemically, they serve as an absorption and retention complex for inorganic plant nutrients. Nutritionally, they are sources of nitrogen, phosphorus, and sulfur for plants and the soil.

Commercial organic carbon substances added to the soil do not directly contribute significant quantities of nutrients to plants. Indirectly, however, the effect of these materials on soil and fertility is significant. Micronutrients, especially iron, become more available to plants in the presence of carbons. Inorganic iron compounds are very unstable in soil and tend to become insoluble and unavailable, especially in calcareous soils. Organic carbon compounds can incorporate iron into chelated complexes, making it available to plants, although still in an insoluble form. Soil phosphates are often immobilized by reactions with iron and aluminum, which in turn may be complexed with organic matter. Chelating agents can break the iron or aluminum bonds between the phosphate and organic matter, releasing phosphate ions into solution. This dissolution is a process which occurs in soil in the presence of naturally occurring carbon substances or plant root exudates. The addition of organic carbons normally increases this process, thereby increasing the availability of phosphorus to plants.

Pesticides applied to the soil interact with organic carbon substances, and the reactions are complex. Some pesticides may be immobilized by carbons and practically disappear from the soil. In this case, organic carbons can be very effective in removing excess pesticides from sandy soils low in organic matter. The most common reaction between pesticides and organic carbons is absorption, followed by a release to the soil solution at a rate dependent on the chemical structure of the pesticide. Degradation of the pesticide will be determined in part by the rate of release. Organic carbon substances may be used in this case to control the concentration of pesticide in the soil solution, and to avoid toxicity hazards.

Organic carbons can have a positive effect on plant growth in a number of ways. They

have been shown to stimulate seed germination. Both plant root and top growth have been stimulated by organic carbons, although the effect is usually more prominent in the roots. A proliferation in root growth, resulting in an increased efficiency of the root system, is a likely cause of higher plant yields seen in response to organic carbon treatment. Organic carbons have been shown to increase the uptake of nitrogen by plants, and to enhance soil nitrogen utilization. They also enhance the uptake of potassium, calcium, magnesium and phosphorus. Chlorosis in plants has been prevented or corrected by organic carbon application, probably the results of the ability of organic carbon to hold soil iron in a form which can be assimilated. This phenomenon can be particularly effective in alkaline, calcareous soils, which are normally deficient in available iron and low in organic matter content.

# Soap, Surfactant and Soil Conditioners

### Everything the Consumer Should Know



You see it on labels everywhere. Ammonium Laurel Sulfate, sometimes called "Laureth Sulfate" or "Laurel Ether" is a primary ingredient in everything from dish detergent to shampoo, and from soap to wetting agents. It is essentially soap - a cleansing agent - that incidentally reduces the size of water droplets. This is what makes it a wetting agent. The ability to make water "thinner" or "wetter" enhances its ability to spread water evenly on leaf surfaces thus ensuring uniform coverage while at the same time reducing the possibility of prism effect. Liquids applied using ALS will have a much higher rate of efficacy than those applied without it.

Some manufacturers of soil conditioners, including most used on golf courses, use surfactants as a aid to water percolation. Having been misinformed, some greenskeepers apply these "conditioners" to tees, fairways and greens - and some farmers to fields - to treat problems with standing water after rain. Some trade literature, without actually saying so, leads them to believe they are changing the makeup of subsurface soil strata when in fact the material is really just a surfactant: a wetting agent that simply thins water enough to find cracks through which it may penetrate.

It is, of course, an illusion. The soil is not being treated at all and the root cause of standing water problems is not addressed by these products. Neither are problems associated with soil compaction like anaerobic bacteria proliferation, root binding and, above all, cessation of the soil evapotranspiration cycle.

Which brings us to true soil conditioners. These products really do treat soil conditions, and do so in a most ingenious way. While it is true that the prime ingredient is still ALS, just like surfactants sold as soil conditioners, there is a major difference.

A true soil conditioner is an *anionic* surfactant with an electrical charge. Using its penetration ability to reach subsurface soil strata, its electrical charge attracts oppositely charged particles in clay, gumbo, super-phosphates and other compaction-causing materials. Once attracted by positive ions, these particles tend to cling together in the soil as clumps, leaving non-ionized soil to allow movement of moisture and root propagation. Newly aerated, the soil also becomes friendly to aerobic bacteria, that is, bacteria necessary for organic matter decomposition and chelation of proper soil minerals as plant nutrients.

There you have it - why a true soil conditioner works like no other surfactant. Don't you get a charge out of it?

# The Golden Rule: Keep it simple!



**Here's what's needed to make all growing things happen:**

1. **Ionization**.

All plant nutrients must have an electrical charge, either positive or negative. This is the only way minerals can be taken up by root systems. No electrical charge can exist in soil without the element Carbon, which is a function of soil organic matter. Simply put, no organic matter, no carbon. No carbon, no ionization. No ionization, no plant. Not much grows on sandy beaches, where there is no organic matter.

2. **Chelation.**

All minerals, many of them metals, must be altered by enzymes manufactured by soil bacteria to be taken in by plants. You can't chew an iron bar and neither can a plant. In your internal digestive system and in that of the plant, metals must be transformed by enzymes to be able to pass through cell walls, which are otherwise sealed tight. If they weren't, you would leak. Start using high-salt (muriated) fertilizers and herbicides and you kill off the bacteria that do the job. No bacteria, no enzymes. No enzymes, no chelation. No chelation, no plant. Increasing doses of fertilizer are required to maintain growth since the soil is essentially dead. You end up with weak, stressed out plants susceptible to every parasite, fungus, and virus to come down the road. Watering requirements will increase as well.

3. **Brix**

Brix is simply system sugar, the kind of sugar that translates to energy in the plant. Sugars are carbohydrates, and carbohydrates are what give plants energy needed to grow, produce, and stay healthy. They do exactly the same thing in you. They also come from the same place you get them: through quality nutrition. You wouldn't feel good about eating industrial waste and neither do your plants. Remember, in humans, animals, computers, or plants: garbage in, garbage out.

## 4. **Water**

Do you *really* think you know why water is so important to plants? Think about it. All the rain in the world passing downward past the root system does little good for plants, except to lend a helping hand to soil micro-organisms. The real value begins when soil moisture begins to move *upward* as a result of capillary action. When the sun warms the surface and upper level moisture is evaporated, lower level moisture begins to seep upward, bringing soil nutrients with it. This is how soil minerals are brought to root systems. Extended use of super-phosphate fertilizers will create a layer of hardpan in the soil under the roots, stopping this upward movement. We call these fertilizers "Hardpan in a Can" for a reason. The result is much the same as your taking an overdose of Kaopectate, except that you can't hear your soil grunt.

**Keep it simple. Build organic matter, keep the soil loose, and feed quality fertilizer. Balanced soil and energetic plants will make weeds and parasites a memory.**

# Not-So-Super-Phosphates
**or**
# Scrapping Your DAP



MAP (Mono-ammoniumphosphate) and DAP (Di-ammonium Phosphate) have for years been used as a source of agricultural phosphate ($P_2O_5$), but not without causing long term detrimental side effects.

When the U.S. Navy Construction Battalions (CB's) built island airbases throughout the Pacific in WWII, they used these materials as a surface paving agent in lieu of concrete because they were strong as concrete and as impervious to water penetration. The very characteristic that make them so is the primary reason that knowledgeable farmers do not use them as fertilizers: longevity.

As fertilizers, these materials are represented as being available to plants in high doses. While this may be true in the extremely short term, they tend to remain in soil as hardpan almost forever. As important as the moisture evapo-transpiration cycle is to proper crop nutrition, farmers can ill afford to build solid layers hardpan in or under the root zone.

This is how MAP and DAP degrade from fertilizer assets to solid hardpan:

Very soon after application - the timing is weather and soil moisture dependent - the Ammoniacal components of both products evaporate into the atmosphere, leaving insoluble phosphate behind in the ground. Since the Ammoniacal components of MAP and DAP are the agents that are responsible for their solubility - thus their ability to pass through a cell wall - the insoluble phosphate left in the soil is not available to plants and is therefore useless as a fertilizer.

Furthermore, additional time and money must now be spent in overcoming problems caused by inadequate nutrition.

We believe in using liquid 0-20-0 or 0-20-20, based on phosphoric and phosphorous acids respectively, because there is no ammonia to evaporate off and the phosphate component remains available (soluble and able to penetrate cell walls) indefinitely. In addition, because they are already water soluble, there is no delay required for bacteria-produced enzymes to chelate the nutrients components.

To recap, not only are liquids available immediately they are applied - even to the soil, they remain available as nutrients until depleted. There are no economic or environ-mental side effects.

So slap your MAP and zap your DAP. It just makes good sense to go liquid...

# Fulvic Acid



## What it is

Fulvic Acid is a carbonaceous substance not unlike Humic Acid. Like Humic Acid, Fulvic Acid is a product of organic matter decomposition.

Where Humic Acid is processed in nature under anaerobic conditions, Fulvic Acid is processed naturally under aerobic conditions.

Both materials are found roughly in equal concentration in nature. They represent the beginning of the coal segment of the carbon cycle. Application of time and pressure cause these materials - existing as they do side by side in soil - to compress into what will eventually become Leonardite and Lignite ores, themselves simply stops in the carbon cycle.

Humic acid products manufactured with Leonardite, the best known humate source, are not to be confused with naturally occurring humic acid per se. Humic acids contain both natural humic and natural Fulvic acids, both being present as ingredients of Leonardite.

## What it does

There is no significant difference between Humic and Fulvic acids in terms of their presence in soil systems. While they are indeed two separate materials, they are still closely related in that they are carbonaceous in nature. As such, their functions in the ground are essentially identical.

## Refractive Index of Crop Juices Calibrated in Degrees Brix (

| Fruits | Poor | Average | Good |
|---|---|---|---|
| Blueberries | 8 | 10 | 12 |
| Apple | 6 | 10 | 14 |
| Avocado | 4 | 8 | 16 |
| Banana | 8 | 10 | 12 |
| Cantaloupe | 8 | 12 | 14 |
| Casaba | 6 | 8 | 14 |
| Cherry | 6 | 8 | 14 |
| Coconut | 8 | 12 | 14 |
| Grape | 8 | 12 | 16 |
| Grapefruit | 6 | 10 | 14 |
| Honey Dew | 8 | 10 | 12 |
| Kumquat | 4 | 6 | 10 |
| Lemon | 4 | 6 | 8 |
| Lime | 4 | 6 | 10 |
| Mango | 4 | 6 | 10 |
| Orange | 6 | 10 | 16 |
| Papaya | 6 | 10 | 16 |
| Peach | 6 | 10 | 14 |
| Pear | 6 | 10 | 12 |
| Pineapple | 12 | 14 | 20 |
| Raisins | 60 | 70 | 75 |
| Raspberry | 6 | 8 | 12 |
| Straw berry | 6 | 10 | 14 |
| Tomato | 4 | 6 | 8 |
| Watermelon | 8 | 12 | 14 |
| **Vegetables** | | | |
| Asparagus | 2 | 4 | 6 |
| Beet | 6 | 8 | 10 |
| Bell Pepper | 4 | 6 | 8 |
| Broccoli | 6 | 8 | 10 |
| Cabbage | 6 | 8 | 10 |
| Carrot | 4 | 6 | 12 |
| Cauliflow er | 4 | 6 | 8 |
| Celery | 4 | 6 | 10 |
| Corn, Stalk | 4 | 8 | 14 |
| Corn, Young | 6 | 10 | 18 |
| Cow Peas | 4 | 6 | 10 |
| Endive | 4 | 6 | 10 |
| Escarole | 4 | 6 | 10 |
| English Peas | 8 | 10 | 12 |
| Field Peas | 4 | 6 | 10 |
| Green Bean | 4 | 6 | 8 |
| Hot Pepper | 4 | 6 | 8 |
| Kohlrabi | 6 | 8 | 10 |
| Lettuce | 4 | 6 | 8 |
| Onion | 4 | 6 | 8 |
| Parsley | 4 | 6 | 8 |
| Peanut | 4 | 6 | 8 |
| Potato, Irish | 3 | 5 | 7 |
| Potato, Red | 3 | 5 | 7 |
| Potato, Sw eet | 6 | 8 | 10 |
| Romaine | 4 | 6 | 10 |
| Rutabaga | 4 | 8 | 10 |
| Squash | 6 | 8 | 12 |
| Sw eet Corn | 6 | 10 | 18 |
| Turnip | 4 | 6 | 8 |
| **Grasses** | | | |
| Alfalfa | 4 | 8 | 16 |
| Grains | 6 | 10 | 14 |
| Sorghum | 6 | 10 | 22 |

# Temperature Correction Chart

| Temperature | | Percent Sucrose | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F | C | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 |
| | | Subtract From % Sucrose | | | | | | | | | | |
| 50 | 10 | 0.50 | 0.54 | 0.58 | 0.61 | 0.64 | 0.66 | 0.68 | 0.70 | 0.72 | 0.73 | 0.74 |
| 52 | 11 | 0.46 | 0.49 | 0.53 | 0.55 | 0.58 | 0.60 | 0.62 | 0.64 | 0.65 | 0.66 | 0.67 |
| 54 | 12 | 0.42 | 0.45 | 0.48 | 0.50 | 0.52 | 0.54 | 0.56 | 0.57 | 0.58 | 0.59 | 0.60 |
| 55 | 13 | 0.37 | 0.40 | 0.42 | 0.44 | 0.46 | 0.48 | 0.49 | 0.50 | 0.51 | 0.52 | 0.52 |
| 57 | 14 | 0.33 | 0.35 | 0.37 | 0.39 | 0.40 | 0.41 | 0.42 | 0.43 | 0.44 | 0.45 | 0.45 |
| 59 | 15 | 0.27 | 0.29 | 0.31 | 0.33 | 0.34 | 0.33 | 0.35 | 0.36 | 0.37 | 0.37 | 0.38 |
| 61 | 16 | 0.22 | 0.24 | 0.25 | 0.26 | 0.27 | 0.28 | 0.28 | 0.29 | 0.30 | 0.30 | 0.30 |
| 63 | 17 | 0.17 | 0.18 | 0.19 | 0.20 | 0.21 | 0.21 | 0.21 | 0.22 | 0.22 | 0.23 | 0.23 |
| 64 | 18 | 0.12 | 0.13 | 0.13 | 0.14 | 0.14 | 0.14 | 0.14 | 0.15 | 0.15 | 0.15 | 0.15 |
| 66 | 19 | 0.06 | 0.06 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 |
| | | Add to % Sucrose | | | | | | | | | | |
| 70 | 21 | 0.06 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| 72 | 22 | 0.13 | 0.13 | 0.14 | 0.14 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.16 | 0.16 |
| 73 | 23 | 0.19 | 0.20 | 0.21 | 0.22 | 0.22 | 0.23 | 0.23 | 0.23 | 0.23 | 0.24 | 0.24 |
| 75 | 24 | 0.26 | 0.27 | 0.28 | 0.29 | 0.30 | 0.30 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 |
| 77 | 25 | 0.33 | 0.35 | 0.36 | 0.37 | 0.38 | 0.38 | 0.39 | 0.40 | 0.40 | 0.40 | 0.40 |

# The Metaphysical Approach to Crop Fertilization
# Or
# "Come On, Mister! How About Feeding Me Now and Zen?"



Sometimes to make a point I'll tell my clients, especially female clients, that there was a time when my kids were small that I tried to get away with feeding them once a month because I didn't know any better. I continue to say that I crammed a month's worth of food down their throats so I wouldn't have to be bothered when I had other things to do. Then I say that I found out that the kids would get healthier if I fed them every day - even more so if fed them a couple of times a day! I learned about regular, well-balanced diets and sure enough - my kids never got sick after that!

Of course I am kidding. My kids would have killed me had I tried that. But my point is a valid one. In my farming experience as well as my experience with kids, the "Law of Little Bits" applies. Whether you are feeding a kid or a kumquat, it is invariably better to feed small amounts at frequent intervals rather to cram a season's nutrition in one feeding. Don't take my word for it. Ask my kids!

Unlike my kids, however, it turns out that there is another way of introducing food to plants, other than through roots- one that is actually about 10 times more efficient. It's called "foliar feeding", and it's perfect for following the Law of Little Bits. Instead of saturating the soil at the roots with nutrients, you just mix a little water-soluble plant food with water and mist onto the lower side of the leaves. You use only a tiny amount of food at each feeding, but you feed every 10 to 14 days. Your plants will react much as my kids did - by growing big, strong and able to get even with me - big time - had I not learned my lesson.

Oh, and while you are shopping for a good foliar-feed plant food, try to make it the best balanced, energy-packed food you can buy. Stay away from anything with chlorine in it (as in muriate of potash, which is 40% chlorine) or anything chelated with EDTA. I gave neither my kids nor my crops junk food, and it seems they all came out rather well! If you are not sure about what to look for in plant nutrients, re-read the articles in this package or call, write or e-mail me.

# The Cosmos - Cucumbers - and You



Hey you! Yes you! I bet you thought you were mortal. Of course you did, and of course you're right. But what would you say if I told you that not a molecule of matter in you is? Believe it or not, every atom of the billions of atoms that comprise your body is as old as the earth itself and probably older. Chances are that the water in your cell tissue was once part of an primordial ocean, and virtually every bit of the organic material that is *you* has been around since even before that!

Take a walk outside tonight and look up. If you are a farmer, you are already aware of the impact the sun and moon have on your livelihood. But what you may not know is the direct connection between the stars and yourself. You, sir or madam, are made of starstuff. The organic carbon from which you were made did not magically appear on Earth. Since the very beginning of the universe, particulate matter - much of it carbon - has been coalescing out of interstellar dust clouds into ever larger masses. Some of these masses have grown so large that the pull of their own gravity has compressed them so incredibly dense that they built extreme temperatures and internal pressures. When some of that material grows dense enough, nuclear fusion can result. Hence the birth and development of our sun.

The planets and their moons of our solar system, like billions of other plants and moons of countless solar systems in the universe, have not reached the size and density necessary to become stars. But the creation of stars is an ongoing, cyclical process. Stars burn out, condense and become Black Holes. But more often than not, they simply explode as supernovae, strewing fresh particulate matter back into the interstellar dust cloud. Starstuff.

This, then, is the stuff and substance of every living thing on our planet, including you. Yes, you are indeed mortal. But the material from which you were made has been around since the beginning of time.

By now you must be asking yourself what, if anything, any of this has to do with agriculture, your lifestyle or the way you make your living. The answer is only this: everything you will encounter in your life is cyclical. You are in fact recycled starstuff. So is everything you grow and eat. All natural processes are cyclical. For example, there is a carbon cycle, a water cycle and an oxygen cycle, to name just a few. Your survival depends on continued functioning of these cycles. The earth has had nearly 5 billion years to develop natural fertilization and pest controls. While intensive agriculture makes it necessary to restrain parasites as much as possible, we suggest that it makes more sense to focus and accelerate natural processes rather than risk interruption of vital organic cycles with indiscriminate applications of toxic chemicals.

There is no such thing as a safe poison. Try to keep that in mind the next time you plant your cucumbers - or anything else.

# Don't Be A Study Fuddy-Duddy



It seems every time one turns around today, somebody somewhere is citing a study to prove something. As often as not, it is somebody with more money than morals trying to sell you something based on "university studies". For every study cited in product advertising, there is at least one more that disputes the findings of the first. What is politically correct today is often taboo tomorrow. To no one's surprise, results of test and studies more often than not reflect the interests of those who fund them. Yo! Is this accidental? Maybe a coincidence? Yeah, Right!

No doubt there are valid studies out there that actually go a long way to establish truth and scientific documentation. The problem is that for every valid study performed, there are dozens that are just plain unreliable. When you enter the world of "Publish or Perish", you do so at your own risk. Most university studies and tests are performed at the behest of commercial companies in return for large fees - and those fees pay for salaries and sometimes entire university departments. In case you can't see what follows, let me explain that results of studies and tests paid for by commercial clients will suit the interests of those commercial clients - or else. Neither large universities or commercial entities are known for altruism. Future testing or study for an irritated client will just as easily be done by someone else, someone who maybe doesn't suffer from a terrible case of scruples. Let's face it. Virtually everyone who funds studies and research does so with an ax to grind. They have a point of view - or a product line - they wish to promulgate, and nothing seems to sell a point of view or product line better than endorsements from recognized institutions or the people with letters after their names who staff them.

Does this mean that all studies are frauds? Of course not! But my problem is that I can't tell by looking which study is valid and which study is simply bought and paid for pure and simple. I once had a university professor, a Ph.D. chief of an entire university department, offer to run any test I wanted - and make it come out any way I wanted - for a flat $25,000 up front, no questions asked. I respectfully declined and found another, more honest university with which to do business. I once had access to university test results - from a test I neither paid for nor authorized - deliberately gun-decked, that is, falsified from the ground up. I daresay no test was ever actually run; that imaginary results were published. I can't say I was surprised, but I *was* insulted. The wizard who published the test results expected his subscribers to believe that eight different nematode-control products produced the exact same results, identical to the second decimal! I wanted to call the guy and make him a presentation on some prime ocean-front property I own in Iowa.....but you know how it is. We don't often do unto people what they so gleefully do unto us! Well, not *too* often, anyway....

With the exception of "USTP", (U.S.Taxpayer) I do not have a bunch of letters after my

name. But I am now skeptical enough to second-guess those who do until such time as they have demonstrated their veracity to my satisfaction. I cannot distinguish a valid study from trash by simply looking. I'm not smart enough. And very often my rolodex is insufficient to point me toward an opposite opinion. Too much money is involved in the study publication business - and it is indeed a business - to ensure accuracy or even honesty.

So what are you and I, just plain people with needs to make valid decisions in our own businesses or lifestyles, to do?

At the risk of sounding like a crusty old curmudgeon, this is what I do:

- Studies are nice; hard data is better. When in doubt, go directly to the horse and ask him. If you *must* rely on a study to make a decision, check out the documentation and satisfy yourself the study conclusions are valid.
- Where money is involved, I don't believe *anything* anyone tells me. I will get second opinions and references whenever possible.
- It is absolutely necessary to filter out meaningless glitz and double-talk when making decisions. Beware of propaganda. Cut right to the chase. Salesmen, insurance agents and politicians hate it when you do that, but you will find it refreshing and often comical.
- If someone makes a claim or offers you a deal that sounds too good to be true, you can bet it is. Always look hard at a deal, then turn it upside down and inside out. Then look just as hard again.
- Network! I doubt you will be the first person on earth to try a product or buy into a deal. Do your best to locate someone who already has, then ask him. Believe me. Someone who has been stung will more than likely tell you all about it when asked. (Except for Honda owners...They're almost always too embarrassed to admit their mistake!)
- Check magazines, newspapers and trade journals for opposite views or results. I never believe just one, but I will almost always go with the consensus. All of them can't be wrong!

So don't be a study fuddy-duddy. Don't make decisions based on test results or studies alone - especially those funded by commercial entities - unless you are absolutely satisfied by the honesty and integrity of the agency performing the test or study. And don't be satisfied too easily..... The fact that you may have gone to school at a particular university doesn't automatically make above or beyond reproach.

Finally, the only means I know for sure to separate wheat from chaff is to see with my own eyes - in person. Show me a demonstration and I *might* believe you. Show me a demonstration, then let me talk to a couple people with experience. *Then* I will probably believe you. Usually, I find it necessary to purchase small amounts of the product in question and run my own tests. I find I do this more often if the future of my checkbook depends on it. One thing works for me every time: I just stifle the impulse to go out and

buy something - or buy into something - just because it's backed by a university study. As sure as God made little green apples, the study was bought and paid for by someone who wants my money.

# Diversify or Die?



## A Little Imagination and a Lot of Nerve Can Change Everything

I believe it was Yogi Berra who once said the best way to win a ballgame was to "hit 'em where they ain't". When you think about it, this makes good sense no matter what business you're in, but it's especially true if you are a small farmer.

One of the things that bothers me about the state of modern agriculture is the rate at which small and medium size farmers are selling out, going bankrupt or otherwise leaving the business. Small farm profits are not keeping up with costs and farmers are having to make some terrible decisions.

Worse, younger generations of farm folk are leaving farms in record numbers, not because they are afraid of work, but because they just don't see small farming as a road to riches. Who can blame them? With so many ways to make money and become successful today, a kid going into college is easily lured into the business world, leaving Dad to cope with the trials and tribulations of running a farm with no one to leave it to when that time comes.

There are a lot of aging small farmers out there with terrible, hollow aches in their stomachs, wondering if their hopes and dreams and family traditions have gone down the drain.

Well, before you decide to throw in the towel, there are some things I'd like to bring to your attention that just might perk you up a bit, enough even to see a light at the end of the tunnel that's not really a train coming toward you.

I'm going to give you some ideas on how to achieve success in your business and maybe motivate Junior to stay home on the farm. Some might be difficult because they involve possible changes in the way you farm. Others because they might mean short term changes in your lifestyle. None are easy, but the results may well mean the difference whether you live on your farm next year or move to a condo. Let's see if any of these ideas are useful to you...

## 1. **What crops do you grow?**

Have you ever noticed the way farmers - especially smaller farmers - in a given area all tend to grow the same crop? There is an area east of Tampa, Florida where everybody and his brother grows nothing but tomatoes. They grow tomatoes mostly because their fathers grew tomatoes and *their* fathers grew tomatoes. Their ground has seen nothing but tomatoes for a coon's age. There is another area just north of the city where everybody grows strawberries. And nothing but strawberries. What's wrong with this picture?

You can live or die by the crop you grow. One of the reasons why my partner and I were successful was because we stayed one step ahead of the pack. Here's how we did it. Maybe it will work for you.

We never grew the same crop on the same ground twice in a row. Every crop cycle saw a different crop in the ground. This had a number of benefits. First was the obvious benefit of good crop rotation. You might be amazed at the number and amount of weed and insect controls you *don't* need once a good crop rotation plan is established. Soil organic matter improved over time with resulting improvement of fertility. Our direct input costs to grow our crops went down accordingly.

Next, we always had the advantage of the highest possible market prices for our crops. Why not? We were the only ones in the neighborhood growing what we grew. Other farmers would keep an eye on us to see what prices we brought, and then they would all grow that crop over the following cycle. Of course, that just drove the price right through the cellar. After a while, it got so they would try everything they could think of to learn what crop we would be growing so they might get the same high price. We swore our seed dealers to secrecy and kept our crop plans to ourselves.

Our local farmers all tended to lunch in the same country restaurant every day, and of course we all knew each other pretty well. I'll never forget the day my favorite waitress, in a fit of giggles, told us that our friends had been asking her - real innocent of course - if she ever overheard my partner and I discussing our plans. "Y'all can trust me to never tell 'em a thang!" she told us. We learned how to keep secrets and still be friendly, and we never talked about our plans anywhere but in our office after that. Remember Yogi Berra and "hit 'em where they ain't".

## 2. **Why grow only one crop?**

This one is fairly straightforward. When you grow only one crop, a hiccup in the market can kill you. Stockbrokers tell their clients to diversify their investments so a failure of one stock won't mean ruination. The same goes for crops. Like a good poker player, you need to keep an ace in the hole.

This is a lot easier to do these days than it used to be. Modern biological fertilizer programs and foliar feed technology make it possible to use the identical tank mix on most vegetable and fruit crops. Not only can you sub-divide fields into individual crop-plots, it's easy today to alternate rows.

In a single field, we once grew three different row crops: beans, peppers and melons. We then learned that we would have been better off planting a legume crop between rows of nitrogen feeders, saving a bunch on our N costs. You are breathing about 78% nitrogen as it is. Where is it written that you need to buy more to grow your crops, especially if at least one of your crops is pumping it into the ground for you?

The following year we simply moved each crop over one row. Neat, hey? You bet! It worked like a charm and actually improved soil conditions in the process. The upshot is even if you don't have the room to rotate whole fields, you at least can rotate row crops in a single field. With a little knowledge of companion planting and basic biology, you can put Nature to work for you rather than try to force it. Anyone who has ever gone to sea or survived a hurricane, tornado or earthquake knows very well that no mere human will ever win a battle with Nature. So why try? Work on putting natural forces to work for you, instead. The amount of energy, time and money you will save will make your head spin.

A word about proper crop rotation is in order here. Nothing, and I mean nothing, opens the door to pests and weeds faster or farther than a lack of crop rotation. Forget what the chemical companies tell you. No chemical will ***ever*** cure your infestation problems. We are not fanatics about this. We realize that you may from time to time have to spot-spray this or that. But you can take my word that natural insect controls are far more powerful than anything manufactured in Delaware, and a heck of lot less hazardous to you and your family. In twenty years of farming in South Florida, the land of tropical multi-engine insects, my partner and I never had to spend a dime on insecticides. The money you save by not having to buy pesticides can put a

large dent in - or even pay for - your seed bill next year.

### 3. Where are you selling your crop?

This is going to be a tough one to sell. In the final analysis, selling your crop is where you can make or break a season. I know, *anything* can, break a season. Murphy's Law says that if anything *can* break you, it inevitably *will*. Well, maybe not. With a little imagination, you can stay one step ahead of Mr. Murphy!

Look, it doesn't take a rocket scientist to figure out that if you haul your crop - the same crop as everybody else's - to the packing house the same time everybody else does, you probably are not going to be paid as much as you think you should be. As often as not, after your fertilizer, fuel and seed bills are squared up and your pickers paid, you end up with *bupkus*, wondering whose idea it was to become a farmer when you could have had a *real* job.

Try this on for size: If you take the time and trouble to grow a pesticide and herbicide-free crop, and do it properly so sugar and mineral levels are higher than the average, why sell your produce to the same market that buys lesser quality material? I know I had the advantage of year-round growing seasons, but we made a bundle selling a lot of our produce at our own fruitstand in front of the property - at nearly retail prices. That's when we found out that word of mouth advertising is better than any you can buy. We had people coming from the Interstate 20 miles away to buy our veggies. (The fact that we had a very cute college girl working the stand for us *might* have had something to do with it!) We were able to deal directly with restaurants and grocery chains to sell the rest. They were happy to deal with us for two reasons: We were able to sell to them at prices less that those demanded by their wholesalers, though still higher than what we would have realized from a packing house. And they were getting high quality produce that they advertised as pesticide-free and either marking it up accordingly or taking advantage of the public relations position.

The trick to making this happen was in having a constant supply of produce available. Remember, we were growing in an area of the country lucky enough to have year-round growing seasons. So we staggered our planting schedules weekly (sometimes even daily) and picked constantly. Often we planted and picked the same numbers of rows per day of the various crops we grew, so had a never-ending harvest each day to stock the fruitstand and

to truck to our other customers. I probably don't need to remind you of the advantages of running a cash business!

We were able to hire a small full-time crew who picked in the early mornings and planted in the afternoons, beginning their shifts at 6AM and working until 2PM. It took a while to get the kinks out, but we settled into a steady production schedule in almost no time.

To make this work, we had advantages other than climate to work with. First and foremost was the physical layout of our operation. Instead of one large farm, we worked two (and sometimes three) smaller fields no larger than 50 acres. A quirk of Florida law allows fruitstands to be operated without regulation so long as they are located on the actual property where the crop is grown. So we sometimes had two separate stands in operation, fronting on two different roads. It got a little complicated making sure the right equipment was on the right field at the right time, but again, it became simple with a little practice. The bottom line is not only did we have a constant supply of product to sell, we were never overwhelmed with *too much* to get rid of.

For you folks who don't have our advantages, there is another way to move your product and make a buck or two. USDA has opened a new office in its Washington headquarters just for farmers like us. It's called the Alternative Marketing Program. In talking with these people, I got the distinct impression that they really were interested in helping small farmers find specialty markets for crops. When I asked them for some literature, I was nearly buried under the mass of material they sent: everything from Farmers' Market directories throughout the country to plans for opening your own, right down to how much room it takes to turn around a semi-trailer. Best of all was that it's all free!

## 4. **Conclusion (for now)**

Some or all of this information may be of use to you; maybe none of it will. But if it only gives you pause to think about new ways to do what you like to do best, it's worth it. To recap:

1. Look hard at the crops you grow and determine if that's the best you can do. Diversify.

2. Take an even harder look at the program you're using to grow them. The science exists today - right now - to cut back or eliminate chemical use without hurting your total yield. Save up to 40% of your input costs and grow crops of better quality in the bargain.

3. Give some thought to alternate ways of marketing your product. Maybe knowing what we did can help you, even if only to get you thinking.

The best way for a small farmer to beat the system today is to find a niche and work it for all its worth. Why compete with the rest of the herd when you can do an end run around them? A little imagination can go a long way toward financial stability. Remember Yogi Berra and "hit 'em where they ain't"!